Increasing specificity of correlate research

The development of questionnaires to measure the predictors of lunchtime and after-school physical activity in children

Rebecca Megan Stanley

Bachelor of Applied Science (Occupational Therapy) with Honours

School of Health Sciences

Division of Health Sciences

University of South Australia

A thesis submitted for the degree of Doctor of Philosophy

Submitted August 2012

TABLE OF CONTENTS

LIST OF FIGURES ..... **x**
LIST OF TABLES ..... **xi**
DEFINITION OF TERMS ..... **xiv**
LIST OF PUBLICATIONS AND PRESENTATIONS ARISING FROM THIS THESIS ..... **xvi**
SUMMARY ..... **xviii**
DECLARATION ..... **xx**
ACKNOWLEDGEMENTS ..... **xxi**
1 Introduction **2**
1.1 Behavioural epidemiology framework 3
1.2 Importance of context 4
1.3 Physical activity interventions 5
1.4 Assessment of correlates 6
1.5 Research purpose, questions and aims 7
1.6 Study design 8
1.7 The population group for this study 11
1.8 Summary 12
2 Overview of the literature **14**
2.1 Physical activity and health in children 14
2.2 Characteristics of physical activity 16
2.3 Physical activity guidelines for children 16
2.4 Trends in children's physical activity 19
2.4.1 Age-related trends 19
2.4.2 Secular trends 21
2.4.3 Context-specific physical activity trends 22
2.5 Lunchtime period and physical activity 24
2.6 After-school period and physical activity 30

2.7 Physical activity interventions....34
2.8 Investigating factors that influence children's physical activity....37
2.8.1 Theories and models of physical activity behaviour....37
2.8.1.1 Ecological models of physical activity behaviour....39
2.8.2 An overview of the correlates of children's physical activity....40
2.8.2.1 Biological and demographic correlates....44
2.8.2.2 Intrapersonal correlates....44
2.8.2.3 Behavioural correlates....47
2.8.2.4 Sociocultural correlates....47
2.8.2.5 Physical environmental/policy correlates....49
2.8.3 Limitations in identifying correlates of physical activity....50
2.8.4 Increasing specificity of correlate research....54
2.8.5 Measurement of correlates....56
2.9 Significance of the research study....61
2.10 Summary....63
3 Systematic review of the correlates of children's lunchtime and after-school physical activity....65
3.1 Introduction....65
3.2 Methods....67
3.2.1 Search strategy....67
3.2.2 Selection criteria....67
3.2.2.1 Types of articles....67
3.2.2.2 Sample....68
3.2.2.3 Dependent variable inclusion criteria....68
3.2.2.4 Independent variable inclusion criteria....69
3.2.3 Quality assessment of methodology....69
3.2.4 Coding associations with physical activity....70
3.3 Results....71
3.3.1 Characteristics of the studies reviewed....71
3.3.2 Methodological quality of the studies reviewed....78

3.3.3 Correlates of school break time and after-school physical activity 79
3.3.3.1 Potential correlates of school break time physical activity 90
3.3.3.2 Potential correlates of after-school physical activity 91
3.4 Discussion 93
3.4.1 Limitations 96
3.5 Conclusion 97
4 A qualitative exploration of children's perceptions of potential correlates of lunchtime and after-school physical activity 100
4.1 Introduction 100
4.1.1 Research aims 102
4.1.2 Ethics approval 103
4.2 Methods 103
4.2.1 Study design and methods 103
4.2.2 Recruitment and sampling 104
4.2.3 Development of questions and focus group procedures 105
4.2.4 Focus group procedure 106
4.2.5 Data collection during the focus groups 110
4.2.6 Data coding and analysis 110
4.3 Results 112
4.3.1 Description of participants 112
4.3.2 Focus group findings 112
4.3.2.1 Children's perceptions of the correlates of lunchtime play 113
4.3.2.1.1 Intrapersonal factors 113
4.3.2.1.2 Sociocultural factors 116
4.3.2.1.3 Physical environmental/policy factors 117
4.3.2.2 Children's perceptions of the correlates of after-school physical activity 120
4.3.2.2.1 Intrapersonal factors 120
4.3.2.2.2 Sociocultural factors 121
4.3.2.2.3 Physical environmental/policy factors 124
4.4 Discussion 133

4.4.1 Strengths and limitations 140
4.4.2 Future research and practical implications 141
4.5 Conclusion 142
4.6 Summary of Chapters 2 and 3: item identification 143
5 Development of the Y-PASS questionnaires 151
5.1 Introduction 151
5.2 Theoretical and child developmental considerations to questionnaire development 154
5.2.1 Child development and literacy considerations 155
5.3 Step One: item generation, structure and administration mode of the Y-PASS questionnaires 156
5.3.1 Item generation of the Y-PASS questionnaires 156
5.3.1.1 Lunchtime and after-school specific measures 156
5.3.1.1.1 Demographic items 157
5.3.1.1.2 Correlate items 157
5.3.1.1.3 Activity checklists 158
5.3.2 Structure of the Y-PASS questionnaires 163
5.3.2.1 Questionnaire introduction 163
5.3.2.2 Definition of common terms 164
5.3.2.3 Item order 165
5.3.2.4 Response format 166
5.3.2.5 Visual stimuli 167
5.3.2.6 Item wording and readability 167
5.3.2.7 Scoring mode 169
5.3.3 Administration mode of the Y-PASS questionnaires 169
5.3.3.1 Online computer-delivered format 169
5.3.3.2 Administration techniques 171
5.4 Step Two: expert panel review 172
5.4.1 Methods 173
5.4.1.1 Participants and sampling 173

5.4.1.2 Procedure 173
5.4.2 Results 175
5.4.2.1 Demographic items 175
5.4.2.2 Terminology 175
5.4.2.3 Response format 178
5.4.2.4 Order 179
5.4.2.5 Length 179
5.4.2.6 Readability 180
5.4.2.7 Additional correlates 181
5.4.3 Summary 183
5.5 Step Three: pilot testing 183
5.5.1 Study aims 184
5.5.2 Methods 184
5.5.2.1 Participants and sampling 184
5.5.2.2 Procedure 185
5.5.3 Results 188
5.5.3.1 Pilot study 1 188
5.5.3.2 Pilot study 2 191
5.5.4 Summary 193
6 Assessment of the psychometric properties of the Y-PASS questionnaires 195
6.1 Factor analysis and item reduction 196
6.1.1 Methods 197
6.1.1.1 Participants and sampling 197
6.1.1.2 Ethical approval 201
6.1.1.3 Y-PASS questionnaire administration 201
6.1.1.4 Statistical analysis 201
6.1.2 Results 209
6.1.2.1 Evaluation of the appropriateness of factor analysis 209
6.1.2.2 Extraction of factors 211
6.1.2.3 Factor rotation and interpretation 215
6.1.2.3.1 Lunchtime Y-PASS questionnaire 215
6.1.2.3.1.1 Intrapersonal subscale 215

6.1.2.3.1.2 Sociocultural subscale 219
6.1.2.3.1.3 Physical environmental/policy subscale 220
6.1.2.3.2 After-school Y-PASS questionnaire 222
6.1.2.3.2.1 Intrapersonal subscale 222
6.1.2.3.2.2 Sociocultural subscale 227
6.1.2.3.2.3 Physical environmental/policy subscale 230
6.1.2.4 Item reduction 234
6.1.3 Discussion 237
6.1.3.1 Limitations and strengths 239
6.1.4 Conclusion 240
6.2 Test-retest reliability study 241
6.2.1 Methods 242
6.2.1.1 Participants and sampling 242
6.2.1.2 Ethics 243
6.2.1.3 Measures 243
6.2.1.3.1 The LEAP II questionnaire 243
6.2.1.3.2 Lunchtime and after-school Y-PASS questionnaires 248
6.2.1.4 Data collection procedure 248
6.2.1.5 Data reduction 259
6.2.1.6 Statistical analysis 259
6.2.2 Results 260
6.2.2.1 Participant characteristics 260
6.2.2.2 Test-retest reliability 260
6.2.3 Discussion 266
6.3 Summary of Chapters 5 and 6: questionnaire development 271
7 Assessment of the predictive utility of the Y-PASS questionnaires 273
7.1 Introduction 273
7.2 Study aims and design 276
7.3 Methods 276
7.3.1 Participants and sampling 276
7.3.1.1 Power analysis 277

7.3.2 Instruments 278
7.3.2.1 Generic correlate questionnaire: LEAP II questionnaire 278
7.3.2.2 Context-specific correlate questionnaires: lunchtime Y-PASS and after-school Y-PASS questionnaires 278
7.3.2.2.1 Lunchtime Y-PASS questionnaire 278
7.3.2.2.2 After-school Y-PASS questionnaire 279
7.3.2.3 Objective physical activity measurement 280
7.3.2.3.1 Protocol for the number of days to be measured 281
7.3.2.4 Anthropometry measures 283
7.3.2.5 Demographic measures 284
7.3.2.6 Activity checklist 284
7.3.3 Data collection procedure 285
7.3.4 Data reduction and cleaning 287
7.3.4.1 Accelerometer data cleaning and reduction 287
7.3.4.2 Activity checklist data reduction 289
7.3.4.3 Imputation of missing questionnaire data 289
7.3.4.4 Questionnaire scoring 290
7.3.5 Data analysis 291
7.4 Results 293
7.4.1 Participants 293
7.4.1.1 Response rates 293
7.4.1.2 Demographic characteristics 295
7.4.2 Activity profile for whole sample 296
7.4.2.1 Objective measurement of physical activity 296
7.4.2.2 Activity checklists 298
7.4.2.3 Summary of activity profile 298
7.4.3 Predictors of lunchtime and after-school physical activity 301
7.4.3.1 Lunchtime Y-PASS questionnaire for predicting lunchtime physical activity 301
7.4.3.2 After-school Y-PASS questionnaire for predicting after-school physical activity 304
7.4.3.3 LEAP II questionnaire for predicting lunchtime physical activity 307
7.4.3.4 LEAP II questionnaire for predicting after-school physical activity 308

7.4.4 Comparison of the predictive utility of the Y-PASS questionnaires and the LEAP II questionnaire 311
7.5 Discussion 312
7.5.1 Predictive utility of a context-specific correlate questionnaire and a generic correlate questionnaire 313
7.5.2 Predictors of lunchtime and after-school physical activity 319
7.5.2.1 Predictors of lunchtime physical activity 323
7.5.2.2 Predictors of after-school physical activity 327
7.5.2.3 Summary of the predictors identified by the LEAP II questionnaire 329
7.5.3 Physical activity behaviour during the lunchtime and after-school periods ..332
7.5.4 Strengths and limitations 337
7.5.5 Practical implications and future recommendations 339
7.6 Conclusion 341
8 Conclusion 344
8.1 Summary of the main findings 346
8.1.1 Study One: systematic review of the correlates of children's lunchtime and after-school physical activity 346
8.1.2 Study Two: qualitative exploration of children's perceptions of potential correlates of lunchtime and after-school physical activity 347
8.1.3 Study Three: development of the Y-PASS questionnaires 349
8.1.4 Study Four: assessment of the predictive utility of the Y-PASS questionnaires 350
8.1.5 Summary 353
8.2 Implications and future research 356
8.3 Final conclusion 362
REFERENCES 363
APPENDICES 409
Appendix 1: Methodology quality assessment of studies included in the systematic review 409

Appendix 2: Ethics approval letters 413
Appendix 3: Recruitment material for the focus group study 417
Appendix 4: Focus group procedures 424
Appendix 5: Summary of the correlates, number of items and the source of items for Draft One the Y-PASS questionnaire 434
Appendix 6: Invitation letter to the panel of experts 439
Appendix 7: Recruitment material for the pilot studies 440
Appendix 8: Feedback form for the pilot study 443
Appendix 9: Recruitment material for the factor analysis study 444
Appendix 10: Recruitment material for the reliability study 449
Appendix 11: Lunchtime and after-school Y-PASS questionnaires 454
Appendix 12: Administration scripts for the Y-PASS questionnaires and LEAP II questionnaire 482
Appendix 13: The LEAP II questionnaire 487
Appendix 14: Recruitment material for the predictive utility study 501
Appendix 15: Accelerometer instruction sheet and log sheet 507
Appendix 16: Variance Inflation Factor scores 509
Appendix 17: Univariate analyses between the potential predictor factors and predictor items and lunchtime and after-school physical activity 512
Appendix 18: Complete list of activities identified from the activity checklist (for boys and girls) 517

LIST OF FIGURES

Figure 1.1 Spectrum of physical activity characteristics 5

Figure 1.2 A visual depiction of the thesis structure 10

Figure 3.1 Flow chart of search results 72

Figure 5.1 Steps in questionnaire development 153

Figure 7.1 Standardised coefficients for the Y-PASS predictors of lunchtime physical activity in boys (blue) and girls (red) 303

Figure 7.2 Standardised coefficients for the Y-PASS predictors of after-school physical activity in boys (blue) and girls (red) 306

Figure 7.3 Standardised coefficients for the LEAP II questionnaire predictors of lunchtime physical activity in boys (blue) and girls (red) 308

Figure 7.4 Standardised coefficients for the LEAP II questionnaire predictors of after-school physical activity in boys (blue) and girls (red) 310

Figure 7.5 Effect size (R^2) of the questionnaires for predicting context-specific physical activity (tolerance intervals are represented by the error bars) 312

Figure 8.1 Studies implemented toward the development and testing of the Y-PASS questionnaires 346

LIST OF TABLES

Table 1.1 The behavioural epidemiology framework applied to physical (in)activity behaviour 3

Table 2.1 Contribution of lunchtime MVPA to daily physical activity levels and physical activity recommendations 28

Table 2.2 Contribution of after-school MVPA to daily physical activity levels and physical activity recommendations 33

Table 2.3 Overview of findings from reviews of correlates of children's habitual physical activity 41

Table 2.4 Specificity characteristics of measures used in lunchtime and after-school physical activity studies....59

Table 3.1 Characteristics of the studies included in the systematic review....75

Table 3.2 Summary of the associations of potential correlates with school break time physical activity across cross-sectional studies (n=7) 80

Table 3.3 Summary of the associations of potential correlates with school break time physical activity across intervention studies (n=5) 85

Table 3.4 Summary of the associations of potential correlates with after-school physical activity across cross-sectional studies (n=10) 86

Table 4.1 Focus group questions and procedures 109

Table 4.2 Complete list of correlates relating to lunchtime and after-school physical activity identified during the focus group discussions....127

Table 4.3 Summary of the correlates of lunchtime physical activity (identified through the focus groups and systematic review) 144

Table 4.4 Summary of the correlates of after-school physical activity (identified through the focus groups and systematic review) 147

Table 5.1 Lunchtime activity checklist 159

Table 5.2 After-school activity checklist 160

Table 5.3 Flesch-Kincaid Grade level and Flesch Reading Ease scores for the Y-PASS questionnaires used for pilot studies....168

Table 5.4 Summary of members of the expert review panel 174

Table 5.5 Summary of items removed from first draft of the Y-PASS questionnaires ...181

Table 5.6 Summary of additional items included in the Y-PASS questionnaires based on recommendations from the expert panel....182
Table 5.7 Frequency distribution of pilot study participants (n=21)....185
Table 5.8 Questions asked during the evaluation of the Y-PASS questionnaires....187
Table 6.1 Subject to item ratio for each subscale....200
Table 6.2 Lunchtime subscales: intrapersonal, sociocultural and physical environmental/policy....203
Table 6.3 After-school subscales: intrapersonal, sociocultural, physical environmental/policy....205
Table 6.4 Cronbach alpha, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity for the intrapersonal, sociocultural and physical environmental/policy subscales of the Y-PASS questionnaires....210
Table 6.5 Lunchtime intrapersonal subscale (27 items)....212
Table 6.6 Lunchtime sociocultural subscale (9 items)....212
Table 6.7 Lunchtime physical environmental/policy subscale (14 items)....213
Table 6.8 After-school intrapersonal subscale (47 items)....213
Table 6.9 After-school sociocultural subscale (28 items)....214
Table 6.10 After-school physical environmental/policy subscale (34 items)....214
Table 6.11 Factor analysis after rotation (sorted by size) for the lunchtime intrapersonal subscale, rotated component matrix (n=189)....217
Table 6.12 Factor analysis after rotation (sorted by size) for the lunchtime sociocultural subscale, rotated component matrix (n=189)....219
Table 6.13 Factor analysis after rotation (sorted by size) for the lunchtime physical environmental/policy subscale, rotated component matrix (n=189)....221
Table 6.14 Factor analysis after rotation (sorted by size) for the after-school intrapersonal subscale, rotated component matrix (n=240)....224
Table 6.15 Factor analysis after rotation (sorted by size) for the after-school sociocultural subscale, rotated component matrix (n=240)....228
Table 6.16 Factor analysis after rotation (sorted by size) for the after-school physical environmental/policy subscale, rotated component matrix (n=240)....231
Table 6.17 Items removed from the lunchtime Y-PASS questionnaire....235
Table 6.18 Items removed from the after-school Y-PASS questionnaire....236

Table 6.19 Summary of published psychometric properties of the LEAP II questionnaire 247
Table 6.20 List of potential predictor factors and predictor items for Draft Four of the lunchtime Y-PASS questionnaires 249
Table 6.21 List of potential predictor factors and predictor items for Draft Four of the after-school Y-PASS questionnaires 252
Table 6.22 Reliability for the lunchtime and after-school Y-PASS questionnaires 262
Table 6.23 Reliability of the online LEAP II questionnaire 266
Table 7.1 Summary of valid datasets used in analyses 294
Table 7.2 Demographic characteristics of the sample 295
Table 7.3 Descriptive details of accelerometer data for different time periods 297
Table 7.4 The top ten most reported lunchtime activities 299
Table 7.5 The top ten most reported after-school activities 300
Table 7.6 Results of the CCR analyses to explain lunchtime physical activity in boys (n=186) and girls (n=215) using the lunchtime Y-PASS questionnaire 302
Table 7.7 Results of the CCR analyses to explain after-school physical activity in boys (n=179) and girls (n=208) using the after-school Y-PASS questionnaire 305
Table 7.8 Results of the CCR analyses to explain lunchtime physical activity in boys (n=196) and girls (n=208) using the LEAP II questionnaire 307
Table 7.9 Results of the CCR analyses to explain after-school physical activity in boys (n=185) and girls (n=200) using the LEAP II questionnaire 309
Table 7.10 Specificity characteristics of measures used in lunchtime and after-school physical activity studies 317
Table 7.11 A summary of the primary predictors of children's lunchtime and after-school physical activity 321
Table 7.12 Contribution of lunchtime MVPA to daily physical activity levels and physical activity recommendations 334
Table 7.13 Contribution of after-school MVPA to daily physical activity levels and physical activity recommendations 336

DEFINITION OF TERMS

The following definitions are provided specific to the context of this research:

After-school period	The end of the school day until the evening meal (i.e. approximately 3.00 pm – 6:00 pm) (Atkin, Gorely, Biddle, Marshall, & Cameron, 2008).
Children	Here defined as individuals aged 10 – 14 years.
Context	All the temporal, environmental and social characteristics of and circumstances in which physical activity occurs.
Correlates	Factors that demonstrate reproducible associations or predictive relationships with physical activity (Bauman, Sallis, Dzewaltowski, & Owen, 2002).
Factors	Variables that have not yet been tested for an association with physical activity.
Lunchtime period	The main scheduled break time during the school day, where children have the opportunity to play after eating lunch.
Metabolic equivalent (MET)	Used as an index of the intensity of activities. One MET is energy consumed at rest (Sallis & Owen, 1999, p. 10).
Moderate physical activity (MPA)	Activity requiring three to six times as much energy as rest (≥ 3 METs, < 6 METs) (Pate et al., 1995; Sallis & Owen, 1999).
Moderate to vigorous physical activity (MVPA)	Activity requiring greater than three times as much energy as rest (≥ 3 METs) (Pate, et al., 1995; Sallis & Owen, 1999).

Physical activity	Any bodily movement produced by skeletal muscles that results in caloric expenditure (Caspersen, Powell, & Christenson, 1985). Physical activity is often classified by four main characteristics: type, duration, intensity and frequency (Welk, 2002).
Physical inactivity	An absence of physical activity (Biddle, Gorely, Marshall, Murdey, & Cameron, 2004).
Predictors	Correlates that have a predictive relationship with physical activity (Bauman, et al., 2002).
Sedentary behaviour	A distinct class of behaviours characterised by low energy expenditure (e.g. TV viewing) (Biddle, Gorely, Marshall, et al., 2004).
Vigorous physical activity (VPA)	Activity requiring greater than or equal to six times as much energy as rest (≥ 6 METs) (Pate, et al., 1995; Sallis & Owen, 1999).

LIST OF PUBLICATIONS AND PRESENTATIONS ARISING FROM THIS THESIS

PUBLICATIONS (peer-reviewed)

Stanley, R.M., Boshoff, K. & Dollman, J. (2012). A qualitative exploration of the 'critical window': factors affecting Australian children's after-school physical activity. *Journal of Physical Activity and Health*, *9*, 33-41.

Stanley, R.M., Ridley, K. & Olds, T. (2011). The type and prevalence of activities performed by Australian children during the lunchtime and after-school periods. *Journal of Science and Medicine in Sport, 14*(3), 227-232.

Stanley, R.M., Boshoff, K. & Dollman, J. (2012). Voices in the playground: a qualitative exploration of the barriers and facilitators of lunchtime play. *Journal of Science and Medicine in Sport*, *15*(1), 44-51.

Stanley, R.M., Ridley, K. & Dollman, J. (2012). Correlates of children's time-specific physical activity: a review of the literature. *International Journal of Behavioral Nutrition and Physical Activity, 9*(50).

CONFERENCE PODIUM PRESENTATIONS (peer-reviewed)

Stanley, R.M. (2009). Voices at play: children's perceptions of what influences their lunchtime play. *Being Educated in Contemporary Australia Conference*, Flinders University, Adelaide, Nov 23.

Stanley, R.M., Dollman, J., Boshoff, K. & Ridley, K. (2010). Voices at play: children's perceptions of what influences their lunchtime physical activity. *Obesity Research and Clinical Practice: Abstracts of the Australian and New Zealand Obesity Society Annual Scientific Meeting*, *4*(Suppl 1), s52.

Stanley, R.M., Ridley, K. & Olds, T. (2011). What activities are Australian kids engaging in at lunchtime and after school? *Annual Meeting of the International Society for Behavioral Nutrition and Physical Activity*, Melbourne, Australia, June 15-18.

Stanley, R.M. & Olds, T. (2012). Intra-individual consistency of physical activity at different periods of the school day: Implications for measurement. Annual Meeting of the *International Society for Behavioral Nutrition and Physical Activity*, Austin, Texas, May 23-26.

POSTER PRESENTATIONS (peer-reviewed)

Stanley, R.M. (2009). Children's perceptions of the factors that influence lunchtime and after-school physical activity. *Journal of Science and Medicine in Sport*, *12*(6), 118-119.

ABSTRACTS ACCEPTED FOR CONFERENCE PODIUM PRESENTATIONS (peer-reviewed)

Stanley, R.M., Olds, T., Ridley, K. & Dollman, J. (2012). Increasing specificity to correlate research: can we improve the prediction of children's context-specific physical activity? Abstract accepted for presentation at the *4th International Congress on Physical Activity and Public Health*, Sydney, Australia, Oct 31-Nov 3.

SUMMARY

The lunchtime and after-school contexts are two important and characteristically unique periods of the school day when children have an opportunity to engage in physical activity. However, evidence shows that a disturbingly high percentage of children are not engaging in adequate levels of physical activity during these periods. Efforts to increase physical activity levels during these periods have had modest and short lived outcomes. It has been proposed that increasing the specificity of correlate research can improve prediction and understanding of context-specific physical activity. The primary aims of this research were to (1) compare the predictive utility of a context-specific questionnaire, the "Youth Physical Activity Survey for Specific Settings" (Y-PASS), with a generic correlate questionnaire in predicting children's lunchtime and after-school physical activity, and (2) identify the predictors of lunchtime and after-school physical activity in South Australian children aged 10-14 years.

Using a mixed method design, four related studies were implemented to address the main research aims, with each study contributing evidence toward the development and testing of the context-specific correlate questionnaires. **Study One** was a systematic review of the current quantitative literature to identify intrapersonal, sociocultural and physical environmental/policy correlates of children's lunchtime and after-school physical activity. **Study Two** was a descriptive qualitative focus group study conducted with 54 South Australian children to identify their perceptions of the factors that influence children's lunchtime and after-school physical activity. This study was developed to supplement the findings from the systematic review to ensure that all possible factors were identified prior to developing the questionnaire items. The pool of potential correlates identified from the systematic review and the focus group discussions were transformed into context-specific items relating to the different domains of the social ecological model (intrapersonal, sociocultural and physical environmental/policy domains). The psychometric properties of the context-specific correlate questionnaires were tested in **Study Three**. Face and content validity of the questionnaires were established and refined through an evaluation of item content, design and usability by an expert review panel and a subsample of the targeted

population. Factorial structure (using an exploratory factor analysis), internal consistency and test-retest reliability were also investigated. All subscales demonstrated acceptable internal consistency, except for the lunchtime sociocultural subscale, which demonstrated moderate internal consistency, and fair to almost perfect test-retest reliability.

Study Four tested the utility of the questionnaires in predicting children's lunchtime and after-school physical activity and investigated the predictors of lunchtime and after-school physical activity. Physical activity was assessed using accelerometers. Context-specific correlates were assessed using the Y-PASS questionnaires and the LEAP II questionnaire was used as the generic correlate instrument. Multivariate analysis using Correlated Component Regression for linear regression models was conducted to derive predictors of context-specific physical activity and to determine the percentage of variance explained by the prediction equations. Overall, the prediction of context-specific lunchtime and after-school physical activity was stronger using a context-specific correlate questionnaire rather than a generic correlate questionnaire, except for girls' after-school physical activity.

In light of a number of limitations in the current correlate literature, the poor prediction of physical activity and modest performance of physical activity interventions, there has been a call for a conceptual shift in how correlate research is conducted. This thesis has revealed some important correlate research implications, with a view to contributing to the continuing and evolving conceptual development of correlate theory.

DECLARATION

I declare that:

- this thesis presents work carried out by myself and does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university;
- to the best of my knowledge it does not contain any materials previously published or written by another person except where due reference is made in the text; and all substantive contributions by others to the work presented, including jointly authored publications, is clearly acknowledged.

_____

Rebecca Megan Stanley

Date:_____

ACKNOWLEDGEMENTS

There are a number of people who I would like to acknowledge and thank for their assistance and support throughout my PhD studies.

To my supervisor, Dr Jim Dollman, thank you so much for all your guidance and support. You inspired me to undertake this PhD from the very moment I met you during my honours and have continued to give endless time, encouragement and scholarly advice. To my associate supervisors, Dr Kate Ridley, Dr Kobie Boshoff and Prof Tim Olds, all of you have challenged me and push me to my limits. I have achieved more than I could have ever expected and this would not have been possible without your dedication and generous support. I am extremely fortunate to have such a talented supervisory team.

I would also like to extend my gratitude to all my research assistants who helped me along the way. Leanne Martin, Kerry McCarthy, Michael O'Reilly, Caitlin Stanley, Lauren Gillis, Breanna Dolman, Tom Bowler and Katia Ferrar, I would not have been able to get through data collection without you. Thank you for being an amazing, reliable and hardworking team. I wish you all the best with whatever path you decide to take.

Thank you also to the children, parents and schools who participated in each study. Your enthusiasm and willingness to take part has made this thesis possible.

Many thanks need to go to John Petkov for his statistical expertise. You have challenged the norm and push the boundaries in this area of research, which has made an invaluable contribution to my thesis. I really appreciate everything you have given me and I thank you and your wife for opening your home to me and only being a phonecall or email away during the "emergency moments".

Thank you to Dr Nicky Ridgers, Dr Emily Brindal, Dr Katherine Dix, Dr Greg Yates and Dr Tricia Knott for giving up your time and sharing your expert advice on questionnaire development, focus groups and correlate research. Your guidance has led to many valuable improvements to this thesis.

To David Beaumont, words cannot express how appreciative I am of your friendship and generous support in helping me solve my technological issues during the development of the online questionnaires. One day I hope I can return the favour.

To my fellow Health and Use of Time Group colleagues, Emily Vaughton, Louise Wiles, Natasha Schranz, Nicole Lewis, Lucy Lewis, Sjaan Gomersall, Carol Maher, Katia Ferrar and Julie Walters, I would like to extend a massive thank you for your friendship and support during my whole PhD. You were always there to help me through any problem, celebrate the milestones or encourage me to take a break with a walk or a coffee when things just got too much.

I would like to acknowledge and thank the Australian Government and the University of South Australia for providing me with a PhD scholarship and the financial and technical support needed to complete my thesis.

On a more personal note, I would like to thank all my friends and family for keeping me sane while I completed my thesis. I am extremely fortunate to have such a supportive and loving group of people around me. Whether it was taking me out for a coffee or dinner, going for a walk, encouraging me to go to a dance class, or sending a text message, I am so appreciative of all these gestures and I hope one day I can give back as much as you have given me. There are a few people I would like to thank individually. Firstly, to Scott Guy, thank you so much for your love and support during my PhD, especially towards the end. I am so appreciative of everything you have done for me, especially when I needed an extra pair of hands during data collection. You have always been there for me, encouraging me to keep going, and I simply couldn't have finished the final year without you.

Finally, to my wonderful family, words cannot express how grateful I am for everything you have done for me. I would not be where I am today without your endless love, encouragement and support. From day one, you have inspired me and given me the tools to achieve this PhD. In particular, I would really like to thank Mum and Dad for reading and helping me edit and format my thesis, and for helping take the load off when things became too overwhelming (you don't understand how much a simple cup of tea, a shopping trip or a night watching movies on the couch helped me get through). All of you have been my rock during this whole process and I love you all very much.

CHAPTER 1

Introduction

Chapter 1

1 Introduction

Society has changed considerably over recent decades due to technological advancements and environmental changes. The invention and increased availability of new technologies that promote passivity, such as television (TV), computers and passive transport modes; increased safety concerns in the neighbourhood, such as “stranger danger”; and changes in school curricula, such as the reduction or elimination of physical education time, all contribute to reduced opportunities for children to be active in a multitude of contexts (Smith & Biddle, 2008). Consequently, a number of children are not obtaining sufficient levels of physical activity (Commonwealth of Australia, 2008), placing them at increased risk of developing chronic lifestyle-related health conditions, such as type 2 diabetes, cardiovascular disease and obesity (Riddoch, 1998; U.S. Department of Health and Human Services, 2008).

Youth of today are constantly faced with an array of appealing sedentary and energy-minimising pursuits (Biddle, Gorely, & Stensel, 2004; Thompson, Baxter-Jones, Mirwald, & Bailey, 2003). With the knowledge of the health benefits of physical activity, researchers, policy-makers and professionals are faced with a significant challenge in promoting physical activity among youth populations within this technology-saturated society. International and national government and non-government organisations, such as the World Health Organisation (World Health Organisation, 2000, 2010), the National Health and Medical Research Council (National Health and Medical Research Council, 1997) and the Australian Department of Health (Commonwealth of Australia, 2003), are recognising this as a significant public health challenge and a priority for health research. Position statements and policy documents on physical activity promotion have been released (Australian Research Council, 2008; World Health Organisation, 2004), highlighting the need for a greater understanding of physical activity and the factors that influence children’s choice between active and inactive pursuits (Biddle, Gorely, Marshall, et al., 2004; Thompson, et al., 2003).

1.1 Behavioural epidemiology framework

The use of a behavioural epidemiology framework has been advocated in the research of physical activity behaviour (Sallis, Owen, & Fotheringham, 2000). The behavioural epidemiology framework used in physical activity research specifies five main research phases (see Table 1.1), with one of the priority areas being the need to identify correlates that influence behaviour (highlighted below in blue). The design and development of interventions need to be informed by the correlate literature and theories or models of health behaviour. The major challenge with physical activity intervention design is to target the primary correlates which have been shown to be associated with physical activity behaviour in the specific context in which the intervention will be implemented.

Table 1.1 The behavioural epidemiology framework applied to physical activity behaviour

Phase	Purpose	Example
I	Establish the links between physical activity and health	Determine the dose-response relationships between level and patterns of physical activity and excess adiposity among children.
II	Develop methods for accurately assessing physical activity	Establish the validity and reliability of a self-report measure of time-use
III	Identify correlates that influence levels of physical activity	Identify modifiable intrapersonal, social and environmental correlates of lunchtime and after-school physical activity.
IV	Evaluate interventions to increase physical activity	Conduct a randomised controlled trial to increase light physical activity among adolescents.
V	Translate research into practice	Incorporate a new program into a school health promotion curriculum to help increase children's physical activity between 3:00 pm and 6:00 pm.

Notes: Adapted from Sallis, Owen and Fotheringham (2000).

1.2 Importance of context

Physical activity is a complex behaviour that is typically characterised by type (or mode), intensity, frequency and duration (Smith & Biddle, 2008; Welk, 2002). More recently however, researchers have been exploring physical activity in relation to a relatively new, and subsequently less frequently studied 'context' characteristic (Giles-Corti, Timperio, Bull, & Pikora, 2005; Smith & Biddle, 2008). The context can be considered as a multi-dimensional acknowledgement of all the characteristics of physical activity and the circumstances in which physical activity occurs (Giles-Corti, et al., 2005; Smith & Biddle, 2008). Context in essence 'personalises' the physical activity behaviour to a particular person, time, place and activity type. By contextualising physical activity behaviour, the interpretation and relationships with health and well-being and physical activity correlates become specific and multi-dimensional, rather than one dimensional and generic. Figure 1.1 shows a basic representation of the spectrum of physical activity characteristics from one dimensional and generic at one end, progressing through to multi-dimensional and context-specific at the other end of the spectrum.

Why is the context of physical activity important? The context of physical activity can affect health and well-being relationships (Samitz, Egger, & Zwahlen, 2011). In addition, the relative importance of correlate relationships can vary with the context of physical activities because children behave differently in different contexts (Giles-Corti & King, 2009; Giles-Corti, et al., 2005). For example, investigating the amount of walking a child does in a day may present very different health outcomes and correlate relationships to the investigation of context-specific walking around the school yard at lunchtime with friends. This knowledge is vital for the development of evidence-based physical activity interventions.

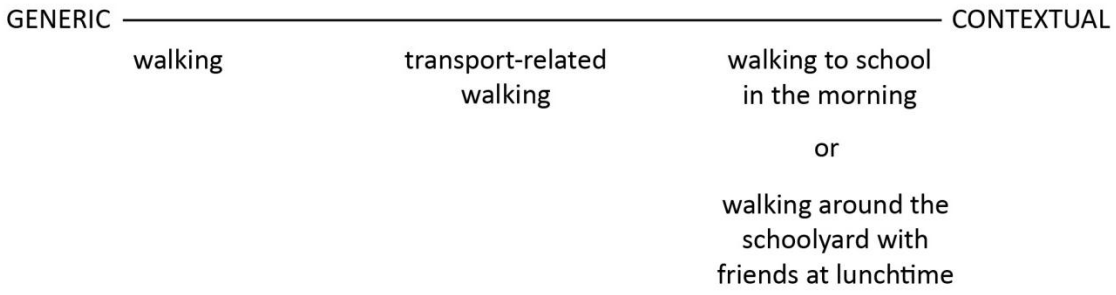


Figure 1.1 Spectrum of physical activity characteristics

Context-specific physical activity classification allows for the integration of multiple characteristics, all of which may play varying but important roles in the relationships with correlates and health outcomes. This information is essential to understand and improve the health and well-being of children. For the purpose of this thesis, the physical activity context is defined by the **time period** (e.g. lunchtime or after school). This definition also encompasses, but will not be specifically stratified by the **type of activity** (e.g. lunchtime play, organised sports and activities, non-organised activities or active transport) and the **location of activity** (e.g. school, home, or in the neighbourhood) during the designated **time period**. The lunchtime and after-school contexts have been identified as two critical windows during a school day for physical activity promotion (Beighle, Morgan, Le Masurier, & Pangrazi, 2006; Mota, Santos, Guerra, Ribeiro, & Duarte, 2003). These contexts are considered discretionary periods where children are able to make some choices about their participation in physical activity (Beighle, et al., 2006) and will form the focus of this research.

1.3 Physical activity interventions

In response to concerns about children not achieving the recommended physical activity levels, a number of interventions have been designed in an attempt to increase physical activity in children, with varying degrees of success (Salmon, Booth, Phongsavan, Murphy, & Timperio, 2007). A number of systematic reviews have been conducted on the effectiveness of interventions to promote physical activity in children (Atkin, Gorely, Biddle, Cavill, &

Foster, 2011; Jago & Baranowski, 2004; Ridgers, Stratton, & Fairclough, 2006; Salmon, et al., 2007; Van Sluijs, McMinn, & Griffin, 2007). Salmon et al. (2007) and Van Sluijs et al. (2007) found that only 38% and 47% of the interventions reviewed had a statistically significant positive effect on children's physical activity, respectively. Of these interventions, the effect on physical activity was only small and short lived.

Using the behavioural epidemiology framework, the modest performance of published interventions may be attributed to the inability to accurately assess physical activity behaviour and physical activity correlates, the use of physical activity and correlate measures with unknown reliability and validity (Salmon, et al., 2007) and the application of a "one size fits all approach" to intervention design. Interventions may be targeting factors that are of secondary importance or inappropriate factors that are not relevant to a specific physical activity context under investigation or participant sub-groups (Thomas, 2006). For example, when children participate in organised sports, their perceived competence may have a stronger role in their participation compared to their lunchtime play. If perceived competence is not a strong predictor of lunchtime physical activity then it could be assumed that this would not be the focus of interventions aiming to increase lunchtime physical activity. Baranowski et al. (1998) argue that interventions which target the primary modifiable predictors of behaviour should be more effective in changing behaviour, yet these modifiable physical activity predictors are not well researched, particularly in specific contexts, such as the lunchtime and after-school periods, and are seldom applied to intervention designs (Sallis, Owen, et al., 2000).

1.4 Assessment of correlates

In order to identify the correlates of physical activity, there is a need for accurate assessment of these correlates in specific contexts. However, there is limited research on (1) how to accurately identify potential physical activity correlates, with a number of studies focusing on hypothesised factors which are often adult-inferred and may or may not be relevant to the context under investigation, and (2) the relative strength of these correlates in predicting behaviour in different contexts. This is a significant gap in the area of physical activity epidemiology and needs to be the focus of future research. Due to the modest

performance of interventions delivered to children, researchers are calling for additional research into context-specific predictors of children's physical activity from a social ecological perspective (Baranowski, et al., 1998; Dunton, Berrigan, Ballard-Barbash, Graubard, & Atienza, 2009; Sallis, Prochaska, & Taylor, 2000). The accurate assessment and identification of context-specific physical activity correlates will assist researchers in better understanding children's physical activity behaviours and the correlates of physical activity, which in turn helps focus intervention designs to target correlates that are most likely to bring about positive physical activity behaviour change (Baranowski, et al., 1998; Dunton, Berrigan, et al., 2009; Sallis, Prochaska, et al., 2000).

1.5 Research purpose, questions and aims

The overall purpose of this research is to improve the prediction of children's physical activity behaviour, according to the behavioural epidemiology framework (Sallis, Owen, et al., 2000). To improve the prediction and understanding of physical activity behaviour and advance the field of correlate research and intervention design, it has been acknowledged that there is a need to consider attitudinal research (Ajzen & Fishbein, 1980) by introducing greater specificity to physical activity outcome measurement and physical activity correlate measurement (Giles-Corti, et al., 2005). This in turn will contribute to future efforts aimed at promoting children's physical activity. To date, only one study has tested this concept for children's context-specific physical activity (e.g. lunchtime and after-school physical activity) from a social ecological perspective (Ommundsen, Klasson-Heggebo, & Anderssen, 2006). This research aims to further the context-specific physical activity work of Ommundsen et al. (2006) by exploring correlates of objectively measured lunchtime and after-school physical activity using context-specific questionnaires and addressing some of the methodological limitations of the previous work.

A number of different correlate measures exist in the literature. Only a few have been used to investigate the correlates of children's lunchtime and after-school physical activity. However, no single measure contains all the following components: (1) assesses all domains of the social ecological model, (2) contains specifically worded items for the lunchtime and after-school periods, and (3) assesses correlates which have been conceptualised and

defined by children. Therefore, there is a need to develop a questionnaire that addresses all of these components.

The overarching aim of this program of research was to develop and trial correlate questionnaires that will measure context-specific intrapersonal, sociocultural and physical environmental/policy correlates of lunchtime and after-school physical activity among South Australian children in Grades 5, 6 and 7.

To address the gaps in the literature and contribute to the current body of evidence, two key questions have been proposed for this program of research:

1. Do context-specific correlate questionnaires predict context-specific physical activity in children better than non-context-specific correlate questionnaires?
2. What are the intrapersonal, sociocultural and physical environmental/policy predictors of children's physical activity occurring in the lunchtime and after-school contexts?

1.6 Study design

Figure 1.2 provides a visual depiction of the structure of this thesis. This program of research followed a mixed method design consisting of four related studies. Each study contributed evidence toward the major steps of questionnaire development and testing (Frazer & Lawley, 2000; Streiner & Norman, 1995). Study One is a systematic review of the current literature to identify any correlates of children's lunchtime and after-school physical activity from existing quantitative studies. This study has been published as a journal article (Stanley, Ridley, & Dollman, 2012) but is presented in the traditional chapter style and forms Chapter 3 of the thesis. Chapter 4 describes Study Two, a descriptive qualitative study conducted with children to identify their perceptions of the factors that influence children's lunchtime and after-school physical activity (Stanley, Boshoff, & Dollman, 2012a, 2012b). This study was developed to supplement the findings from Study One and ensured all possible factors were identified. The results from Study One and Study Two were used to inform Study Three. Chapter 5 describes Study Three which was the development and psychometric

testing of the lunchtime and after-school "Youth Physical Activity Survey for Specific Settings" (Y-PASS), two context-specific correlate questionnaires that measure potential predictors of children's lunchtime and after-school physical activity. In Study Three, the Y-PASS questionnaires were reviewed by a panel of physical activity experts and pilot tested with a sample of South Australian children from Grades 5, 6 and 7. Chapter 6 discusses the assessment of the psychometric properties of the Y-PASS questionnaires, which forms the final component of the questionnaire development. The psychometric properties investigated were the factorial structure and internal consistency through factor analysis and item reduction, and the test-retest reliability of the Y-PASS questionnaires. Chapter 7 describes Study Four which investigated the utility of the questionnaires in predicting children's lunchtime and after-school physical activity using a cross-sectional design. A cross-sectional design is an efficient way of screening potential correlates that might influence context-specific physical activity behaviour (Sallis, Owen, et al., 2000). The aims of this study were to test the effectiveness of the Y-PASS with a generic correlate questionnaire in predicting lunchtime and after-school physical activity and identify the predictors of lunchtime and after-school physical activity. This provided evidence for the need to increase specificity in correlate research in order to better predict physical activity. This thesis culminates with Chapter 8, which summarises the key findings from Studies One, Two, Three and Four, and presents practical implications and avenues for future research.

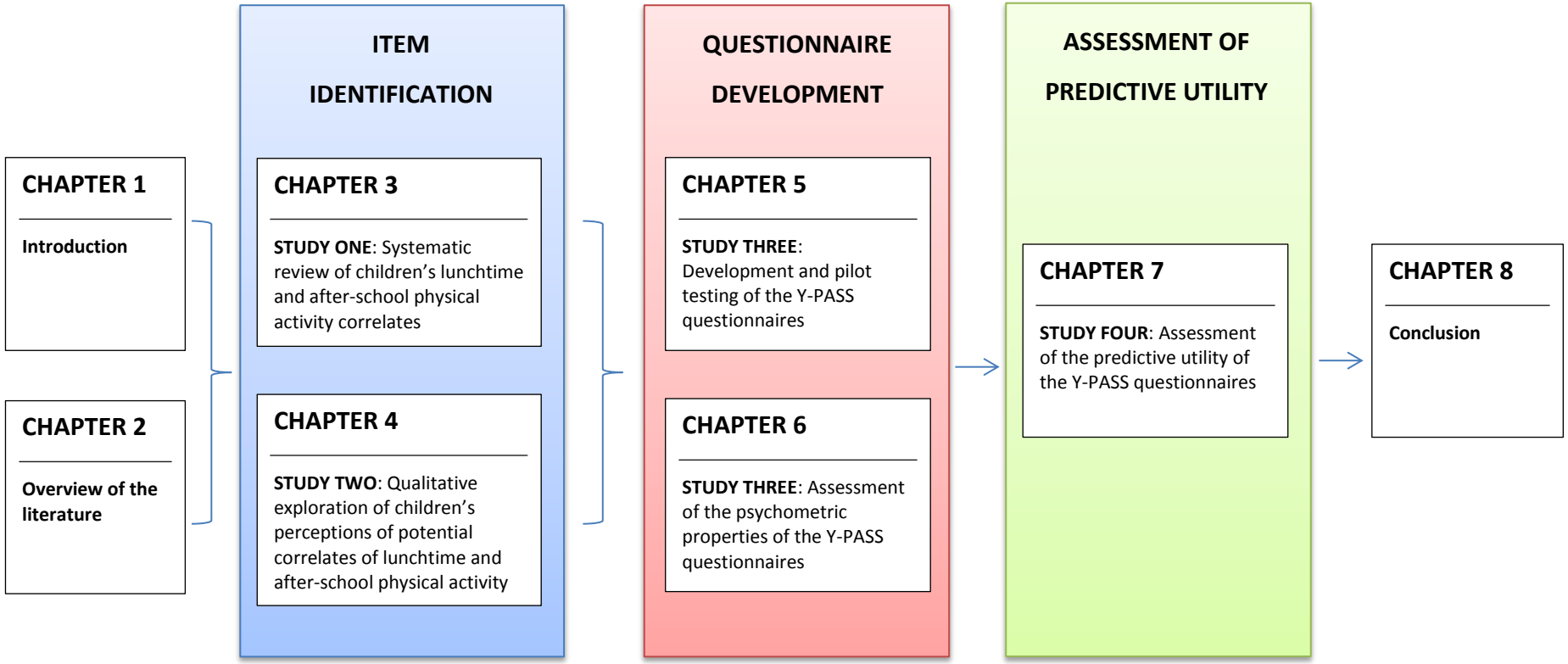


Figure 1.2 A visual depiction of the thesis structure

1.7 The population group for this study

The age group focus for this program of research is children aged 10-14 years. There have been a number of terms used in the literature to define this age group, such as “tween”, which was originally used in market research (Simpson, Douglas, & Schimmel, 1998), “children”, “preadolescents” and “preteens”. Using puberty timing to define preadolescence, there is some confusion as to how to define preadolescence by age in years. Some studies define preadolescence as children aged 8-12 years, 9-14 years, 9-13 years or 12-14 years (Aeffect Inc, 2000; Simpson, et al., 1998). Studies suggest that children are reaching puberty at a much younger age compared to their 19th century counterparts (Danubio & Sanna, 2008; Parent et al., 2003), particularly in specific pubertal biomarkers including breast development and menarche in girls (Euling et al., 2008). This has contributed to the confusion in the age definition of preadolescents. For the purposes of this thesis, preadolescents will be defined as children aged 10-14 years (Grades 5, 6 and 7) and will be referred to as ‘children’ from this point forward.

Regardless of the term or age used to describe this age group, it is a period representing a preadolescent developmental stage of life, where children have left childhood but are not yet considered adolescents or teenagers and are beginning to become more independent from their parents in making decisions, although some parental influence is still apparent (Aeffect Inc, 2000). In terms of pubertal development, preadolescence is a period when changes to the physical appearance and body shape of children begin. Along with these physical changes are changes to children’s self-esteem and perceptions of body image (Thompson, et al., 2003), as well as substantial declines in physical activity levels (Dumith, Gigante, Domingues, & Kohl, 2011; Hills, King, & Armstrong, 2007). Evidence also shows that there are a large percentage of children who are not sufficiently active according to the recommended physical activity guidelines (Commonwealth of Australia, 2008; Nader, Bradley, Houts, McRitchie, & O'Brien, 2008). Having a clear understanding of the factors that influence physical activity will enable the design, development and implementation of appropriate interventions to develop lifelong physical activity behaviours that reduce health consequences of inactivity in this age group.

1.8 Summary

This chapter has outlined the background to the research and described the research purpose, questions, aims and study design. Chapter 2 will present an overview of the literature relating to children's physical activity, particularly children's lunchtime and after-school physical activity, physical activity interventions and correlate research. It will also highlight gaps in the literature and present a discussion on the significance of the research.

CHAPTER 2

Overview of the literature

Chapter 2

2 Overview of the literature

This chapter introduces important background information pertaining to children's physical activity, including a brief introduction to the importance of physical activity, current trends in physical activity and an overview of the correlates of children's daily physical activity. An examination of the importance of modifying the way we explore correlates of physical activity by increasing research specificity will be presented, followed by a rationale for the research. It should be noted that while sedentary behaviour is acknowledged as an important aspect in the overall picture of children's physical activity behaviour, it is not the focus of this thesis and discussions will be directed toward physical activity and physical inactivity.

2.1 Physical activity and health in children

Recognition of physical activity as an integral part of a healthy lifestyle has been well documented in the literature (Biddle & Mutrie, 2008; Pate, et al., 1995; U.S. Department of Health and Human Services, 2008; Warburton, Nicol, & Bredin, 2006). Interest in this field has intensified in recent years among researchers, policy-makers and professionals with the increased prevalence of obesity, diabetes and related disease states among children (Biddle, Gorely, Marshall, et al., 2004; Thompson, et al., 2003). Alongside other healthy behaviours, such as healthy eating, there has been evidence to show that consistent and appropriate participation in physical activity can potentially prevent the development and improve the state of these diseases, thus reducing the risk of premature mortality in adulthood (Barlow, 2007; Biddle, Gorely, Marshall, et al., 2004; Riddoch, 1998; U.S. Department of Health and Human Services, 1996).

Literature discussing the association between health outcomes and physical activity in children is limited compared to the adult-related literature (U.S. Department of Health and Human Services, 1996, 2008). Difficulties in identifying clear health outcomes in children lie

with complications of measuring physical activity behaviour (Trost, 2001; Twisk, 2001; Welk, Corbin, & Dale, 2000) and the time required for diseases to manifest from inactive lifestyles (Biddle, Gorely, & Stensel, 2004; Twisk, 2001). In addition, current evidence has predominantly been drawn from cross-sectional studies or uncontrolled studies, rather than randomised controlled trials (Smith & Biddle, 2008). Despite these limitations and difficulties, it is still clear that engaging in physical activity during childhood can improve current and future health status (Twisk, 2001). A number of systematic reviews have recently been published that summarise the literature exploring the links between physical activity and health outcomes in children (Biddle, Gorely, & Stensel, 2004; Janssen & LeBlanc, 2010; Strong et al., 2005).

Physical activity appears to provide a number of physical, social and psychological benefits for children. Evidence has shown that physical activity has immediate benefits on physical fitness and small but significant benefits on adiposity for the child population (Trost, Sirard, Dowda, Pfeiffer, & Pate, 2003; Twisk, 2001). In particular, the review conducted by Janssen and LeBlanc (2010) reported small but significant benefits of aerobic-based physical activity in reducing adiposity in overweight children. There is evidence that engaging in aerobic-based physical activity can have more favourable outcomes for children who are at a greater risk of cardiovascular disease by lowering blood pressure and blood lipids (Janssen & LeBlanc, 2010; U.S. Department of Health and Human Services, 1996). Physical activity, particularly resistance training and other high-impact activities such as jumping at a moderate intensity, has also been found to be effective in enhancing skeletal health in children (Janssen & LeBlanc, 2010; McKay et al., 2005; Yu et al., 2005). An intervention study found evidence that relatively low doses of activity can significantly increase bone health in pre-pubertal children (McKay, et al., 2005). Only a small number of studies have investigated the changes in psycho-social health in response to a physical activity intervention (Janssen & LeBlanc, 2010). The evidence suggests that aerobic exercise can significantly improve depressive symptoms, such as stress, depression and anxiety (Biddle, Gorely, & Stensel, 2004; Dunn, Trivedi, & O'Neal, 2001; Janssen & LeBlanc, 2010) and improve self-confidence, self-esteem, self-efficacy, energy levels, concentration levels and quality of sleep in children (Biddle, Gorely, & Stensel, 2004; Burdette & Whitaker, 2005).

2.2 Characteristics of physical activity

Physical activity is characterised by, and can differ in regard to type, intensity, frequency, duration and context (Smith & Biddle, 2008; Welk, 2002), and is important in the development of healthy outcomes. The type of physical activity, also known as mode, can refer to the physiological mechanisms involved, such as anaerobic or aerobic, or can refer to features of physical activity, such as weight bearing. In addition, the type of physical activity can also be defined by the mode of physical activity, for example walking, sport or play. Frequency and duration are easily conceptualised, with frequency referring to how often an activity is performed with reference to a time period, such as the number of times per week, and duration defined as the length of time an activity is performed, which is usually in minutes. Intensity refers to the level of effort required to perform an activity. Level of effort can be expressed in a number of different ways, such as the amount of kilojoules expended per minute ($kJ.min^{-1}$) or metabolic equivalents (METs). A MET is the energy expenditure relative to a person's resting metabolic rate. MET values can be categorised into levels of intensity from sedentary (<1.5 METs), light (≥1.5 and <3 METs), moderate (≥3 and <6 METs) and vigorous (≥6 METs) (Pate, et al., 1995). While there has been some debate regarding the classification of MET intensity thresholds for each category for children and adolescents, these are the most commonly used intensity thresholds in the literature (Harrell et al., 2005; Ridley & Olds, 2008). The context of physical activity is the integration of multiple characteristics and the circumstances in which physical activity occurs. These characteristics of physical activity are important components in shaping the dose-response relationships of healthy outcomes and have been used to guide the development of physical activity guidelines for children.

2.3 Physical activity guidelines for children

To achieve health benefits related to physical activity, such as improvement in skeletal health, aerobic fitness, muscle strength and endurance, and adiposity, it is advocated that children should participate in specific amounts, types and modes of physical activity (Biddle, Sallis, & Cavill, 1998). For example, it has been found that engaging in aerobic-based activities that stress the cardiovascular and respiratory system can have significant health benefits. For bone health, children are encouraged to engage in high-impact weight bearing

activities, such as jumping (Janssen & LeBlanc, 2010). For improved mental health, Harvey et al. (2010) found a stronger relationship between leisure activities and mental health compared with non-recreational activities in an adult population, which may be explained by the contextual factors associated with the mode of physical activity. Leisure activities are different from non-recreational activities because there is a greater level of enjoyment and social interaction related to leisure activities compared to non-recreational activities (Harvey, et al., 2010). Similarly, Dunton et al. (2011) found that children's enjoyment of leisure activities was higher when performed outdoors and in social settings compared to indoors and alone.

Failure to obtain appropriate levels of physical activity may potentially have a negative impact on children's physical, mental and social health and well-being, and increase susceptibility to preventable health conditions (Hinkley, Crawford, Salmon, Okely, & Hesketh, 2008). It is important to note that while the shape of these dose-response relationships varies from health outcome to health outcome, it is almost universally found that the greater the dose of physical activity, the greater the health benefits (Janssen & LeBlanc, 2010; Sothern, Loftin, Suskind, Udall, & Blecker, 1999). Even small amounts of physical activity have been shown to have significant health benefits in high-risk children (e.g. children who are obese) in experimental studies (Janssen & LeBlanc, 2010). However, there is evidence that very high levels of vigorous activity can potentially increase the risk of injury (Janssen & LeBlanc, 2010). The minimal and optimal dose of physical activity for good health remains unclear and warrants further investigation using well designed dose-response studies (Janssen & LeBlanc, 2010). This suggests that any guideline is quite arbitrary and needs to consider an appropriate balance between frequency, intensity, duration and types of activities in order to achieve good health in children.

Prior to 1997, physical activity guidelines developed for children were similar to adult guidelines (Trost, 2004). For example, the United States Surgeon General's Report on Physical Activity and Health (U.S. Department of Health and Human Services, 1996), recommended that everyone over the age of two years should participate in 30 minutes of moderate intensity activity a day. Similar recommendations were presented by the Centers

for Disease Control and Preventions (CDC) and the American College of Sports Medicine (ACSM) (Pate, et al., 1995). However, children are physiologically different from adults and their activity patterns differ considerably in type, intensity, frequency and duration (National Health and Medical Research Council, 2003; Pellegrini & Smith, 1998). Children's physical activity is not usually planned, structured activity; rather it is sporadic with a stop-start nature (Fulton et al., 2001; Hinkley, et al., 2008; McKenzie et al., 1997; Pellegrini & Smith, 1998; Poulsen & Ziviani, 2004). Studies have shown that relatively few children engage in sustained bouts of physical activity greater than 20 minutes. Instead they exhibit numerous 5 and 10 minute bouts of physical activity (Mark & Janssen, 2009; Pate et al., 2002; Trost, Pate, Sallis, et al., 2002). Recommendations have been specifically developed to be more consistent with typical patterns exhibited by children and young people (Trost, 2004).

Physical activity recommendations for children and young people are gradually becoming aligned, but with slight differences across countries. Australia and New Zealand have adopted national physical activity guidelines that state that children should accumulate 60 minutes of moderate-to-vigorous physical activity (MVPA) each day and partake in no more than two hours of electronic media a day to maintain an acceptable level of health and well-being (Commonwealth of Australia, 2004; New Zealand Ministry of Health, 2010). Canada has developed incremental recommendations based on current physical activity status of each child (i.e. children who are sedentary), as they believe 60 minutes may be unrealistic for some young people (Janssen, 2007; Kesaniemi, Riddoch, Reeder, Blair, & Sorensen, 2010). They recommend that after five months children should try to accumulate 90 minutes (60 min of MVPA and 30 min of vigorous physical activity [VPA]). The 90 minute recommendation is based on evidence found by Andersen et al. (2006), which shows that 90 minutes of physical activity may be needed to prevent insulin resistance, an important cardiovascular risk factor. The United States (U.S.) physical activity guidelines for children state that children should accumulate at least 60 minutes, and up to several hours, of age-appropriate physical activity on most if not all days of the week (National Association for Sport and Physical Education, 2004). The United Kingdom (U.K.) recently revised their recommended guidelines in 2011 (Department of Health, Physical Activity, Health Improvement, & Protection, 2011). The guidelines state that all children should engage in MVPA for at least 60 minutes and up to several hours every day, and VPA (including those

that strengthen muscles and bones) should be incorporated at least three days a week. The U.K. guidelines also state that children should minimise the amount of time spent being sedentary for extended periods but do not propose a length of time that is considered 'extended'. It is important to note that the recommended level of physical activity for children is double that of the recommended adult level, with all guidelines emphasising the accumulation of physical activity rather than sustained continued bouts.

The recommended physical activity guidelines are used to encourage promotion of physical activity, help classify people as sufficiently and insufficiently active, monitor activity levels, and enable better planning and implementation of interventions and policies, as stated by the behavioural epidemiology framework (Sallis, Owen, et al., 2000; Trost, 2004).

2.4 Trends in children's physical activity

2.4.1 Age-related trends

There is a common perception that physical activity levels decline across the lifespan, especially in adolescents (Boreham & Riddoch, 2001). Dumith et al. (2011) conducted the first review to pool longitudinal data from international literature to see if a decline in physical activity with age was consistent across the literature. Findings from this review confirmed that physical activity levels consistently decline as children approach adolescence and continues to decline rapidly throughout adolescence (Dumith, et al., 2011). Furthermore, this review reported a greater decline in girls compared to boys, which may be explained by earlier sexual maturation in girls compared to boys (Euling, et al., 2008). Nader et al. (2008) conducted a longitudinal study following children from 9-15 years old. Using accelerometers to measure physical activity, they found a 75% decrease in MVPA over the six year period. In addition to this decline, it was noted that at age 9, 99% of the children were achieving the recommended 60 minutes of MVPA a day, but by the time participants reached 15 years of age, this percentage had declined to only 26.7% (Nader, et al., 2008). It is acknowledged, however, that accelerometer data are not a good measure of meeting physical activity guidelines because the data are dependent on researcher-derived decisions made about the cut-points used to classify physical activity intensity and averaging epochs

over longer periods (Nilsson, Ekelund, Yngve, & Sjöström, 2002; Puyau, Adolph, Vohra, & Butte, 2002). The inability of accelerometers to accurately assess movement of the arms and additional energy expenditure related to carrying loads while moving, have been identified as important limitations (Sirard & Pate, 2001) and therefore, data relating to physical activity guidelines should be interpreted with caution.

Using self-report physical activity, Thompson et al. (2003) also found that physical activity levels decreased with increasing age when tracking Canadian young people from age 9-18 years. In Australia, the most recent national survey conducted, the 2007 Australian National Children's Nutrition and Physical Activity survey (Commonwealth of Australia, 2008), showed that engagement in MVPA decreased by approximately 10 minutes per day with each year of age. This study also found that only 32% of young people aged 9-16 years met the daily 60 minutes of MVPA guidelines on all four days tested, with the percentage decreasing with age (Commonwealth of Australia, 2008).

Even though there is limited evidence for younger children, these trends do not seem to be as pronounced in younger children aged 5-9 years (Pate, et al., 2002; Spinks, Macpherson, Bain, & McClure, 2007; Whitt-Glover et al., 2009). Combined, the evidence demonstrates two important points. Firstly, there are a large percentage of children who are not sufficiently active based on recommended physical activity guidelines and secondly, there is a marked decrease in physical activity levels with age from preadolescence to adolescence. This further highlights the need to focus research on this age group.

Even though there is strong evidence to support a decline in physical activity with increasing age, it is still not fully understood if this is a biological mechanism or the result of environmental influences (Hills, et al., 2007; Sallis, 2000). A review of the animal literature (Ingram, 2000) was conducted to provide further insights into the decline of physical activity with age in humans as presented in a review by Sallis et al. (2000). Ingram (2000) reviewed animal studies using rodents, mice, monkeys and insects, showing findings that were consistent with human studies. While this review mainly focused on aged animals, primarily males, the findings do provide evidence that decline in physical activity may be partly due to

biological processes. However, physical activity is a complex multi-dimensional behaviour in which non-biological processes may also be involved (Sallis, Prochaska, et al., 2000). There is evidence that psychological, social and environmental variables are related to physical activity in both cross-sectional and longitudinal studies (Sallis, Owen, & Fisher, 2008; Sallis, Prochaska, et al., 2000; Sallis, Prochaska, Taylor, Hill, & Geraci, 1999; U.S. Department of Health and Human Services, 1996).

2.4.2 Secular trends

A decline in children's population levels of total daily physical activity over time (i.e. secular trends) is also often claimed but not necessarily supported by the current literature (Eisenmann, 2003). There are relatively few longitudinal data on secular trends of children's physical activity (Salmon & Timperio, 2007). Data from the Youth Risk Behaviour Survey (YRBS), a national survey conducted in the U.S., have shown no significant change in adolescents' self-reported VPA between 1993 and 1997 (Pratt, Macera, & Blanton, 1999). In a cross-national Health Behaviour in School-aged Children study (HBSC) in youth, data showed slightly different trends across European countries, with evidence of a small but consistent increase in self-reported VPA between 1985/86 to 2001/02 in Finland and an increase in VPA from 1985/86 and 1997/98 followed by a decline in 2001/02 in Scotland and Wales. In Austria, Norway, Hungary and Sweden, self-reported VPA remained stable across 1985/86 to 2001/02. The overall pattern in Canadian youth's self-reported VPA over a 7-day period was found to be unchanged from 1997 to 2001 (Irving et al., 2003). In another Canadian study, Eisenmann et al. (2004) examined data from five national physical activity surveys and found that leisure time physical activity in Canadian youth aged 12-19 years increased from 1981 to 1988 but then remained relatively stable from 1988 to 1998.

One of the key challenges in monitoring trends of children's physical activity is the assessment of physical activity (Welk, et al., 2000). The majority of studies tend to rely on self-report due to ease of use and convenience with large populations. To obtain a more accurate picture of population physical activity trends, objective measures, such as accelerometry, could be used in conjunction with self-report (Pratt, et al., 1999). However,

further research is still required to determine the appropriateness of objective measurement in population surveillance (Pratt, et al., 1999).

Overall, there currently appears to be a lack of conclusive evidence to suggest a secular decline in children's population levels of overall physical activity. However, even in the absence of change in population levels of physical activity, a shift in the prevalence of context-specific activity may be plausible and potentially pertinent in understanding children's physical activity behaviour and identifying key areas for physical activity promotion that could help children achieve recommended physical activity guidelines.

2.4.3 Context-specific physical activity trends

In addition to identifying levels of overall physical activity, identifying key contexts where low levels of physical activity exist or the proportion of children engaging in different physical activity contexts has changed, may help future health promotional efforts (Findlay, Garner, & Kohen, 2010). Each day children are provided with a number of opportunities in different contexts to accumulate the recommended levels of physical activity. For example, children may actively commute to and from school, participate in physical education classes, use school break times to play games and sports, and participate in organised competitive sports after school. There is evidence of a secular and age-related change in the prevalence of specific types of activities, such as organised sport and activities (Eiðsdóttir, Kristjánsson, Sigfúsdóttir, & Allegrante, 2008; Hardy, Okely, Dobbins, & Booth, 2008; Norton, Dollman, Klanarong, & Robertson, 2001; Sport and Recreation New Zealand, 2003; U.S. Department of Health and Human Services, 1996), non-organised activities (Eisenmann, et al., 2004; Hardy, et al., 2008; Laakso, Telama, Nupponen, Rimpelä, & Pere, 2008), active transport (Buliung, Mitra, & Faulkner, 2009; Harten, 2005; Hohepa, 2008; McDonald, 2007; Salmon, Timperio, Cleland, & Venn, 2005) and physical education (Harris, 1994; Lowry, Wechsler, Kann, & Collins, 2001; Pratt, et al., 1999; Salmon, et al., 2005). However, very few studies have explored trends in physical activity occurring during different periods of the days.

In addition to exploring trends of specific types of physical activity, it is important to delineate key periods of a day when children are active or inactive in order to help future promotional efforts. The time-specific physical activity context has received much less attention compared to specific types of physical activity, which may be attributed to the lack of, or poor description of the time period within studies. For example, studies exploring organised sport may not delineate whether this is performed after school or on weekends. This level of detail and specificity is vital in understanding physical activity behaviour because children behave and are influenced very differently at different times of the day and in different settings (Giles-Corti, et al., 2005; Mota, et al., 2003). The paucity of research in this area and the lack of clear description of time periods within the literature have likely contributed to the equivocal findings of the relative importance of these time periods for children to accumulate physical activity.

Key time periods of a school day include before school, recess, lunch, after school and the evening. While all these periods provide important opportunities for children to accumulate physical activity towards the recommended daily physical activity levels, the lunchtime and after-school time periods have specifically been identified as two critical windows during a school day for physical activity promotion (Beighle, et al., 2006; Mota, et al., 2003). This is because lunchtime and after school are considered discretionary periods, where children are able to make some choices about their participation in physical activity (Beighle, et al., 2006). Unlike physical education and organised sport which occur infrequently during a school week, physical activity participation during these discretionary time periods can make a significant contribution to children's overall physical activity levels because children are exposed to these periods on a daily basis and often lasting for substantial amounts of time (e.g. up to three hours during the after-school period). As a result, these periods are the focus of this research. It is important to acknowledge that other shorter school break times, such as morning recess, are also important discretionary periods and can contribute to the school-related critical window of physical activity. However, these shorter school break times will not be assessed in this program of research. The relative importance of the lunchtime and after-school periods will be discussed in more detail below.

2.5 Lunchtime period and physical activity

Children spend a large proportion of their day at school and therefore the school is a potentially important setting for physical activity promotion. While schools should not be solely responsible for increasing children's physical activity, they are in a good position to simultaneously provide support to a large group of children to enhance and maintain a healthy lifestyle (Booth & Okely, 2005; Stone, McKenzie, Welk, & Booth, 1998; Wechsler, Devereaux, Davis, & Collins, 2000; Weisner, 2002). Most schools provide access to appropriate facilities (such as playgrounds, ovals and gymnasiums), equipment (such as balls and skipping ropes) and supervision needed for physical activity promotion (Booth & Okely, 2005; Jago & Baranowski, 2004; Stone, et al., 1998; Weisner, 2002). Given that children are encouraged to obtain approximately 60 minutes of MVPA a day and are required to attend school in Australia (Booth & Okely, 2005), the lunchtime period provides an important opportunity during the school day for children to be active and an ideal context for physical activity promotion (Ramstetter, Murray, & Garner, 2010; Ridgers, Stratton, & Fairclough, 2006; Verstraete, Cardon, De Clercq, & De Bourdeaudhuij, 2006; Wechsler, et al., 2000).

Lunchtime, also referred to as 'recess' in a number of American studies, is defined as a regularly scheduled discretionary period where all children within a school are generally given equal opportunity for unstructured physical activity and play for five days of the week, regardless of sex, ethnicity and socio-economic background (Beighle, et al., 2006; Stellino, Sinclair, Partridge, & King, 2010). Lunchtime play usually takes place outdoors (weather permitting) and the length of lunchtime periods varies between schools and within schools. This is an important point as studies have shown that children who spend more time outdoors are more likely to accumulate larger quantities of overall physical activity (Brockman, Jago, & Fox, 2010; Burdette, Whitaker, & Daniels, 2004; Sallis, Prochaska, et al., 2000). The lunchtime period is a necessary component of the school day that serves as the main break from academic challenges and rigorous concentration in the classroom (Ramstetter, et al., 2010). It provides children with equal opportunities to develop physical competence, health-related fitness, personal and social responsibility, and enjoyment of physical activity, thereby contributing to the development of healthy life-long physical activity patterns (Stellino, et al., 2010; Wechsler, et al., 2000). For some groups, this may be

the only regular and consistent opportunity for discretionary physical activity (Weisner, 2002) and is therefore becoming an increasingly important focus in physical activity research (Jago & Baranowski, 2004).

There are concerns that the time allocated to school break times, such as lunchtime, is being reduced or removed altogether in response to pressures on maximising curricular time and improving academic performance (Ramstetter, et al., 2010). There has, however, been a growing body of evidence that has shown that the lunchtime period not only provides an opportunity for children to engage in physical activity, but also that the act of engaging in physical activity improves academic performance, attentiveness, discipline problems, school attendance and reduces the likelihood of students smoking or using alcohol or drugs (Ramstetter, et al., 2010; Weisner, 2002). In an observational study with Grade 4 students, findings showed that both boys and girls were more on task and less fidgety on recess days compared to non-recess days (Jarrett et al., 1998). Similarly, teachers' ratings of classroom behaviour were better for children who engaged in some recess compared to those who had no or a minimal break during the school day (Barros, Silver, & Stein, 2009). This evidence demonstrates that the lunchtime period not only has immediate benefits to physical activity levels, but it also influences classroom behaviour beyond the lunchtime period and should be the focus of physical activity promotional efforts.

There is some evidence of how lunchtime physical activity and inactivity has changed over time. A study conducted by Lewis et al. (2007) found that the proportion of Australian children reporting inactive behaviours during lunchtime, such as 'sit and talk', increased between 1985 and 2004 from 16.6% to 34.5% for the whole sample, while the incidence of 'running around' decreased from 49% in 1985 to 38% in 2004. In comparison, in the 1970s American children spent 60% of their recess periods engaged in MVPA as assessed by direct observation (Hovell, Bursick, Sharkey, & McClure, 1978). More recent studies using direct observation and accelerometers indicate that American children now spend less than 50% of their recess time engaged in MVPA (McKenzie, et al., 1997; Wickel & Eisenmann, 2007).

A number of cross-sectional studies have investigated children's physical activity levels during lunchtime. Table 2.1 represents a selection of studies that have focused on the lunchtime patterns of children's physical activity (i.e. children less than 13 years old) using objective measurement of physical activity and the relative contribution this period makes to daily physical activity levels and recommended physical activity levels. Research has shown that the lunchtime period can contribute 9% to 68% towards children's recommended daily MVPA, with the lunchtime period contributing more for boys (30%) compared to girls (21%) (see Table 2.1). In a study using pedometers, the lunchtime period was identified as the most important component of a school day, contributing up to 16% of daily MVPA (Tudor-Locke, Lee, Morgan, Beighle, & Pangrazi, 2006). Alternatively, a study using accelerometers found that the lunchtime period only contributed 7% and 8% towards boys' and girls' daily physical activity, respectively (Mota et al., 2005). The difference in percentage between these studies may be due to cultural differences (one study was conducted in the U.S. and the other was conducted in Portugal), methodological differences, such as how each study defined MVPA and a valid day, or the length of lunchtime breaks in each study. The length of lunchtime periods in these two studies were 40 minutes (Tudor-Locke, et al., 2006) versus 30 minutes (Mota, et al., 2005).

The majority of studies presented in Table 2.1 show that children tend to spend less than 50% of school break time in MVPA. Ridgers et al. (2005) found that boys and girls spent only 33% and 23% of their total lunchtime in MVPA measured by accelerometers, respectively. Conversely, Beighle et al. (2006) found boys spent 78% and girls spent 63% of their lunchtime engaged in MVPA measured by pedometers. This evidence indicates that many children are not voluntarily engaging in 'enough' physical activity during lunchtime. McKenzie et al. (1997) suggest that the remaining time not spent in physical activity during lunchtime is spent waiting to play, conversing with students, observing others or playing with toys while being seated. Also, schools may be unconsciously restricting children's opportunities for play because of safety concerns and fear of litigation (Bundy et al., 2011). While safety policies are put in place to minimise risk, such policies have been shown to decrease play opportunities (Carver, Timperio, & Crawford, 2008b) and schools should be mindful of achieving a balance between risk and play opportunities. Further research is required to understand the patterns of lunchtime physical activity, and in particular, the

factors preventing children from utilising the whole lunchtime period for physical activity. This contextual detail could assist in targeting and developing appropriate physical activity promotional interventions.

Table 2.1 Contribution of lunchtime MVPA to daily physical activity levels and physical activity recommendations

Author	Country	Sample characteristics (sample size, age)	Physical activity measure	Lunchtime in MVPA (%)		Contribution of lunchtime MVPA to daily physical activity (%)		Contribution of lunchtime MVPA to physical activity recommendations (%)[a]	
				Boys	Girls	Boys	Girls	Boys	Girls
(Ridgers & Stratton, 2005)	U.K.	270, aged 6-11 yrs	Accelerometer	33	25	-	-	47	35
(Mota, et al., 2005)	Portugal	22, aged 8-10 yrs	Accelerometer	15	19	7	8	15	19
(Verstraete, et al., 2006)	Belgium	235, aged 10-11 yrs	Accelerometer	57	44	-	-	68	50
(Ridgers, Stratton, Fairclough, & Twisk, 2007b)	U.K.	470, aged 8.1±1.6 yrs	Accelerometer	32	24	-	-	-	-
(Wickel & Eisenmann, 2007)	U.S.	113, aged 6-12 yrs	Accelerometer	45	-	16	-	30	-
(Ridgers, Toth, & Uvacsek, 2009)	Hungary	98, aged 9-12 yrs	Accelerometer	25	17	13	11	32	22
(Jones et al., 2010)	U.K.	2064, aged 9-10 yrs	Accelerometer	15	10	-	-	30	20
(Ridgers, Stratton, Fairclough, & Twisk, 2007a)	U.K.	297, aged 5-10 yrs	Accelerometer	32	24	-	-	43	33
(Brusseau et al., 2011)	U.S.	829, aged 9.6±0.7 yrs	Pedometer	-	-	13	12	20	18
(Beighle, et al., 2006)	U.S.	270, aged 8-10 yrs	Pedometer	78	63	-	-	20	16
(Tudor-Locke, et al., 2006)	U.S.	81, aged 11.8±0.5 yrs	Pedometer	-	-	15	16	27	24

Author	Country	Sample characteristics (sample size, age)	Physical activity measure	Lunchtime in MVPA (%)		Contribution of lunchtime MVPA to daily physical activity (%)		Contribution of lunchtime MVPA to physical activity recommendations (%)[a]	
				Boys	Girls	Boys	Girls	Boys	Girls
(Loucaides, Jago, & Charalambous, 2009)	Cyprus	228, aged 11.1±0.3 yrs	Pedometer	-	-	-	-	9	9
(Stratton & Mullan, 2005)	U.K.	99, aged 7-11 yrs	Heart rate	41	35	-	-	17	15
(Ridgers, et al., 2007b)	U.K.	470, aged 8.1±1.6 yrs	Heart rate	33	25	-	-	-	-
(Stratton, Ridgers, Fairclough, & Richardson, 2007)	U.K.	375, aged 6-10 yrs	Heart rate	30	23	-	-	43	33
(Fjørtoft, Kristoffersen, & Sageie, 2009)	Norway	61, aged 6 yrs	Heart rate	64	57	-	-	43	38
(Ridgers, et al., 2005)	U.K.	207, aged 8.1±1.4 yrs	Heart rate	31	24	-	-	43	34
(Jennings-Aburto et al., 2009)	Mexico	431, Grade 4 and 5	Direct observation	43	36	-	-	22	18
(Waring, Warburton, & Coy, 2007)	U.K.	374, aged 5-11 yrs	Direct observation	14	8	-	-	17	10
MEDIAN				33	25	13	12	30	21

Notes: "-" Cannot be calculated due to limited details provided

[a] The recommended physical activity guidelines are based on the 60 minutes of at least moderate physical activity a day or 12000 steps (girls) and 15000 steps (boys) [BMI-referenced physical activity cut-points] criteria (Tudor-Locke et al., 2004)

2.6 After-school period and physical activity

Exploring the after-school period is important because this is a time when children have discretion over how they use their time, away from the constraints of school and parental curfews that may restrict behaviour during the lunchtime period and evenings (Atkin, et al., 2011). This period is typically defined in the literature as the time from the end of school until 6:00 pm (Brockman, et al., 2010; Mota, et al., 2003; Veitch et al., 2006), with some variation among studies, such as 3:00 pm to 7:00 pm (Fairclough, Butcher, & Stratton, 2007; Jago, Anderson, Baranowski, & Watson, 2005), 3:00 pm to 5:30 pm (Hager, 2006) and 3:30 pm to 6:30 pm (Atkin, et al., 2008). For the purposes of this research, the after-school period was defined using the typical definition of after school (i.e. the time from the end of school until 6:00 pm).

The after-school period was initially noted as being potentially important in the behaviour of young people following a study exploring patterns of juvenile delinquency across a day (Sickmund, Synder, & Poe-Yamagata, 1997). Researchers found that youth-driven crime peaked between the hours of 3:00 pm and 6:00 pm on school days and young people were at greatest risk of engaging in or being a victim of crime during this critical window. This study highlighted the need for intervention to reduce antisocial behaviour during this period (Sickmund, et al., 1997). Atkin et al. (2008) expanded this notion of time-specific patterns of behaviour to physical activity behaviour and found that both boys and girls spent approximately 12% of the after-school period in MVPA and boys spent 28% and girls spent 19% of the after-school period in technology-based sedentary behaviours. This study provides some evidence that children are choosing to engage in sedentary rather than active behaviours, which is of concern as children have the opportunity to be active for approximately three hours of the day for five days a week during this time period.

The after-school period appears to define a child's propensity for physical activity (Mota, et al., 2003). Research has shown that children who report higher incidents of active play during the after-school period, particularly outdoors, are more active overall and active at a greater intensity than those who report fewer incidences of after-school active play (Brockman, et al., 2010; Burdette, et al., 2004; Sallis, Prochaska, et al., 2000). Katzmarzyk et

al. (1998) suggest that those who choose to be active after school are more likely to have limited time to devote to less active pursuits, such as TV viewing. In light of this evidence, the after-school period should be a focus for physical activity promotion strategies.

Very few studies have explored how physical activity during the after-school period has changed over time. More evidence exists on the trends of different types of activities typically performed during this time period, such as organised sports, active commuting and non-organised activities (Buliung, et al., 2009; Eiðsdóttir, et al., 2008; Eisenmann, et al., 2004; Hardy, et al., 2008; Harten, 2005; Hohepa, 2008; Laakso, et al., 2008; McDonald, 2007; Norton, et al., 2001; Salmon, et al., 2005; Sport and Recreation New Zealand, 2003; U.S. Department of Health and Human Services, 1996), as well as changes to the home and neighbourhood settings, which are the common settings where children engage in after-school physical activity (Australian Bureau of Statistics, 1995, 1999; Brownson, Boehmer, & Luke, 2005). Only one study was identified that explored secular trends in after-school physical activity. This study, conducted in Melbourne, Australia, found that children's MVPA assessed using accelerometers decreased significantly during the after-school period over a five year span (Veitch, et al., 2006). In 2001, boys and girls aged 10-12 years spent on average 33 and 29 minutes, respectively, engaged in MVPA during the after-school period and this had decreased to 16 minutes for boys and 12 minutes for girls by 2006.

In relation to changes in after-school physical activity settings over time, the focus has been on changes in physical characteristics in home and neighbourhood locations. For example, over the last two decades evidence has emerged to suggest increases in access to TV, internet and electronic games in the home (Australian Bureau of Statistics, 1995, 1999), increases in house sizes in conjunction with decreases in yard and garden sizes (Australian Bureau of Statistics, 2001) and changes in neighbourhood design, such as street connectivity (Brownson, et al., 2005). Little is known about the extent to which the changes in these physical characteristics have influenced physical activity levels after school (Smith & Biddle, 2008). Studies have found that children's time outdoors has greatly decreased with more children becoming 'indoor children' (Karsten, 2005). This may be the result of changes in physical characteristics of the home and neighbourhood settings and the number of parents

needing to work, as well as changes in adults' perceptions of safety. However, the relationship between time outdoors and these changes is not well established (Smith & Biddle, 2008).

Studies exclusively investigating after-school physical activity patterns are even less prevalent than lunchtime studies, particularly in relation to objective measurement of physical activity (see Table 2.2). As can be seen in Table 2.2, the after-school period provides an opportunity where children can obtain a considerable proportion of their recommended physical activity (approximately one third of the recommended 60 minutes of MVPA per day). It is important to note that the definition of the after-school period was not consistent across all studies. Sixth grade children in the U.S. were found to accumulate almost half of their daily steps during after-school activities (Tudor-Locke et al., 2006). Studies using accelerometers have found that the after-school period can account for 21% to 47% of children's daily MVPA. This is expected given that the after-school period equates to 21% of the waking day (a waking day for children is approximately 14 hours) (Olds et al., 2009). Also, boys appear to be more active than girls during the after-school period (Beighle, et al., 2006; Brockman, et al., 2010; Jago, et al., 2005; Mota, et al., 2003; Tudor-Locke, et al., 2006; Veitch, et al., 2006), which is consistent with daily physical activity data.

When viewing how much of the after-school period is spent in MVPA, the evidence illustrates that children are not taking advantage of this period to engage in MVPA. For example, Brockman et al. (2010) found that primary school boys and girls only spend 7% and 5% of the after-school period in MVPA, respectively, while Beighle et al. (2006) found that boys and girls spend approximately one fifth of their after-school time in MVPA. The limited evidence available makes it difficult to fully understand the physical activity patterns during the after-school period, and thus the relative importance of this period. Future research should focus on contributing to the evidence pool that already exists by examining after-school physical activity patterns using objective measurement and determining the contribution of after-school MVPA to daily physical activity and recommended physical activity levels.

Table 2.2 Contribution of after-school MVPA to daily physical activity levels and physical activity recommendations

Author	Country	Sample characteristics (sample size, age)	Physical activity measure	After-school time in MVPA (%)		Contribution of after-school MVPA to daily physical activity (%)		Contribution of after-school MVPA to physical activity recommendations (%)[a]	
				Boys	Girls	Boys	Girls	Boys	Girls
(Tudor-Locke, et al., 2006)	U.S.	81, aged 11.8±0.5 yrs	Pedometers	-	-	48	48	52	49
(Beighle, et al., 2006)	U.S.	270, aged 8-10 yrs	Pedometers	23	20	-	-	48	48
(Mota, et al., 2003)	Portugal	84, aged 8-15 yrs	Accelerometer	22	12	29	25	67	37
(Jago, et al., 2005)	U.S.	81, aged 13.3±0.5 yrs	Accelerometer	6	1	47	27	23	5
(Brockman, et al., 2010)	U.K.	747, aged 10-11 yrs	Accelerometer	7	5	26	27	20	15
(Veitch, et al., 2006)	Australia	876, aged 10-12 yrs	Accelerometer	-	-	21	21	44	34
MEDIAN				14.5	8.5	29	27	46	35.5

Notes: "-" Cannot be calculated due to limited details provided

[a] The recommended physical activity guidelines are based on the 60 minutes of at least moderate physical activity a day or 12000 steps (girls) and 15000 steps (boys) [BMI-referenced physical activity cut-points] criteria (Tudor-Locke, et al., 2004)

2.7 Physical activity interventions

In response to concerns of children not achieving the recommended physical activity levels and declining levels of physical activity in specific contexts, a number of interventions have been designed in an attempt to increase physical activity levels in children (Salmon, et al., 2007). However, interventions have yielded varying levels of success with very few exhibiting long term changes to children's physical activity (Salmon, et al., 2007; Van Sluijs, et al., 2007). Interventions targeting children are predominantly implemented in school settings (Cale & Harris, 2006). There has been a strong focus on physical education (PE) interventions to increase children's physical activity (McKenzie et al., 1996; Sallis et al., 1997). While PE is a vital context for children in regard to skill development, it is only a small contributor to overall daily physical activity with limited time allocated to PE classes in schools (Cale & Harris, 2006; Verstraete, et al., 2006). Alternative settings, such as community, family and primary care settings (Cale & Harris, 2006; Salmon, et al., 2007), and non-curriculum opportunities, such as school break time, active transport and active lesson breaks (Jago & Baranowski, 2004), are beginning to emerge as important contexts for physical activity promotion.

Interventions conducted specifically during the lunchtime period have been reviewed by Ridgers et al. (2006). Only five intervention studies were located, with one study implementing fitness breaks (Scruggs, Beveridge, & Watson, 2003), another implementing a games intervention which was taught by playground supervisors (Verloigne, Van Lippevelde, Maes, Brug, & De Bourdeaudhuij, 2012), and three studies introducing playground markings as strategies for increasing physical activity levels (Lourenço & Machado, 1996; StataCorp LP; Stratton, 2000). Only two of the five intervention studies had a control group (Lourenço & Machado, 1996; Stratton, 2000). All intervention strategies were found to have a positive effect on children's physical activity levels. However, all the studies were short-term with limited longer-term follow-up (Ridgers, Stratton, & Fairclough, 2006). More recently, Ridgers et al. (2007b) investigated the longitudinal effects of the playground marking intervention and found that the increased physical activity levels in children were maintained for six months following the implementation of the intervention, which does demonstrate some

promise for implementing this simple school interventions which is accessible to all children, regardless of age, sex and ethnicity.

In a review specifically investigating the after-school period (Atkin, et al., 2011), only three of the nine studies reviewed reported an increase in physical activity following an intervention (Annesi et al., 2007; Weintraub et al., 2008; Wilson et al., 2002), of which one study had very weak methodology quality rating (Weintraub, et al., 2008). The interventions that were effective included an after-school sports program conducted in the school setting (Wilson, et al., 2002), an after-school and physical education 'Youth Fit for Life' intervention involving the teaching of self-management and goal setting strategies (Annesi, et al., 2007) and an after-school football program (Weintraub, et al., 2008). The after-school football program only had significant effects on physical activity three months post-intervention but not six months post-intervention.

A number of reasons for the modest performance of interventions have been proposed in the literature. A review in the U.S. Report of the Surgeon General (U.S. Department of Health and Human Services, 1996) found that interventions guided by either no theoretical approach or uni-dimensional theories, such as the Social Learning Theory, had no effect on physical activity behaviour. This may be due to an inadequate understanding of the range of factors that impact on physical activity behaviour for a particular population in a specific context across different domains. For example, a program that focuses on increasing physical activity by targeting self-efficacy may be guided by the Social Cognitive Theory. Whilst self-efficacy may increase, environmental barriers may be preventing individuals from partaking in physical activity, thus impacting on overall physical activity participation and the effectiveness of a program. Furthermore, the lack of use or reporting of a theoretical framework in studies reduces the ability to assess why interventions succeeded or failed (Thomas, 2006). Modest results may also be attributed to poor methodological quality, such as lack of baseline data, no control groups, use of physical activity measures with unknown reliability and validity and poor reporting of study details (such as sample size, randomisation procedure, blinding of assessors and duration of intervention) (Salmon, et al., 2007). This makes it difficult to draw comparisons between studies and introduces the

potential for bias, such as participant selection bias and assessor bias. Finally, it has been suggested that a “one size fits all approach” of factors influencing physical activity is being applied to interventions. Interventions may be targeting factors that are of secondary importance, rather than the primary factors, or inappropriate factors that are not relevant to specific physical activity context (i.e. type of behaviour, time of day or location) or participant sub-groups (e.g. boys and girls) (Thomas, 2006). Qualitative work with potential target participants has been identified as an important strategy for identifying factors that are specific to the context under investigation and designing relevant interventions for implementation (Thomas, 2006).

Physical activity interventions provide promise for encouraging lifelong healthy habits. However, a number of interventions are failing to maintain long-term increases in children’s physical activity levels. As a result of the modest performance of interventions delivered to children, researchers are calling for additional research into context-specific predictors of children’s physical activity from a social ecological perspective in order to better understand physical activity behaviours and provide a more concrete foundation for future approaches to enhance children’s participation in physical activity (Baranowski, et al., 1998; Dunton, Berrigan, et al., 2009; Sallis, Prochaska, et al., 2000). This ‘call for research’ has been acknowledged and forms the focus for this thesis.

The following section will discuss the need for correlate research, theories and models used to understand correlates of physical activity behaviour and the importance of using an ecological framework in physical activity research. In addition, an overview of the correlates of children’s physical activity and a discussion on the current status of correlate research will be presented, introducing the need for increasing specificity of correlate research and correlate measurement. Finally, this chapter will conclude with an overview of the research problem.

2.8 Investigating factors that influence children's physical activity

Identifying factors that influence children's physical activity is a fundamental research priority (Bauman, et al., 2002; Sallis, Owen, et al., 2000). A number of cross-sectional studies have attempted to explain and predict physical activity behaviour, reporting correlation associations or predictive relationships between a factor and physical activity behaviour (Sallis, Prochaska, et al., 2000). Such studies do not report the causal relationships but are necessary to generate hypotheses for future research (Bauman, et al., 2002). These types of factors are correctly defined as correlates because they have not been established as true determinants (Bauman, et al., 2002) and will be referred to as such for the remainder of the thesis.

2.8.1 Theories and models of physical activity behaviour

Theories, frameworks and conceptual models are utilised by researchers to describe and understand the correlates that influence physical activity behaviour (Welk, 2002) and to provide the knowledge base for the design of activity promotion interventions (Baranowski, et al., 1998). For activity promotion programs to be effective, the models must be predictive of the specific behaviour that will be targeted by the programs (Baranowski, et al., 1998).

There are a range of theories and models used in behavioural research to identify correlates that are believed to influence physical activity (Bauman, et al., 2002; Smith & Biddle, 2008) and have the potential to predict, explain and induce change in physical activity behaviour (Jeffery, 2004; Rothman, 2004). Theories and models commonly used in physical activity research include the Social Cognitive Theory (Bandura, 1986), Theory of Reasoned Action and Planned Behaviour (Ajzen, 1988, 1991), the Transtheoretical Model (Prochaska & DiClement, 1983) and the Health Belief Model (Becker et al., 1977).

The predictive utility of the different models is determined by the amount of variance explained by a particular set of correlates (Welk, 2002). Correlates that account for a significant portion of the variance of behaviour are deemed to be considered a primary correlate of physical activity. It is important to note that there is considerable co-variation

among physical activity correlates and the order in which correlates are entered into statistical models can potentially mask important correlates, thus giving a misrepresentation of the primary correlates of physical activity (Welk, 2002). This has contributed to the significant ambiguities in the current correlate literature, as well as the modest performance of physical activity interventions (Baranowski, et al., 1998; Welk, 2002). When used singularly, one-dimensional behavioural theories and models tend to explain a small amount of variance of physical activity and do not capture the complex dimensions of such a multi-level behaviour (Bauman, et al., 2002; Trost et al., 1997). For example, Ajzen and Fishbein's Theory of Reasoned Action and Theory of Planned Behaviour (Ajzen & Fishbein, 1980) tend to concentrate on intrapersonal correlates, with limited recognition of external influences, such as the physical environment, which may also influence behaviour. Spence and Lee (2003) found that, when used singularly, these models only explain 20% to 40% of variance in physical activity behaviour in children and adolescents, leaving a large percentage of the variance in physical activity unexplained. This may be due to the difficulties in measuring physical activity and the associated correlates and lack of psychometrically sound measurement tools, but also demonstrates the complexity of physical activity behaviour (Stokols, 1996; Welk, 1999).

Despite the potential usefulness of existing models and theoretical frameworks in understanding health behaviour, a number of these models and theories were primarily developed for adults, which have since been applied to youth (Theunissen & Tates, 2004). Life responsibilities, biological maturation and social influences are very different in childhood compared to adulthood and therefore, caution is warranted when assessing the applicability of models for specific population groups. In addition, intrapersonal theories imply that behaviour is more choice driven, whereas extrapersonal theories emphasise the role of the environment for enabling choice and therefore, models used to explain and understand behaviour need to include both intrapersonal and extrapersonal theories (Baranowski, et al., 1998; Baranowski, Lin, Wetter, Resnicow, & Hearn, 1997; King, Stokols, Talen, Brassington, & Killingsworth, 2002). Researchers have acknowledged the limitations of these theoretical approaches and research is now shifting towards the development and use of ecological models.

2.8.1.1 Ecological models of physical activity behaviour

While some behavioural theories and models examine intrapersonal correlates associated with children's physical activity, ecological models take a broader approach, emphasising that physical activity behaviour is influenced by the interaction of correlates at multiple levels, including the person and the social, physical, cultural and institutional environments (Bronfenbrenner, 1994; Leatherdale, Manske, Faulkner, Arbour, & Bredin, 2010; Spence & Lee, 2003). These domains are interdependent, whereby change in one domain can directly or indirectly impact on the other domains (Welk, 1999). Due to the explicit consideration of multiple levels of influence, ecological models provide a strong foundation for understanding complex health behaviours, such as physical activity (Sallis, et al., 2008).

Research using ecological frameworks has gained momentum in recent years, with the majority of evidence existing in the adult literature (Giles-Corti, et al., 2005; Sallis, et al., 2008). Initially, ecological models were originally designed to apply broadly to behaviours but have since become more specific to population groups, such as youth, and specific health conditions, such as diabetes (Cohen, Scribner, & Farley, 2000; Elder et al., 2007; Fisher, Brownson, et al., 2005). Welk (1999) developed the Youth Physical Activity Promotion Model that synthesises the various theoretical models into a social ecological model. This model provides a broad perspective on the psychological (identified as predisposing correlates), social (identified as reinforcing correlates) and environmental (identified as enablers) correlates that influence children's physical activity. Spence and Lee (2003) developed the Ecological Model of Physical Activity which situates individual correlates, such as biological and psychological correlates, within the broader environmental context. While this model was not developed specifically for children, it is particularly useful in understanding the impact of the environment on physical activity and can easily be applied to different population groups. The diversity of ecological models demonstrates the adaptability of these models and potential usefulness in different physical activity contexts.

Despite the recent surge of literature in this area, it is still unclear as to how well these ecologically based models predict physical activity behaviour and the relative power of the correlates within the model in predicting physical activity behaviour (Biddle & Mutrie, 2008;

Giles-Corti, et al., 2005; Hohepa, 2008). Dietary research has provided some initial clues as to how to improve prediction of complex behaviours. Prediction of dietary behaviour tends to be higher (e.g. R^2>0.60) when the focus is on one specific aspect of dietary behaviour, such as milk consumption (Tuorila & Pangborn, 1988). Baranowski et al. (1998) recommend a similar concept be applied to physical activity research by developing separate models for specific behaviours at specific times of the day, such as walking to and from school, playing during lunchtime and sport activities on weekends. This context-specific concept will be discussed in more detail below. The utility of ecological models in predicting context-specific physical activity behaviour needs to be further explored in order to drive physical activity research and improve the development of physical activity promotion programs aimed at increasing physical activity levels and decreasing physical inactivity (Giles-Corti, et al., 2005).

2.8.2 An overview of the correlates of children's physical activity

Identifying the primary correlates of physical activity behaviour is a major priority for systematically advancing intervention design and effectiveness (Bauman, et al., 2002; Welk, 2002). Physical activity behaviour is influenced by a complex interaction of factors in multiple domains, including psychological (e.g. beliefs, attitudes and efficacy), social (e.g. peer, teacher and parental support) and physical environment (e.g. geographical location and topography) domains (Sallis, Prochaska, et al., 1999). The body of literature describing the correlates that influence physical activity in children is extensive and has significantly escalated in recent years (Giles-Corti, et al., 2005). A number of high quality comprehensive systematic reviews have attempted to make sense of the current quantitative literature (Bauman, et al., 2002; Biddle, Whitehead, O'Donovan, & Nevill, 2005; Davison & Lawson, 2006; Duncan, Spence, & Mummery, 2005; Ferreira et al., 2007; Gustafson & Rhodes, 2006; Pugliese & Tinsley, 2007; Sallis, Prochaska, et al., 2000; Scruggs, et al., 2003; Van Der Horst, Paw, Twisk, & Van Mechelen, 2007; Verloigne, et al., 2012). More recent studies have employed qualitative approaches to provide more in-depth insights into primary school-aged children's experiences and perceptions of factors that influence engagement in physical activity (Casey, Eime, Payne, & Harvey, 2009; Mulvihill, Rivers, & Aggleton, 2000a, 2000b; O'Dea, 2003; Vu, Murrie, Gonzalez, & Jobe, 2006).

The remainder of this section will provide an overview of key correlates of children's habitual physical activity as identified from the aforementioned reviews and qualitative studies. The most commonly reviewed correlates are presented in Table 2.3. Correlates were assigned a summary code based on the direction and consistency of the association with physical activity. When four or more studies within each review supported an association or no association, the correlate was coded as either "++", "--" or "00". A correlate that had been frequently studied with considerable lack of consistency in the finding was coded as "??". This coding system was used by Sallis et al. (2000) and adopted by the aforementioned reviews. A social ecological approach has been adopted to present the findings.

Table 2.3 Overview of findings from reviews of correlates of children's habitual physical activity

Correlate	**++**	**--**	**00**	**??**
Biological				
Male	6, 7			
Female		1		
Age		1	7	6
Caucasian	1		7	6
Body Mass Index		1	7	6
Family socio-economic status			6, 8	3, 4
Family income	1			
Parental occupation status			3, 5, 8	
Parent education	1		3, 8	7

Correlate	++	--	00	??
Intrapersonal				
Self-efficacy	1, 7			6
Sports competence/perceived competence	1			6
Self-perception	1		7	
Enjoyment	1		7	
Social norms			3	
Perceived barriers to physical activity		1	7	
Perceived benefits to physical activity			6	
Perceived body image	1		6	
Self-esteem			6	
Attitudes/outcome expectations				6
Behavioural				
Watching TV			7	1, 6
Smoking		1		
PE/sport participation	1			8
Walking to/from school	8			
Classroom problems		8		
Previous physical activity	6			
Sociocultural				
Parent/family physical activity	5, 7[B], 8		3, 7[G]	4, 6
Parent support	1, 4, 7		3, 5, 6	8
Friend support				1, 3
Teacher support				3
Single parent			3, 7	
Two-parent			8	
Family size			3	
Parental ethnicity			8	
Maternal physical activity	8		3	1
Paternal physical activity	1			3, 8
Physical activity with parents	8			6

Correlate	++	--	00	??
Parental attitudes/beliefs towards physical activity	4			8
Logistic support (e.g. paying fees)	8		3, 6	
Parent supervision/license			8	
Parental rules/restrictions (screen-based activities)		8		
Parental rules/restrictions (physical activity)				8
Physical environment/policy				
Access to facilities/home equipment			2, 3, 7, 8	
Distance to and from school (large)		2		
Facilities at school	2		8	
Facilities in the neighbourhood	2		3	
Traffic safety	2		3	
Personal safety			2, 3	
Size of school			2	
Road and sidewalk infrastructure	2			
Presence of bike lanes				2
Street connectivity				2
Proximity of playgrounds and parks				2
Crime and area deprivation		2	6	
Weather (unsuitable)			2	
Average temperature		2		3
Rural location				2, 3, 6

Notes:
1 = Biddle, Whitehead et al., 2006; 2 = Davison and Lawson, 2006; 3 = Ferreira, Van Der Horst et al., 2007; 4 = Gustafson and Rhodes, 2006; 5 = Pugliese and Tinsley, 2007; 6 = Sallis, Prochaska et al., 2000; 7 = Van Der Horst, Paw et al., 2007; 8 = Verliogne, Van Lippevelde et al., 2012
++ = four or more studies within each review supporting a positive association; -- = four or more studies within each review supporting a negative association; 00 = four or more studies within each review supporting no or non-significant association; ?? = a variable that has been frequently studied with considerable lack of consistency in the findings.
B = boy; G = girl

2.8.2.1 Biological and demographic correlates

One of the most frequently studied biological correlate is sex with research consistently showing that boys are more active than girls (Biddle, et al., 2005; Sallis, Prochaska, et al., 2000; Van Der Horst, et al., 2007). Age, body mass index and ethnicity show inconsistent associations with physical activity. In a review focusing on the correlates of girls' physical activity, Biddle et al. (2005) reported that being younger, having a smaller body mass index and being Caucasian were associated with higher levels of physical activity. However, Sallis et al. (2000) concluded indeterminate associations with habitual physical activity, while Van Der Horst et al. (2007), an update of the Sallis et al. (2000) review, found no overall association between these correlates and children's habitual physical activity.

Different measures of socio-economic status (SES) have been used across studies. Review studies using family SES as a correlate have defined this as an integration of parental occupation, education, income, housing and residential area features to create an overall measure of SES (Verloigne, et al., 2012). Family SES has had mixed results with indeterminate associations with children's habitual physical activity reported by two systematic reviews (Ferreira, et al., 2007; Gustafson & Rhodes, 2006) and no association reported by another two reviews (Sallis, Prochaska, et al., 2000; Verloigne, et al., 2012). Specific individual measures of SES have also been reviewed, including family income, parental occupation status and parental education level. Biddle et al. (2005) found a consistent positive relationship between family income and girls' habitual physical activity. However, parental education has been found to have mixed results, with Biddle et al. (2005) reporting a positive association, Verloigne et al. (2012) and Ferreira et al. (2007) reporting no association and Van Der Horst et al. (2007) concluding an indeterminate association. Parental occupation status is consistently unrelated to children's physical activity (Ferreira, et al., 2007; Pugliese & Tinsley, 2007; Verloigne, et al., 2012).

2.8.2.2 Intrapersonal correlates

Ten intrapersonal correlates relating to psychological factors are commonly investigated in the quantitative literature, including self-efficacy, sports competence/perceived competence, self-perception, self-esteem, enjoyment of physical activity, social norms,

perceived benefits and barriers to physical activity, perceived body image and attitudes/outcome expectations. Self-efficacy refers to an individual's confidence in changing or maintaining certain behaviours and is closely linked to other psychological correlates, such as intention, self-perception, outcome expectancy and social norms (Kohl & Hobbs, 1998). This variable is the key to many theoretical health behaviour models, such as the Social Cognitive Theory (Bandura, 1986), Theory of Reasoned Action and Planned Behaviour (Ajzen, 1988, 1991) and the Transtheoretical Model (Prochaska & DiClement, 1983). In a comprehensive review of studies published between 1970 and 1998, Sallis et al. (2000) found indeterminate associations between self-efficacy and physical activity. However, in more recent and updated reviews of physical activity correlates (Biddle, et al., 2005; Van Der Horst, et al., 2007), a consistent positive relationship has been reported, particularly for girls.

Perceived competence is considered to be one component of self-efficacy and is defined as the belief in one's capability to be physically active (Biddle, et al., 2005). For girls, this correlate has been shown to have a small but positive effect on physical activity (Biddle, et al., 2005), whereas Sallis et al. (2000) reported an inconsistent association with children's habitual physical activity. On the other hand, Casey et al. (2009) qualitatively explored children's perceptions of factors that influence physical activity and found that participation in physical activity was enhanced when participants' perceived competence was high.

Self-perception, enjoyment of physical activity, perceived barriers to physical activity and perceptions of body image have mixed results across the review literature. Van Der Horst et al. (2007) and Sallis et al. (2000) found a consistent lack of association between self-perception, enjoyment, perceived barriers to physical activity and perceived body image and children's habitual physical activity. However, in a review focusing only on girls' physical activity, positive self-perception, enjoyment of physical activity and positive body image perception were associated with higher levels of physical activity, while perceptions of barriers to physical activity was associated with lower levels of physical activity (Biddle, et al., 2005). These findings are supported by qualitative evidence (Mulvihill, et al., 2000b). Furthermore, enjoyment is consistently identified as an important facilitator of physical

activity in qualitative studies (Mulvihill, et al., 2000a, 2000b; O'Dea, 2003). Children often report that enjoyment is enhanced when they engage in activities with friends (Casey, et al., 2009; Mulvihill, et al., 2000a) or when activities are less competitive (for girls) (Mulvihill, et al., 2000a). For boys, enjoyment appears to be enhanced when activities are team-related and competitive (Mulvihill, et al., 2000a). This provides some initial support for sex-specific influences on physical activity and the need for sex-specific analyses in correlational research.

Specific perceived barriers, such as lack of time and the cost related to engaging in physical activity, have not consistently been identified in the quantitative literature but have been identified in a number of qualitative studies of children's physical activity (Mulvihill, et al., 2000a, 2000b; O'Dea, 2003; Vu, et al., 2006). For example, a lack of time (including both the child's and parent's time) was considered a barrier to children engaging in more physical activity. In a qualitative study, children reported that their parents often worked late and were too busy with housework (Mulvihill, et al., 2000a). Having too much homework has also been qualitatively identified as an important barrier to being physically active (Vu, et al., 2006).

Perceived benefits have been explored in both the quantitative and qualitative literature. No association was found between perceived benefits and habitual physical activity in quantitative studies (Sallis, Prochaska, et al., 2000). Using focus groups, Mulvihill et al. (2000a, 2000b) and Casey et al. (2009) reported that children have a high level of awareness of the health-related benefits (e.g. keeping fit, living longer and reduced risk of heart attacks) and social benefits of engaging in physical activity. While children may hold these perceptions, this evidence suggests that they may not necessarily be acting on these perceptions.

Attitudes and outcome expectations of physical activity have also been investigated as correlates of habitual physical activity in children. It is generally thought that children who hold positive attitudes for certain activities are more likely to participate in those activities (Kohl & Hobbs, 1998). However, results of an association between attitudes of physical

activity and habitual physical activity in children in quantitative studies have been indeterminate (Sallis, Prochaska, et al., 2000).

2.8.2.3 Behavioural correlates

For children, certain behavioural variables have been associated with habitual physical activity. Smoking, and problems in the classroom (e.g. being left out of peer groups, rowdiness and difficulties sitting still during class time), are associated with lower levels of physical activity in girls (Biddle, et al., 2005; Verloigne, et al., 2012). Walking to and from school and previous physical activity are consistently associated with higher levels of physical activity (Sallis, Prochaska, et al., 2000; Verloigne, et al., 2012). There are mixed results for PE/sport participation and watching TV correlates. A consistent positive association has been reported for PE/sport participation and girls' physical activity (Biddle, et al., 2005) but indeterminate in a review of studies involving both boys and girls (Verloigne, et al., 2012). On the other hand, children's perceptions of PE participation at school have been explored in more detail through qualitative studies (Mulvihill, et al., 2000a, 2000b) and results show that older girls tend to report a general dislike for PE lessons and the PE teachers, whereas younger children identified PE as a 'favourite activity'. Biddle et al. (2005) and Sallis et al. (2000) reported indeterminate associations between watching TV and habitual physical activity but in a more recent review, Van Der Horst et al. (2007) found no association between watching TV and habitual physical activity.

2.8.2.4 Sociocultural correlates

The majority of sociocultural correlates studied in the literature relate to parental influences. The mechanisms in which parents influence children's physical activity can be direct (e.g. providing a supportive environment, transporting children to physical activity venues, paying fees), indirect (e.g. role modelling) or a combination of both (Verloigne, et al., 2012). Results of a relationship between sociocultural influences and physical activity have been mixed. Children with active parents or family members are more likely to be active compared to children with inactive parents (Pugliese & Tinsley, 2007; Van Der Horst, et al., 2007; Verloigne, et al., 2012). This is particularly true for boys, in which Van Der Horst et al. (2007) reported consistent positive associations for boys but not for girls. These findings are

reflected in the qualitative literature (Casey, et al., 2009; Mulvihill, et al., 2000a, 2000b; Vu, et al., 2006). However, a comprehensive review of environmental correlate reviews (de Vet, de Ridder, & de Wit, 2011) found that, overall, family physical activity was not related to children's physical activity.

Evidence of a relationship between parental support (including encouragement and logistic support), engaging in physical activity with parents and parental attitudes and beliefs towards physical activity and children's physical activity have been inconsistent across the review articles. Results of an association between friend support and habitual physical activity have consistently been reported as indeterminate in two systematic reviews (Biddle, et al., 2005; Ferreira, et al., 2007). Similar findings have been reported for teacher support (Ferreira, et al., 2007) and parental rules/restrictions relating to physical activity (Verloigne, et al., 2012). In contrast, qualitative studies have identified peer support as an important factor of children's physical activity, with children more likely to partake in physical activity if their friends take part (Casey, et al., 2009; Mulvihill, et al., 2000a, 2000b; O'Dea, 2003). Casey et al. (2009) found that children who did not receive positive feedback from or were teased by their peers were less likely to engage in physical activity. In particular, girls have reported that male peers are very intimidating and often deterred them from engaging in physical activity (Casey, et al., 2009; Mulvihill, et al., 2000a, 2000b; Vu, et al., 2006).

Family size (Ferreira, et al., 2007), the number of parents per household (Ferreira, et al., 2007; Van Der Horst, et al., 2007; Verloigne, et al., 2012), parental ethnicity (Verloigne, et al., 2012) and parent supervision and permission (Verloigne, et al., 2012) are consistently reported as not being correlated with children's habitual physical activity. Interestingly, children are more likely to be in a low-active category if their parents have rules and restrictions in relation to screen-based activities (e.g. allowing children to watch television during mealtime, supervision during TV viewing) (Verloigne, et al., 2012). In a number of qualitative studies, children reported that parents have a substantial influence over their physical activity, determining whether or not children could walk to school, play sports, how far they were allowed to ride or how far away from the house they were allowed to play

(Dwyer et al., 2006; Mulvihill, et al., 2000a, 2000b; O'Dea, 2003; Vu, et al., 2006). This was consistently discussed in relation to fears and safety concerns held by the parents.

2.8.2.5 Physical environmental/policy correlates

Investigation of physical environmental/policy correlates has escalated since the publication of the Sallis et al. (2000) review, resulting in the publication of a number of systematic reviews focusing only on the environmental literature (Davison & Lawson, 2006; Ferreira, et al., 2007) and a review of systematic reviews (de Vet, et al., 2011). In the home environment, access to facilities and equipment has no association with habitual physical activity (Davison & Lawson, 2006; Ferreira, et al., 2007; Van Der Horst, et al., 2007; Verloigne, et al., 2012). In the school environment, a lack of association has been consistently reported between the number of enrolments at the school (size of the school) (Davison & Lawson, 2006), whereas mixed results have been reported for access to facilities at school (Davison & Lawson, 2006; Verloigne, et al., 2012). A number of neighbourhood-related variables have been investigated and reported in systematic reviews. Of these, large distances to and from school have been consistently associated with lower levels of physical activity and road and sidewalk infrastructure has been associated with higher levels of physical activity (Davison & Lawson, 2006). Indeterminate relationships have been identified for the presence of bike lanes (Davison & Lawson, 2006), street connectivity (Davison & Lawson, 2006), proximity of playgrounds and parks (Davison & Lawson, 2006) and whether children live in rural locations and children's habitual physical activity (Davison & Lawson, 2006; Ferreira, et al., 2007; Sallis, Prochaska, et al., 2000). In a qualitative study, Casey et al. (2009) reported that children perceived living in rural locations as a barrier to being active. Common barriers identified were limited opportunities, having to travel long distances to access sports and activities and a lack of players to fill a team (Casey, et al., 2009). However, the social norm associated with participating in sports and the strong encouragement from the community were identified as important facilitators of physical activity in rural areas (Casey, et al., 2009).

Facilities in the neighbourhood and traffic safety have mixed results, with Davison et al. (2006) reporting a consistent positive relationship but Ferreira et al. (2007) reporting a lack

of an association with daily physical activity. An association between crime and area deprivation and lower levels of physical activity have been reported (Davison & Lawson, 2006). However, this does not support the conclusions drawn from Sallis et al. (2000) who did not find an overall association with children's physical activity. Similarly, mixed results have been reported for the average temperature. Both Sallis et al. (2000) and Ferreira et al. (2007) concluded an indeterminate relationship with physical activity, whereas Davison et al. (2006) reported that lower physical activity levels were associated with higher average temperatures.

Investigating and understanding the influences of children's physical activity have both practical and theoretical implications (Bauman, et al., 2002). Correlational studies provide evidence to generate hypotheses about possible causal relationships between correlates and physical activity which can be targeted in intervention studies (Bauman, et al., 2002). From a theoretical perspective, studies investigating correlates of physical activity can be used to test, develop, modify or evolve theories and models of physical activity behaviour (Bauman, et al., 2002). However, as shown above, the overall picture of what consistently influences children's physical activity is still equivocal. There are a number of limitations associated with these studies that may be contributing to the overall confusion in the literature and need to be acknowledged.

2.8.3 Limitations in identifying correlates of physical activity

Identifying correlates that influence physical activity behaviour for inclusion into ecological models is extremely difficult because of the range and volatility of possible correlates, the complex interaction of these correlates, particularly in the youth population, and the limited capacity of respondents to conceptualise notions, such as self-efficacy (Dishman et al., 2002). As shown above, a number of high quality reviews have attempted to summarise the current quantitative literature (Bauman, et al., 2002; Biddle, et al., 2005; Davison & Lawson, 2006; Duncan, et al., 2005; Sallis, Prochaska, et al., 2000; Trost, Owen, Bauman, Sallis, & Brown, 2002; Van Der Horst, et al., 2007), but the diversity in research design, theoretical approaches, measurement approaches, population groups, predictors investigated and physical activity outcomes across correlate studies makes it difficult to integrate the findings

and identify consistently reported correlates. In addition, these reviews tend to adopt their own specific approach to reviewing the literature by focusing on a particular type of influence (e.g. physical environmental correlates or psychosocial correlates) or on specific samples (e.g. girls) and using different methods for analysing the data. This makes it difficult to comprehend the integrated evidence and to draw appropriate conclusions, adding to the equivocal nature of the correlate literature (Bauman, et al., 2002). These limitations have been well documented in the literature (Giles-Corti, et al., 2005; Sallis, et al., 2008; Sallis, Prochaska, et al., 2000; Welk, 2002).

Quantitative research has provided valuable insights into the modifiable and non-modifiable correlates of habitual physical activity (as discussed above in section 2.8.2) but these 'global' physical activity correlates tend to be used in correlate measurement tools and then applied to subpopulation groups of children and physical activity intervention programs without consideration of the context and settings in which physical activity occurs (Spink et al., 2006). Even though some predictors may be 'universal' and applicable across different contexts, such as sex and age, it cannot be assumed that all children are influenced in the same way across different contexts (Baranowski, et al., 1998; Welk, 1999). For example, social support may differ depending on the type of activity or the location of the activity (Hohepa, Scragg, Schofield, Kolt, & Schaaf, 2007). Parental support may be significant when children participate in organised sports but teacher support may be more important when children participate in lunchtime play (Sallis, Prochaska, et al., 2000). Hohepa et al. (2007) found that encouragement from parents, siblings, friends and schools was dependent on the time-specific physical activity examined in adolescents. In the lunchtime period, low peer support was associated with lower levels of physical activity, whereas in the after-school period, both low parent support and peer support was found to be associated with lower physical activity levels (Hohepa, et al., 2007). Furthermore, a large majority of current studies focusing on children's physical activity predictors have been conducted in the U.S. A systematic review of the physical activity correlate literature found that over 80% of studies conducted with children and 68% of studies conducted with adolescents were performed in the U.S. (Sallis & Saelens, 2000). There are significant context-specific differences between the U.S. and Australia, such as weather, school break times and types of activities. Therefore, results may not be applicable to the Australian context. By applying global correlates to

different contexts, there is no assurance that the dominant predictors will be captured, thus reducing the ability to describe why children do or do not participate in physical activity (Baranowski, et al., 1998). To date, no reviews have summarised the literature on correlates of lunchtime and after-school time-specific physical activity.

Correlates of physical activity can be assessed by a number of different methods, including direct observation and self-report methods. Observational methods (e.g. "System for Observing Children's Activity and Relationships during Play" [SOCARP] and "System for Observing Play and Leisure Activity in Youth" [SOPLAY] tools) tend to be used to collect objective data on environmental correlates, while self-report methods (e.g. Children' Physical Activity Correlates [CPAC] questionnaire or focus groups) obtain data on children's perceptions of intrapersonal, sociocultural and physical environmental/policy correlates. The choice of assessment has been shown to influence the strength of association between the specific correlate and the physical activity outcome (Ball et al., 2008; Prins, Oenema, Van Der Horst, & Brug, 2009). In a review of environmental correlates, de Vet et al. (2011) observed a negative association between the statistical incidents of crime and physical activity, whereas studies using perceptions of crime reported no association with physical activity. The distinction between objective and subjective correlates has important implications for intervention design because this will determine whether the focus should be targeted at the person or the environment.

Another important limitation of the correlate literature that needs to be acknowledged is that children completing questionnaires are often restricted to respond to a list of 'global' correlates or a list of correlates that have been predetermined and hypothesised as being relevant to the context under investigation (Darbyshire, MacDougall, & Schiller, 2005; Hohepa, Schofield, & Kolt, 2006; Scott, 1997). These correlates tend to have limited or poor evidence supporting the relationship with the physical activity context under investigation. This can lead to misconceptions of the primary correlates and possibly biased results. Welk (1999) also noted that some adult-derived correlate measurement tools have been reworded and administered to the youth population. There is an assumption that the correlates influencing adults' physical activity are salient to children's physical activity

(Stone, et al., 1998). However, adults and children have distinct physical activity patterns and types of behaviours and it cannot be assumed that these measurement tools will capture the range of important perceived correlates specific to children's activities.

Researchers tend to use purposely designed correlate questionnaires, which have not always been psychometrically tested in the target population or do not cover all domains of the social ecological model (Dishman, et al., 2002; McMinn, van Sluijs, Wedderkopp, Froberg, & Griffin, 2008; Ommundsen, Page, Ku, & Cooper, 2008; Sallis, Prochaska, et al., 2000). For example, Brustad (1993) studied the parental and psychological influences on children's attraction to physical activity using specifically developed measures. Only internal reliability was reported for this measure, which cast doubt on the conclusions drawn. Nichol et al. (2009) assessed the association between school environments and physical activity but did not report or refer to studies that have assessed the psychometric properties of the measurement tools used. Conversely, the Children's Physical Activity Correlates Questionnaire (CPA-C) is a tool used to measure psycho-social predictors that demonstrates acceptable internal consistency of 0.79–0.92 and moderate concurrent validity of 0.31 – 0. 53 (Schaben, Welk, R, & Hensley, 2006). However, this tool does not take into consideration environmental correlates, which may account for the relatively moderate value of variance explained (21%) (Schaben, et al., 2006). There are even fewer studies that have used correlate measurement tools where children have been the key informants during the development, with some notable exceptions (Ommundsen, et al., 2008; Wu, Ronis, Pender, & Jwo, 2002). Involving children in the research process can be highly beneficial in gaining further insights into correlates influencing children's physical activity that may get overlooked when relying on adult-adapted or predetermined correlate questionnaires (Bauer, Yang, & Austin, 2004; Biddle, Markland, Gilbourne, Chatzisarantis, & Sparkes, 2001; Masse, Dassa, Gauvin, Giles-Corti, & Motl, 2002).

Research on correlates of physical activity is also limited by problems in measuring the physical activity outcome (Dishman, 1994). Majority of correlate research utilise self-report measures of physical activity rather than gold standard measures, such as doubly labelled water and direct calorimetry. However, these gold standard methods are usually not

practical for larger samples and assessment of free-living physical activity. Researchers tend to trade accuracy for more practical methods, such as self-report, heart rate monitors, accelerometers and direct observation (Ferreira, et al., 2007). Each different physical activity measure has known advantages and limitations, which need to be carefully considered when researching correlates of physical activity (Dale, Welk, & Matthews, 2002).

Research has shown differences in the relationships between correlates and activity level as a function of the type of physical activity assessment technique used (Dishman, Darracott, & Lambert, 1992; Epstein, Paluch, Coleman, Vito, & Anderson, 1996). Dishman et al. (1992) found that a composite measure of psychological correlates predicted self-report physical activity but did not predict objectively measured physical activity. Baranowski et al. (1998) alludes to the fact that the type of measurement technique used may also impact on the prediction of physical activity. Studies using objective measures of physical activity, such as heart rate monitoring and accelerometers, as opposed to self-reported, have generally only been able to explain 5-13% of variance and fewer significant associations (Sallis, Taylor, & Dowda, 2002; Trost, Pate, Ward, Saunders, & Riner, 1999; Trost, Saunders, & Ward, 2002). This may be because objective measurement is less prone to measurement error or fails to capture actual physical activity (e.g. accelerometers cannot capture energy expenditure association with arm movements) (Sallis & Saelens, 2000; Welk, et al., 2000). Choosing an appropriate measure of physical activity is fundamental to exploring context-specific physical activity correlates because it can have implications for explaining and identifying predictors of physical activity. Not all studies have the capacity to utilise gold standard measures of physical activity. Therefore, time should be given to carefully consider the advantages and limitations of other types of physical activity measures.

2.8.4 Increasing specificity of correlate research

In light of a number of limitations in the current correlate literature, the poor prediction of physical activity and modest performance of physical activity interventions, there is a need for a conceptual shift in how correlate research is conducted (Nichol, et al., 2009; Owen, Leslie, Salmon, & Fotheringham, 2000). Ajzen and Fishbein (1980) proposed that in order to maximise predictive capacity of attitudinal models and measurement tools, the predictor

(correlate) and criterion (behaviour) should be measured at the same level of specificity. In 2005, Giles-Corti et al. (2005) published a key article calling for increased specificity of ecological models and correlate research in the physical activity field. In researching walking behaviour in different contexts, such as walking in neighbourhoods and walking for active transportation, Giles-Corti et al. (2005) identified a significant gap in the current correlate research, in which a large majority of studies lacked correspondence between the behaviour and correlates being investigated (i.e. collecting data on environmental correlates at the neighbourhood level but measuring overall walking). From this, it was proposed that the predictive capacity of ecological models and correlate research could potentially be further enhanced by measuring context-specific behaviour in clearly defined environments along with the correlates that are specific to the behaviour outcome under investigation (Giles-Corti, et al., 2005; Owen, et al., 2000). In a selective review, Giles-Corti et al. (2005) found that the predictive capacity of ecological models appeared to improve when the environmental correlates measured were more closely matched to the behaviour of interest and the setting in which the behaviour took place. In addition to this, Humpel et al. (2004) also found that the predictive capacity of ecological models could be improved if greater specificity was incorporated into the measurement of context-specific behaviour.

Although the majority of studies investigating the concept of increasing specificity of ecological models and correlate research have primarily focussed on adult populations in the field of walking, this approach can also be applied to children's context-specific physical activity. Children engage in a number of different types of physical activity behaviours, in various locations and at different times of the day (Ridgers, Stratton, & McKenzie, 2010). For example, children may actively commute via walking or cycling to school in the morning, participate in physical education during class time, engage in active games during school break times and participate in an organised sport in the after-school period. The relative importance of correlates influencing their physical activity in the various contexts may vary depending on the characteristics of the activity, person (such as age and sex) and the subjective meaning that children place on activities (e.g. active transport versus sport) (Vilhjalmsson & Kristjansdottir, 2003) and therefore, warrants further exploration.

Emerging research is beginning to address the challenge of examining the impact of the context on physical activity behaviour in children (Humbert et al., 2006; Ommundsen, et al., 2006; Sjolie & Thuen, 2002; Spink, et al., 2006; Trost, et al., 1997; Verstraete, et al., 2006; Ziviani et al., 2008). For example, Ommundsen et al. (2006) conducted a study in Norway as part of the European Youth Heart Study to demonstrate that psycho-social and perceived environmental predictors of physical activity are location-specific. They concluded that there were some similarities but also some important differences in physical activity predictors according to the age and sex of the participants and location where participants engaged in physical activity. For example, peer support, enjoyment and perceived competence generalised across before, during and after-school activities, whereas parental support was a predictor of after-school activity and teacher support was a predictor of free play during school. However, there are a number of important limitations in this study that need to be acknowledged, including a lack of objectively measured physical activity, a narrow view of hypothesised predictors and a limited number of items to measure each construct. Spink et al. (2006) conducted a study exploring the predictors of unstructured and structured activity in active youth. Results showed that enjoyment, perceived competence, parental support and coaches' support were related to engaging in structured activities, whereas friends' participation was a predictor of unstructured activities. The results from this study provide initial evidence that predictors differ depending on the types of activity performed.

2.8.5 Measurement of correlates

The use of context-specific correlate measures (i.e. measures that contain items that have been worded to place the correlate into a specific context) based on a social ecological model is also a vital component to increasing specificity of correlate research and improving prediction of context-specific behaviour (Giles-Corti, et al., 2005). As discussed previously, observational methods are used to objectively assess environmental correlates (e.g. participation with friends, number of facilities, average temperatures), whereas self-report methods are more commonly used to assess intrapersonal (e.g. self-efficacy, enjoyment) and perceptions of environmental correlates (e.g. quality of equipment and spaces, perceptions of safety).

There are a number of self-report questionnaires specifically designed to assess location-specific environmental correlates, such as the home, neighbourhood and school environments (Durant et al., 2009; Hume, Ball, & Salmon, 2006; Robertson-Wilson, Levesque, & Holden, 2007) and correlates associated with specific types of physical activity, such as active transport, physical education and leisure activities (Evenson et al., 2006; Kerner & Kalinski, 2002; Papaioannou, 1994). However, few self-report measures exist that assess correlates specific to time-specific physical activity in children.

The level of specificity and measurement properties of correlate tools used in lunchtime and after-school cross-sectional studies conducted with children that claim to use a social ecological model have been investigated and presented in Table 2.4. After reviewing the literature focusing on the correlates of lunchtime and after-school time-specific physical activity, there are no known measures used that assess correlates at all levels of the social ecological model, contain items that are specifically worded for the lunchtime and/or after-school time periods, and assess correlates that have been conceptualised and defined by children. The time-specific context was chosen as the anchor point for this review because it also captures the domain or specific type of physical activity and the location in which physical activity occurs. Specific measures were defined as those that made reference to a specific time of the day within any item and may include items that are domain or location specific with reference to the time of day. There was no report of any measures being developed in conjunction with participants from the target population. Furthermore, even though the studies by Ommundsen et al. (2006), Rushovich et al. (2006) and Leslie et al. (2010) contain specific items that assess correlates in each social ecological domain, the physical activity outcome used in these studies was assessed using subjective measures. However, it has been found that children have a tendency to underestimate low intensity physical activity behaviour and overestimate high intensity physical activity behaviours, thus introducing measurement error (Bates, 2006; Klesges et al., 1990; Welk, et al., 2000). This can potentially result in the incorrect identification of significant associations. Rushovich et al. (2006) was the only study that used an objective time-specific physical activity outcome and a specific correlate measure.

Not all studies reported the amount of variance explained by the correlates. The studies that did report explained variance generally explained quite significant amounts of variance in context-specific physical activity (Ommundsen, et al., 2006; Sallis et al., 2001). This may be explained by the correspondence of specificity between the correlate questionnaire items and the physical activity outcome, further supporting the importance for increasing specificity of correlate research. However, what is particularly noticeable is the number of studies where the correlate measures have been researcher-determined. It is unclear whether there are other important correlates related to lunchtime and after-school physical activity that should have been assessed. This is a potential limitation of the current evidence in this area because it may limit the amount of physical activity variance that can be explained and prevent the identification of all the potential primary correlates that influence the context-specific physical activity under investigation. It has been recommended that the use of qualitative approaches is effective in identifying additional correlates that may not be prevalent in the current evidence, thus potentially contributing to explaining additional variance (Humbert et al., 2008). Based on the evidence presented here, there is a need to develop a measurement tool that specifically measures intrapersonal, sociocultural and physical environmental/policy correlates of lunchtime and after-school physical activity in children, which has been informed not only by what the primary researcher believes is important for a particular context based on existing evidence, but also from other sources, such as children.

Table 2.4 Specificity characteristics of measures used in lunchtime and after-school physical activity studies

Study	Country	Components of the social ecological model addressed	Correlate tool (generic/specific)	Type of correlate measurement	Correlate identification	Physical activity outcome	Type of physical activity measurement	Variance explained
LUNCHTIME								
(Ridgers, Fairclough, & Stratton, 2010)	U.K.	Intrapersonal and Physical environment	Specific	Direct observation (SOCARP)	NR	Specific	Direct observation (SOCARP)	NR
(Willenberg et al., 2010)	Australia	Intrapersonal and Physical environment	Specific	Direct observation (SOPLAY)	NR	Specific	Direct observation (SOPLAY)	NR
(Ommundsen, et al., 2006)	Norway	All	Specific	Self-report	Researcher-derived	Specific	Self-report (PAQ-C)	55%
(Hohepa, et al., 2007)	New Zealand	Intrapersonal and Sociocultural	Generic	Self-report	NR	Specific	Self-report (PAQ-C)	NR
(Sallis, et al., 2001)	U.S.	Physical environment	Specific	Direct observation (SOPLAY)	NR	Specific	Direct observation (SOPLAY)	42-59%
AFTER SCHOOL								
(Rushovich, et al., 2006)	U.S.	All	Specific	Self-report	Researcher-derived	Specific	Self-report (3DPAR) and Accelerometry	NR
(Timperio et al., 2008)	Australia	Physical environment	Specific	Direct observation	Researcher-derived	Specific	Accelerometry	NR

Study	Country	Components of the social ecological model addressed	Correlate tool (generic/specific)	Type of correlate measurement	Correlate identification	Physical activity outcome	Type of physical activity measurement	Variance explained
(Leslie, et al., 2010)	Australia	All	Specific	Self-report	NR	Specific	Self-report (PAQ-A)	NR
(Ommundsen, et al., 2006)	Norway	All	Specific	Self-report	Researcher-derived	Specific	Self-report (PAQ-C)	15 - 44%
(Saunders et al., 1997)	U.S.	Intrapersonal and Sociocultural	Generic	Self-report	Researcher-derived	Specific	Self-report (PDPAR)	NR
(Pate et al., 1997)	U.S.	All	Generic	Self-report	Researcher-derived	Specific	Self-report (PDPAR)	NR
(Adkins, Sherwood, Story, & Davis, 2004)	U.S.	All	Generic	Self-report	NR	Specific	Accelerometry	NR
(Hohepa, Scragg, Schofield, Kolt, & Schaaf, 2009)	New Zealand	Intrapersonal and Sociocultural	Generic	Self-report	NR	Specific	Self-report (PAQ-C)	NR
(Hohepa, et al., 2007)	New Zealand	Intrapersonal and Sociocultural	Generic	Self-report	NR	Specific	Self-report (PAQ-C)	NR

Notes: NR = not reported; PAQ-C and PAQ-A = Physical Activity Questionnaire for Children and Adolescents; PDPAR = Previous Day Physical Activity Recall; 3DPAR = 3 Day Physical Activity Recall; SOPLAY = System for Observing Play and Leisure Activity in Youth; SOCARP = System for Observing Children's Activity and Relationships during Play.
Specific correlate measures are defined as those that make reference to a specific time of the day within any item and may include items that are domain- or location-specific with reference to the time of day. A specific physical activity outcome refers to physical activity occurring in a specific time period. Generic correlate measures are defined as those that make no reference to a specific time of the day, type of activity or a location in which the activity occurs.

2.9 Significance of the research study

Several opportunities exist within a day where children can be active. However, a number of children are not as active as they could be and there is an overall concern about the number of children failing to achieve the recommended levels of physical activity (Fisher, Reilly, et al., 2005; Hinkley, et al., 2008; Sallis, Prochaska, et al., 2000). It is important that research efforts focus on exploring and understanding children's physical activity behaviours and the correlates that influence their behaviour in different contexts from a multi-dimensional perspective. Physical activity is influenced by a number of different variables and no one variable can account for all the variance. Different correlates may be more influential at different times of the day and it is important to identify the relative influence of these correlates in different contexts (Giles-Corti, et al., 2005; Hohepa, et al., 2007; Ommundsen, et al., 2006). This would facilitate the development and improve the overall performance of physical activity promotional interventions and programs that are tailored and targeted to different contexts. Research into children's lunchtime and after-school physical activity is still in its infancy and requires further detailed exploration using objective physical activity monitoring methods, such as accelerometry.

Previous research has identified a number of potential correlates of children's physical activity (e.g. Biddle, et al., 2005; Ferreira, et al., 2007; Sallis, Prochaska, et al., 2000; Van Der Horst, et al., 2007). However, these studies tend to identify correlates relevant to habitual physical activity or specific types of behaviour without defining the time of day in which these behaviours are performed. In addition, quantitative studies aiming to identify correlates of children's physical activity behaviour appear to focus on a narrow set of predefined correlates, which are often inferred by adults (Darbyshire, MacDougall, et al., 2005). Studies applying these predefined correlates to predict context-specific physical activity have reported modest amounts of explained variance in context-specific behaviour (Haerens et al., 2009; Ommundsen, et al., 2006). This raises a number of concerns as to the relevance of these correlates in child populations and specifically defined contexts. Furthermore, correlate studies lack the appropriate level of measurement correspondence between the correlate and the physical activity outcome, preventing the identification of the primary correlates that may influence context-specific physical activity and reducing the

study's predictive capacity of the context-specific physical activity outcome. This has significant implications for health promoters, program developers and health professionals who aim to develop and tailor strategies to enhance children's participation in physical activity. Additional research is required to systematically examine the intrapersonal, sociocultural and physical environmental/policy context-specific correlates that influence children's context-specific physical activity.

Emerging research is beginning to address the challenge of defining context-specific physical activity predictors (Humbert, et al., 2006; Ommundsen, et al., 2006; Sjolie & Thuen, 2002; Spink, et al., 2006; Verstraete, et al., 2006; Ziviani, et al., 2008). There have been few studies that have looked specifically at the correlates that influence lunchtime and after-school physical activity, which are two critical "windows" in the development of children's habitual physical activity. As discussed above, a key study was conducted by Ommundsen et al. (2006) in Norway as part of the European Youth Heart Study. This is the only known study to date that has explored context-specific physical activity and demonstrated that psycho-social and perceived environmental predictors of physical activity are location-specific. The proposed research will build on the study conducted by Ommundsen et al. (2006) and contribute to and evolve the body of knowledge by:

- undertaking a systematic review of the correlate literature to identify evidence of correlates of lunchtime and after-school physical activity
- identifying predictors perceived to be important by children and that are relevant to the Australian context
- designing context-specific questionnaires (containing context-specific worded items) to identify time-specific differences in the correlates of lunchtime and after-school physical activity
- conducting a factor analysis to verify the factorial validity of the perceived correlates
- assessing differences in correlates between boys and girls based on recommendations from previous physical activity correlate research (Sallis, Prochaska, et al., 2000; Van Der Horst, et al., 2007)
- using objective measurement to quantify lunchtime and after-school physical activity, and

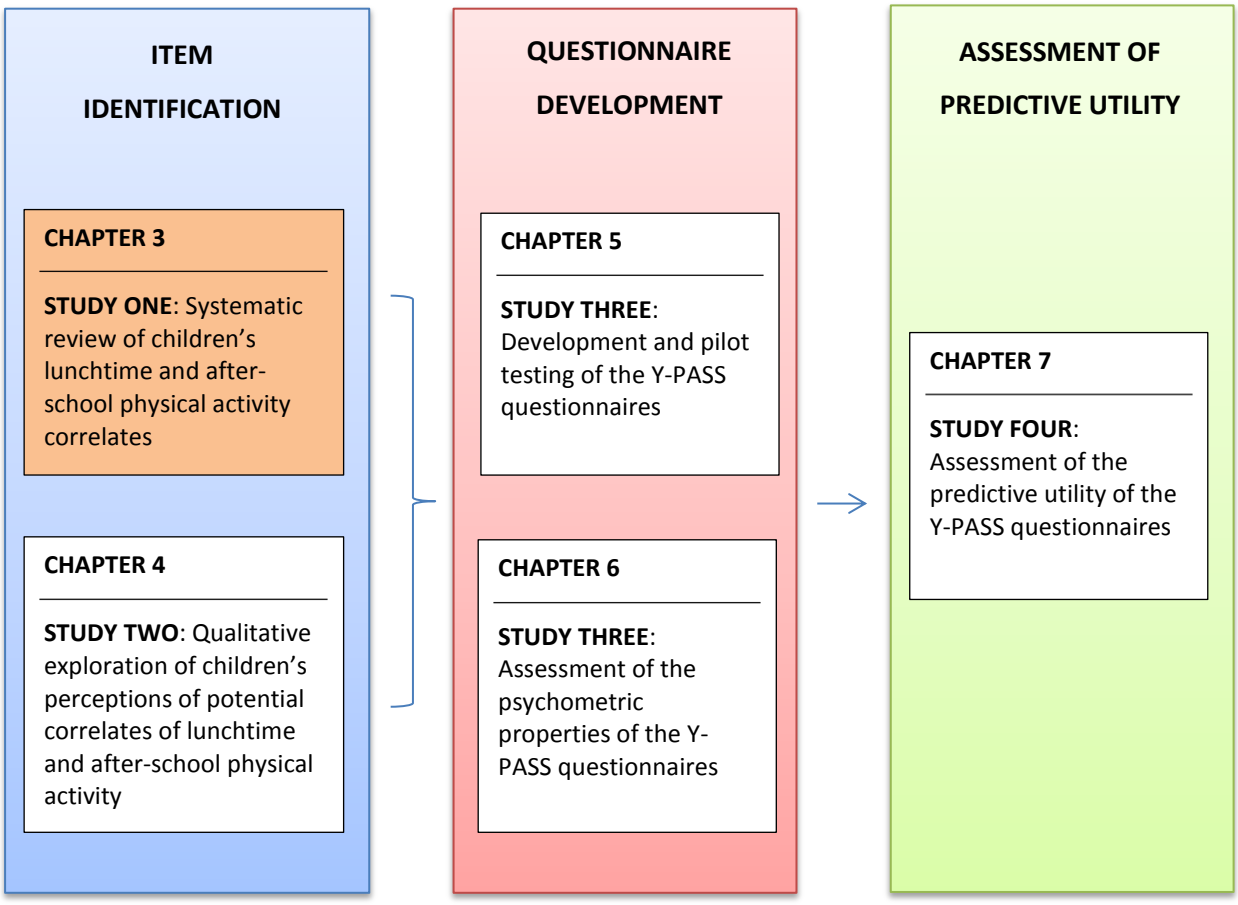
- demonstrating the effectiveness of increasing specificity of correlate research in the areas of children's lunchtime and after-school physical activity.

2.10 Summary

This chapter has provided an overview of the literature, highlighting the importance of exploring correlates of children's context-specific physical activity. A number of limitations of the current correlate literature relating to its applicability to exploring context-specific physical activity have been exposed. This chapter has also established that few theoretically derived questionnaires exist that measure the contextual correlates of lunchtime and after-school context-specific physical activity, highlighting the need for the development of new questionnaires. Chapter 3 will present the findings from a systematic review of the lunchtime and after-school correlate literature, undertaken to assist in designing context-specific correlate questionnaire items, which forms the first step in questionnaire development.

CHAPTER 3

Study One: Systematic review of the correlates of children's lunchtime and after-school physical activity



Chapter 3

3 Systematic review of the correlates of children's lunchtime and after-school physical activity

Research aim:

To undertake a systematic review of the literature to identify the correlates of children's lunchtime and after-school physical activity.

3.1 Introduction

The literature review established that there are few theoretically derived questionnaires available to measure the contextual correlates of lunchtime and after-school context-specific physical activity, highlighting the need for development of new questionnaires. The first step of questionnaire development is to identify potential content for inclusion in the questionnaires (Frazer & Lawley, 2000; Streiner & Norman, 1995). This can be achieved by conducting a systematic review of the literature, which will establish whether any existing empirical studies have been conducted and provide an in-depth understanding of the available evidence on the correlates of lunchtime and after-school physical activity (Pett, Lackey, & Sullivan, 2003). To date, no systematic reviews have been conducted on the correlates of lunchtime and after-school physical activity.

A number of high quality reviews have attempted to synthesise the current literature for understanding correlates of habitual physical activity (Bauman, et al., 2002; Biddle, et al., 2005; Davison & Lawson, 2006; Duncan, et al., 2005; Sallis, Prochaska, et al., 2000; Trost, Owen, et al., 2002; Van Der Horst, et al., 2007), with very few focusing on correlates of physical activity in specific contexts (Ferreira, et al., 2007). Previous reviews have used habitual physical activity, an overall measure of total physical activity, as the dependent

variable without consideration of the specific type of behaviour (e.g. walking, moderate to vigorous physical activity), location (e.g. home, neighbourhood, school) or time of day in which physical activity is performed (Bauman, et al., 2002; Biddle, et al., 2005; Davison & Lawson, 2006; Duncan, et al., 2005; Sallis, Prochaska, et al., 2000; Trost, Owen, et al., 2002; Van Der Horst, et al., 2007). Furthermore, these reviews tend to combine conceptually similar correlates. For example, access to specific spaces, such as green spaces and bitumen spaces, are collapsed into one 'access to space' correlate. While this is done for ease of interpretation, a level of contextual information is lost, which may be crucial in understanding physical activity behaviour in specific contexts. Ferreira et al. (2007) did conduct an important review of environmental correlates using physical activity performed in the home, school and neighbourhood contexts as the dependent variable. However, this review did not include the psychological or behavioural domains of the ecological model, leaving an important gap in the reviewed literature.

While these reviews are useful for obtaining an overview of correlates of children's habitual physical activity, applying these findings to understand the influences on specific physical activity behaviours in different contexts may be less useful, as the correlates may not be applicable to the specific context under investigation. Similarly, when using these correlates in intervention design and questionnaire development there is no assurance that the dominant correlates will be captured or targeted, thus reducing the ability to gain a comprehensive understanding and effectively influence physical activity behaviour (Baranowski, et al., 1997; Bauman, et al., 2002).

The aim of this study was to undertake a systematic review of the literature to identify the correlates of children's lunchtime and after-school physical activity. In addition, a qualitative exploration of potential correlates was also conducted (reported in Chapter 4) to supplement the findings from the systematic review and ensure all potential correlates were identified. The list of potential correlates generated from the systematic review and qualitative exploration informed the questionnaire development (Chapter 5) and was subsequently tested for reliability, validity and usability (Chapter 6 and 7). This chapter uses the term "school break time" instead of "lunchtime" as there were some studies included in

the review that also assessed other school break times, such as recess, in addition to the lunchtime period. This study has been published in a peer-reviewed journal (Stanley, Ridley, et al., 2012).

3.2 Methods

3.2.1 Search strategy

A systematic search of the literature was conducted to identify studies that assessed potential correlates of school break time and after-school physical activity. Peer-reviewed journal articles (in the English language), published between 1990 and January 2011 were searched using electronic databases (Medline, Scopus, EbscoHost [Academic Search Premier, CINAHL, ERIC, Health Source: Nursing/Academic Edition, Pre-CINAHL, PsycARTICLES, Psychology and Behavioral Sciences Collection, PsycINFO, SPORTDiscus, Academic Search Alumni Edition] and Web of Knowledge), as well as conducting manual searches of reference lists of retrieved studies. The following keyword combinations were used: children, adolescents, youth, younger person, young people, physical activity, sport, exercise, free play, play, leisure activity, organised activity, non-organised activity, transport, active transport, active commuting, recreation, correlate, determinant, predictor, factor, association, influencers, recess, lunchtime, lunch break, recess break, recess time, school break, after-school, environment, physical environment, facilities, school, built environment, psychosocial, social environment, sociocultural environment, neighbourhood, and perceived environment. The truncation symbol was used to ensure all terms with the respective prefix were identified. The search strategy (databases and search terms) was validated by an experienced research librarian. Titles and abstracts of potential articles were reviewed for relevance. The full-text copy of the article was retrieved for all abstracts fitting the selection criteria.

3.2.2 Selection criteria

3.2.2.1 Types of articles

Studies that reported cross-sectional, longitudinal or experimental results were included in the review. Questionnaire validation studies focusing on testing psychometric properties of

measurement tools were only included if they explored the association between a correlate and time-specific physical activity. Qualitative studies, expert opinion, conference proceedings, dissertations and case studies were excluded.

3.2.2.2 Sample

Studies were required to have been conducted with participants of preadolescent years in primary schools. There is some confusion as to how to define preadolescence by age in years. Typically, preadolescence is defined as 9-13 years (Breinbauer, 2005, p. 262) but some reports include children aged 8-12 years, 9-14 years, 9-13 years or 12-14 years (Aeffect Inc, 2000; Simpson, et al., 1998). For this review, preadolescence was defined as 8-14 years to capture all potential studies focusing on this age group. Due to variability of the age at which children transition from primary to secondary school across countries and likely differences between social and environmental characteristics of these two school settings (Garcia, Pender, Antonakos, & Ronis, 1998; Sallis, et al., 2002), only preadolescent studies containing primary school children's data were included. If an identified study included students from both primary and secondary schools and conducted separate age or grade analyses, only the findings corresponding to primary school grade level were used.

Only studies on healthy populations were included. Studies on specific groups or non-healthy populations (e.g. children with a disability, cancer, clinical populations, clinically overweight/obese etc.) were excluded because these population groups often have unique physical activity patterns and related correlates that are specific for that population group and cannot be generalised to the wider population.

3.2.2.3 Dependent variable inclusion criteria

To qualify for inclusion, studies needed to measure time-specific physical activity, accrued during the school break time or after-school time periods, as a dependent variable. The school break time period was defined as any scheduled break time during school hours (e.g. lunchtime, morning/afternoon break). The after-school period was defined as the time between 3.00 – 6:00 pm (or within 30 minutes of the identified period), which is

approximately the end of the school day until dinner time (Atkin, et al., 2008). Studies investigating specific types of physical activity, such as active transport, sport and exercise, with no description of the time of day when these behaviours were performed, were excluded. Studies focusing solely on sedentary behaviour were also excluded because physical activity and sedentary behaviour are distinct behaviours with unique correlates (Biddle, Gorely, & Stensel, 2004; Ferreira, et al., 2007; Gordon-Larsen, McMurray, & Popkin, 2000). It is acknowledged that sedentarism is an important behaviour but it is not the focus of this review. Recent reviews have been conducted to identify the correlates of sedentary behaviour (Hoyos Cillero & Jago, 2010; Van Der Horst, et al., 2007).

3.2.2.4 Independent variable inclusion criteria

The correlates measured in the studies needed to be tested for an association with physical activity that occurred either during the school break time or after-school periods. Studies that did not demonstrate this were excluded.

3.2.3 Quality assessment of methodology

The methodological quality of cross-sectional studies and intervention studies that met the inclusion criteria were independently assessed by two reviewers (RMS, JD). Where there was disagreement between the two reviewers, consensus was reached by discussion. The quality of the cross-sectional studies was assessed using an 8-item quality assessment scale adapted from a previous review (Lubans, Boreham, Kelly, & Foster, 2011) for a school break time and after-school context (refer to Appendix 1). A score was assigned to each study based on whether the quality assessment items were sufficiently described (1), absent (0) or insufficiently described (?). The scores were summed and described as low quality (0-2), medium quality (3-5), and high quality (6-8). Intervention studies were assessed for quality using an 8-item assessment scale adapted from Van Sluijs et al. (2007) (refer to Appendix 1). Each study was scored on whether the quality assessment items were sufficiently described (1), absent (0) or insufficiently described (?). The scores were summed and the quality classification was defined as low quality (0-2), medium quality (3-5) and high quality (6-8).

3.2.4 Coding associations with physical activity

As no reviews of time-specific correlates have previously been conducted, all correlates measured in at least one study were included. Studies included in the review used a range of statistical techniques to evaluate the associations, including both univariate and multivariate analyses, which were adjusted for demographic and/or other potential correlates. Where possible, the adjusted model was used to evaluate the associations. Where results for sex and physical activity intensity were reported separately and different associations obtained, they have been treated as separate results and noted accordingly. If the associations for sex and physical activity intensity were reported in the same direction, the results were combined. This same approach was used in a previous systematic review (Hinkley, et al., 2008). The correlates were grouped into six main categories of demographic/biological, psychological, behavioural, social/cultural, physical environment and policy. This categorisation of correlates was used by Sallis et al. (2000) and subsequent reviews (Biddle, et al., 2005; Ferreira, et al., 2007; Van Der Horst, et al., 2007) and is based on a social ecological framework.

Correlates were coded based on statistical significance and the direction of association. The direction of the association between the correlate and time-specific physical activity was coded as either positive (+), inverse (-) or no association (0). No association was identified if there was a non-significant association between the independent variable and time-specific physical activity. The consistency of an identified association was determined by the number of findings supporting a hypothesised association. The cut-off coding was based on the codes used by Sallis et al. (2000). If 0-33% of the findings supported the association it was coded as "0"; if 34-59% of the findings supported the association it was defined as indeterminate and coded as "?"; and if 60-100% of the findings supported the association it was coded depending on the direction of the association, as either negative (-) or positive (+). Potential correlates related to school break time and after-school physical activity and the direction of association are reported separately in Tables 3.2 and 3.4. Correlates identified in intervention studies were reported separately as these indicate correlates of behavioural change (Welk, 2002). These correlates can provide additional insights into which correlates

should be specifically targeted to help promote time-specific physical activity and are reported in Table 3.3.

3.3 Results

3.3.1 Characteristics of the studies reviewed

Of the 5681 studies identified from the electronic database and manual searches, 151 studies met the inclusion criteria, based on their titles and abstracts. After reviewing the full-text of these studies in more detail, only 22 studies met the inclusion criteria for this systematic review, 12 of which related to school break time physical activity and ten studies related to after-school physical activity. The main reasons for exclusion of some full-text articles were: the age of the sample, the study design, the study was a duplicate, the school setting was a secondary school, the focus was a specific behaviour without reference to a specific time period, the dependent variable was habitual physical activity (i.e. not time specific), the study did not measure potential correlates, and physical activity was not the dependent variable. Refer to Figure 3.1, which demonstrates how the final number of studies was identified for inclusion in the systematic review.

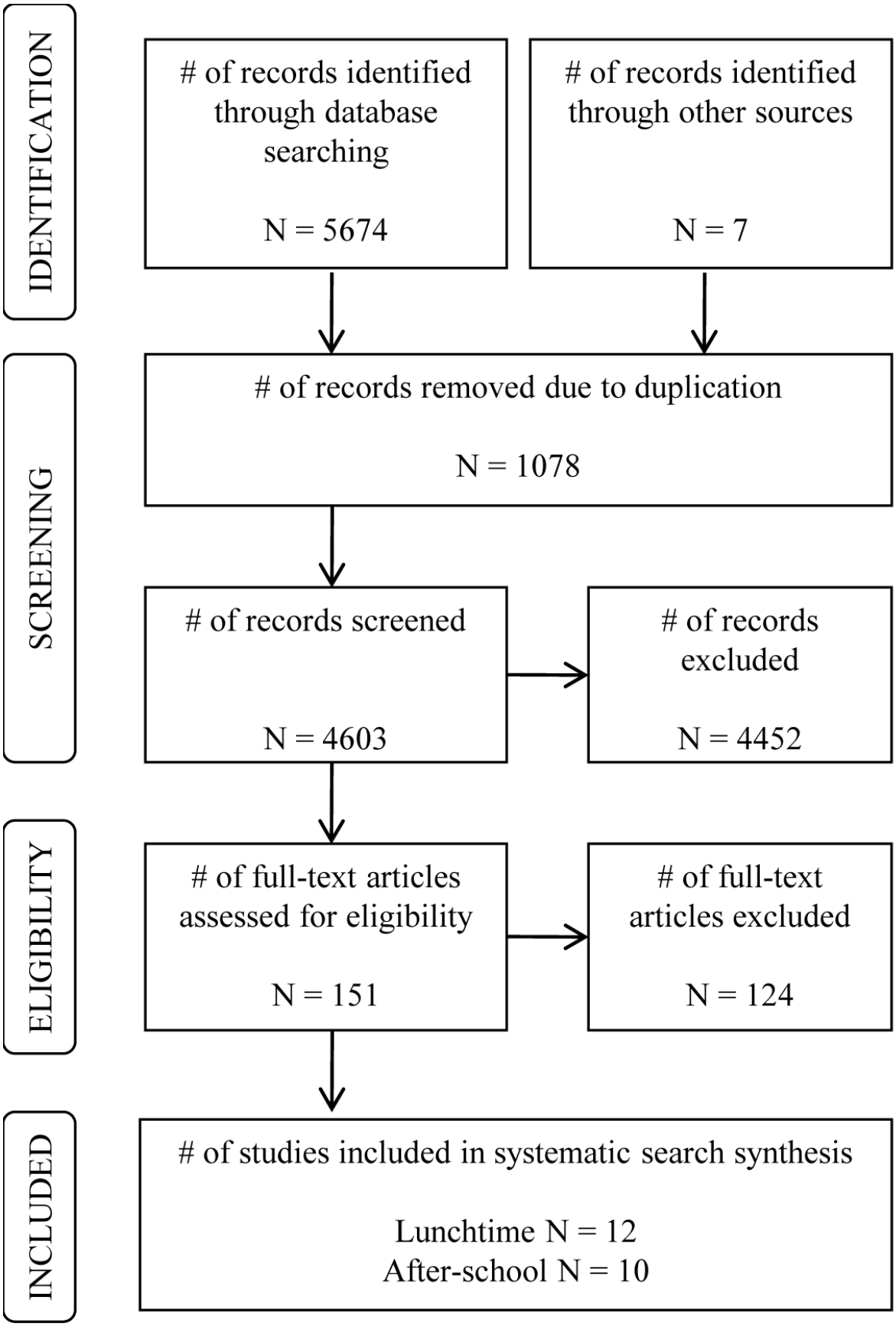


Figure 3.1 Flow chart of search results

Table 3.1 summarises the study characteristics, including the study design, theoretical framework and measurement methods. Of the studies included in the review, five were intervention studies, with two being randomised controlled trials (Loucaides, Jago, & Charalambous, 2009; Verstraete, et al., 2006), two being quasi-experimental studies (Ridgers, et al., 2007b; Stratton & Mullan, 2005) and one using a pretest-posttest design on a single sample (Harten, Olds, & Dollman, 2008). Nine studies focusing on the after-school period (Adkins, et al., 2004; Dowda et al., 2007; Hager, 2006; Leslie, et al., 2010; Pate, et al., 1997; Rushovich, et al., 2006; Scott, Evenson, Cohen, & Cox, 2007; Timperio, et al., 2008; Tucker et al., 2009) and six studies focusing on school break times (Harten, et al., 2008; Haug, Torsheim, Sallis, & Samdal, 2010; Haug, Torsheim, & Samdal, 2008; Nichol, et al., 2009; Ridgers, Fairclough, et al., 2010; Willenberg, et al., 2010) were cross-sectional in design. One school break time study (Jones, et al., 2010) and one after-school study (Saunders, et al., 1997) were questionnaire validation studies, containing correlational data. Studies were published between 1997 and 2010 (only two of these studies were published prior to 2000) and conducted across a number of different countries, all of which are developed countries. Only five studies [two school break time (Ridgers, Fairclough, et al., 2010; Willenberg, et al., 2010) and three after-school studies (Leslie, et al., 2010; Rushovich, et al., 2006; Timperio, et al., 2008)] based their research on an ecological theoretical framework, while the remaining were either based on behavioural theories, such as Social Cognitive Theory (Adkins, et al., 2004; Pate, et al., 1997; Saunders, et al., 1997) and Theory of Reasoned Action (Pate, et al., 1997; Saunders, et al., 1997), or there was no discussion of the theory (Dowda, et al., 2007; Hager, 2006; Harten, et al., 2008; Jones, et al., 2010; Loucaides, et al., 2009; Nichol, et al., 2009; Ridgers, et al., 2007b; Scott, et al., 2007; Stratton & Mullan, 2005; Tucker, et al., 2009; Verstraete, et al., 2006).

School break time physical activity was assessed using a range of methods, including observation [SOPLAY (Harten, et al., 2008; Willenberg, et al., 2010) and SOCARP (Ridgers, Fairclough, et al., 2010)], objective measures [accelerometry (Harten, et al., 2008; Jones, et al., 2010; Ridgers, et al., 2007b; Verstraete, et al., 2006), heart rate (Ridgers, et al., 2007b; Stratton & Mullan, 2005) and pedometry (Loucaides, et al., 2009)], and self-report measures (Haug, et al., 2010; Haug, et al., 2008; Nichol, et al., 2009). Two studies used self-report measures of physical activity but did not disclose the exact tool used (Haug, et al., 2010;

Haug, et al., 2008). After-school physical activity was only measured using accelerometry (Adkins, et al., 2004; Dowda, et al., 2007; Hager, 2006; Rushovich, et al., 2006; Scott, et al., 2007; Timperio, et al., 2008), and self-report [Previous Day Physical Activity Recall (PDPAR) (Pate, et al., 1997; Saunders, et al., 1997; Tucker, et al., 2009) and 3 Day Physical Activity Recall (3DPAR) (Rushovich, et al., 2006)]. One study (Leslie, et al., 2010) did not specify the self-report tool used for measuring after-school physical activity. The independent variables (i.e. potential correlates) were predominantly assessed through self-report (Adkins, et al., 2004; Dowda, et al., 2007; Hager, 2006; Haug, et al., 2010; Haug, et al., 2008; Leslie, et al., 2010; Nichol, et al., 2009; Pate, et al., 1997; Ridgers, Fairclough, et al., 2010; Rushovich, et al., 2006; Saunders, et al., 1997; Scott, et al., 2007), observation (Adkins, et al., 2004; Dowda, et al., 2007; Harten, et al., 2008; Loucaides, et al., 2009; Ridgers, Fairclough, et al., 2010; Ridgers, et al., 2007b; Stratton & Mullan, 2005; Verstraete, et al., 2006; Willenberg, et al., 2010) or proxy-report (Dowda, et al., 2007; Hager, 2006; Haug, et al., 2010; Haug, et al., 2008; Nichol, et al., 2009; Timperio, et al., 2008; Tucker, et al., 2009).

Table 3.1 Characteristics of the studies included in the systematic review

	School break time	After school
Country		
Australia	(Harten, et al., 2008; Willenberg, et al., 2010)	(Leslie, et al., 2010; Timperio, et al., 2008)
Norway	(Haug, et al., 2010; Haug, et al., 2008)	-
United Kingdom	(Jones, et al., 2010; Ridgers, Fairclough, et al., 2010; Ridgers, et al., 2007b; Stratton & Mullan, 2005)	(Tucker, et al., 2009)
United States	-	(Adkins, et al., 2004; Dowda, et al., 2007; Hager, 2006; Pate, et al., 1997; Rushovich, et al., 2006; Saunders, et al., 1997; Scott, et al., 2007)
Canada	(Nichol, et al., 2009)	-
Belgium	(Verstraete, et al., 2006)	-
Cyprus	(Loucaides, et al., 2009)	-
Study design		
Observational (Cross-sectional)	(Harten, et al., 2008; Haug, et al., 2010; Haug, et al., 2008; Nichol, et al., 2009; Ridgers, Fairclough, et al., 2010; Willenberg, et al., 2010)	(Adkins, et al., 2004; Dowda, et al., 2007; Hager, 2006; Leslie, et al., 2010; Pate, et al., 1997; Rushovich, et al., 2006; Scott, et al., 2007; Timperio, et al., 2008; Tucker, et al., 2009)
Interventional (Randomised Controlled Trial)	(Loucaides, et al., 2009; Verstraete, et al., 2006)	-
Interventional (Pretest-Posttest)	(Harten, et al., 2008)	-

	School break time	After school
Interventional (Quasi-experimental)	(Ridgers, et al., 2007b; Stratton & Mullan, 2005)	-
Questionnaire validation study	(Jones, et al., 2010)	(Saunders, et al., 1997)
Theoretical framework		
Social ecological model	(Ridgers, Fairclough, et al., 2010; Willenberg, et al., 2010)	(Leslie, et al., 2010; Rushovich, et al., 2006; Timperio, et al., 2008)
Environmental correlates of an Ecological framework	(Haug, et al., 2010; Haug, et al., 2008)	-
Social Cognitive Theory	-	(Adkins, et al., 2004; Pate, et al., 1997; Saunders, et al., 1997)
Theory of Reasoned Action	-	(Pate, et al., 1997; Saunders, et al., 1997)
Not discussed	(Harten, et al., 2008; Jones, et al., 2010; Loucaides, et al., 2009; Nichol, et al., 2009; Ridgers, et al., 2007b; Stratton & Mullan, 2005; Verstraete, et al., 2006)	(Dowda, et al., 2007; Hager, 2006; Scott, et al., 2007; Tucker, et al., 2009)
Assessment of physical activity		
Observation	(Harten, et al., 2008; Ridgers, Fairclough, et al., 2010; Willenberg, et al., 2010)	-
Objective (accelerometry)	(Harten, et al., 2008; Jones, et al., 2010; Ridgers, et al., 2007b; Verstraete, et al., 2006)	(Adkins, et al., 2004; Dowda, et al., 2007; Hager, 2006; Rushovich, et al., 2006; Scott, et al., 2007; Timperio, et al., 2008)
Objective (heart rate)	(Ridgers, et al., 2007b; Stratton & Mullan, 2005)	-

	School break time	After school
Objective (pedometry)	(Loucaides, et al., 2009)	-
Self-report	(Haug, et al., 2010; Haug, et al., 2008; Nichol, et al., 2009)	(Leslie, et al., 2010; Pate, et al., 1997; Rushovich, et al., 2006; Saunders, et al., 1997; Tucker, et al., 2009)
Assessment of correlate variable		
Observation	(Harten, et al., 2008; Loucaides, et al., 2009; Ridgers, Fairclough, et al., 2010; Ridgers, et al., 2007b; Stratton & Mullan, 2005; Verstraete, et al., 2006; Willenberg, et al., 2010)	(Adkins, et al., 2004; Dowda, et al., 2007)
Proxy-report (school principal)	(Haug, et al., 2010; Haug, et al., 2008; Nichol, et al., 2009)	-
Proxy-report (parent)	-	(Dowda, et al., 2007; Hager, 2006; Timperio, et al., 2008; Tucker, et al., 2009)
Self-report	(Haug, et al., 2010; Haug, et al., 2008; Nichol, et al., 2009; Ridgers, Fairclough, et al., 2010)	(Adkins, et al., 2004; Dowda, et al., 2007; Hager, 2006; Leslie, et al., 2010; Pate, et al., 1997; Rushovich, et al., 2006; Saunders, et al., 1997; Scott, et al., 2007)
Objective	(Jones, et al., 2010; Ridgers, Fairclough, et al., 2010)	(Dowda, et al., 2007; Scott, et al., 2007; Tucker, et al., 2009)

3.3.2 Methodological quality of the studies reviewed

All the school break time studies using a cross-sectional design were assigned a methodological quality score of 3 or more, with one study considered high quality with a score of 6 out of 8 (Ridgers, Fairclough, et al., 2010). Of the ten studies assessing correlates of after-school physical activity, eight were medium quality (Adkins, et al., 2004; Dowda, et al., 2007; Hager, 2006; Leslie, et al., 2010; Saunders, et al., 1997; Scott, et al., 2007; Timperio, et al., 2008; Tucker, et al., 2009) and two were assessed as high quality (i.e. ≥6) (Pate, et al., 1997; Rushovich, et al., 2006) (see Appendix 1 for methodological quality scores for all cross-sectional studies). Very few studies randomly selected the study sample (i.e. were representative of the study population) (Harten, et al., 2008; Leslie, et al., 2010; Rushovich, et al., 2006). Only three lunchtime studies and five after-school studies reported both a valid physical activity measure and correlate measure(s) with appropriate psychometric properties (Adkins, et al., 2004; Harten, et al., 2008; Jones, et al., 2010; Pate, et al., 1997; Ridgers, Fairclough, et al., 2010; Rushovich, et al., 2006; Saunders, et al., 1997; Timperio, et al., 2008). The remaining studies used either physical activity measures with poor or unknown validity/reliability (Willenberg, et al., 2010), correlate measures with poor or unknown validity/reliability (Hager, 2006; Scott, et al., 2007; Tucker, et al., 2009) or both (Haug, et al., 2010; Haug, et al., 2008; Leslie, et al., 2010; Nichol, et al., 2009). No studies reported a power calculation; therefore, it was unclear whether they were adequately powered to detect hypothesised relationships between the physical activity behaviour and correlate. Four school break time studies (Haug, et al., 2010; Haug, et al., 2008; Nichol, et al., 2009; Ridgers, Fairclough, et al., 2010) and seven after-school studies (Dowda, et al., 2007; Hager, 2006; Leslie, et al., 2010; Pate, et al., 1997; Rushovich, et al., 2006; Scott, et al., 2007; Tucker, et al., 2009) clearly described and accounted for potential confounders in analyses. The majority of studies provided a clear description of the context of the specific physical activity behaviour (e.g. location in which the physical activity occurred, length of time engaged in physical activity).

The methodological quality of intervention studies ranged from medium (Harten, et al., 2008; Loucaides, et al., 2009; Stratton & Mullan, 2005; Verstraete, et al., 2006) to high (Ridgers, et al., 2007b) (see Appendix 1 for methodological quality scores for intervention

studies). Key baseline characteristics for the intervention and control groups were adequately described and statistically tested in all studies. None of the studies clearly described the process of randomisation. Only four studies used physical activity measures that had been validated in the participant age group (Harten, et al., 2008; Loucaides, et al., 2009; Ridgers, et al., 2007b; Verstraete, et al., 2006), with one of these studies also using a correlate measure with reported psychometric properties (Ridgers, et al., 2007b). Ridgers et al. (2007b) was the only study to use a six month follow-up, with the other studies using follow-up periods of four weeks (Loucaides, et al., 2009) to four months (Stratton & Mullan, 2005; Verstraete, et al., 2006). Two studies accounted for potential confounders in analyses (Ridgers, et al., 2007b; Verstraete, et al., 2006). No studies reported a power calculation to determine whether the sample size was adequate to detect hypothesised relationships.

3.3.3 Correlates of school break time and after-school physical activity

Potential correlates of school break time and after-school physical activity were extracted and categorised separately according to the social ecological framework (demographic/biological, psychological, behavioural, social/cultural, physical environment and policy) (see Tables 3.2, 3.3 and 3.4). Across the seven cross-sectional school break time studies, 39 potential correlates were identified, of which 20 correlates (56%) were investigated just once, ten (21%) were investigated twice, five (13%) were investigated three times, and four (10%) were investigated four or more times (see Table 3.2). In the intervention studies, five correlates of physical activity change in school break time were investigated, with two correlates being investigated once, one correlate investigated twice and two correlates being investigated three or more times (see Table 3.3). Thirty-six potential correlates were identified in the cross-sectional after-school studies, with 20 correlates (56%) investigated once, six (17%) were investigated twice, five (14%) were investigated three times and five (14%) were investigated four or more times (see Table 3.4).

Table 3.2 Summary of the associations of potential correlates with school break time physical activity across cross-sectional studies (n=7)

Correlate	Association	Reference	Summary (n[a])			
			+	0	-	Assoc.[b]
Demographic/biological						
Sex (boys)*	+	(Harten, et al., 2008), (Haug, et al., 2010; Haug, et al., 2008; Nichol, et al., 2009), (Ridgers, Fairclough, et al., 2010)VPA, (Willenberg, et al., 2010)VPA	6	1	0	+
	0	(Willenberg, et al., 2010)MPA				
Motor skills	+	(Harten, et al., 2008)M	1	1	0	?
	0	(Harten, et al., 2008)F				
Age	-	(Haug, et al., 2010; Nichol, et al., 2009)	0	1	2	-
	0	(Ridgers, Fairclough, et al., 2010)				
Family affluence (SES)	+	(Nichol, et al., 2009)	1	0	0	+
Body Mass Index	0	(Ridgers, Fairclough, et al., 2010)	0	1	0	0
Social/cultural						
Teacher supervision	+	(Willenberg, et al., 2010)VPA	1	2	0	0
	0	(Ridgers, Fairclough, et al., 2010), (Willenberg, et al., 2010)MPA				

Correlate	Association	Reference	Summary (n[a])			
			+	0	-	Assoc.[b]
Physical environment						
Access to loose equipment	+	(Ridgers, Fairclough, et al., 2010)MPA, (Willenberg, et al., 2010)VPA M	2	2	1	?
	-	(Willenberg, et al., 2010)VPA F				
	0	(Ridgers, Fairclough, et al., 2010) VPA, (Willenberg, et al., 2010)MPA				
Access to fixed equipment	+	(Haug, et al., 2008), (Willenberg, et al., 2010)MPA	2	2	1	?
	-	(Willenberg, et al., 2010)VPA M				
	0	(Haug, et al., 2010), (Willenberg, et al., 2010)VPA F				
Playground markings	+	(Willenberg, et al., 2010)MPA	1	2	0	0
	0	(Ridgers, Fairclough, et al., 2010), (Willenberg, et al., 2010)VPA				
Size of play space	+	(Harten, et al., 2008)M	1	2	0	0
	0	(Harten, et al., 2008)F, (Ridgers, Fairclough, et al., 2010)				

Correlate	Association	Reference	Summary (n[a])			
			+	0	-	Assoc.[b]
Access to specific spaces						
Access to play space	+	(Ridgers, Fairclough, et al., 2010)VPA	1	1	0	?
	0	(Ridgers, Fairclough, et al., 2010)MPA				
Access to green space (no markings)	+	(Haug, et al., 2008)	1	2	0	0
	0	(Haug, et al., 2010), (Willenberg, et al., 2010)				
Access to court space	0	(Haug, et al., 2010), (Haug, et al., 2008)	0	2	0	0
Access to playing fields (with markings)	0	(Haug, et al., 2010), (Haug, et al., 2008), (Nichol, et al., 2009), (Willenberg, et al., 2010)	0	4	0	0
Access to sledding hill	0	(Haug, et al., 2010)	0	1	0	0
Access to ski tracks	0	(Haug, et al., 2008)	0	1	0	0
Access to ice-skating areas	0	(Haug, et al., 2008)	0	1	0	0
Access to fenced courtyard space	0	(Haug, et al., 2008)	0	1	0	0
Access to a wooded area	0	(Haug, et al., 2008)	0	1	0	0
Access to water (sea, river, lake)	0	(Haug, et al., 2008)	0	1	0	0
Access to bitumen areas	0	(Willenberg, et al., 2010)	0	1	0	0

Correlate	Association	Reference	Summary (n[a])			
			+	0	-	Assoc.[b]
Access to areas for hopscotch/skipping	0	(Haug, et al., 2010)	0	1	0	0
Access to areas for board/skating	0	(Haug, et al., 2010), (Haug, et al., 2008)	0	2	0	0
Access to indoor activity space	0	(Nichol, et al., 2009)	0	1	0	0
Access to specific facilities						
Access to climbing wall	0	(Haug, et al., 2008)	0	1	0	0
Access to outdoor obstacle course	+	(Haug, et al., 2008)	1	1	0	?
	0	(Haug, et al., 2010)				
Access to a gym with cardio and weightlifting equipment	+	(Haug, et al., 2008)	1	0	0	+
Access to swimming facilities	0	(Haug, et al., 2008)	0	1	0	0
Access to seating	0	(Ridgers, Fairclough, et al., 2010)	0	1	0	0
Access to facilities	+	(Jones, et al., 2010)M	1	1	0	?
	0	(Jones, et al., 2010)F				
Number of facilities	+	(Haug, et al., 2008)	1	1	0	?
	0	(Haug, et al., 2010)				

Correlate	Association	Reference	Summary (n[a])			
			+	0	-	Assoc.[b]
Number of programs/activities	+	(Nichol, et al., 2009)	1	0	0	+
Design of the school grounds	+	(Jones, et al., 2010)F	1	1	0	?
	0	(Jones, et al., 2010)M				
Condition of field	+	(Nichol, et al., 2009)	1	0	0	+
Condition of a gymnasium	0	(Nichol, et al., 2009)	0	1	0	0
Aesthetics	0	(Jones, et al., 2010)	0	1	0	0
Length of recess time	0	(Ridgers, Fairclough, et al., 2010)	0	1	0	0
Temperature	-	(Ridgers, Fairclough, et al., 2010)VPA	0	1	1	?
	0	(Ridgers, Fairclough, et al., 2010)MPA				
Policy						
Physical activity school policy	0	(Nichol, et al., 2009)	0	1	0	0

Notes: *Boys are the reference point for sex associations

[a] n = the number of identified associations reported across studies (note: the number of studies are indicated in the reference column)

[b] Association shows the direction of the individual/summary association; + = positive association; - = negative association; 0 = no association or a non-significant association; ? = indeterminate

SES = socio-economic status; LPA = light physical activity; MPA = moderate physical activity; VPA = vigorous physical activity; M = male; F = female

Table 3.3 Summary of the associations of potential correlates with school break time physical activity across intervention studies (n=5)

Correlate	Association	Reference	Summary (n[a])			
			+	0	-	Assoc.[b]
Physical environment						
Access to loose equipment	+	(Loucaides, et al., 2009), (Ridgers, et al., 2007b), (Verstraete, et al., 2006)MPA VPA MVPA	3	0	1	+
	-	(Verstraete, et al., 2006)LPA				
Access to fixed equipment	+	(Ridgers, et al., 2007b)	1	0	0	+
Playground markings	+	(Loucaides, et al., 2009), (Ridgers, et al., 2007b), (Stratton & Mullan, 2005)	3	0	0	+
Size of/access to play space	+	(Harten, et al., 2008),(Loucaides, et al., 2009)	2	0	0	+
Length of recess time	+	(Ridgers, et al., 2007b)	1	0	0	+

Notes:
[a] n = the number of identified associations reported across studies (note: the number of studies are indicated in the reference column)
[b] Association shows the direction of the individual/summary association; + = positive association; - = negative association; 0 = no association or a non-significant association; ? = indeterminate
LPA = light physical activity; MPA = moderate physical activity; VPA = vigorous physical activity; MVPA = moderate to vigorous physical activity; M = male; F = female

Table 3.4 Summary of the associations of potential correlates with after-school physical activity across cross-sectional studies (n=10)

Correlate	Association	Reference	Summary (n[a])			
			+	0	-	Assoc.[b]
Demographic/biological						
Sex (boys)*	+	(Hager, 2006), (Leslie, et al., 2010), (Pate, et al., 1997)	3	1	0	+
	0	(Timperio, et al., 2008)				
Age	-	(Dowda, et al., 2007)F, (Pate, et al., 1997)	0	1	2	-
	0	(Adkins, et al., 2004)F				
Ethnicity	-	(Dowda, et al., 2007)Hispanic or other F	0	2	1	0
	0	(Dowda, et al., 2007)African American White F, (Pate, et al., 1997)				
Perception of general health	0	(Leslie, et al., 2010)	0	1	0	0
Body Mass Index	-	(Adkins, et al., 2004)F, (Dowda, et al., 2007)F	0	0	2	-
Socio-economic status	0	(Dowda, et al., 2007)F	0	1	0	0
Psychological						
Self-efficacy (overcoming barriers)	+	(Saunders, et al., 1997)	1	1	0	?
	0	(Pate, et al., 1997)				
Self-efficacy (support seeking)	+	(Pate, et al., 1997)VPA	1	1	0	?
	0	(Pate, et al., 1997)MPA				

Correlate	Association	Reference	Summary (n[a])			
			+	0	-	Assoc.[b]
Self-efficacy (competing activities)	0	(Pate, et al., 1997)	0	1	0	0
Physical activity enjoyment	+	(Leslie, et al., 2010)M	1	1	0	?
	0	(Leslie, et al., 2010)F				
Beliefs about physical activity	0	(Pate, et al., 1997)	0	1	0	0
Behavioural						
Television viewing/playing video games	-	(Adkins, et al., 2004), (Hager, 2006)M, (Pate, et al., 1997)	0	1	3	-
	0	(Hager, 2006)F				
Use of facilities	+	(Dowda, et al., 2007)F	1	1	0	?
	0	(Tucker, et al., 2009)				
Member of organised activities	0	(Leslie, et al., 2010)	0	1	0	0
Social/cultural						
Social influences	+	(Saunders, et al., 1997)	1	1	0	?
	0	(Pate, et al., 1997)				
Peer support	+	(Dowda, et al., 2007)F, (Leslie, et al., 2010)M	2	2	0	?
	0	(Adkins, et al., 2004)F, (Leslie, et al., 2010)F				
Parental/family support	-	(Leslie, et al., 2010)F	0	2	1	0

Correlate	Association	Reference	Summary (n[a])			
			+	0	-	Assoc.[b]
	0	(Dowda, et al., 2007)F, (Leslie, et al., 2010)M				
Parental supervision	-	(Rushovich, et al., 2006)F	0	0	1	-
License (parental influence)	0	(Adkins, et al., 2004)F	0	1	0	0
Perceived physical activity habits of parents/peers	0	(Pate, et al., 1997)	0	1	0	0
Physical environment						
Access to facilities	+	(Dowda, et al., 2007)F, (Leslie, et al., 2010), (Scott, et al., 2007)subjective F	3	2	0	+
	0	(Adkins, et al., 2004)F, (Scott, et al., 2007)objective F				
Number of facilities	+	(Scott, et al., 2007)subjective F,(Tucker, et al., 2009)subjective	2	3	1	0
	-	(Timperio, et al., 2008)F				
	0	(Scott, et al., 2007)objective F, (Timperio, et al., 2008)M, (Tucker, et al., 2009)objective				
Number of amenities	0	(Timperio, et al., 2008)	0	1	0	0
Condition of facilities	0	(Tucker, et al., 2009)	0	1	0	0
Presence of specific environmental structures						
Presence of walking and cycling paths	0	(Timperio, et al., 2008)	0	1	0	0
Presence of lighting along paths	0	(Timperio, et al., 2008)	0	1	0	0

Correlate	Association	Reference	Summary (n[a])			
			+	0	-	Assoc.[b]
Presence of trees	0	(Timperio, et al., 2008)	0	1	0	0
Presence of shade	0	(Timperio, et al., 2008)	0	1	0	0
Presence of a water feature	0	(Timperio, et al., 2008)	0	1	0	0
Presence of signage regarding dogs	0	(Timperio, et al., 2008)	0	1	0	0
Presence of signage restricting other activities	0	(Timperio, et al., 2008)	0	1	0	0
Park coverage	0	(Tucker, et al., 2009)	0	1	0	0
Land use mix	0	(Tucker, et al., 2009)	0	1	0	0
Access to equipment	+	(Pate, et al., 1997)MPA	1	2	0	0
	0	(Leslie, et al., 2010), (Pate, et al., 1997)VPA				
Neighbourhood safety	+	(Leslie, et al., 2010)	1	2	0	0
	0	(Adkins, et al., 2004)F, (Tucker, et al., 2009)				
Environmental barriers to active transport	0	(Leslie, et al., 2010)	0	1	0	0

Notes: *Boys are the reference point for sex associations

[a]n = the number of identified associations reported across studies (note: the number of studies are indicated in the reference column)

[b]Association shows the direction of the individual/summary association; + = positive association; - = negative association; 0 = no association or a non-significant association; ? = indeterminate

MPA = moderate physical activity; VPA = vigorous physical activity; M = male; F = female; objective = objective measurement of physical activity; subjective = subjective measurement of physical activity

3.3.3.1 Potential correlates of school break time physical activity

Five demographic/biological correlates were examined across ten studies, including sex, age, family affluence, motor skills and body mass index. Sex was the most frequently studied correlate, with boys being significantly more active than girls during the school break time (Harten, et al., 2008; Haug, et al., 2010; Haug, et al., 2008; Nichol, et al., 2009; Ridgers, Fairclough, et al., 2010; Willenberg, et al., 2010). Age was explored in three studies (Haug, et al., 2010; Nichol, et al., 2009; Ridgers, Fairclough, et al., 2010), with two studies finding a negative association with school break time physical activity (Haug, et al., 2010; Nichol, et al., 2009). Motor skills, assessed in one study (Harten, et al., 2008), were found to be important in boys but had no association with girls' school break time physical activity, resulting in an overall classification of indeterminate.

Teacher supervision was the only social/cultural correlate explored in the school break time setting (Ridgers, Fairclough, et al., 2010; Willenberg, et al., 2010). No overall association was found between teacher supervision and school break time physical activity.

Thirty-two physical environmental correlates were examined in the school break time period, six of which were studied three or more times. Access to loose equipment (Ridgers, Fairclough, et al., 2010; Willenberg, et al., 2010) and fixed equipment (Haug, et al., 2010; Haug, et al., 2008; Willenberg, et al., 2010) were the most frequently studied correlates and the association with school break time physical activity was inconclusive. Access to play space had a positive association with vigorous physical activity but no association with moderate physical activity during the school break time. A positive association was found for access to facilities (Jones, et al., 2010), access to a gym (Haug, et al., 2008) and condition of a playing field (Nichol, et al., 2009). In one study, children were more active where there was greater provision of programs/activities (Nichol, et al., 2009). Inconclusive evidence was found for overall facility provision (i.e. the sum of facilities available). Temperature was explored in one study (Ridgers, Fairclough, et al., 2010), with evidence of an inverse association with vigorous physical activity and no association with moderate physical activity during school break time. Playground markings, size of play space, access to specific play spaces (e.g. court space, playing fields, sledding hill, bitumen areas), access to swimming

facilities, access to seating, condition of a gymnasium, aesthetics and length of recess time were determined to have no association with school break time physical activity. Provision of a physical activity school policy was the only policy correlate explored (Nichol, et al., 2009). No association was found between this correlate and school break time physical activity.

In the intervention studies, access to loose equipment and fixed equipment, playground markings, size of/access to play space and length of recess time were all manipulated to determine the effect on school break time physical activity. All five physical environmental correlates were found to positively facilitate change in school break time physical activity (see Table 3.3).

3.3.3.2 Potential correlates of after-school physical activity

Six demographic/biological correlates were addressed across seven different studies. These correlates included sex, age, ethnicity, perception of general health, body mass index (BMI) and socio-economic status (SES). There was evidence of a negative association between age and after-school physical activity (Dowda, et al., 2007; Pate, et al., 1997); and girls' BMI and after-school physical activity (Adkins, et al., 2004; Dowda, et al., 2007). Sex had an association with after-school physical activity, with boys being more active than girls (Hager, 2006; Leslie, et al., 2010; Pate, et al., 1997). No associations were found for SES, perception of general health or ethnicity.

There was limited evidence of associations with psychological correlates, with only three studies investigating this domain. Self-efficacy in seeking support was positively associated with after-school vigorous physical activity, but not moderate after-school physical activity (Pate, et al., 1997). Physical activity enjoyment was positively associated with after-school physical activity for boys but not for girls (Leslie, et al., 2010). Evidence for an association between self-efficacy in overcoming barriers and after-school physical activity was inconclusive. No association was found for self-efficacy (competing activities) and beliefs about physical activity.

Behavioural correlates included TV viewing/playing video games, use of facilities and membership in organised activities. Television viewing/playing video games was the most frequently studied behavioural correlate, with evidence of a negative association with after-school physical activity (Adkins, et al., 2004; Hager, 2006; Pate, et al., 1997). The evidence for an association between after-school physical activity and the use of facilities was indeterminate, while no association was found for membership of organised activities.

Six social/cultural correlates were examined across six studies in the after-school period. Parental supervision was found to have a negative association with after-school physical activity for girls (Rushovich, et al., 2006). Evidence for an association with social influences and peer support was inconclusive. No associations were found for parental/family support, license (parental permission) and perceived physical activity habits of parents/peers.

Sixteen individual physical environmental correlates were identified, three of which were studied three or more times. Correlates included access to physical activity facilities (e.g. playgrounds, playing fields and dance studios), condition of facilities, presence of specific structures, access to equipment and neighbourhood safety. Access to facilities had a positive association with after-school physical activity. No association was found between the number of facilities and after-school physical activity. However, when viewed more closely, there was a consistent positive association between the number of facilities and after-school physical activity when the number of facilities was subjectively assessed (Scott, et al., 2007; Tucker, et al., 2009). No associations were found for neighbourhood safety, environmental barriers to active transport, access to equipment, land use mix, park coverage, presence of specific structures, condition of facilities and number of amenities.

3.4 Discussion

This review has provided an overview of the current evidence and quality of evidence for influences on children's physical activity behaviour during two periods of the day, the school break time and after-school time periods. Despite these day segments being identified as "critical" periods for physical activity promotion (Atkin, et al., 2008; Ferreira, et al., 2007), they remain relatively unexplored. Past reviews have identified correlates of whole day physical activity behaviour for children and adolescents but have not explored correlates relating to a specific time, location or behaviour context (Biddle, et al., 2005; Sallis, Prochaska, et al., 2000; Van Der Horst, et al., 2007). To date, no other review has been conducted on the correlates of time-specific physical activity in children from a multi-factorial perspective. Ferreira et al. (2007) focused on environmental correlates in location-specific settings (i.e. home, school and neighbourhood) but did not examine other domains of the ecological model, limiting our understanding of the multi-dimensionality of context-specific physical activity behaviour.

Relatively few studies met the inclusion criteria for this review, with the majority of included studies only exhibiting medium methodological quality, highlighting the limited evidence upon which setting- and context-specific physical activity interventions can currently be based. Due to the paucity of high quality evidence, the findings of this review cannot be used to draw definitive, meaningful conclusions about the correlates of time-specific physical activity and should be interpreted with some caution. Sex and age, with boys and younger children being more active, were consistently associated with school break time physical activity in two or more studies (Harten, et al., 2008; Haug, et al., 2010; Haug, et al., 2008; Nichol, et al., 2009; Ridgers, Fairclough, et al., 2010; Willenberg, et al., 2010). Family affluence (Nichol, et al., 2009), access to a gymnasium (Haug, et al., 2008), access to four or more physical activity programs (Nichol, et al., 2009) and the condition of a playing field (Nichol, et al., 2009) were all associated with school break time physical activity in one study. Access to loose and fixed equipment (Loucaides, et al., 2009; Ridgers, et al., 2007b; Verstraete, et al., 2006), playground markings (Loucaides, et al., 2009; Ridgers, et al., 2007b; Stratton & Mullan, 2005), size of and access to play space (Harten, et al., 2008; Loucaides, et al., 2009) and the length of school break time (Ridgers, et al., 2007b) were all positively

associated with changes in school break time physical activity in intervention studies. In the after-school period, sex (with boys again more active) (Hager, 2006; Leslie, et al., 2010; Pate, et al., 1997), younger age (Dowda, et al., 2007; Pate, et al., 1997), lower body mass index (for girls) (Adkins, et al., 2004; Dowda, et al., 2007), lower TV viewing/playing video games (Adkins, et al., 2004; Hager, 2006; Pate, et al., 1997) and greater access to facilities (Dowda, et al., 2007; Leslie, et al., 2010; Scott, et al., 2007) were associated with higher levels of after-school physical activity in two or more studies, while parental supervision was negatively associated with girls' after-school physical activity in one study (Rushovich, et al., 2006).

Higher levels of physical activity among boys compared with girls is consistently reported in the literature, regardless of whether comparisons relate to total physical activity (Hinkley, et al., 2008; Sallis, Prochaska, et al., 2000; Van Der Horst, et al., 2007) or context-specific physical activity, as shown in this review. These differences may be explained by underlying biological mechanisms but may also be attributable to the social context of the specific time period. Boys typically view school as a chance to engage in competitive games that tend to dominate play spaces in the school yard (Harten, et al., 2008), while girls view the school break period as a time for socialising (Boyle, Marshall, & Robeson, 2003). During the after-school period, evidence suggest that parents perceive the neighbourhood to be safer for adolescent boys compared to adolescent girls (Carver, Timperio, & Crawford, 2008a), which may contribute to the observed sex differences in this time period.

Recent reviews present an inconsistent picture in relation to age and physical activity among children and adolescents. Sallis et al. (2000) found a consistent negative association with habitual physical activity and age among adolescents (13-18 years), while Van Der Horst et al. (2007) reported inconclusive evidence in adolescents (13-18 years). In the current review, age was found to be negatively associated with both the school break time and after-school periods. However, it should be noted that this was only assessed in three studies. Consequently, there is a need for additional research into the relationship between age and time-specific physical activity. As sex and age are non-modifiable correlates of physical activity, the development of effective interventions to promote physical activity will depend

on a deeper understanding of how these biological attributes interact with the settings and contexts within which physical activity occurs (Sallis, 2000). This requires further research into environmental factors specific to different periods of the day.

The current review identified a negative association between TV viewing and after-school physical activity. Hohepa et al. (2009) also found a significant inverse association of TV time with after-school physical activity among adolescents aged 12-18 years, suggesting that TV viewing is in direct competition with physical activity opportunities in this time period. Notably, other correlate reviews (Sallis, Prochaska, et al., 2000; Van Der Horst, et al., 2007) found no association of screen time with habitual activity. While TV viewing may not influence whole day physical activity, these findings, along with results from Hohepa et al. (2009), provide some initial support that TV viewing may negatively influence physical activity during periods of relatively high TV accessibility or when outdoor physical activity is an option (i.e. when TV viewing and outdoor physical activity are direct competitors for participation). Recent evidence has shown that TV viewing is the most prevalent activity performed by children of this age group during the after-school period (Atkin, et al., 2008; Stanley, Ridley, & Olds, 2011), and could potentially be an important intervention target as a means of increasing after-school physical activity.

In the present study, 'access to facilities', represented as a composite variable, was correlated with after-school physical activity, with inconclusive evidence in relation to school break time physical activity. Previous reviews have tended to collapse specific facility correlates into a general 'access to facilities' score, which may mask important context-specific associations. Using this approach, Sallis et al. (2000) found a consistent association between access to facilities and adolescents' habitual physical activity, whereas the findings from Ferreira et al. (2007) and Van Der Horst et al. (2007) did not support this association. Access to specific facilities, such as swimming pools and playing fields, was examined separately in this review in order to minimise loss of contextual information. However, these specific facility correlates were represented too infrequently to draw any conclusions. Future studies using a context-specific approach should identify and report specific facilities

relevant to the context in question, which will contribute to a clearer understanding of context-specific physical activity.

The relatively small number of studies that met inclusion criteria for this review varied in terms of theoretical framework, study design, sample characteristics, measurement techniques, analytical approaches, and representations of physical activity. Thirteen studies used objective physical activity measures while eight studies used self-reported physical activity measures. Twelve studies used an objective correlate measure while 14 studies used a self-reported correlate measure. Only eight studies reported relevant psychometric properties of both the physical activity and correlate measures. Associations between physical activity and a potential correlate have been shown to differ depending on how either physical activity or the correlate was measured (Dishman, et al., 1992; Ferreira, et al., 2007). Future studies should choose measurement tools with appropriate psychometric properties. Analytical techniques varied across studies with some using univariate (Adkins, et al., 2004; Hager, 2006; Harten, et al., 2008; Jones, et al., 2010; Rushovich, et al., 2006; Saunders, et al., 1997; Timperio, et al., 2008; Verstraete, et al., 2006; Willenberg, et al., 2010) and others using multivariate strategies (Dowda, et al., 2007; Loucaides, et al., 2009; Nichol, et al., 2009; Pate, et al., 1997; Ridgers, Fairclough, et al., 2010; Ridgers, et al., 2007b; Stratton & Mullan, 2005; Tucker, et al., 2009). Multivariate analysis can result in fewer significant associations because of co-variation among physical activity correlates (Van Der Horst, et al., 2007), and the order in which correlates are entered into multivariate models can influence the final model structure. Therefore, differences in analytical approaches among studies are likely contributors to the current confusion in the literature (Welk, 2002).

3.4.1 Limitations

The current review identified a small number of studies that varied widely in important methodological aspects, thereby limiting the generalisable conclusions that can be drawn. Further, there are limitations of the review process that need to be acknowledged. Firstly, there may have been studies that were missed because of the search terms used, or unclear titles or abstracts. Secondly, the relatively high proportion of cross-sectional studies included in the review made it impossible to identify those correlates of physical activity behaviour

change that would provide the most powerful evidence for intervention design. Some studies stratified analyses by salient variables such as age, sex and intensity of physical activity, resulting in an over-representation of these studies in the review. While this level of specificity is important in correlate research, there may be consequential bias towards studies that reported numerous associations compared to those that reported few associations. Also, age and sex will not be identified as correlates in studies that stratified analyses by age and sex. Finally, the relatively narrow age range specified in the current review is a limitation. It is acknowledged that the age at which children transition from primary to secondary school may differ internationally and factors influencing physical activity of 8 year olds and 14 year olds may differ (Garcia, et al., 1998; Sallis, et al., 2002). To minimise the effect of this on the review's findings, only studies conducted in primary schools were included. Summarising the findings for narrower age ranges (i.e. 8-12 and 13-14 year olds) is not feasible due to the small number of studies in this area.

3.5 Conclusion

While there is strong evidence that school breaks and after-school periods are 'critical windows' for physical activity promotion among young people, this review has clearly identified the paucity of high quality evidence upon which physical activity promotion in young people can be tailored to these specific settings and contexts. The relatively small number of studies provided preliminary evidence that the intrapersonal and interpersonal influences on physical activity vary according to different contexts such as the school break time and after-school periods. However, the review also exposed a lack of clarity in this area and underscores the importance of focusing attention on context- and setting-specific physical activity among young people.

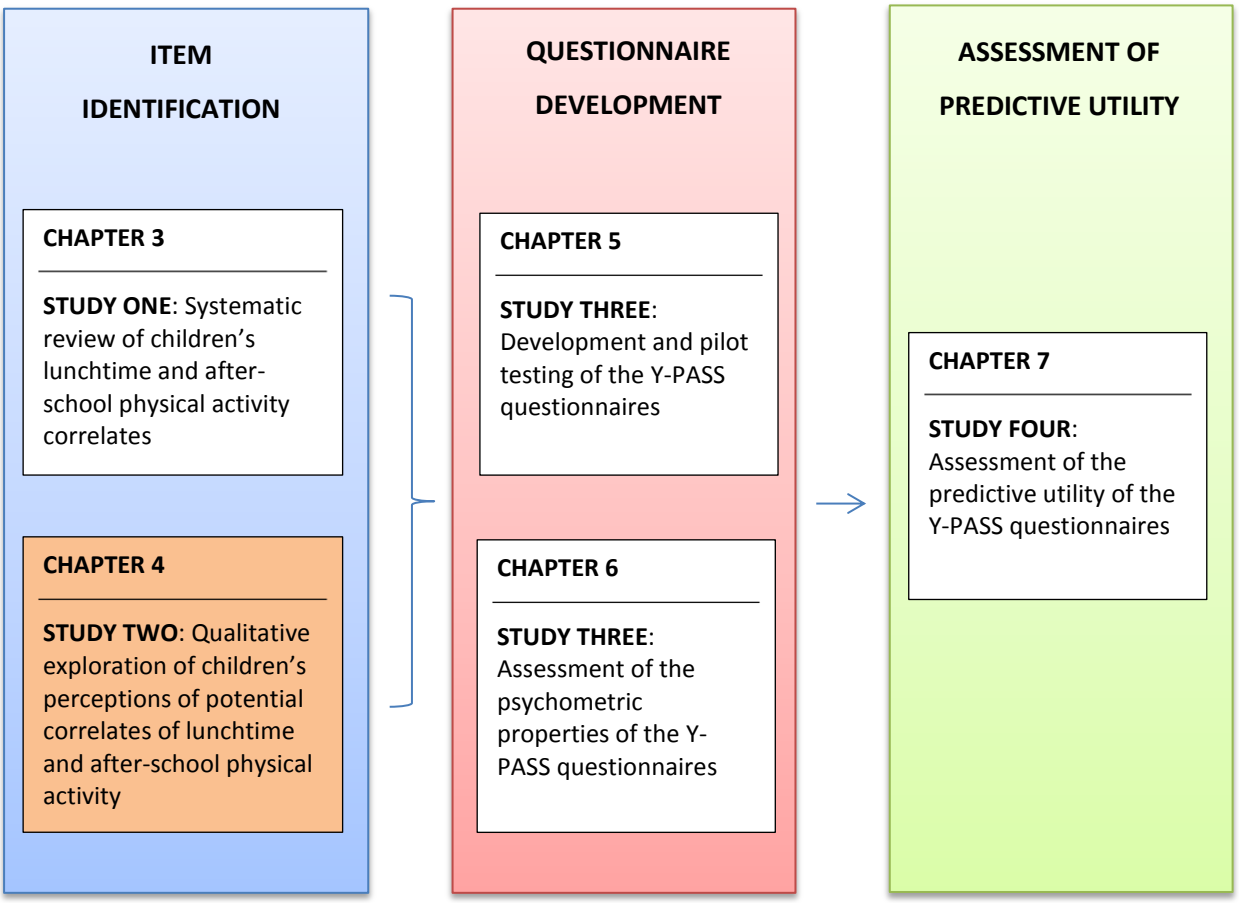
The most salient correlates of school break time physical activity identified by this review included sex, age, family affluence, access to a gym, access to four or more physical activity programs and the condition of a playing field. Access to loose and fixed equipment, playground markings, size of and access to play space and the length of school break time were all positively associated with changes in school break time physical activity in intervention studies. Sex, age, body mass index (for girls), parental supervision (for girls), TV

viewing/playing video games and access to facilities were identified as correlates of after-school physical activity.

The next chapter will describe a qualitative study using focus groups to identify children's perceptions of correlates of lunchtime and after-school physical activity. The purpose of the qualitative study was to supplement the findings from this systematic review to ensure all potential factors were identified, which will be used to inform the content of the context-specific correlate questionnaires.

CHAPTER 4

Study Two: A qualitative exploration of children's perceptions of potential correlates of lunchtime and after-school physical activity



Chapter 4

4 A qualitative exploration of children's perceptions of potential correlates of lunchtime and after-school physical activity

Research aim:

To identify children's perceptions of the factors that influence lunchtime and after-school physical activity using a descriptive qualitative approach.

4.1 Introduction

The main purpose of this research is to develop a tool to measure the correlates of children's lunchtime and after-school physical activity. Qualitatively exploring children's perceptions of the factors that influence context-specific physical activity is an important step in questionnaire development, where children not only assist in generating the content for the questionnaire but also indicate how questions or items are phrased (Pett, et al., 2003; Scott, 1997; Streiner & Norman, 2008). This methodology may be pivotal in exposing new insights into influencing factors and the perceived importance of these factors (Allender, Cowburn, & Foster, 2006), which may not have previously been considered, and provides a more in-depth and complete picture of the phenomenon under investigation. This chapter will discuss Study Two, which explored children's perceptions of the factors that influence lunchtime and after-school physical activity. The findings from this study, along with the correlates identified from the systematic review in Study One, were used to identify a list of potential correlates to be included in the correlate questionnaires.

As shown by the systematic review conducted in the previous chapter, there is little research examining the correlates of both lunchtime and after-school physical activity. Furthermore, children's own views from a qualitative perspective do not seem to be as prevalent in the

current literature (Humbert, et al., 2008; Scott, 1997). This is due to assumptions that children (1) lack insight into important issues pertaining to their health and well-being, (2) lack capacity for abstract thinking, and (3) lead unsophisticated lifestyles, and are thus incapable of being taken seriously in discussions about their needs (Blignault & Ritchie, 2009; Darbyshire, 2000; MacDougall, Schiller, & Darbyshire, 2004). Involving children as active agents can provide a unique opportunity to gain a more complete picture and in-depth understanding of influences on physical activity (Bauer, et al., 2004; Biddle, et al., 2001; Masse, et al., 2002).

The assumptions around involving children in research, mentioned above, have been challenged in recent times. The U.K. based Economic and Social Research Council "Children 5-16 Programme" was created in an attempt to understand children's views and experiences and position children as valued members of society (Prout, 2002). The program has had a profound influence on child-related research and has tried to increase international awareness of the 'new sociology of childhood' research concept, which posits children as the central focus of any research aiming to understand the nature of childhood (Darbyshire, MacDougall, et al., 2005). The United Nations Charter inspired a Children's Rights movement (United Nations, 1989), which highlights that children have valid and valuable views and should be taken seriously. International organisations, such as UNICEF, are also endorsing the involvement of children in research, particularly around listening to their views about their own health and well-being (Lansdown, 2001). The extensive body of evidence produced from these programs (Prout, 2001, 2002) and the vast international collaborations provide enough support for a conceptual shift in current thinking about children's involvement in research, from 'research on' to 'research with' or 'research for' children (Darbyshire, 2000; Darbyshire, Schiller, & MacDougall, 2005).

A broad range of disciplines have embraced this 'new' research paradigm, including education (Dockett & Perry, 1999; Freeman, 1997; Osborne & Collins, 2001) and health (Dean & Stain, 2007; Hume, Salmon, & Ball, 2005; Morrow, 2001; Neumark-Sztainer, Story, Perry, & Casey, 1999; Ryan-Wenger & Walsh, 1994). The physical activity field has also begun to accept the value of adopting this concept for research (Darbyshire, MacDougall, et al.,

2005; Humbert, et al., 2006; Hume, et al., 2005; MacDougall, et al., 2004; Whitehead & Biddle, 2008). This is evident from the recent rise in qualitative research focusing on children's perceptions about their physical activity behaviour (Ahlport, Linnan, Vaughn, Evenson, & Ward, 2008; Bauer, et al., 2004; Casey, et al., 2009; Dwyer, et al., 2006; Hohepa, et al., 2006; Humbert, et al., 2008; Humbert, et al., 2006; Jago, Brockman, et al., 2009; Mulvihill, et al., 2000b; O'Dea, 2003; Ries, Voorhees, Gittelsohn, Roche, & Astone, 2008; Vu, et al., 2006; Whitehead & Biddle, 2008), as well as quantitative studies reporting a qualitative component, where children have been involved in the development of questionnaires (Ommundsen, et al., 2008; Wu, et al., 2002). These qualitative studies have exposed a number of important findings in relation to factors influencing children's physical activity that may have been overlooked if children's voices were excluded in the research process. This does not negate the importance of quantitative, survey or experimental research or incorporating adults in the research process, but it should be recognised that these methodologies used independently from qualitative research may not be sufficient to provide the detailed information or insight required to fully understand the complexity of children's experiences (Darbyshire, Schiller, et al., 2005). Study Two was developed for children to voice their perceptions about the influences of their physical activity behaviour and supplement the findings identified through the systematic review in Study One. This study has been transformed into two manuscripts and has been published in peer-reviewed journals (Stanley, Boshoff, et al., 2012a, 2012b).

4.1.1 Research aims

The aim of this study was to explore children's perceptions of the factors influencing their engagement in physical activity during the lunchtime and after-school periods, from a social ecological perspective, using a descriptive qualitative approach. The importance of using a social ecological perspective has been discussed in Chapter 2. The findings from Studies One and Two informed the development of two context-specific correlate questionnaires, which will be discussed in subsequent chapters.

The lunchtime period was defined for the purpose of this study as the main scheduled break time during the school day, where children have the opportunity to play after eating lunch.

The after-school period was defined as the end of the school day until dinner time (i.e. approximately 3.00 pm – 6:00 pm) (Atkin, et al., 2008). Recruitment and data collection took place between March and July 2009.

4.1.2 Ethics approval

Ethics approval was obtained from the University of South Australia Human Research Ethics Committee, Department of Education and Children Services (DECS), the South Australian Commission for Catholic Schools (SACCS) and from the relevant school authority (see Appendix 2). Assent and consent were obtained from the participants and parents, respectively.

4.2 Methods

4.2.1 Study design and methods

An in-depth qualitative descriptive research design (Kennedy, Kools, & Krueger, 2001) was chosen to explore children's experiences, feelings and thoughts about why they do or do not participate in physical activity during lunchtime and after school. This qualitative design is frequently used when little is known about a topic of interest (Patton, 2002), which was confirmed by the limited evidence identified through the review of the lunchtime and after-school correlate literature. The aim of a qualitative descriptive design is to obtain a description of the topic, including the what, when and how, using the participants' vocabulary (Sandelowski, 2000). Studies employing a qualitative descriptive design tend to be less interpretative compared to other qualitative designs, such as ethnography and phenomenology, and present data as a description of the 'facts' (Sandelowski, 2000), which fits appropriately with questionnaire development.

Focus groups are commonly used in qualitative descriptive research (Sandelowski, 2000) and are designed to engage children and stimulate peer interaction and discussion. A focus group consists of a small group of participants, with the discussion overseen by a facilitator and an assistant facilitator (Krueger & Casey, 2000). The main purpose for using focus groups as a data collection method is to generate data through participant interactions, which allow

thoughts to be triggered and ideas to be explored and articulated by the participants (Krueger & Casey, 2000). As children are more comfortable communicating with peers than adults, focus groups are an effective forum to generate rich data that may be difficult to obtain through other approaches, such as one-on-one interviews (Peterson-Sweeney, 2005).

4.2.2 Recruitment and sampling

Maximum variation purposive sampling was used to obtain a description of potential factors that influence children's lunchtime and after-school physical activity from boys and girls across a wide range of socio-economic status (SES), geographic locations and school types. This sampling procedure was considered appropriate for this study as it maximises the likelihood of capturing influences that are common to all children, as well as those that are unique to subpopulations (Patton, 2002).

Schools were purposively selected to reflect the range of school types in various SES populations in South Australia. School types included a rural school, a non-government single-sex girl's school, a non-government single-sex boy's school, a non-government co-educational school, a high SES government co-educational school and a low SES government co-educational school. A list of all South Australian government and non-government schools was obtained along with each school's School Card Register (SCR). The SCR is the percentage of students in a school whose families receive government support to meet the costs of school attendance, and is therefore an inverse indicator of SES at the school level. The list of schools was stratified according to SCR score and split at the 50th percentile to categorise high and low SES schools (SCR cut-off for low SES = 31.8%; 50th percentile). Recruitment letters were sent to six schools that fitted each school type category. A total of 14 letters were sent until consent was received from a school in each school type category, resulting in a school response rate of 43%.

As the purpose of the study was to identify diversity in factors that influence physical activity as perceived by children, it was essential to incorporate participants who engaged in a wide range of activity types and levels (Humbert, et al., 2006). In addition, children had to be able

to communicate in English and feel comfortable talking in groups in order to take part in the focus groups. Exclusion of children with a diagnosed physical, intellectual or sensory disability was purposely chosen because they have unique patterns of physical activity behaviour, which may not be reflective of the population without disability (Maher, Williams, Olds, & Lane, 2007). The school principal or nominated teacher was asked to identify nine potential boys and nine potential girls across Grades 5, 6 and 7 who were:

- aged between 10 and 13 years,
- spoke and understood English,
- represented diversity in activity level (i.e. active or not very active) and the activities they engaged in, as perceived by the principal or teacher,
- were comfortable talking in group situations, and
- did not have a diagnosed physical, intellectual or sensory disability.

Information packages containing details about the project and consent forms were distributed to eligible students through each school's distribution system (see Appendix 3). A total of 54 participants provided consent to participate in the focus groups (56% response rate).

4.2.3 Development of questions and focus group procedures

A semi-structured questioning route was developed prior to the focus group discussions to ensure consistency across groups and allow for flexibility of the discussion (Peterson-Sweeney, 2005). Focus groups were structured around two central questions, "What influences your lunchtime physical activity?" and "What influences your after-school physical activity?" A number of prompting questions were designed around a social ecological model to obtain specific information about intrapersonal, sociocultural and physical environmental/policy influences (refer to Table 4.1). The questioning route was reviewed for structure, content and expected length by a panel of experts with research experience in conducting children's focus groups. Changes were made to the number of questions per discussion group and inclusion of discussion-stimulating activities into the questioning route. Following guidelines by Krueger and Casey (2000) and Peterson-Sweeney (2005), the

questions were piloted with a group of children from Grades 5, 6 and 7 in a South Australian school to ensure the questions could be answered within an appropriate timeframe, were worded and sequenced appropriately and elicited the required information (Krueger & Casey, 2000; Peterson-Sweeney, 2005). Following the pilot focus group, the package was reviewed and revised according to observations made by the principal researcher (RMS) and the two assistants. All subsequent focus groups were based around the revised standardised semi-structured questioning route (refer to Appendix 4 for the complete discussion package).

4.2.4 Focus group procedure

The procedure for the focus groups followed recommendations by Krueger et al. (2000) and Morgan et al. (2002). Initially, ten focus groups were proposed across the six consenting schools (i.e. two focus groups per co-education school and one focus group per single-sex school). However, after a discussion with the principal at one of the schools, an additional two focus groups were included for children on a different campus. Consent was only obtained from girls on the second campus, resulting in only one additional focus group. Eleven focus groups were conducted on school premises during class time. The number of participants varied, ranging from two to nine participants per focus group. Based on recommendations from the literature (Morgan, et al., 2002; Peterson-Sweeney, 2005), separate focus groups were conducted for boys and girls to provide a safe environment to discuss sex-specific physical activity influences, such as body image, which may be difficult to discuss in mixed groups.

The principal researcher (RMS) facilitated the discussions, supported by a trained research assistant. The assistant and principal researcher participated in training sessions (conducted by an experienced focus group facilitator) and a pilot focus group to familiarise themselves with how to run a focus group, the questions and the focus group procedure. A third assistant was present during the pilot focus group to provide additional feedback to the facilitators on aspects relating to group facilitation, participation and responses (Krueger & Casey, 2000). It is acknowledged that the presence of additional research staff may lead to children feeling intimidated, which can potentially inhibit group interaction and responses

(Lewis, 1992). However, strategies were incorporated during the pilot focus group to minimise the potential influence of additional research staff, such as introducing all research staff and including them in the ice breaker activity.

Each focus group followed the same basic structure (refer to Table 4.1). The focus group discussion was divided into two one-hour sessions, with the first hour dedicated to discussing lunchtime factors and the second hour to after-school factors. The two sessions were separated by either the participants' recess or lunchtime break. Each participant completed a short demographic questionnaire, which was used to describe the demographic characteristics of the participants. The purpose of the focus groups was explained to ensure participants were aware of why they were attending. Participants were assured that all information they contributed during the session would remain confidential and they had the right to withdraw from the study at any stage without explanation or negative consequence. Time was allowed for participants to clarify any questions or concerns.

The focus groups started with an ice breaker game to ensure that an informal, safe atmosphere was created. During this game, children were required to throw a ball to each member of the group, say their name and a favourite activity they enjoy doing during lunchtime and after school (Greenbaum, 1998; Krueger, 1998; Krueger & Casey, 2000; Morgan, 1998; Morgan, et al., 2002). Children were then asked the question, "What is the first thing that comes to mind when you hear the term physical activity?" to encourage them to start thinking about the concept of physical activity. A similar approach was also used by Mulvihill et al. (2000b). This question was included since the term "physical activity" is often used in research with children without much consideration for how children interpret its meaning. According to MacDougall et al. (2004), children view the terms "physical activity" and "exercise" as adult concepts. It was important to use terms that children can relate to in order to elicit rich, meaningful data (Darbyshire, MacDougall, et al., 2005; Pearce, Harrell, & McMurray, 2008). Following responses from the children, the principal researcher also provided a commonly used definition of physical activity (Caspersen, et al., 1985) and asked the children to come up with some terms that they would like to use in the discussion. Responses varied, with groups wanting to use either "physical education", "play", "sport"

and “physical activity”, with “play” and “sport” being the most common terms to describe physical activity.

A range of activities, including mapping exercises, writing exercises, drawing exercises and verbal discussion were incorporated into the sessions to maintain interest, stimulate thinking and discussion about lunchtime and after-school physical activity and provide a host of different avenues for children to express their views and ideas (Colucci, 2007; Darbyshire, MacDougall, et al., 2005; Morgan, et al., 2002). The following activities were included:

- *Mapping*

  During the lunchtime discussion, the children were asked to take the facilitators on a tour of the school by pointing out important buildings or places in the school yard using a bird’s eye map of their school printed from “Google Earth” (Google, 2009). Children placed a picture of a stick figure and a drawing of the activity on the map to indicate where and what they played in the school yard. Research has shown that by age 4, children have the ability to interpret maps (Blades et al., 1998) and this approach has been successfully used in other studies related to children’s perceptions of their environment (Darbyshire, MacDougall, et al., 2005; Hume, et al., 2005; Morrow, 2001, 2003; Veitch, Salmon, & Ball, 2008). The map was used as the basis to stimulate discussion topics and was regularly referred to during the discussion.

- *After-school routine time-use worksheet*

  In the second session of the focus group, children were asked to write about and/or draw the activities they did after school on any chosen day. After school was defined as the time from when the bell goes to signal the end of school until dinner time. Generally this time was between 3.00 pm and 6.00 pm. The worksheet was used to stimulate discussion about the factors that influence their after-school activities and help the children posit their responses within concrete examples.

Table 4.1 Focus group questions and procedures

The procedure for each focus group was as follows:

1. Introduction and "icebreaker" game.
2. Introductory discussion to focus thinking around the concept of physical activity.
3. School yard mapping activity where children identified where they usually played at lunchtime and the activity they played.
4. A discussion to identify factors that influence children's lunchtime physical activity using the following questions.

   When thinking about the time you spend during lunchtime at school…can you tell me about…

   - What influences your lunchtime physical activity?
   - Why do you/others do this activity?
   - Is there anyone who helps you do this activity?
   - What helps you or stops you from doing this activity?
   - Is there anything that you would really like to do at lunchtime that you can't do or don't do?
   - Was there ever a time when you stopped being active at lunchtime?
   - What do you think stops children from playing elsewhere in the school yard?
   - When you and others are doing this activity, is there anything you have to be careful about?
   - Who do you do this activity with?
   - What do you think schools can do to help children be more active at lunchtime?
5. Sticker dot activity where children identified the five most important factors.

BREAK

6. Introductory discussion to focus thinking around the concept of physical activity.
7. After-school timeline activity where children were asked to write and/or draw the activities they did after school on any chosen day.
8. A discussion to identify factors that influence children's after-school physical activity using the following questions.

   When thinking about the time you spend on weekdays, after school…can you tell me about…

   - What influences your after-school physical activity?
   - Why do you/others do this activity?
   - Is there anyone who helps you do this activity?
   - What helps you or stops you from doing this activity?
   - Is there anything that you would really like to do after school that you can't do or don't do?
   - Was there ever a time when you stopped being active after school?
   - What do you think stops children from playing elsewhere in the neighbourhood?
   - When you and others are doing this activity, is there anything you have to be careful about?
   - Who do you do this activity with?
9. Sticker dot activity where children identified the five most important factors.

4.2.5 Data collection during the focus groups

As children expressed their views during the discussions, a list of factors in the form of key words and phrases were documented on a whiteboard by the research assistant until saturation was reached. Saturation was reached when no new ideas were being expressed by the children and was used as a way to increase the trustworthiness of the data (Depoy & Gitlin, 1998; Krueger, 1998). To ensure rigour of the data, member checking occurred, during which children were given an opportunity to make any changes or additions to the list before the conclusion of the session. Children were given time at the end of the discussion to identify what they thought were the five most important factors. Each child was given five sticker dots and was asked to approach the whiteboard as a group and place the stickers next to the corresponding factors. The discussions were audio-taped and transcribed verbatim after each focus group (Krueger & Casey, 2000).

Following each focus group, a debrief meeting was held between the principal researcher and assistant facilitator to discuss observations and impressions of the group, review the questions and identify emerging ideas and topics (Depoy & Gitlin, 1998; Krueger & Casey, 2000). This was documented in a reflective journal and referred to during data analysis. All these techniques were employed to increase the accuracy and rigour of the data (Depoy & Gitlin, 1998).

4.2.6 Data coding and analysis

Prior to the analysis of the data, the audio-tapes were transcribed verbatim by the principal researcher immediately following the discussion to reduce recall bias, thus enhancing the confidence in the accuracy of the data (Depoy & Gitlin, 1998). All transcripts were read several times prior to analysis. To further enhance rigour of the data, the transcript data were used in combination with the whiteboard summaries of factors containing the sticker dots illustrating the factors that the children perceived to be the most important. This is known as triangulation (Depoy & Gitlin, 1998).

Qualitative content analysis utilising a long table inductive thematic approach (Krueger & Casey, 2000; Sandelowski, 2000) was used to analyse the data. Each comment was coded and arranged on poster boards under headings derived from the social ecological model (intrapersonal, sociocultural and physical environmental/policy characteristics), which was used to provide a context for interpreting and summarising the range of factors identified by the children (Dwyer, et al., 2006; Humbert, et al., 2006). Under each heading, the coded comments were compared for similarities and differences and "clustered" together into major categories and sub-categories based on similar content. Consistent with the long table approach, data that were initially discarded were reviewed a second time to see if they fitted with any new categories or sub-categories developed during the initial analysis (Krueger & Casey, 2000).

The poster boards assisted in identifying connections among the categories and comparisons across demographic characteristics. The list of factors was specifically compared across sex to see if this added to the overall picture. As no major differences were found between boys and girls, the list remained combined as an overall list of factors that influence engagement in lunchtime and after-school physical activity.

The list of factors and the sticker dot frequencies were used to guide the development of a set of prioritised factors, according to perceived importance. Perceived importance was interpreted from the sticker dot activity, the number of verbalisations and the enthusiasm with which factors were described. Factors perceived as the most important contained more than five sticker dots and were discussed with high enthusiasm by the participants. Factors of secondary importance contained three to five sticker dots and were discussed with moderate enthusiasm and least important factors contained two sticker dots or less and were discussed with little enthusiasm. Enthusiasm was interpreted from observations during the focus groups by the principal researcher and the research assistant and was based on observations of non-verbal responses, vocal intonation and eagerness to discuss a topic. The number of comments was taken into consideration but only used in the broadest sense with less weight placed on this activity during the final decision-making process (Sandelowski, 2000). This "counting" activity was a "means to an end" in that it allowed for further

exploration and confirmation of the patterns and regularities in the data (Sandelowski, 2000). The final list was triangulated with the whiteboard summaries developed during the focus groups.

Analysis was conducted separately by the principal researcher and an external coder, a PhD candidate from the University of South Australia. Coding and clustering discrepancies were discussed with a research team until 100% agreement was reached. Once this systematic process was complete, the factors were organised into facilitators and barriers. Quotes were selected to illustrate the factors. The final list of quotes and presentation of the factors were reviewed by researchers in the field as a validity check.

4.3 Results

In this section, a description of the characteristics of the focus group participants and the findings from the analysis of the focus group data are presented.

4.3.1 Description of participants

Focus group participants had a mean age of 11.05 (±0.86) years, ranging from 10-13 years. There were 54 participants (23 boys), of whom five boys and six girls attended schools in low SES areas and 18 boys and 25 girls attended schools in high SES areas (SCR cut-off for low SES = 31.8%; 50th percentile). Of the six participating schools, five were metropolitan and one was rural; three were private and three were public schools. The imbalance in the number of boys and girls was due to the additional focus group for girls on a separate campus in one of the high SES schools.

4.3.2 Focus group findings

The factors identified by the participants congregated under three major themes corresponding to the social ecological model (i.e. intrapersonal, sociocultural and physical environmental/policy) and provided a structure for interpreting the findings. This structure was used to guide the development of the questionnaires (discussed in Chapter 5). Under

each major theme, only the factors perceived as the most important by the children and/or were unique to the lunchtime or after-school context will be described. Perceived importance was interpreted from the sticker dot activity and the enthusiasm with which factors were described (Krueger & Casey, 2000; Sandelowski, 2000).

Table 4.2 provides a summary of all the factors identified by the children during the focus groups for the lunchtime and after-school periods. There were a number of similarities in the factors identified in the two specific time periods. However, there were some factors that were unique to the setting and these were mainly found in the sociocultural and physical environmental/policy categories, such as teacher influence versus parental/family influence, school rules versus parents' rules, school uniform, things to carry and homework commitments. Despite a number of factors appearing to be consistent across the settings (e.g. peer influence), the perceived importance of similar factors differed according to the time of day. For example, someone/friends to play with was perceived as most important during lunchtime but moderately important during after school, and access to programs was only of secondary importance during lunchtime but most important during the after-school period. The factors will be discussed below in relation to the context.

4.3.2.1 Children's perceptions of the correlates of lunchtime play

As outlined in Table 4.2, participants identified a number of factors across all components of the social ecological model. A total of 60 factors were identified by the children with varying degrees of perceived importance. The factors perceived to be of most importance or unique to the lunchtime setting will be described in detail below.

4.3.2.1.1 Intrapersonal factors

This domain included the sub-categories of "self-efficacy", "behavioural attitudes, beliefs and feelings about physical activity" and "enjoyment".

Self-efficacy

A component of self-efficacy discussed by a number of children during the focus group discussions was “perceived competence”. Perceived competence was identified as both a barrier and a facilitator of lunchtime play among boys and girls. For example, one child mentioned, “*I am really good at handball so I play all the time*”, while another child said, “*I suck at physical running and stuff so I do nothing*”. Based on the perceptions of the participants in this study, perceived competence appears to be linked to whether a child engages in an activity or not. One child commented, “*If I wasn’t that good at it then what would be the point in playing it*”.

Behavioural attitudes, beliefs and feelings about physical activity

The majority of comments relating to "behavioural attitudes, beliefs and feelings about physical activity” were considered facilitators of lunchtime play. For example, children chose to play at lunchtime because it gave them “*something to do rather than just sitting down*”. On the other hand, in low SES areas only, one of the reasons why children did not play in certain areas in the school yard or play games at lunchtime was they had the perception that there was “*nothing to do*”. This was reflected in a number of responses, such as “…*there’s not much things to do at school really. It’s really boring*”.

When asked why children play sports or games at lunchtime, responses centred on the belief that being active at lunchtime helped children improve their skills or provided an opportunity to practice. A participant reported, “*We both play in the school cricket team so we treat lunchtimes and recess times as practice mainly*”. The belief that being active at lunchtime provided an important opportunity to hang out with friends was another motivating factor for lunchtime play but also served as a means to being active. Statements included, “*Playing football is a form of hanging out with friends*” and “*I like to talk with my friends as well and when you are playing ball you are kind of still talking so that’s one of the reasons why I like to play because you are still doing something active but you can also talk*”.

A unique characteristic of free-play at lunchtime was the belief that children had the freedom to "*make up their own rules*". This assisted in making lunchtime games more fun and facilitated motivation to play games. Of particular note, children commented that they often modify existing rules to match personal and group capabilities, making lunchtime play more appealing. For example, one child commented, "…*at recess and lunch you don't have to play by the rules so much. You can make up your own rules. You can make it much funner [sic] than normal games*" and "*If your friend is a beginner or something, you can lessen the rules for them or make it a bit easier*".

Preference for certain activities, including both active and sedentary pursuits, were an important behavioural attitude discussed by children during the focus groups. When asked why children engaged in certain activities, responses often referred to having a preference for certain types of activities. For example, one child mentioned, "*I prefer Handball and Pokémon because I like it, it's the two best things*", compared to another child who commented, "*Some people think that [school] subjects are more fun than actual play-time*".

Enjoyment

When children were asked why they participated in activities, the most common and often the first response across all groups was "*because it's fun*" or "*I enjoy it*". When asked to explain this response in more detail, participants gave specific examples of what makes activities fun. For example, boys found an activity fun because "*it's dangerous*", while girls described fun in relation to activities being challenging. Lunchtime play was also considered fun if it meant hanging out with friends, such as "*It's fun because my friends are there and it's really fun being with them and doing something that I enjoy*".

4.3.2.1.2 Sociocultural factors

Within this category, participants identified factors relating to "peer influence" and "teacher influence".

Peer influence

A number of specific factors were identified under this category. "Someone/friends to play with" was one of the most important factors facilitating play. Children believed that having friends or someone to 'hang out' with created opportunities for play, contributed to the enjoyment of the activity and made activities worthwhile. This is illustrated by a comment made by one of the participants who was describing what children can do if they have a group of people to play with compared to being on their own. "*All they do is walking [if they do it on their own] and they're probably not going anywhere. They might just walk around in circles and stay in one place but if you have a couple of friends you might play chasey*". On the other hand, having no-one to play with hindered children's opportunities for physical activity, with one child commenting, "*There is a kid in our class and he doesn't have any friends and he just sits down and reads books all the time*" and "*Sometimes people don't play because they don't have any friends*".

An unexpected peer influence to physical activity identified by the majority of children was "bullying or teasing". A direct influence of bullying was the prevention of children playing in certain areas of the school yard or with specific pieces of equipment. Avoidance behaviour as a result of being bullied also appeared to have an indirect influence on physical activity. Statements reflecting this aspect of bullying included, "*The bullies always go on the oval. I usually go near the edge so they can't really see me*" and "*Kids try and hide from the bullies so they can't do much playing*".

"Peer acceptance/social norm" was another important factor during lunchtime. This factor can act as a facilitator and a barrier to physical activity, which is illustrated by the following comments, "*You are very influenced by your friends. You do what your friends want to do…If they don't want to play then you won't be influenced [to play]*" and "*…all my friends were*

skipping then I skipped because I didn't want to look like a loner. I had to skip with my friends". Interestingly, being active was often linked to being popular among peers, such as "*The people think you are uncool if you are not skipping*".

Teacher influence

"Teacher influence", in particular teacher support, was only mentioned by children from two of the schools and was not considered as important as peer influence in the lunchtime context. Irrespective of this, children commented that teachers sometimes helped with their play at lunchtime, with one child commenting, "[*Teachers] give us better ideas about what to do and stuff*". With a requirement to enforce school policies and maintain children's safety, teachers are often viewed by children in a negative light when considering their supervisory role during the lunchtime period. Children perceived that teachers enforce rules, which prevent children from playing certain games at lunchtime. One child commented, "*All the fun stuff, the teachers say 'that's dangerous. You're not allowed to do that'*".

4.3.2.1.3 Physical environmental/policy factors

In this domain, "access to and suitability of space", "access to programs/facilities and equipment", "weather", "school uniform" and "time constraints" were identified as being important to the lunchtime context.

Access to and suitability of space

Many different facets of space were described by children during the focus groups. "Lack of access to space" was defined as space being available but not accessible. A number of reasons for inaccessibility included peers taking up the space for sedentary activities (sitting and talking), space being used for other school-related activities (e.g. training), school rules relating to where children are allowed to play, and the condition of a space (e.g. wet and muddy ovals). The size of the space was also identified as both a facilitator and a barrier to lunchtime play. This was illustrated by one child who said, "…*sometimes you don't have an area that you can play in. There's just not enough room in the school*".

Another aspect of accessibility was the suitability of a space for a particular activity. For instance, there may be times when available play spaces are not conducive to a particular activity. This is reflected in the statement, "*In the Junior School there's no hiding spaces for hide and seek, it's so open*". Suitability of space was also identified as a facilitator of physical activity. In this context, the availability of a space suitable for a specific activity assisted children to play at lunchtime. For example, if children want to play football, they would choose to play on the oval instead of the tennis courts. One child also commented, "*…sometimes it's just better to play some games in one area than all over the place so if you are playing chasey then the oval would be good because you can't exactly run around the school*".

Access to programs/facilities and equipment

Discussions on access to programs, facilities and equipment were common across most schools. Facilities mentioned included basketball courts, grassed areas, swimming pools, soccer nets and football goals. Children commented that access to these facilities made it easy to engage in particular activities, such as basketball, whereas no access to these facilities prevented some children from playing particular activities. Children were asked what they would really like to do at lunchtime and the reason why they do not currently do those activities. Common responses included, "*They've taken it down at the moment*" and "*We don't have a pool*". Reasons for the "lack of facilities" were linked to safety concerns and the cost of facilities. For example, one child thought the school should have a swimming pool but when asked why the school does not have one the response was "*…because of money and safety".*

"Access to equipment" was consistently raised in all schools, with emphasis on the current condition and maintenance of equipment rather than lack of equipment. For example, one child commented, "*There used to be soccer nets and there used to be footy goals, but they were destroyed*". The majority of children commented that their schools provided opportunities for children to access loose equipment, such as hula hoops and balls. One child commented, "*All the sports equipment you can get from the sports shed*", while another child from a different school mentioned that the sports shed is only open at certain times of

the day, "*Sometimes the sports shed is not open [at lunchtime] so you can't really borrow anything*".

Weather

A factor often mentioned across most schools was "weather". In extreme weather conditions, such as very hot or very wet, opportunities to be active were restricted by the school's weather policy. More often than not, the weather policy was viewed as a barrier to physical activity. For example, "*If it is over 36 degrees you have to stay in and if it's raining they ring the bell three times and you have to go in*". Each school had different rules about weather. In the rural school, there was no strict policy related to hot weather and the decision to be active was made by the child. Common responses from children were reflected in the following statement, "*When it's hot you just kind of sit around and you don't want to do anything*". Different types of weather influenced the selection of specific activities. For example, during cold weather more active games were likely and during warmer weather more sedentary activities were performed. One child mentioned, "*You can do [skipping] in any weather…and when you do skipping when it's cold it warms you up*".

School uniform

The school uniform was a factor discussed only briefly by girls and was relevant to the lunchtime setting, particularly in high SES schools. When girls were asked why they chose certain activities over others, uniforms were identified as a significant restriction to playing specific types of activities, such as basketball. This was an important concern for one group of children where the uniform was a heavy pinafore and heavy school shoes. Other comments related to having to wear hats and the negative consequence of not wearing a hat, such as "*Hats is one big influence. You have to have a hat to play. No hat, no play*".

Time constraints

Children identified "other commitments", such as meetings, music practice, and sport shed duty, as important barriers to lunchtime play. One child mentioned, "*Sometimes you have meetings so you can't go outside to play*". An interesting barrier to playing at lunchtime was

scheduled sports trainings. Even though this is still an active pursuit, it was viewed as taking time away from play, demonstrating that play is highly valued by children in the lunchtime context.

School rules

"School rules" were not only raised in relation to specific factors such as space and weather, but also enthusiastically discussed in general. These rules often had a negative connotation for children and were seen as a major barrier to lunchtime play. When asked, "What stops you from being active at lunchtime?" common responses were "*All the rules*". Also, the consequence of breaking school rules result in a timeout where children are not allowed to play. For example, "*When you get told off by a teacher you have to pick up papers during your lunchtime" and "We're not allowed to run around the hall, around buildings and if we do we'll get time out. We have to just sit down".*

4.3.2.2 Children's perceptions of the correlates of after-school physical activity

Transport, organised and non-organised activities were the three main activity domains that emerged from the discussions and were subsequently used to uncover the factors related to the after-school context. A total of 81 factors were identified by children, however, only the most important or unique influences to after-school physical activity will be described in detail below and are outlined in Table 4.2.

4.3.2.2.1 Intrapersonal factors

"Perceived competence" and "enjoyment" were perceived to be of high importance in the intrapersonal domain.

Perceived competence

"Perceived competence" is one component of self-efficacy which is described as the belief in one's capability to be physically active (Biddle, et al., 2005). This was discussed by children as both a barrier and facilitator in all physical activity domains (i.e. active transport, organised and non-organised activities). Children mentioned that they chose to engage in activities if

they perceived themselves to be competent ("*good at it*") or found the activity easy. An example of the importance of perceived competence came from one child who commented, "*I like sport because I am a good runner. I like soccer mostly because I'm good with my feet so I get the ball and I can dribble it really well and I do basketball as well and I'm pretty good at it*". Alternatively, some of the children did not participate in particular organised and non-organised activities because they did not think they were competent. This is illustrated by one child who described the reason why she does not engage in organised activities, stating, "*I don't play sport because I am not good at sports and I don't really see much point in doing it if I can't really play very well*". This was particularly apparent when children compared their own competence to their peers. One child provided her insights into why she thinks some children do not engage in physical activities after school, mentioning, "*You might not be as good as everybody else, you might be the worst in the team*".

Enjoyment

One of the most important facilitators of physical activity in all contexts discussed by the children was "enjoyment". When children were asked why they participated in the activities, again the most common response was "*because it's fun*", "*I enjoy it*" or "*because I love it*". After further prompting of what makes an activity fun, it became apparent that 'hanging out' with friends was one of the reasons that made activities fun after school, "*When you are with friends. That makes it fun*", and having people to play with, "*Netball's really fun because half of my class does it* [plays netball after school]". Enjoyment was also linked to feelings of perceived competence, with many children mentioning that activities were fun if they were good at them, such as "*I like sport because I am a good runner*".

4.3.2.2.2 Sociocultural factors

Within this domain, children identified "peer influence", including having someone/no-one to play with and bullying or teasing, and "parental influence", including perceptions of parents' rules, parents' concern for safety and parental support/lack of support, as important categories.

Peer influence

Children mentioned "peer influence" as an important factor for participating in non-organised and organised activities. Having "someone to play with" was particularly important in the non-organised activity context. One child mentioned "*It's always more interesting when someone's there with you*". In comparison, having "no-one to play" with was viewed as an important barrier to play by the majority of the children. One child provided his perception of why children do not play after school, stating, "*If you have no-one to play with. That's what stops people*". Having no-one to play with was also linked to expressed feelings of loneliness for children living in isolated locations. One child stated, "*…being on a farm you get lonely*".

Another aspect of peer influence identified in both the non-organised and organised activity contexts was bullying/teasing. Bullying/teasing was identified as something that would stop participation completely or make it harder to participate in activities, and was perceived to be particularly important for girls. One child provided her insights on why some children might not engage in after-school activities, stating "*Someone might be mean to you at dancing and you might stop it because they are mean to you*". Also, the body size of a person was also linked to bullying/teasing, with one child suggesting "*Maybe because they are too big for the teams and no-one picks them when they get on the teams so they can't actually do a sport*". Another perception for why some children are bullied in the after-school context revolved around engaging in activities classified as gender-specific. This is illustrated in the following comments, "*People get teased if they play a boys' sport or a girls' sport*" and "*maybe they* [girls] *are scared if they do some sort of sport that is classified by some people as a boys' sport. They won't do it because they get teased*".

Parental influence

"Parental influence" included perceptions of parents' rules surrounding physical activity, parents' concerns for a child's safety, parental support and lack of parental support, which were discussed in all focus groups. Parents' rules about physical activity were identified by the children as an important factor in the transport context. When children were asked why they chose a particular mode of transport, responses clustered around parents not allowing

them to use active modes of transport, such as "*I asked mum if I could ride my bike to school and she said no*". Other reasons why children had to use active transport modes or bus transport, as perceived by the focus group participants, were parents had to work or they were busy with other commitments, such as picking up other siblings. One child commented, "*My dad and mum both work in the city so they drive. I'll have to wait until about 5 o'clock in the library and most nights I don't really want to do that and I've got something on so I catch the bus home and let myself in*".

Children also discussed that some parent-driven rules prevented them from playing and engaging in non-organised activities. For example, one child was not allowed to play after school because "*They just make you do chores which stop you*". One child also commented that he gets into trouble if he tries to be active, "*Me and my brother, we run around the house or throw balls in the house and then we get in trouble*". In some circumstances, children reported that their parents placed limits on the number of activities they were allowed to engage in, such as "*My mum said that I'm not allowed to do three things; I am only allowed to do two things [i.e. two sport activities]*". These limits were perceived quite negatively by many children. On the contrary, some children stated that they were forced to engage in sports and activities because it was a family rule, such as "*There's a rule in our house that you have to play at least one sport so I play netball*" and "*Sometimes my mum makes me go outside and jump on the trampoline*".

Children also mentioned that they believed some of their parents' rules were governed by safety concerns. For transport, children reported that their parents' concerns for stranger danger influenced the decisions about how their child would get home after school. For example, "*I get driven home because my mum doesn't trust me to take the bus because she thinks I might get stolen*". For the organised activities, parents' perceived fears of their children getting injured prevented children from engaging in some after-school organised and non-organised activities. One child provided his insights into why he believes some children do not engage in organised activities after school, stating "*Maybe something has happened to them [the parents] and they don't want their younger ones to continue on with*

that [sport], like risk them getting hurt or something, so they're maybe just looking out for their safety".

One of the most important social factors identified by children was "parental support". Support is defined as resources provided by parents to help children's participation in activities (Biddle & Mutrie, 2008). Provision of transport to activities was perceived to assist children engage in specific sport and play activities, with one child commenting, "*Maybe parents are able to drop the kids and take them back home*". Parents' availability to help the child during play and sport was also identified as an important facilitator to after-school activities. One child commented "*They shoot hoops with me in the back yard, help me practise and get rebounds*". In addition, children perceived that parents were sometimes unable to support them in their activities after school. This "lack of parental support" factor was discussed across the three activity contexts (i.e. active transport, organised activities and non-organised activities) and centred on parents being too busy. One child commented that the reason she did not play sport after school was because her parents "*have fulltime work and they can't get to the games and stuff*".

4.3.2.2.3 Physical environmental/policy factors

In the physical environmental/policy domain, important categories identified by children included "safety", "distance", "weather" and "time".

Safety

"Safety" was mentioned as a very important barrier to after-school physical activity. A number of children discussed not partaking in active transport home from school or playing in the neighbourhood due to the presence of strangers and not feeling safe. For example, one child provided a reason why she did not play outside after school, saying "*When I go home, alone, I stay inside because I get really scared that someone's going to come and take me*". One child mentioned that she did not walk home from school "*because there are weird people out there*". Another barrier to actively commuting home from school was road safety. This is illustrated by a comment from a child who described why he chose the bus over

walking home from school, "*You are on a main road* [when you walk home] *and you would have to cross quite a few main roads and there are very few traffic lights*".

Children also discussed the presence of dangerous objects and animals as a safety barrier to being active after school. Children living in rural regions mentioned that they had to be careful of scrap pieces of metal and wire in their backyards. These objects would either prevent them from playing in their backyards at home altogether or limit where they could play in their backyards at home. Children, both in rural and urban locations surrounded by bushland, also refused to play outside due to a fear of dangerous animals, such as snakes and wasps, particularly during the summer months. One child commented, "*I won't go out in summer in the bigger bit [of our backyard] because we've got a wood heap and I'm scared of snakes*".

Distance

Distance to and from a place of interest was described as both a facilitator and barrier to active transport. Children who perceived they lived too far from school or activity facilities would often commute by motorised transport modes. One child had to be driven because "*it is too far to walk home. It would probably take an hour".* On the other hand, if children lived close, they would either ride or walk. One child mentioned, "*I live so close. There's not really any point [taking a car]*". This was only discussed by children living in urban locations.

Distance to and from places also influenced children's engagement in specific activities after school. One child described how he rarely had friends over to play after school because "*I'm too far away to have all my friends up for fun play*". Children chose to engage in specific after-school organised activities or sporting clubs because they are conveniently located in the neighbourhood. For example, one child commented on the reason why she participated in school sport instead of club sport, stating, "*If you do school sport, it's in your district and it's not driving an hour to get there but if you were to do club sport you often have to drive quite far, like maybe to the other side of the city*".

Weather

The weather was an important factor mentioned by children across most schools. This influenced children's physical activity in organised sports, non-organised activities and active transport during the after-school period, acting as both a facilitator and a barrier. When the weather was fine and sunny, children described being more active, but in extreme weather conditions, such as very hot or wet days, children commented that they would opt to either stay inside or participate in more sedentary activities, such as "*In summer I don't really like to play outside because it's too hot"*. One child commented, "*I ride the bike in summer but I don't ride it in winter because it is cold*". In relation to organised activities, engagement in these activities after school is also governed by the weather with one child commenting, "*We call off our cricket games if it's over 35 degrees*".

Time

"Lack of time" was mentioned by children as a barrier to active transport, organised and non-organised activities. Common reasons provided by the children for not having enough time were "other commitments" and "too much homework". When transport options were discussed, children often mentioned that they had to be driven after school because they had other commitments to get to and did not have enough time to actively commute. One child mentioned, "*My house isn't very far away but I am busy mostly every night with other things and the only times we get to walk is when we don't have anything on*" and "*On Fridays I'm really really busy so I drive*". Children mentioned having "*too much homework*" as one of the main reasons why they did not participate in non-organised and organised physical activity after school. One child commented, "*I used to have so much stuff on Wednesdays. I quit because I had lots of homework, too much homework. I used to do figure skating and gymnastics but now I only do trampolining*". This tended to be a particular issue for children attending high SES schools.

Table 4.2 Complete list of correlates relating to lunchtime and after-school physical activity identified during the focus group discussions

Category of correlate	Correlate[a]	Sub-correlate[a]	Perceived importance[b]	
			Lunchtime	After school
Intrapersonal	Enjoyment	Enjoyment (+)	1	1
		Lack of enjoyment (-)	-	3
	Self-efficacy	Perceived competence (- +)	2	1
		Barrier self-efficacy (+)	3	
		Self-efficacy (- +)	-	3
		Self-esteem (- +)	-	3
	Behavioural attitudes/belief about physical activity	You need energy for physical activity (- +)	2	3
		Perceived skill requirement (- +)	3	2
		You need to be active (+)	3	-
		Make up own rules (+)	2	-
		Makes you feel good (+)	3	-
		Keeps you fit (+)	3	1
		I feel like it (+)	2	-
		Lack of motivation (-)	2	3
		Boredom avoidance (+)	2	-
		Practice to get better and work toward something (+)	2	2
		Socialisation opportunities (+)	2	2
		Peer acceptance/social norm (- +)	1	2
		It is something to do (+)	1	3
		Gets you active (+)	-	3

Category of correlate	Correlate[a]	Sub-correlate[a]	Perceived importance[b]	
			Lunchtime	After school
		Makes you feel good (+)	-	3
		Keeps you healthy (+)	-	2
		I want to get exercise (+)	-	3
		I'm too tired (-)	-	2
		Opportunity to utilise skills (+)	-	3
		Don't want to meet people (-)	-	3
		Try new things (+)	-	3
	Feelings about physical activity	I like competitions (+)	2	-
		Activity preference (- +)	3	2
		Fear of injury (-)	2	2
		Fear of older children (-)	2	-
		Fear of injury (-)	2	-
		I like team sports (+)	-	2
		Fear of dangerous objects/animals (-)	-	2
		Activity preference (best option available) (+)	-	2
		I like competitions (+)	-	3
		I like/don't like the coach (- +)	-	3
	Body image (-)		3	2
	Biological	Sex (- +)	3	-
		Size of the person (- +)	3	3
		Physical health (-)	2	3
		Age (-)	3	3

Category of correlate	Correlate[a]	Sub-correlate[a]	Perceived importance[b]	
			Lunchtime	After school
		Disability (-)	-	3
Sociocultural	Peer influence	Someone/friends to play with (+)	1	2
		No-one to play with (-)	2	1
		Bullying/teasing (-)	1	1
		Peer support (peers help me) (+)	2	-
		Peer barriers (-)	3	-
		Lack of peer encouragement (-)	-	3
	Teacher influence	Teacher barriers (-)	2	-
		Teacher support (+)	2	-
		Teacher role modeling (+)	2	-
		Teacher supervision (+)	3	-
		Lack of teacher support (-)	3	-
	Coach influence	Lack of coach encouragement (-)	-	3
		Coach support (+)	-	3
		Lack of coach support (-)	-	3
	Parental/family influence	Lack of parental supervision (-)	-	3
		Parental supervision (+)	-	3
		Parental support (+)	-	2
		Lack of parental support (-)	-	2
		Parental encouragement (+)	-	3
		Lack of parental encouragement (-)	-	3
		Parental rules (have to do physical activity) (+)	-	3

Category of correlate	Correlate[a]	Sub-correlate[a]	Perceived importance[b]	
			Lunchtime	After school
		Parental rules (barriers) (-)	-	2
		Family commitments (-)	-	3
		Family role modeling (+)	-	3
	Sibling/cousin influence	Sibling role modeling (+)	-	3
		Sibling encouragement (+)	-	3
		No siblings to play with (-)	-	3
		Siblings to play with (+)	-	2
	Media influence (-)		3	-
Physical environment/policy	Cost (-)		2	2
	Safety	Stranger danger concerns (-)	-	1
		Road safety concerns (-)	-	1
	Access to equipment	Access to equipment (+)	1	2
		Condition of equipment (-)	2	-
		Size of equipment (-)	3	-
		Lack of access to equipment (-)	2	3
	Access to programs/facilities	Access to programs/facilities (+)	2	1
		Lack of programs/facilities (-)	3	2
		Seasonal access to programs/facilities (- +)	3	3
		Quality of programs (- +)	-	3
		Knowledge of programs/facilities (- +)	-	3
	Time availability	Length of lunch time (- +)	3	-
		Other commitments (-)	1	2

Category of correlate	Correlate[a]	Sub-correlate[a]	Perceived importance[b]	
			Lunchtime	After school
		Time availability (+)	-	2
		Homework commitments (-)	-	1
		General lack of time (-)	-	1
	Access to space	Size of space (- +)	1	2
		Condition of space (-)	3	3
		Number of people in space (- +)	1	3
		Access to space (general) (+)	-	2
		Access to a specific type of space (+)	-	3
		Lack of access to space (general) (-)	1	-
		Lack of access to space (dog poo) (-)	-	2
		Lack of access to space (house renovations) (-)	-	3
	Suitability of space for a chosen activity (- +)		2	-
	School rules	School rules/policy (general) (-)	1	-
		School rules (types of games allowed) (-)	2	-
		School rules (types of equipment allowed) (-)	3	-
		School rules (who you are allowed to play with) (-)	3	-
		School rules (where you are allowed to play) (-)	1	-
	School uniform (-)		2	-
	Neighbourhood terrain (-)		-	3

Category of correlate	Correlate[a]	Sub-correlate[a]	Perceived importance[b]	
			Lunchtime	After school
	Weather	Type of weather (- +)	1	1
		Weather policy (-)	3	-
	Distance	Too far (-)	-	1
		Close by (+)	-	2
	Things to carry (-)		-	2
	Pets (+)		-	2

Notes:

[a] Barrier = -; Facilitator = +

[b] Perceived importance was based on the sticker dot activity and interpretation of the level of enthusiasm with which factors were described. Level three factors contained two sticker dots or less and were discussed with little enthusiasm, level two factors contained three to five sticker dots and discussed with moderate enthusiasm and level one factors contained more than five sticker dots and discussed with a lot of enthusiasm.

4.4 Discussion

Most correlate studies can explain about 15-20% of the variance in children's physical activity (Humbert, et al., 2008). These findings suggest that there is a need to better understand the factors and search for new factors in order to provide a more comprehensive picture of influences on children's physical activity behaviour (Humbert, et al., 2008). Research aiming to improve the understanding of the factors that influence physical activity should ensure that the factors being studied are relevant to the context and the behaviour being measured and address all aspects of a social ecological framework (Giles-Corti, et al., 2005). The findings from this study illustrate the importance of understanding factors pertinent to specific contexts. Several factors were identified as being important in one context but not another, implying that children's physical activity may be influenced by different factors at different times of the day, while other factors were identified in both the lunchtime and after-school contexts but were ascribed different meanings and perceived importance. This is consistent with literature that emphasises a need for explicit description of physical activity-related factors that are relevant to specific contexts (Giles-Corti, et al., 2005; Hohepa, et al., 2007; Ommundsen, et al., 2006). In addition, the use of a qualitative design has provided further insights into factors that are rarely considered in quantitative physical activity correlate research, such as the school uniform and bullying. The description of the factors in this study creates a picture of the potential barriers and facilitators to physical activity in two critical contexts in a child's day.

The most important factors influencing lunchtime physical activity as perceived by children included:

- perceived competence,
- behavioural attitudes/beliefs/feelings about physical activity (e.g. improving skills, hanging out with friends, something to do/nothing to do, making up game rules and activity preferences),
- enjoyment,
- peer influence (someone/friends to play with, no-one to play with, bullying/teasing and peer acceptance/social norm),
- teacher influence (teacher barriers and teacher support),

- access to and suitability of space
- access to programs/facilities
- access to equipment
- weather
- school uniform
- time constraints, and
- school rules.

The most important factors influencing after-school physical activity as perceived by children included:

- perceived competence,
- enjoyment,
- parental influence,
- peer influences
- safety in the neighbourhood and home settings,
- travel distance to and from places in the neighbourhood,
- weather, and
- time available for active pursuits.

Hohepa et al. (2006) reported that facilitators and barriers of physical activity are predominantly based on perceptions of choice. The majority of the barriers identified during the focus groups tend to relate to aspects that children perceived to be out of their control with no sense of choice. During the lunchtime period, children's perceptions of choice were compromised by poor accessibility or availability of physical activity opportunities, such as access to equipment and play space, and availability of time. Interestingly, these were often viewed as being controlled and restricted by the school. The choice to be active after school was often compromised by factors such as availability of parents (e.g. parents not available to take them to training), parents' rules and perceptions of safety, and distance to and from places. By increasing opportunities and choice, Wilson et al. (2005) reported that children are more likely to be motivated to engage in physical activity. Supporting this finding,

children in the current study provided a number of solutions that would facilitate engagement in physical activity, including increasing access to equipment and providing indoor activity spaces during lunchtimes on days with extreme weather conditions. Even though the findings from Wilson et al. (2005) were based on non-specific physical activity, they do provide important insights that should be considered when developing context-specific physical activity interventions.

The concept of perception of choice also extends to school rules, parental rules, the school uniform and making up own game rules. Children verbalised a desire to be more active at lunchtime but were constrained by school rules. Rules tended to cluster around what they were allowed to play, who they played with and where they played. Even though school rules are established for safety and legal reasons and a means of controlling situations (Ommundsen, et al., 2006), schools need to be aware that children generally perceive these to be barriers to their lunchtime play, in which access to spaces, equipment and ultimately their opportunities to be active, are restricted. In the after-school period, rules were related to parents (e.g. rules about the number of sports the child is allowed to play, household chores and TV watching). While some of these rules were facilitators of play, such as having to play a sport, the majority of these were viewed as barriers because children perceive these as being out of their control. This finding is consistent with other qualitative studies (Dwyer, et al., 2006; O'Dea, 2003).

The school uniform has long been an important factor in the culture of a school (Meadmore & Symes, 1997). It is a symbol of discipline and status in the community (Meadmore & Symes, 1997). However, there is little evidence of the impact of the school uniform on children's physical activity. In the current study, school uniforms were perceived to be a significant barrier to lunchtime play. Uniform design, particularly in the private school sector, restricts movement and is generally impractical for the majority of physical activities. This leads to feelings of discomfort, particularly in mixed-sex environments, and reluctance to engage in play. A qualitative study (Williams & Bedward, 2002) found that girls felt uncomfortable wearing the required sex-specific physical education uniform of short skirts, preferring to not participate in mixed-sex activities. In addition, the students also felt the

skirt uniform was inappropriate for the activities chosen during PE class, preferring uni-sex uniforms consisting of shorts, t-shirts and jumpers. In private schools, children are often not allowed to wear their PE uniform outside of PE lessons. Schools could potentially reconsider policies to allow a uni-sex PE uniform during the lunchtime period. A practical design allowing ease of movement would increase children's feelings of comfort and self-confidence when engaging in physical activities.

Children also indicated that freedom to make up or modify rules was important during lunchtime play. Lunchtime physical activity is often characterised by its unstructured nature. According to MacDougall et al. (2004), children hold a unique meaning for "play", which is quite distinguishable from other forms of physical activity. Play is often linked with fun, spontaneity, interaction with friends, and with no competitive components. Humbert et al. (2008) reported that children wanted to be able to choose the level of competition in any physical activity context and to make their own rules. The opportunity to modify activities to be less competitive, to change the physical demands of an activity and to include other children, can enhance opportunities and promote enjoyment and motivation to engage in activities (Humbert, et al., 2008).

Bullying/teasing is not a new phenomenon and is well documented in the literature, as evidenced by systematic reviews (Espelage & Swearer, 2003; Merrell, Gueldner, Ross, & Isava, 2008) and other qualitative research (Bauer, et al., 2004; Casey, et al., 2009). However, it is still often overlooked in quantitative physical activity correlate research. This factor was identified in both contexts but children described different aspects of bullying/teasing, which were specific to each setting. In the lunchtime context, bullying was discussed more generally with no specific underlying reasons why children are bullied, whereas bullying in the after-school setting was linked to body image and engagement in gender-stereotyped activities.Casey et al. (2009) also found that teasing was linked specifically with body image, but also with academic performance and skill competence, with the indirect outcome of reduced confidence and avoidance of physical activity. Bauer et al. (2004) also reported that children experienced direct gender and weight-related bullying, inhibiting full engagement in physical activity. This can have profound negative effects on

self-competence and potentially lead to lower preference for physical activity and a higher preference for sedentary activities (Bauer, et al., 2004; Casey, et al., 2009). Studies have found a link between bullying and avoidance of physical activities (Bauer, et al., 2004; Vu, et al., 2006). This demonstrates the importance of addressing bullying when trying to promote healthy behaviours. Additional research is required to understand the full extent of the influence of bullying/teasing on children's physical activity in different settings.

Fear has previously been investigated in relation to crime (Timperio, Salmon, Telford, & Crawford, 2005), dogs (Evenson, et al., 2006) and injury (particularly parental perceptions of fear of injury) (Boufous, Finch, & Bauman, 2004). In the current study, fear of dangerous objects and animals was identified by children residing in rural or urban bushland settings as a specific factor in the after-school period. MacDougall et al. (2009) also identified that fear of dangerous animals, such as snakes, limited play boundaries for children living in rural regions but not children living in urban regions. There have been few quantitative studies looking at the association between fear of dangerous animals and physical activity. Despite limited quantitative evidence on the association of perception of fear of hazardous factors, this qualitative evidence demonstrates location context-specificity, that is rural and urban children are influenced differently, and this should be a consideration when trying to understand behaviour in different locations.

Another factor linked with fear was safety, which is a complex factor that incorporates diverse components (Carver, et al., 2008b). In comparison to other studies that have looked at overall safety, the children in this study identified a number of aspects of safety that relate particularly to the after-school context, including 'stranger danger' and road safety. These findings are supported by a number of qualitative studies (Hohepa, et al., 2006; Humbert, et al., 2008; Humbert, et al., 2006; Ries, et al., 2008) but existing empirical evidence provides little support for associations between perceptions of safety and physical activity (Carver et al., 2005; Timperio, Crawford, Telford, & Salmon, 2004). For example, Carver et al. (2005) found no associations between adolescents' perceptions of 'stranger danger' and walking to and from places in the neighbourhood. However, peer influence was associated with higher levels of walking and riding in the neighbourhood for adolescents

(Carver, et al., 2005). Similarly, children in this study discussed the importance of friends when walking or riding home from school, which suggests that social support can modify children's perceptions of safety and potentially be an intervention priority to increase neighbourhood physical activity. The Walking School Bus program, a voluntary program where one or more adults escort groups of children, by foot or bicycle, to and from school each day, is one example of an intervention strategy that promotes active transport in groups (Davison, Werder, & Lawson, 2008).

Lack of time is an important and consistently reported barrier (O'Dea, 2003), particularly in the after-school physical activity context (Dwyer, et al., 2006; Hohepa, et al., 2006; Mulvihill, et al., 2000b). Unlike the school period where children's time is organised and controlled by a strict regime of consecutive tasks, children's time after school tends to consist of multiple and often competing responsibilities, such as home duties, homework, cultural activities and extracurricular activities. In this study, children indicated that they would like to be more physically active after school but other demands, such as homework and other commitments, limited their opportunities. Strategies to promote physical activity could focus on balancing demands and ensuring more time is given for physical activity opportunities, as suggested by Humbert et al. (2006). Incorporating activity into homework, such as 'active homework' (Erwin, Abel, Beighle, & Beets, 2011), balancing home responsibilities, or restructuring the school day (i.e. starting and finishing the school day earlier) to increase the "critical window", are potential solutions.

Previous research has found that children who have peers, siblings or parents who support them in physical activity are more likely to engage in physical activity compared to children who do not have these supportive networks (Reynolds et al., 1990; Sallis, Prochaska, et al., 2000). In this study the children gave much attention to the negative social influences, such as lack of support, parental rules, bullying/teasing and having no-one to play with. This was a similar finding to Reis et al. (2008), suggesting that children may perceive their social environment to provide more negative rather than positive influences. However, despite the negative focus, children did identify some positive influences, such as having friends to play with and parental support. Empirical research has shown a positive association between

social support and increased physical activity during the lunchtime and after-school period (Hohepa, et al., 2007). Hohepa et al. (2007) found that friends are a consistent source of support during the lunchtime setting, whereas after school, parents and friends are key contributors to children's physical activity. Other quantitative research has found weak correlations between peer influence, such as encouragement, and global physical activity (Prochaska, Rodgers, & Sallis, 2002), which may suggest that peers exert a stronger influence on context-specific physical activity rather than global physical activity. The ecological model posits that influences most proximal to the group under investigation tends to have a greater impact on physical activity behaviour (Spence & Lee, 2003), suggesting that friends, who are more proximal to children during lunchtime, may be more important to children during lunchtime, while parents have a greater influence after school. This is supported by the findings from the current study, in which peer influence was perceived to be more important in the lunchtime context compared to after-school context by the children. These findings highlight the importance of conducting further research into determining whether there is a causal link between social support and increased physical activity and whether this differs in different contexts.

Enjoyment is one of the most common reasons children engage in physical activity. However, when exploring this concept further, children often find it difficult to articulate why an activity is enjoyable (Kimiecik & Harris, 1996). This is further complicated by the individualised meanings given to the term "enjoyment". In the current study, as with other studies (Hohepa, et al., 2006; Humbert, et al., 2006), children articulated that enjoyment is often dependent on the presence of friends and perceived competence. These examples may have come out more strongly because they can be clearly connected to positive feelings and are easily conceptualised and articulated by children compared to other intrinsic processes, such as how enjoyment is experienced (Biddle & Mutrie, 2008). There have been mixed thoughts on how to survey enjoyment. Some believe that multiple dimensions of enjoyment that are tangible in the eyes of the respondent should be surveyed (Biddle & Mutrie, 2008), while others believe enjoyment can be captured by a single item (DiLorenzo, Stucky-Ropp, Vander Wal, & Gotham, 1998; Trost, et al., 1997). Regardless of the confusion in the conceptualisation of enjoyment, all interventions should contain an element of "fun" (Dishman et al., 2005). Based on the findings of this study, interventions designed to

increase physical activity could consider inclusion of a social aspect and activities that are developmentally appropriate.

4.4.1 Strengths and limitations

When considering the focus group findings, some limitations should be noted. The study took place in South Australia, and therefore the generalisability of the results is limited to this context. For example, school policies and physical environments tend to vary across countries and Australian states and the findings may not be applicable to different countries and states. After-school activities clustered into three main physical activity domains (i.e. transport, organised activities and non-organised activities). These were identified to encourage children to explore the factors influencing physical activity in the after-school context. In-depth examination of the factors for transport, organised activities and non-organised activities was limited due to the breadth of behaviours explored. Also, due to time constraints, only one focus group was run per group of children, restricting opportunities to follow up and explore the identified factors in further detail. Some focus groups had a small number of participants in the group, which may have affected the flow of discussion and reduced the ability to expose additional factors. The ratio of boys to girls was uneven, with an overrepresentation of girls (31 girls, 23 boys). The reason for an uneven sex representation was due to no boys providing consent from a middle school campus of one school. Finally, it should be acknowledged that a social desirability bias in the responses provided by the children may be apparent, in that the responses may be a reflection of what children have heard from their parents, teachers or the media, rather than their own perceptions.

Despite these limitations, this study builds on previous research by examining children's perceptions of influences on physical activity and the relative perceived importance of these factors in the lunchtime and after-school period specifically. While the factors identified from this study could be captured using generic questionnaires, this study has provided important contextual information that would be lost with the use of generic questionnaires. The findings are an important contribution to the literature because correlate measurement tools are often developed from a generic perspective using a narrow set of adult-inferred

hypotheses, despite aiming to obtain children's own perceptions through self-report (Darbyshire, MacDougall, et al., 2005). Using these types of questionnaires would obtain children's perceptions of adults' opinions, which does not fit with the new research paradigm of 'research with' and 'research for' children (Darbyshire, 2000; Darbyshire, Schiller, et al., 2005). The findings from this study can be incorporated into questionnaire development, ensuring a better match with children's actual experiences, thus improving the reliability and validity of data obtained. Another strength of this study was the use of maximum variation sampling, which enabled collection of children's perceptions from a range of different contexts, including rural and urban locations and different school environments.

4.4.2 Future research and practical implications

It is important to note that the results in this study reflect a descriptive summary only. These summaries may potentially be used in the future for more in-depth discovery using alternative qualitative methodologies, such as phenomenology or grounded theory, or to generate hypotheses that can be tested by quantitative methods. Future research should also extend this approach to other settings, such as school holiday breaks and weekends, and apply this methodological approach to inform the development of physical activity correlate questionnaires. It is also recommended that researchers focus on specific behaviours in specific contexts, such as active transport during holidays or before school, in order to delve deeper and further improve our understanding of children's physical activity behaviour. To obtain a holistic view of influences on children's physical activity in specific contexts and potentially explain more variance in context-specific physical activity, future research could also include the in-depth exploration of the views of parents, coaches and teachers. The findings from this study can be used by schools, health promoters and policy makers to develop appropriately targeted lunchtime and after-school physical activity interventions or modify existing policies in order to increase children's choices and opportunities to be active at different times of the day. Furthermore, researchers using quantitative methodologies could apply these findings to the development of correlate questionnaires, which are designed to understand context-specific physical activity. Unless changes are made to intervention and questionnaire design and more recognition is paid to

the factors that children perceive to be important, approaches to physical activity promotion are likely to continue to produce modest and short lived effects (Allender, et al., 2006).

4.5 Conclusion

This phase of the program of research illustrated that using an in-depth descriptive qualitative methodology is an effective approach in confirming and uncovering new insights into factors relevant to a specific context that may not be exposed using quantitative methods with predefined and adult-inferred factors. Researchers using quantitative methodologies will be able to incorporate these specific qualitative findings or use this methodology as a template to inform questionnaire design and potentially increase content validity of research tools, rather than modifying existing questionnaires that may not be appropriate for the behaviour and the context in question.

4.6 Summary of Chapters 2 and 3: item identification

Inclusion of children in the research process, along with a review of the current literature described in the previous chapter, has enriched the understanding of children's physical activity behaviour, which may otherwise have been incomplete if children's perceptions were not sought. The correlates identified from both the focus groups and the systematic review fit within all categories of the social ecological model, supporting the interpretation that children's physical activity is a complex multi-dimensional behaviour that is influenced by a range of intrapersonal, sociocultural and physical environmental/policy factors (Sallis, et al., 2008; Sallis et al., 1992). A summary list of variables, identified through the focus groups and literature review, can be viewed in Table 4.3 and Table 4.4.

The limited amount of evidence of correlates in the lunchtime and after-school periods identified through the systematic review shows a considerable need for further research in this area. Interventions that have been implemented during these critical windows have resulted in limited success in increasing physical activity, particularly over time (e.g. Atkin, et al., 2011; Brunton et al., 2005; Jago & Baranowski, 2004; Salmon, et al., 2007). From the current literature, it is still unclear whether the inferred correlates are pertinent to the activities being performed in specific contexts under investigation or whether there are other correlates that influence context-specific behaviour that are not being measured or considered. Brunton et al. (2005) conducted a review of both qualitative and quantitative correlate research and found a significant mismatch between what children/parents say influences participation in physical activity and the factors addressed in interventions. This could suggest that interventions are not targeting the appropriate correlates perceived to be important and applicable to a specific context, and could explain why physical activity interventions produce modest results. The implication of this may be that critical information is missed about influences of context-specific physical activity, which could potentially explain additional variance in physical activity. This study has gone one step beyond the existing reviews of correlates of children's physical activity behaviour by identifying children's perceptions of the influences of context-specific physical activity, highlighting additional factors that warrant further exploration and combining these findings

with quantitative research findings. One of the key aims of this program of research was to determine whether prediction of context-specific physical activity can be improved by assessing these context-specific correlates. In order to achieve this, the pool of potential correlates identified through the systematic review and focus group study will be transformed into items and will serve as the basis for developing the context-specific questionnaires.

Table 4.3 Summary of the correlates of lunchtime physical activity (identified through the focus groups and systematic review)

Domain	Correlate	Sub-correlate	Source
Intrapersonal	Self-efficacy	Barrier self-efficacy	FG
		Perceived competence	FG
	Feelings	Enjoyment	FG
		Fear	FG
		Activity preference	FG
	Behavioural attitude/ belief about physical activity	Motivation	FG
		Lack of motivation	FG
		Improving skills	FG
		Socialisation (hang out with friends)	FG
		Socialisation (make new friends)	FG
		Something to do	FG
		Peer acceptance/social norm	FG
		Making up own game rules	FG
		You need energy for physical activity	FG
		You need to be active	FG
		Keeps you fit	FG
		Makes you feel good	FG
		Perceived motor skills	FG
	Body image		FG
	Biological	Size of person	FG

Domain	Correlate	Sub-correlate	Source
		Physical health	FG
		Age	FG Sys review
		Sex	FG Sys review
		Motor skills	Sys review
		Family affluence (SES)	Sys review
Sociocultural	Negative peer influence	Bullying/teasing	FG
		Peer barriers	FG
		No-one to play with	FG
	Positive peer influence	Someone to play with	FG
		Peer support	FG
	Positive teacher influence	Teacher role modelling	FG
		Teacher supervision	FG
		Teacher support	FG
	Negative teacher influence	Lack of teacher support	FG
		Teacher barriers	FG
	Media influence		FG
Physical environment/policy	Space	Size of space	FG Sys review
		Access to space	Sys review
		Lack of access to space	FG
		Suitability of space	FG
		Condition of space	FG Sys review
		Number of people in space	FG
		Playground markings	Sys review
	School uniform		FG
	Equipment	Access to equipment	FG Sys review
		Lack of equipment	FG
		Condition of equipment	FG

Domain	Correlate	Sub-correlate	Source
		Size of fixed equipment	FG
	Facilities/ programs	Access to facilities/ programs	FG Sys review
		Lack of access to facilities/ programs	FG
		Seasonal access to programs	FG
		Number of facilities	Sys review
		Condition of facilities	Sys review
	Time	Time availability	FG
		Length of lunch times	FG Sys review
	Weather	Type of weather	FG
	Cost		FG
Policy	Policy	School policy/rules	FG

Notes: FG = focus group; Sys review = systematic review

Table 4.4 Summary of the correlates of after-school physical activity (identified through the focus groups and systematic review)

Domain	Correlate	Sub-correlate	Source
Intrapersonal	Self-efficacy	Support seeking self-efficacy	Sys review
		Perceived competence	FG
		Barrier self-efficacy	Sys review
		Self-esteem	FG
	Feelings	Enjoyment	FG Sys review
		Lack of enjoyment	FG
		Fear	FG
		Activity preference	FG
		Activity preference(best option available)	FG
	Behavioural attitude/belief about physical activity	Peer acceptance/social norm	FG
		Lack of motivation	FG
		Too tired	FG
		Socialisation (hang out with friends)	FG
		Socialisation (meet new people/make new friends)	FG
		Lack of socialisation (don't want to meet new people)	FG
		Want to try new things	FG
		Improving skills	FG
		I want to get exercise	FG
		Opportunity to utilise skills	FG
		Keeps you fit	FG
		Gets you active	FG
		Keeps you healthy	FG
		You need energy for physical activity	FG
		Makes you feel good	FG
		Perceived motor skills	FG
	Body image		FG

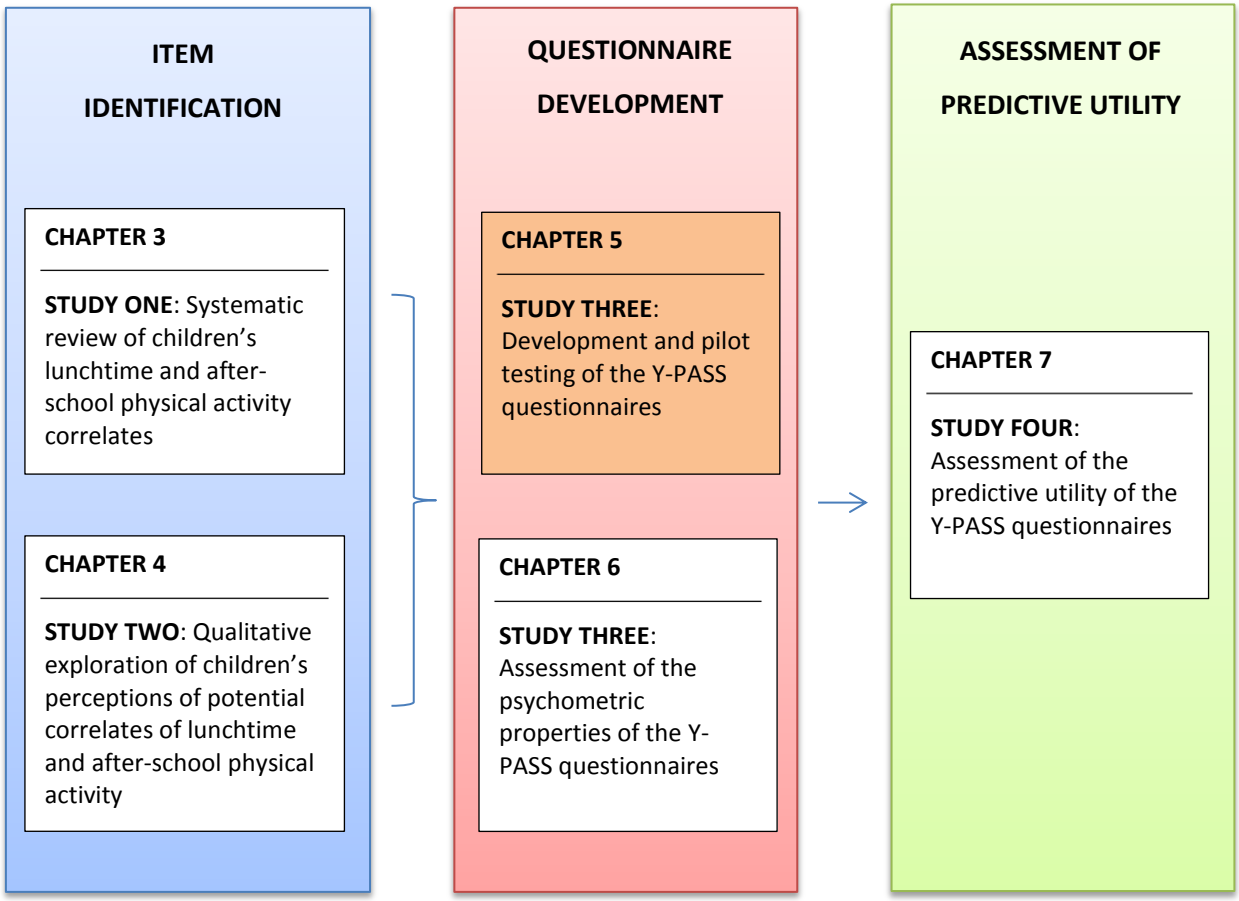
Domain	Correlate	Sub-correlate	Source
	Biological	Physical health	FG
		Size of person	FG
		Disability	FG
		Age	FG Sys review
		Body Mass Index	Sys review
		Sex	Sys review
Sociocultural	Negative peer influence	Bullying/teasing	FG
		No-one to play with	FG
		Lack of peer encouragement	FG
	Positive peer influence	Peer support	Sys review
		Someone to play with	FG
	Negative sibling/cousin influence	No sibling(s)/cousin(s) to play with	FG
	Positive sibling/cousin influence	Sibling(s)/cousin(s) to play with	FG
		Sibling/cousin encouragement	FG
		Sibling/cousin role modelling	FG
	Positive parental influence	Parental support	FG
		Parental encouragement	FG
		Parental supervision	FG
		Parental/family role modelling	FG
		License	FG
	Negative parental/family influence	Lack of parental encouragement	FG
		Lack of parental support	FG
		License	FG
		Lack of parental supervision	FG
		Parental supervision	Sys review
		Family commitments	FG
	Negative coach influence	Lack of coach encouragement	FG

Domain	Correlate	Sub-correlate	Source
		Lack of coach support	FG
	Positive coach influence	Coach support	FG
Physical environment/policy	Pets		FG
	Space	Access to space	FG
		Lack of access to space	FG
		Type of space	FG
		Size of space	FG
		Condition of space	FG
		Number of people in space	FG
	Distance		FG
	Cost		FG
	Facilities/programs	Access to facilities/programs	FG Sys review
		Lack of access to facilities/programs	FG
		Quality of facilities/programs	FG
		Knowledge of facilities/programs	FG
		Seasonal access to programs/facilities	FG
	Equipment	Access to equipment	FG Sys review
		Lack of access to equipment	FG
	Safety	Neighbourhood safety	FG
	Weather	Type of weather	FG
	Time	Time availability	FG
		Lack of time	FG
	Things to carry		FG
	Neighbourhood terrain		FG
Behavioural	Television viewing/playing video games		Sys review

Notes: FG = focus group; Sys review = systematic review

CHAPTER 5

Study Three: Development of the Y-PASS questionnaires



Chapter 5

5 Development of the Y-PASS questionnaires

Research aim:

To develop and pilot test the computer-delivered Y-PASS questionnaire tools that will measure potential predictors of lunchtime and after-school physical activity.

5.1 Introduction

To determine whether context-specific correlate questionnaires can explain more variance in children's physical activity compared to generic correlate questionnaires, there has been a need to develop and evaluate context-specific correlate questionnaires. The overall aim of this chapter was to describe the design and development of the computer-delivered lunchtime and after-school "Youth Physical Activity Survey for Specific Settings" (Y-PASS) questionnaires. These questionnaires assess lunchtime and after-school specific correlates and have been designed specifically for use with children.

With increased recognition that children have a right to be "actors" in the research process (De Leeuw, Borgers, & Smits, 2004), collecting information about children only from proxy reporting when children can also be individually asked is no longer considered adequate in today's society (Darbyshire, 2000; Darbyshire, Schiller, et al., 2005; De Leeuw, et al., 2004; Prout, 2002; Scott, 1997). The issues with proxy reporting have been well documented in the literature (Sallis & Saelens, 2000; Sirard & Pate, 2001; Whiteman & Green, 1997). Proxy reporters are often asked to comment on phenomena that are outside the scope of their knowledge, such as children's feelings, attitudes, and peer influences (De Leeuw, et al., 2004; Streiner & Norman, 2008). Along with other sources of information, children should be given an opportunity to voice their opinions and be involved in developing tools that measure aspects of children's lives.

The content for the Y-PASS questionnaires was informed by the evidence generated from the systematic review and children's voices (i.e. focus groups), described in Chapters 3 and 4, and based on a social ecological model. The design characteristics of the Y-PASS questionnaires were guided by existing correlate questionnaires used with children and based on theoretical knowledge of children's cognitive, communicative and social skills, which may affect their ability to answer questions (Borgers, de Leeuw, & Hox, 2000). The development of the Y-PASS questionnaires followed similar processes identified by Frazer and Lawley (2000), DeVellis (2003) and Streiner and Norman (2008). The steps specified in each of these references have been collated and summarised in Figure 5.1. These steps have been identified to ensure that the content, design and usability of the questionnaires are age-appropriate and capture precise and valid measurement of physical activity correlates. See Appendix 11 for Draft Four of the lunchtime and after-school Y-PASS questionnaires.

The following aspects of questionnaire development will be discussed in detail in this chapter:

- the theoretical and child development considerations used in the design of the Y-PASS questionnaires,
- the development of questionnaire items,
- the administration mode and structure of the Y-PASS questionnaires, and
- the evaluation of content validity (expert panel review and pilot testing).

Additional testing of the psychometric properties (i.e. construct validity [factor analysis], internal consistency and test-retest reliability) will be discussed in Chapter 6. Chapter 7 will describe the evaluation of the appropriateness of the context-specific correlate questionnaires in predicting context-specific physical activity when compared to a generic-correlate questionnaire and the predictors of lunchtime and after-school physical activity in children living in South Australia.

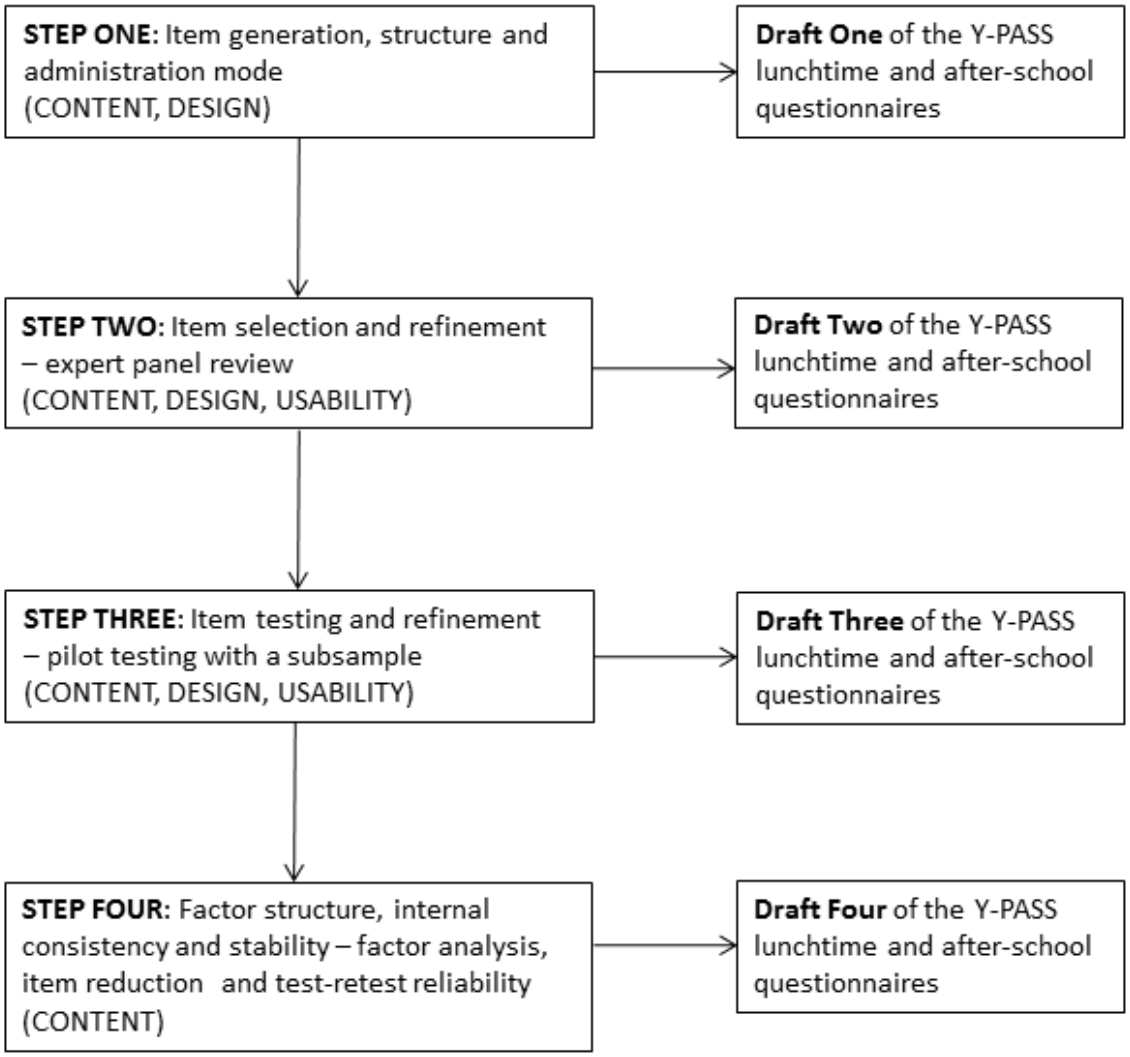


Figure 5.1 Steps in questionnaire development

5.2 Theoretical and child developmental considerations to questionnaire development

Understanding the mental processes required for answering questions is vital when developing questionnaires (Bell, 2007). There are four main tasks required to answer a question. This is known as the question-answer process model, developed by Tourangeau and Rasinski (1988), and includes:

1) Understanding the question
2) Retrieving relevant information from memory and computing an answer
3) Formatting and evaluating the answer
4) Communicating the final answer

These tasks are the same for adults and children. However, the ease of achieving these tasks depends on the respondent's cognitive developmental level, which is considerably different in children compared to adults.

Piaget's Cognitive Developmental Theory (1929) has been identified as a useful and the most comprehensive theory for classifying children's cognitive developmental stages (Borgers, Hox, & Sikkel, 2003). It is important to note that there has been some criticism of this theory around the distinct age categories for each stage (Lourenço & Machado, 1996). These ages should be considered as a guide and children's cognitive abilities do vary, depending on heredity, learning, experiences and socio-environmental factors (Borgers, et al., 2000). This theory highlights that language, literacy and memory skills develop throughout childhood and adolescence (Bell, 2007), which can potentially affect a respondent's ability to answer a question. Using Piaget's Cognitive Developmental Theory (Piaget, 1929), participants of this study (children aged 10-14 years) are considered to be at a stage where "concrete operations" and "formal thought" are developing. The following section describes these developmental stages. These concepts were considered when making methodological choices during the development of the Y-PASS questionnaires.

5.2.1 Child development and literacy considerations

During the "concrete operations" stage, children acquire language and reading skills and start to distinguish between self and others. Children aged 10-11 years in the "concrete operations" developmental stage are still literal in their interpretation of words and struggle with depersonalised or indirect questions, such as "people like you" or "children in general". As a result, items in the Y-PASS questionnaires were specifically worded with a first person focus to avoid the need for developing a response that needs to be generalised to other children. For example, "Bullying often stops kids from playing in the school yard at lunchtime" was reworded to "Bullying stops me from being active in the school yard at lunchtime". The "concrete operations" developmental stage also states that children in this age group have some difficulties comprehending double-barrelled (i.e. asking two questions in the one question) and negatively phrased questions with a negative response option. This is in contrast to the standard practice of surveying adults where an equal number of positive and negative questions is thought to enhance data quality (Bell, 2007; Borgers, et al., 2000). Efforts were taken to avoid or limit the use of negatively phrased items in the Y-PASS questionnaires. When administering questionnaires to children, there is also a risk of 'satisficing' in which respondents choose an appealing response without going through the four main tasks in the question-answer process (e.g. the first option for every question) (Bell, 2007; Borgers, et al., 2000; Borgers & Hox, 2001). Reasons for satisficing may be due to lack of motivation, boredom, complexity of the question and lack of understanding (Bell, 2007; Borgers & Hox, 2001).

As children in this study are between the ages of 10 and 14 years, the "formal thought" stage also needs to be considered, which generally corresponds to children aged 11 years and older. During this stage, cognitive functioning is generally well developed. However, lack of motivation and boredom can still be an issue and affect the quality of data collected. The use of a computer-delivered format for the Y-PASS questionnaires was not only chosen for convenience, but also a strategic methodological choice. Computer-delivered formats have been shown to address the issues of boredom and lack of motivation, which is common with children in this age group (Pearce, Williamson, Harrell, Wildemuth, & Solomon, 2007).

5.3 Step One: item generation, structure and administration mode of the Y-PASS questionnaires

The purpose of the "Youth Physical Activity Survey for Specific Settings" (Y-PASS) is to identify the contextual correlates of context-specific physical activity, as perceived by children residing in South Australia. Children's lunchtime and after-school contexts have been identified as the focus for this study. The justification for this decision has been discussed previously. The underlying theoretical framework used to guide the development of the items for the Y-PASS questionnaires was the social ecological framework. This posits that physical activity behaviour is the result of complex interactions of a multitude of intrapersonal, sociocultural and physical environmental/policy factors (Sallis, et al., 2008). The use of a social ecological model as the guiding framework for correlate research has been well documented in the literature (Elder, et al., 2007; Giles-Corti, et al., 2005; Sallis, et al., 2008; Sallis, Prochaska, et al., 2000; Spence & Lee, 2003).

The Y-PASS name was created by the PhD candidate (RMS) in consultation with experts in the field. It is a computer-delivered questionnaire, consisting of two sub-questionnaires, which correspond to lunchtime and after-school settings, respectively. These sub-questionnaires can be used individually or collectively and follow a similar structure of an introduction, definition of common terms, demographic questions, an activity checklist and items relating to the correlates of context-specific physical activity. The following section will discuss the development of the questionnaire items.

5.3.1 Item generation of the Y-PASS questionnaires

5.3.1.1 Lunchtime and after-school specific measures

The items identified below were developed specifically for this study, which was to identify the correlates of lunchtime and after-school physical activity, as perceived by children residing in South Australia. The first draft of the lunchtime questionnaire (prior to being sent to the expert review panel) contained eight demographic questions and 55 lunchtime-specific correlate items. The first draft of the after-school questionnaire contained the same demographic questions as the lunchtime questionnaire and 126 after-school specific

correlate items. Each questionnaire also contained an activity checklist specific to the context under investigation.

5.3.1.1.1 Demographic items

Questions detailing specific demographic information relating to the child were included in the questionnaires. Initial demographic information asked included the name of the school, year level, sex, date of birth and postcode and was used to describe the participants of the study. Postcode of residence was used to enable calculation of socio-economic status at a neighbourhood level, based on the Australian Bureau of Statistics' Index of Relative Socio-economic Disadvantage (IRSD).

5.3.1.1.2 Correlate items

The development of correlate items was based on the guidelines outlined by Streiner and Norman (2008), Frazer and Lawley (2000) and DeVellis (2003). The factors influencing context-specific physical activity (identified through the systematic review of the literature and the focus groups) were used to develop a preliminary list of potential context-specific items for inclusion in the Y-PASS questionnaires (see Appendix 5).

Due to the extensive collection of correlates identified through the focus groups and the systematic review, not all correlates were transformed into an item. Only correlates identified as having an association with lunchtime or after-school physical activity (identified through the systematic review) and those identified in the focus group discussions as being of most importance, secondary importance or were unique to a specific time period, were translated into correlate items. Importance was established through the sticker dot activity conducted during the focus groups, where the children were asked to identify the five most important correlates by placing a sticker dot next to the corresponding correlate. This method has been effectively used in previous studies (O'Dea, 2003; Sandelowski, 2000). In addition, some correlates identified by the systematic review were not included in the questionnaires as they were not from the child's perception (i.e. they were parent or teacher proxy-reported). The choice to only include items of the most important correlates was

made to reduce the burden on the participants based on the practicality-accuracy trade-off (Ferreira, et al., 2007). If questionnaires are too long, there is an increased risk of non-response and satisficing, impacting on the accuracy of the information (Borgers & Hox, 2001). The decision to only include items considered most important during the focus groups is acknowledged as a limitation of this study.

A preliminary list of 55 lunchtime-specific and 128 after-school-specific correlate items reflecting different aspects of the social ecological model were developed. To assist in the development of the items, and to avoid duplication of existing items, existing correlate questionnaires with acceptable psychometric properties were reviewed. Appropriate items were selected and modified to be context-specific (see Appendix 5 for a list of items modified from existing correlate questionnaires). The PhD candidate and supervisors met to discuss the wording of each item in the questionnaires. This list was then sent to an expert panel for review, which is discussed in section 5.4.

5.3.1.1.3 Activity checklists

Activity checklists were included to stimulate children's thinking about the types of activities commonly performed in the different contexts and provide contextual meaning to the correlates identified during the specific time periods (Ridley, Olds, & Hill, 2006). See Table 5.1 and Table 5.2 for the activity checklists used in the Y-PASS questionnaires. The development of the activity checklists is described below.

Table 5.1 Lunchtime activity checklist

	Do you usually do this activity? (if yes, tick the box)	How often do you do this activity?		
	Yes	1 day a week	2-3 days a week	4-5 days a week
Arts and crafts	□	o	o	o
Basketball	□	o	o	o
Chasey/tag/tips/tiggy	□	o	o	o
Computer work (e.g. typing/internet)	□	o	o	o
Cricket	□	o	o	o
Dodge ball/poison ball/brandy/speed ball	□	o	o	o
Football (Australian/Gaelic/American)	□	o	o	o
Hand tennis (four-square)	□	o	o	o
Kickball	□	o	o	o
Mucking around outdoors in the school yard	□	o	o	o
Netball	□	o	o	o
Playing catch	□	o	o	o
Playing on playground equipment (e.g. monkey bars)	□	o	o	o
Rugby league	□	o	o	o
Running/jogging	□	o	o	o
Skipping/jump rope	□	o	o	o
Sitting (e.g. eating, talking to friends, lunchtime meetings, writing, reading)	□	o	o	o
Soccer (field/indoor)	□	o	o	o
Touch football	□	o	o	o
Walking around the school yard	□	o	o	o

Table 5.2 After-school activity checklist

	Do you do this activity? (if yes, tick the box)	How often do you do this activity?		
	Yes	1 day a week	2-3 days a week	4-5 days a week
Arts and crafts	□	o	o	o
Basketball	□	o	o	o
Computer/console games (e.g. playstation/xbox/handheld)	□	o	o	o
Computer work (e.g. typing/internet)	□	o	o	o
Dancing (general)	□	o	o	o
Dressing and undressing	□	o	o	o
Feeding or caring for pets/farm animals	□	o	o	o
Football (Australian/Gaelic/American)	□	o	o	o
Kickball	□	o	o	o
Mucking around indoors (walk/run)	□	o	o	o
Mucking around outdoors	□	o	o	o
Netball	□	o	o	o
Packing/unpacking bag	□	o	o	o
Playing with animals	□	o	o	o
Playing cards/puzzles/board games	□	o	o	o
Playing the piano or organ	□	o	o	o
Riding a bicycle/bike	□	o	o	o
Riding in a bus/train/tram	□	o	o	o
Riding in a car/truck	□	o	o	o
Running/jogging	□	o	o	o
Shopping	□	o	o	o
Sitting (e.g. talking, eating, reading)	□	o	o	o
Soccer (field/indoor)	□	o	o	o
Studying/homework or writing	□	o	o	o
Swimming laps	□	o	o	o

	Do you do this activity? (if yes, tick the box)	How often do you do this activity?		
	Yes	1 day a week	2-3 days a week	4-5 days a week
Tidying/cleaning room	□	○	○	○
Trampoline	□	○	○	○
Walking	□	○	○	○
Walking the dog	□	○	○	○
Watching TV	□	○	○	○

Existing activity checklists were reviewed for inclusion in the Y-PASS questionnaires, such as the Physical Activity Questionnaire for Older Children (Kowalski, Crocker, & Faulkner, 1997), Physical Activity Questionnaire for Adolescents (Kowalski, Crocker, & Kowalski, 1997), Adolescent Sedentary Activity Questionnaire (ASAQ) (Hardy, Booth, & Okely, 2007) and the Children's Leisure Activities Study Survey (CLASS) (Telford, Salmon, Jolley, & Crawford, 2004). However, no appropriate checklists were located for the purposes of this study. In many cases, it was unclear how the activities in existing checklists were identified. Studies tend to comment on identifying and using “common” activities in checklists but lack detailed information and/or a strong evidence-base about how they define “common”. The development of existing physical activity checklists vary considerably in methodology. Some checklists were based on consensus from expert groups (Weston, Petosa, & Pate, 1997), while others were developed through focus groups (Telford, et al., 2004) or assumptions of common activities by the authors (Harrell, Gansky, Bradley, & McMurray, 1997). Research has shown that activity checklists can only be effective if they display content validity (i.e. the activity checklist reflects the types of activities most commonly performed by children) (Kohl, Fulton, & Caspersen, 2000; Sallis & Saelens, 2000). Content validity is continuously evolving with the emergence of new activities for children (Sallis & Saelens, 2000). Activity checklists need to reflect specific activities that are typically performed in the physical activity context under investigation (Booth, Okely, Chey, & Bauman, 2002; Kohl, et al., 2000; Sallis & Saelens, 2000).

A number of different checklists are currently being used to identify types of physical activities performed by children in Australia (Hardy, et al., 2007; Telford, et al., 2004). However, not all are developed for the Australian population or reflect activities performed during a specific time period (Kowalski, Crocker, & Faulkner, 1997; Kowalski, Crocker, & Kowalski, 1997). This raises a number of concerns in terms of the appropriateness of these checklists to the Australian context and use for investigating specific physical activity contexts, and thus the content validity and reliability. Therefore, there was a need to purposely develop lunchtime and after-school activity checklists specific to the Australian context using data collected from Australian children on the types of activities they engage in. Details of the identification of the activities for inclusion in the activity checklists used in this study has been published in a peer-reviewed journal (Stanley, et al., 2011).

The lunchtime and after-school activity checklists were developed using a comprehensive dataset from the 2007 Australian National Children's Nutrition and Physical Activity Survey (Commonwealth of Australia, 2008). Data were collected using the Multimedia Activity Recall for Children and Adults (MARCA), a use-of-time tool with comparable validity and reliability to other self-report use-of-time measures (Ridley, et al., 2006). Using a segmented day format with self-determined anchor points (i.e. wake up; start of school; start of recess break; start of lunch break; end of school; and bedtime for a school day recall), respondents participating in the 2007 Australian National Children's Nutrition and Physical Activity Survey reported all they did on the previous day from wake-up to bedtime. Only school day profiles were analysed for Australian children aged 10-14 years (n=794). Each participant provided 1 to 3 one school day recall profiles (total n = 1804 profiles).

In order to list self-reported activities for the lunchtime and after-school period, the MARCA analysis module was programmed to output all self-reported activities (type, duration and intensity) for 45 minutes after the self-designated start of the lunch anchor point and for 90 minutes after the self-designated end of school anchor point. The twenty most prevalent lunchtime activities and the thirty most prevalent after-school activities self-reported by Australian children during the lunchtime and after-school periods were determined by mean

duration across the sample (i.e. total minutes reported across the sample divided by the total number of profiles). The findings from this analysis were then used to develop the lunchtime and after-school activity checklists. The frequency of how often the children engaged in these activities in a usual week was based on a similar format used in the SPANS study (Booth et al., 2006).

5.3.2 Structure of the Y-PASS questionnaires

Problems found with surveying adults are often magnified in children and can have a greater impact on data quality (Borgers, et al., 2000; Borgers & Hox, 2001; Borgers, et al., 2003; De Leeuw, et al., 2004). The design characteristics of the Y-PASS questionnaires were specifically tailored to suit the cognitive and communicative skills of children to maximise their question-answer processes and enhance data quality (De Leeuw, et al., 2004). Specific design characteristics, such as item wording and order, response format, visual stimuli and administration techniques, are discussed below.

5.3.2.1 Questionnaire introduction

An introduction was added at the beginning of each questionnaire. The aim of an introduction is to prepare the participant for what is expected during the questionnaire (Bell, 2007) by providing a description of the purpose of the questionnaire and introductory instructions, such as “Please answer every question carefully” and “If something is unclear, please ask for help”.

Clear introductory text were also included at the beginning of every page of the questionnaires, indicating the overall topic of the items (e.g. “Think about the places where you are active after school” and “The following statements are about your confidence to be active at lunchtime”) and providing some simple instructions on how to respond to the item (e.g. “Please click on the circle which most closely describes how much you agree or disagree with each statement”). This was included to establish the platform for the subsequent set of items and assist children through the first step of the question-answer process model

(Tourangeau & Rasinski, 1988). Research has shown that providing 'pre-ambles' to questions can reduce item non-response and satisficing (Borgers & Hox, 2001).

5.3.2.2 Definition of common terms

Physical activity is a complex and difficult concept to comprehend, especially for children (Trost et al., 2000). This term is often used in research with children without much consideration for how children interpret its meaning. A number of studies have speculated that poor or inconsistent psychometrics of reported data derived from self-reported questionnaires may be due to children's lack of understanding of common physical activity-related terms (Baranowski, 1988; Pearce, et al., 2008; Trost, et al., 2000). Darbyshire et al. (2005) advocate using terms that children can relate to in order to elicit rich meaningful data. Therefore, it can be inferred that explicit understanding of common terms should enhance the validity and reliability of data collected by the questionnaire. Consequently, a page containing definitions of common terms used throughout the questionnaires was included as part of the online questionnaires and was also provided as a handout so that participants could easily refer to the definitions when required.

Particular effort was made to ensure definitions were simple with straightforward sentence structure and included words commonly used and understood by children (Bell, 2007). These terms and definitions were guided by the findings from one of the focus group activities discussed in the previous chapter and a search of the literature.

As part of the focus groups described in Chapter 4, children were asked to identify their meaning of "physical activity" and words they preferred to use to describe this concept. Responses varied, with groups wanting to use either "physical education", "play", "sport" and "physical activity", with "play" and "sport" being the most common terms to describe physical activity. Terms, such as "physical activity" and "exercise", were avoided in the Y-PASS questionnaires because previous research has shown that children view these terms as adult concepts (MacDougall, et al., 2004). The initial list contained three main terms used separately throughout the questionnaires and are shown below.

- "Active games": The term active games refers to any activity that you do at school, home or in your neighbourhood where you are moving enough to make your heart beat faster, make you breathe harder or make you sweat. These activities are not led by an adult. Examples of active games include running around, skipping, playing with a ball, swimming, skateboarding, playing in your backyard, walking the dog, playing with friends, or riding your bike. Active games are not activities such as sitting down talking with your friends, playing the computer, board games, watching TV, and reading a book.

- "Play": Play refers to any activity that is not led by an adult, such as playing with friends, in your backyard or on a playground.

- "Sport": The word sport refers to any activity that is led by an adult. Examples of these types of activities include Scouts, Girl Guides and any sport and sport practices, such as soccer, basketball, netball, swimming, and dance lessons.

Visual picture stimuli representing examples of the different types of physical activities were included on the page of definitions to complement the written descriptions and make the definitions more concrete and interesting (Borgers, et al., 2000).

5.3.2.3 Item order

The order of the items was carefully considered during this development phase. Items obtaining descriptive information (i.e. demographic questions and activity checklists), were placed at the beginning of the questionnaire, preceding the introduction. The definition of terms was placed next. Items relating to correlates of context-specific physical activity were grouped together according to the social ecological concepts being measured. Grouping questions that measure similar constructs make it easier for participants to respond (Dillman & Smyth, 2007). The physical environmental items were placed first, followed by items of intrapersonal correlates and finally sociocultural items. The deliberate ordering of the items

was to maximise children's focus, motivation and willingness to complete the questionnaire (Scott, 1997). As physical environmental and sociocultural related items address relatively concrete concepts, it was assumed these would be easy to comprehend and therefore, quicker to formulate an answer. These items were placed first and last, respectively. The intrapersonal items were strategically placed in the middle of the questionnaire as it has been shown that children find these concepts, such as self-efficacy, more difficult to comprehend (Dishman, et al., 2002). These items were not placed first because children may take more time to process them, which could potentially discourage them from completing the rest of the questionnaire. Placing these items toward the end of the questionnaire, when motivation and concentration is fading due to the time lapse, could potentially lead to further processing time and increased risk of satisficing (Scott, 1997).

5.3.2.4 Response format

There has been much discussion on the most appropriate number of response options when surveying children. It is important to avoid placing too many demands on cognition and memory but at the same time provide enough options to facilitate the most appropriate possible choice. According to Borgers et al. (2001), a four to five option response format is deemed appropriate for children aged 11 and older. Therefore, a 5-point Likert scale (i.e. disagree a lot, disagree a little, neither disagree nor agree, agree a little and agree a lot) were developed for the Y-PASS questionnaires. Other questionnaires administered and tested with children of equivalent age to participants in this study also used a 5-point Likert scale with similar labels (Ommundsen, et al., 2006; Sallis, et al., 2002; Saunders, et al., 1997). The response item categories were completely labelled for every item, which has been found to aid memory and increase response reliability in children aged 10 years and older (Borgers, et al., 2003; Scott, 1997). Survey Gizmo (Widgix, 2005-2010) provides an option where children can move onto the next page (indicated by a "next" button) or go back to previous pages (indicated by a "back" button) to modify their responses if required (Streiner & Norman, 2008).

5.3.2.5 Visual stimuli

Visual stimuli, in the form of pictures, were purposely selected and scattered throughout the questionnaire to reinforce the content of particular items. These pictures were identified through Microsoft Office imagery (Microsoft Corporation, 2012). Survey Gizmo (Widgix, 2005-2010) provides an option of a progress bar and this was included at the bottom of each page to provide children with a visual indication of how many more questions were left to complete. Scott (1997) states that incorporating pictures and visual stimuli in questionnaires can stimulate children's willingness to complete the questionnaire, enhance children's understanding and make concepts more concrete, which can be limited if relying solely on verbal or written representation.

5.3.2.6 Item wording and readability

To ensure children interpret the items in the same way, the use of unambiguous, straightforward language is essential (Bell, 2007). Where possible, the language typically used by children was incorporated into the items. This language was taken from the focus groups. For example, the item "I do what my friends do at lunchtime so I don't feel left out" was guided by the language used by the children in the focus groups. In addition, effort was made to ensure the simplicity of the structure of the items. Double-barrelled, negatively phrased and hypothetical items were avoided where possible as these can cause cognition issues for children (De Leeuw, et al., 2004). Due to children's literal thinking and difficulties processing depersonalised or indirect questions (Piaget, 1929; Scott, 1997), items were worded in the first-person context (e.g. "I" and "me").

To determine whether the questionnaire readability was suitable for children aged 10-14 years, the Flesch-Kincaid Grade level and Flesch Reading Ease score (Flesch, 1948) was calculated using a Flesch-Kincaid Grade level and Flesch Reading Ease Score calculator. This is a readability test based on a formula developed by Rudolph Flesch in 1948 (Flesch, 1948) and is commonly used when designing questionnaires. The Flesch-Kincaid Grade level score is based on the average number of syllables per word and the average number of words per sentence and the resultant score indicates a school-grade level (e.g. a score of 5 indicates that a children in Grade 5 would be able to read the document). The Flesch Reading Ease

score is a rating of the text on a 100-point scale, where the higher the score the easier the readability. A score of 90-100 is considered easily understandable for an average 5th Grader (approximately 10 years old in Australia), whereas scores between 60 and 70 are easily understood by young people in Grade 8 and 9. Table 5.3 shows the Flesch-Kincaid Grade level and Flesch Reading Ease scores for the Y-PASS questionnaires used for the pilot studies. For example, the third draft of the lunchtime questionnaire is appropriate for a Grade 4 but with a readability score appropriate for Grade 6 and 7. The third draft of the after-school questionnaire is appropriate for a Grade 5 with a readability score appropriate for Grade 6 and 7. The changes in the Grade and readability scores from Draft One to Draft Three was due to the addition of items and changes in wording suggested by the expert panel (Draft Two) and participants from the pilot studies (Draft Three). The complexity of the questionnaires in regards to readability for children in Grade 5 is acknowledged as a limitation of this study.

Table 5.3 Flesch-Kincaid Grade level and Flesch Reading Ease scores for the Y-PASS questionnaires used for pilot studies

	Flesch-Kincaid Grade Level score			**Flesch Reading Ease score**		
	Draft One	**Draft Two**	**Draft Three**	**Draft One**	**Draft Two**	**Draft Three**
Lunchtime questionnaire	4.99	4.72	4.96	79.82	79.35	78.90
After-school questionnaire	4.60	5.78	5.76	81.84	73.98	74.11

Notes:
Flesch-Kincaid Grade level score (indicator of a school-grade level): 4.0-4.9 = readable by Grade 4; 5.0-5.9 – readable by Grade 5.
Flesch Reading Ease score: 90.0-100.0 = easily understood by Grade 5; 60.0-70.0 = easily understood by Grade 8 and 9; 0.0-30.0 = easily understood by college graduates.

5.3.2.7 Scoring mode

To score the questionnaires, the responses to each item were assigned a number accordingly: Disagree a lot = 1, Disagree a little = 2, Neither disagree nor agree = 3, Agree a little = 4, Agree a lot = 5. Some items are negatively related to physical activity and therefore, need to be reverse coded. The items requiring reverse coding have been identified in Table 6.2 and Table 6.3. Items measuring the same construct were grouped together to create a factor. Scores were generated by summing the response scores across items that measure the same construct and then calculating the average score, thus creating a factor-based score (Pett, et al., 2003). The development of the factors and grouping of items is discussed in Chapter 6. These factors and predictor items were used as potential predictor variables in regression analyses in Study Four (Chapter 7).

5.3.3 Administration mode of the Y-PASS questionnaires

5.3.3.1 Online computer-delivered format

Physical activity correlate questionnaires can be administered by a number of different methods, such as mailed surveys, multimedia modes, personal interviews and telephone interviews. However, it is necessary to identify methods based on the "accuracy-practicality trade-off" as suggested by Ferreira et al. (2007). Pen and paper methods lend themselves to high incompletion rates. In general, studies using pen and paper questionnaires delivered to school-aged children have a questionnaire response rate of approximately 10% (Trost, Kerr, Ward, & Pate, 2001; Vilhjalmsson & Thorlindsson, 1998). Individual interviews are generally impractical in terms of time and cost for studies requiring a large number of participants. The online computer-delivered format was chosen as the most appropriate format for presenting and delivering the questionnaires because it provides considerable advantages over traditional pen and paper questionnaires and other administration modes (Kohl, et al., 2000; Norman, Sallis, & Gaskins, 2005).

Computer-delivered questionnaires provide a familiar format for the techno-savvy children of this generation, commonly known as the "Net Generation" (Combes, 2006). This format can assist in enhancing comprehension of the content and reduce the likelihood of satisficing or other problems relating to lack of concentration or motivation (Ommundsen, et al., 2008).

Computer-delivered questionnaires can be used to improve validity by incorporating automatic checks to ensure all questions are completed, thus reducing the chance of missing data (Norman, et al., 2005; Ridley, Dollman, & Olds, 2001). In addition, the data can be entered concurrently with administration, thus reducing data entry error and providing time saving benefits (Ommundsen, et al., 2008; Ridley, 2005; Stanton & Rogelberg, 2001). A number of studies have compared a range of questionnaire formats and found that children preferred and responded better to questionnaires with computer interfaces (Bushnell, Martin, & Parasuraman, 2003; Mangunkusumo et al., 2006; Pearce, et al., 2007; Ridley, et al., 2001; Van Hattum & De Leeuw, 1999).

The Y-PASS questionnaires were created and administered using Survey Gizmo (Widgix, 2005-2010), an online survey tool platform. The online platform enables the questionnaire to be administered anywhere with internet access and at any time of the day, with results being saved to a secure central data centre. The data are password-protected and can only be accessed by account holders. The Y-PASS questionnaires have been designed to be administered in the school environment with networked computers. This allows a large number of children to undertake the questionnaire at one time, which is more practical for school settings where it is important to minimise the time children are away from class and the disruption to the lesson schedule.

While there are a number of strengths related to online computer-delivered questionnaires, a number of limitations have been noted in the literature and should be acknowledged. The effectiveness of the questionnaire is limited by the user's computer literacy, such as how to navigate the mouse (Norman, et al., 2005). Even though children are considered techno-savvy, this stereotypical generalisation cannot be applied to all children (Zimic, 2009). Secondly, access to a computer and the internet is required. Generally, most schools in South Australia have adequate computing facilities. Finally, computer-delivered questionnaires can be susceptible to potential technological failures, such as computer viruses, power outages and server corruptions. Despite these acknowledged limitations, none of the studies using online computer-delivered questionnaires to date have reported

any of the possible limitations (Bushnell, et al., 2003; Mangunkusumo, et al., 2006; Norman, et al., 2005; Pearce, et al., 2007; Ridley, et al., 2001).

5.3.3.2 Administration techniques

The questionnaires have been designed to be easily administered by researchers and teachers. An administration script was developed to instruct administrators on how to set up the questionnaires on the internet and guide children through each page of the questionnaire (see Appendix 12). Some Frequently Asked Questions (FAQ) and the required responses have been included at the end of the script to address potential issues that may arise during the questionnaire administration. These questions were designed based on the questions raised by the children and observations of children undertaking the questionnaire during the pilot testing. Further details about the pilot testing are discussed below.

During the pilot testing, children were observed completing the Y-PASS questionnaires and their verbal and non-verbal responses were documented. This process allowed for a number of additional administration considerations to be identified. It was noticed that after about 20 minutes of working through the questionnaire, children's concentration began to fade and their attention wandered to other things happening in the room. Children's posture at the computer became noticeably worse and there was an increase in fidgeting behaviour. This is not uncommon in this age group. Pellegrini et al. (1993) conducted a study with elementary school children and found that prolonged periods of academic instruction resulted in increased fidgeting and restlessness and reduced concentration. Research has shown that children's attention, behaviour and academic performance improve after engaging in physical activity, such as physical education or recess and lunchtime activity (Jarrett, et al., 1998; Sallis et al., 1999). Furthermore, more recent evidence has shown that even short periods of activity can result in improved on-task behaviour (Mahar et al., 2006). Therefore, a short "active" break was incorporated into the administration of the questionnaire in an attempt to refocus children's attention. The administrator instructed the children to stop the questionnaire momentarily, step away from the computer and participate in an "active" break. Some examples of active breaks included getting children to do 15-20 star jumps, running on the spot and running around the room. Observations

following the active break showed children having more on-task attention, better posture and less fidgeting.

To ensure the appropriateness of the questionnaires for use with this age group, pilot testing is crucial (Bell, 2007; De Leeuw, et al., 2004; Presser et al., 2004). The draft questionnaire went through a rigorous piloting process to identify any significant gaps in questionnaire content, problems with comprehension, ambiguous question wording, length of the questionnaires and any discrepancies between the children's understanding and the actual intent of questionnaire items (De Leeuw, et al., 2004; Scott, 1997), all of which may impact on quality of data obtained (Presser, et al., 2004).

The questionnaires progressed through two stages:

1) A review by a panel of experts with experience in the pediatric physical activity field and questionnaire development.
2) Pilot tests with groups of students who participated and did not participate in the focus groups.

These two stages will be discussed below.

5.4 Step Two: expert panel review

The purpose of the expert panel review was to assess the content and face validity of the first draft of the Y-PASS questionnaires. This form of piloting can greatly increase the overall robustness of questionnaire design (Bell, 2007) and is considered at least a minimal requirement in questionnaire development (Streiner & Norman, 2008).

5.4.1 Methods

5.4.1.1 Participants and sampling

Members of the expert panel were purposively sampled and comprised national and international researchers and other experts with expertise in children's physical activity, questionnaire development and correlates of physical activity (see Table 5.4). Members were invited to be part of the panel via an email-delivered information letter (see Appendix 6). Of the 17 email invitations sent, 15 experts agreed to review the questionnaires, resulting in an 88% response rate. Two experts did not respond to the email, despite a reminder email. Of the 15 expert members who agreed to review the questionnaires, ten sent back comments and feedback. The five remaining expert members, who were sent the questionnaires but did not return comments, were sent a reminder email. Reasons for not reviewing the questionnaire included health issues, annual leave and lack of time.

5.4.1.2 Procedure

Each member who responded to the invitation email was sent another email containing either the lunchtime Y-PASS questionnaire or the after-school Y-PASS questionnaire and a list of areas requiring feedback. The questionnaires were randomly assigned to each expert member for review. Expert reviewers were asked to comment on the terminology used, response format, order of the items, length of the questionnaire and the readability. In addition, they were given the opportunity to identify additional items that were not considered in the questionnaires and provide any additional comments that may improve the content, design and usability of the questionnaires.

Table 5.4 Summary of members of the expert review panel

Expert review panel	Institution	Areas of expertise	Questionnaire reviewed
Gregory J. Welk, PhD	Department of Health and Human Performance, Iowa State University	Children's physical activity and correlates of children's physical activity	Lunchtime Questionnaire
Jo Salmon, PhD	Centre for Physical Activity and Nutrition Research, Deakin University	Children's physical activity and sedentary behaviour and correlates of children's physical activity	Lunchtime Questionnaire
Kylie Hesketh, PhD	Centre for Physical Activity and Nutrition Research, Deakin University	Children's physical activity and sedentary behaviour and correlates of children's physical activity	After-school Questionnaire
Greg Yates, PhD	School of Education, University of South Australia	Questionnaire development and language specialist	After-school Questionnaire
Katherine Dix, PhD	School of Education, Flinders University	Questionnaire development and survey design	Both questionnaires
Louise Hardy, PhD	NSW Physical Activity, Nutrition and Obesity Research Group, University of Sydney	Children's physical activity	After-school Questionnaire
David Lubans, PhD	Centre for Professional Learning in Education, University of Newcastle	Children's physical activity	After-school Questionnaire
Ralph Maddison, PhD	Clinical Trials Research Unit, University of Auckland	Children's physical activity and correlates of children's physical activity	After-school Questionnaire
Maea Hohepa, PhD	Sport and Recreation New Zealand (SPARC)	Children's physical activity and correlates of children's physical activity	Lunchtime Questionnaire
Timothy Olds, PhD	Health and Use of Time Group, University of South Australia	Children's physical activity and use of time	Both questionnaires

5.4.2 Results

The expert review panel provided feedback on the identified areas of questionnaire design. Five sets of comments were received for the lunchtime questionnaire and six sets were received for the after-school questionnaire. The feedback resulted in the adjustment of wording, definitions of the common terms and addition of items relating to correlates not identified but perceived to be important (Thomas & Nelson, 1996). More detailed description of each of these areas is provided below.

5.4.2.1 Demographic items

The expert review panel made recommendations for additional information in the demographic section. Modifications were made and structured around the demographic questions used in the NSW Schools Fitness and Physical Activity Survey (SPANS) study (Booth, et al., 2006). Information asked included name of school, year level, sex, date of birth, country of birth, Aboriginal or Torres Strait Islander status, suburb and postcode of residence.

5.4.2.2 Terminology

Terminology refers to the wording used throughout the questionnaires, including the definitions of the common terms and general wording of the items. Comments from the review panel revealed that the terms did not capture the true meaning of the activities and the distinction between some of the terms was confusing. In particular, a number of expert reviewers revealed that the terms “play” and “active games” were often used in the same item but had mutually exclusive definitions, making the item hard to comprehend, particularly for children (e.g. “There is enough space to play active games at lunchtime”). Another reviewer recommended the use of the terms “organised” and “non-organised” activities to distinguish between the different types of activities. As a result of these recommendations, the literature was searched for common terms used in questionnaires and other research projects and the terms and definitions were modified to the following.

- "Being active" involves any movement which can make you breathe quicker and heavier than usual. You may start to sweat and feel out of breath.

  There are different ways of being active, including: active transportation; non-organised play, games and activities; and organised sports and activities. You can be active at school, home or in your neighbourhood.

- "Active transportation" is how you get to and from places actively (i.e. not using motorised transport like a car or bus). Some examples of active transportation include:
  - Walking or riding your bike, skateboard or scooter home from school
  - Walking or riding your bike, skateboard or scooter to and from places in your neighbourhood
  - Walking or riding your bike, skateboard or scooter to sport or activity practices
- "Non-organised play, games and activities" are not led by an adult. Some examples of being active in non-organised play, games and activities include:
  - Playing four-square with your friends
  - Playing in the playground
  - Taking the dog for a walk
  - Mucking around with your friends or siblings
  - Riding your bike, skateboard or scooter
  - Jumping on the trampoline
- "Organised sports and activities" are directed by a leader, such as a coach or a teacher. Some examples of organised sports and activities include:
  - Scouts
  - Girl Guides
  - Dancing
  - Any sport or sport practices, such as soccer, football, netball, swimming and basketball

The definition of "being active" used in the Y-PASS questionnaires was similar to the definition used in other validated self-report physical activity questionnaires of moderate

physical activity (Cavill, Biddle, & Sallis, 2001; Kowalski, Crocker, & Faulkner, 1997). In a qualitative study (McKenna, Foster, & Page, 2004), the authors found that children described intensity by physical symptoms, such as “out of breath” and “I am sweating”. This has also been adopted by a number of other studies (e.g. Martin & McCaughtry, 2008; Saunders, et al., 1997). Hence, the description of the physical symptoms were included into the definition of “being active”.

The distinct use of the words “sport” under organised and “play” under non-organised terms was deliberate. MacDougall et al. (2004) conducted a study to determine the difference between these terms and how children relate to them. In this study, children identified these terms as having distinct meanings, whereas general terms like “physical activity”, “exercise” and “fitness” often were confused with “sport”. In addition, the findings from the focus groups also demonstrated that children understood the difference between “sport” and “play”. The distinction between “organised” and “non-organised” activities is often characterised by the presence of adult support (Booth, et al., 2002). Therefore, the description of adult involvement was integrated into the “organised” and “non-organised” definitions. As “play” is not always physical, inclusion of “activities” and “games” with an emphasis on being active was incorporated into the “non-organised” description.

As identified by a member of the expert panel, the lunchtime questionnaire only referred to “play” and “games”, making the remaining definitions redundant and potentially causing unnecessary confusion. Two separate pages reflecting the actual terms used throughout each questionnaire were created for the lunchtime and after-school questionnaires respectively, to avoid confusion.

Due to the modifications to the common terms, the majority of the items also needed to be changed from the original terminology to reflect the new terminology. For example, “There are too many kids in the playground for us to play active games at lunchtime” was modified to “There are too many kids in the playground for me to be active at lunchtime”. In total, 26 items in the lunchtime questionnaire and 54 items in the after-school questionnaire were modified to capture the appropriate terminology.

Some of the items were reworded to capture the correlate with more clarity. The review panel commented that the initial wording was confusing and it was difficult to determine what correlate was being assessed. For example, “School rules stop me from being active at lunchtime” was reworded to “Some school rules keep me from doing the activities I like at lunchtime”; and “There is always a teacher who supervises us during lunchtime” was modified to “There is always a teacher who is on yard duty during lunchtime”.

According to the theoretical framework of children’s cognitive development (Piaget, 1929), the participants completing the Y-PASS questionnaires are at a cognitive level where they have difficulty interpreting generalised and depersonalised items. This was also identified by the expert panel and therefore, items using wording in the third person were changed to the first person. “Bullying often stops kids from being able to play in the school yard at lunchtime” was modified to “Bullying stops me from being active in the school yard at lunchtime”. The item “There are indoor spaces for us to play if it is raining” was initially worded using collective first person grammar and was modified to “There are indoor spaces for me to play if it is raining” to capture the first person grammar and make it easier for children to understand.

A number of items in the initial draft contained the word ‘often’. As identified by the expert panel, this is a frequency term and does not match the response format. Therefore, the word ‘often’ was removed from 24 items across the lunchtime and after-school questionnaires.

5.4.2.3 Response format

There were some differing views among the expert panel as to the most appropriate response format. Some experts agreed with the use of a 5-point Likert scale, while others believed that providing a ‘neutral’ option encouraged the children to sit on the fence, thus making it difficult to determine their actual perceptions about a particular item. Streiner and Norman (2008) state that reducing participants’ response options can potentially lead to an

increased risk of measurement error and therefore reduced reliability of the data obtained. After considering all the reviewers' feedback, a 5-point Likert scale was deemed the most appropriate. Not only do existing correlate questionnaires designed for this age group use this response format, but ethically, children need to have a fence sitting option, as it is deemed unethical to push participants into making a decision (National Health and Medical Research Council, 2001). Some items may not be applicable for participants and having a neutral option gives them an appropriate response option.

5.4.2.4 Order

There was minimal feedback in relation to the order of the items. However, two reviewers commented on the misplacement of the items referring to "Perceived motor skills" and "PE enjoyment" at the beginning of the questionnaire. As these items relate to both the lunchtime and after-school questionnaires they were placed in both questionnaires and grouped with items measuring a similar construct.

5.4.2.5 Length

The initial draft was extremely long, with the number of items exceeding children's cognitive abilities and concentration span. However, as further piloting and a factor analysis was conducted on the questionnaires, the length of the initial drafts was justified. Despite the need for the large number of items, the expert panel did draw attention to a number of items that were duplicates. In the initial draft, items were developed to reflect the different behaviours that children engage in during the after-school period, such as sport and playing games. In order to avoid this duplication and reduce the length of the questionnaires, the expert panel recommended rewording the items to be context-specific rather than behaviour-specific. For example, "I play active games after school because it is fun" and "I play a sport after school because it is fun" were condensed into one item, "It is fun being active after school".

Other items were also removed to reduce the length of the questionnaires. Reasons for removal include duplication and confusion about the underlying purpose of the item. In

total, three items were removed from the lunchtime questionnaire and 11 items were removed from the after-school questionnaire. These have been identified in Table 5.5.

5.4.2.6 Readability

The only recommendations from the expert panel relating to readability were around the use of double negative and double-barrelled items, which can cause major interpretability issues for children (Streiner & Norman, 2008). The double negative items were modified because it has been found that the use of these types of items can be an issue when using a response format with negative options. These can affect the psychometric properties of questionnaires (Dillman & Smyth, 2007; Streiner & Norman, 2008). For example, "I don't play active games in my backyard after school because I don't have a lot of grass" was reworded to "I play actively in my yard after school because I have a lot of lawn". As with double negative items, children find it difficult to comprehend double-barrelled items (i.e. assessing two concepts in the one question) (De Leeuw, et al., 2004). These items were identified by the expert panel and reworded to be single barrelled items, such as "I like to walk and talk at lunchtime" to "I like to walk around at lunchtime".

Table 5.5 Summary of items removed from first draft of the Y-PASS questionnaires

	Correlate	Number of items removed	Reason for removal
Lunchtime questionnaire	Something to do	1	Confusion from the expert panel about the purpose of this item. After reviewing the focus group transcripts, the true underlying purpose of this correlate was still unclear.
	Lack of motivation	1	Confusion from the expert panel about the purpose of this item. After reviewing the focus group transcripts, the true underlying purpose of this correlate was still unclear.
	Enjoyment	1	Recommended by the expert panel to avoid duplication.
After-school questionnaire	Pets	1	Included as an activity in the activity checklist. Recommended removal by the expert panel to avoid duplication.
	Safety	1	Double-barrelled and is addressed in another item. Removed to avoid duplication.
	Activity preference	2	Confusion from the expert panel about the purpose of this item. After reviewing the focus group transcripts, the true underlying purpose of this correlate was still unclear.
	Enjoyment	3	Removed to avoid duplication.
	Fear of injury	1	Removed to avoid duplication.
	Too tired	1	Removed to avoid duplication.
	Body image	2	Removed to avoid duplication.

5.4.2.7 Additional correlates

The expert panel recommended a number of additional correlates that they perceived to be missing from or underrepresented in the initial draft of the Y-PASS questionnaires. Table 5.6 provides the list of additional items developed based on recommendations from the expert panel.

Table 5.6 Summary of additional items included in the Y-PASS questionnaires based on recommendations from the expert panel

	Correlate	Number of items	Source of items
Lunchtime questionnaire	Peer acceptance/social norm	1	Recommended by the expert panel.
	Fear	1	Identified in the focus groups but not included in the original draft due to perceived importance. However, after recommendations from the expert panel, the item was introduced into the questionnaire.
	Leadership	1	Recommended by the expert panel.
	Teacher encouragement	1	Recommended by the expert panel.
	PE enjoyment	1	Recommended by the expert panel. Item taken directly from Ommundsen et al. (2006).
After-school questionnaire	Distance	1	To capture active transport to and from organised sports and activities. Identified in the focus groups but not included in the original draft due to perceived importance. However, after recommendations from the expert panel, the item was introduced into the questionnaire.
	Things to carry	1	To address the weight of bags, which is another dimension to the 'things to carry' correlate. Recommended by the expert panel.
	Enjoyment	3	Additional items included to capture the different aspects of enjoyment. Recommended by the expert panel. Modified from the Physical Activity Enjoyment Scale, adapted for use in adolescents by Motl et al. (2001).
	PE enjoyment	1	Recommended by the expert panel. Item taken directly from Ommundsen et al. (2006).
	Barrier self-efficacy	7	Recommended by the expert panel. Items modified from Motl et al. (2000) self-efficacy questionnaire.

5.4.3 Summary

The recommendations from the expert panel resulted in changes to the Y-PASS questionnaires and the development of a second draft. The removal and addition of items meant that the new draft changed from 55 to 50 lunchtime items and 128 to 109 after-school items. The Flesch-Kincaid Grade level and Flesch Reading Ease score (Flesch, 1948) were recalculated following changes made by the expert panel (see Table 5.3). The scores for the lunchtime questionnaire changed from 4.99 to 4.72 and 79.82 to 79.35, with the second draft having a slightly lower Grade level appropriateness but marginally more complicated readability. For the after-school questionnaire, the scores changed from 4.60 to 5.78 and 81.84 to 73.98, which indicates that the second draft was appropriate for Grade 5 level (compared the first draft which was appropriate for Grade 4 level) and the readability was more complicated for Grade 5 but easily understood by Grades 6 and 7. The difference between the scores is due to rewording of the page of definitions and the corresponding items. As mentioned before, this is an acknowledged limitation of the questionnaire. The second draft was administered to a subsample of children and tested for appropriateness in the following pilot tests. These pilot tests are described in the following section.

5.5 Step Three: pilot testing

The second draft of the Y-PASS questionnaires underwent a two-phase pilot test with a subsample of children. The first pilot test was conducted with participants from the focus groups (discussed in Chapter 4). The second pilot test was conducted with both focus group participants and non-focus group participants. The overall aim of the pilot tests was to assess the content, usability and design characteristics of the lunchtime and after-school Y-PASS questionnaires.

The pilot tests provided an opportunity to evaluate and refine aspects of the questionnaires, such as the wording, item order, usability and aesthetics, design and layout features. In particular, the pilot tests were used to assess whether the items were posed from the child's perspective and not an adult-centric perspective, which tends to be one of the issues with questionnaires developed by adults for children (Scott, 1997). As the Y-PASS questionnaires

are computer-delivered, it was important to test the technological aspects of the questionnaires (Presser, et al., 2004).

Ethics approval (see Appendix 2) to carry out both pilot tests was obtained from the University of South Australia Human Research Ethics Committee, Department of Education and Children Services (DECS), and from the relevant school authorities.

5.5.1 Study aims

The primary aim of the first pilot test was to examine the content, usability and design of the Y-PASS questionnaires before administering the questionnaire to a larger cohort of participants (Thomas & Nelson, 1996). This pilot test also provided the first opportunity to examine whether the questionnaires could be completed in a reasonable timeframe.

The primary aim of the second pilot test was to examine the content, usability and design of the Y-PASS questionnaires and to follow-up on recommendations made by the participants in the first pilot test.

5.5.2 Methods

5.5.2.1 Participants and sampling

The participants for the first-phase pilot test were a sub-set of focus group participants. A convenience sample of nine female participants (mean age = 12 (±0.93) years) from Grades 6 and 7 in one South Australian high SES non-government school were invited to pilot test the questionnaire and participate in an informal discussion (see Appendix 7). Informed consent was obtained from the parent or guardian for each participant in the study. On the day of administration, only eight participants completed the questionnaires, with one student being absent from school.

In the second pilot study, convenience sampling was used to recruit 36 participants with similar demographic characteristics to the target population that will be involved in Study

Three (Portney & Watkins, 2000). Three schools (one from a high SES area, one from a low SES area and a rural school) who took part in the focus group study were invited to take part in this pilot test. Schools were purposively selected from the different SES and geographical locations to test the applicability of the questionnaires across a range of demographic characteristics. Teachers were asked to select two girls and two boys from each grade level (i.e. Grades 5, 6 and 7) with average literacy levels. Average literacy levels were stipulated to test whether the readability level was appropriate. Twelve information packages, containing information and consent forms, were sent to each school for the teachers to distribute to the students (see Appendix 7). Twenty four participants provided consent to participate in the second pilot test, resulting in a 67% response rate. Three participants were absent on the day of testing. Twenty one participants (8 girls, 13 boys) completed the questionnaires and had a mean age of 11.4 (±0.80) years (refer to Table 5.7 for frequency distribution of participants).

Table 5.7 Frequency distribution of pilot study participants (n=21)

	Boy	Girl	Total
Grade 5	4	0	4
Grade 6	5	5	10
Grade 7	4	3	7
TOTAL	13	8	21

5.5.2.2 Procedure

Similar procedures were used for both pilot studies. The lunchtime and after-school Y-PASS computer-delivered questionnaires were administered to participants in a school computer lab during class time. Each participant was given a card containing a unique identification code and space to write their name. This was incorporated into the administration procedure to enable the matching up of multiple sources of data in the predictive utility study described in Chapter 7.

The principal administrator (RMS) and the assistant loaded the questionnaires onto the school computers by entering the unique questionnaire hyperlink. When the web page containing the questionnaires was uploaded onto the computer, participants were instructed to enter their unique identification code in the space provided on the first web page and then click the "next" button located at the bottom of the page. The principal administrator read out a standardized script (see Appendix 12), guiding the participants through the initial pages of the questionnaires.

Using a similar piloting format discussed by Bowden et al. (2002), participants were asked to verbalise any questions or queries they had while completing the questionnaires. This allowed an examination of individual interpretability of the questions. The questions and queries were documented and addressed by either the principal administrator or assistant. In addition, the principal administrator and assistant documented the total time taken to complete the questionnaire and any unusual body language or reactions, such as spending an unusually long time on one question (Bowden, et al., 2002; Boynton & Greenhalgh, 2004; Presser, et al., 2004).

After reviewing the literature on the development of questionnaires, there seemed to be a significant emphasis on quantitative assessment of validity and reliability when piloting questionnaires (Boynton & Greenhalgh, 2004). While the quantitative assessment of these aspects is important in questionnaire development, it tends to ignore the participant's interpretability of the items (Bowden, et al., 2002). As a result, participants in the first pilot study engaged in an informal focus group discussion following the completion of the questionnaires to investigate their perceptions of the different aspects of the questionnaire, such as the ease of use, content, the computer format and questionnaire layout (De Leeuw, et al., 2004). Quantitative assessment of validity and reliability occurred during the factor analysis and the subsequent validity and reliability testing described in Chapter 6.

The qualitative focus group approach is a more open approach and the primary researcher can be more accountable for participant interpretability, thus contributing to the reliability and validity of the final questionnaires (Bowden, et al., 2002; De Leeuw, et al., 2004).

Reliability may be affected by poor wording, resulting in incorrect interpretation of the item and obtaining data that is not consistent with the intention of the item (De Vaus, 2002). Validity occurs when items capture current views and reflect local issues (Bowden, et al., 2002). The informal focus group discussions enabled greater exploration of the key issues and identification of consistent problem areas. This method has advantages over individual interviews, which are very helpful in examining the interpretability of the questions but do not provide opportunities to expose differing opinions (Bowden, et al., 2002). A number of questions were asked during the focus group discussion to assess reliability and validity, such as the interpretability of the terminology and the appropriateness of the content of the items. These questions were modified from Bowden et al. (2002) and are listed in Table 5.8.

Table 5.8 Questions asked during the evaluation of the Y-PASS questionnaires

	Question
1.	What do you think about the instructions provided? Were the instructions easy to understand?
2.	What do you think about the definition of the terms? Did the definitions make sense? Were the pictures appropriate?
3.	What do you think about the activity checklist? Did the example help? Did the activity checklist contain appropriate activities? Was it easy to fill out?
4.	What do you think about the questions in general? Were there any questions that did not make sense or seemed strange? Were there any questions that could be taken out?
5.	What do you think about the response options?
6.	What do you think about the format of the questionnaire? E.g. the number of questions per page? The font? The size of the text?
7.	What do you think about the computer format for the questionnaire? Was it easy to use?
8.	What do you think about the order of the questions? Did the headings make sense?
9.	What do you think about the length of the questionnaires?
10.	What do you find most difficult about the questionnaire?
11.	If you could change anything on the questionnaire, what would you do? What changes could be made to improve the questionnaire? E.g. include any missing questions, change the format, change the layout, include more pictures etc.

Following the initial pilot test, the principal facilitator (RMS) met with the supervisors to discuss the results from the informal focus group discussion. The modified lunchtime and after-school Y-PASS questionnaires were administered to participants during the second pilot study, using the same administration procedure as discussed above. However, instead of participating in informal focus group discussions, participants were asked to complete a feedback form regarding the interpretability, ease of use, content and format, which was adapted from Pearce et al. (2007) (refer to Appendix 8). This feedback form was used for descriptive purposes only and modifications were made to the Y-PASS questionnaires based on the written feedback provided on the form. The feedback form contained four items:

1) The computer questionnaire instructions were easy to understand (interpretability)
2) The computer questionnaire was easy to complete (ease of use)
3) The computer questionnaire included everything I wanted to report (content)
4) The computer questionnaire doesn't take up too much time to fill in (format)

Each participant was asked to respond on a 5-point Likert scale from "agree" to "disagree". Responses were collapsed into "agree", "not sure" and "disagree". Space was provided for children to write down anything else they thought was important about the questionnaires. These open-ended responses were coded and categorised using content analysis. The findings are reported below.

5.5.3 Results

5.5.3.1 Pilot study 1

The 50-item lunchtime Y-PASS questionnaire was pilot tested with four female students (two Grade 6 students, two Grade 7 students) and the 109-item after-school Y-PASS questionnaire was pilot tested with four female students (one Grade 6 student, three Grade 7 students) (total n = 8 students). Participants took on average 14.01 (±2.9) minutes to complete the lunchtime Y-PASS questionnaire (range = 11.42 – 16.55 minutes), while the after-school Y-PASS questionnaire took on average 24.50 (±3.9) minutes to complete (range = 19.15 – 28.12 minutes). This variation in completion time is acceptable with child participants (Scott, 1997).

General comments relating to both Y-PASS questionnaires

In response to the questions asked during the focus groups, participants provided feedback and recommendations on how to improve the questionnaires. These responses clustered into five main categories: layout and style, format (response format and computer-delivered format), content, length and other.

Responses relating to layout and style centred on the aesthetics of the questionnaires. Inclusion of more pictures per page, more colour, bigger headings with different colours and a different "cooler" font were suggested, resulting in a number of modifications to the visual aspects of the questionnaires. In addition, participants mentioned that it was easy to click the wrong answer because the large number of items on each page was distracting. As a result, the number of items per page and the spacing between each item was modified.

In relation to the response format, the majority of participants liked having the choice of "disagree a little" and "agree a little" along the 5-point Likert scale but also thought there should be a "don't know" option. This recommendation was not adopted as it would essentially be the same as leaving the item blank. Participants still had the "neither disagree nor agree" option. One child wanted to modify the response format to "yes, no, maybe". As only one participant made this suggestion, it was decided that this should be tested in the subsequent pilot test. All participants agreed that the computer-delivered format was much better than the pen and paper and "more fun".

Participant feedback on the content of the questionnaires included the addition of more examples within the items, inclusion of additional items and the removal of some neighbourhood-related items, which were deemed repetitive. As only one participant suggested inclusion of the question "Do you consider yourself to be active?" and was not supported by the other participants, this was not addressed during the modification of the questionnaires. All participants who completed the after-school questionnaire agreed that the length was too long, making it feel like a test. There was unanimous agreement that the

length of the lunchtime questionnaire was appropriate. In terms of the removal of neighbourhood-related items and the length of the after-school questionnaire, it was considered necessary to leave items until the factor analysis phase, to ensure that removal of items was based on statistical evidence, rather than anecdotal evidence.

When asked what could be done to improve the questionnaire, participants provided recommendations on different components of the questionnaire. For example, the majority of the participants did not bother to read the instruction page and suggested that the administrator go through this page with all participants. As a result, the questionnaire script was modified to ensure the administrator read out the instructions to the participants, rather than instructing the participants to read through the instructions. All participants did not want the page of definitions to change. Comments included “I liked it a lot” and “It’s easy to understand, especially the pictures”. Participants also made the suggestion of getting everyone to stand up and move around after sitting for prolonged periods.

Specific feedback for the lunchtime Y-PASS questionnaire

Participants provided specific feedback on each questionnaire. The example on how to fill out the lunchtime activity checklist was deemed too small and difficult to distinguish from the activity checklist that needed to be completed by the participants. The feedback led to making the example bigger and a different colour to distinguish it from the checklist that was to be completed. Participants found the item, “Our school play area has painted lines on the ground to help me be active at lunchtime” confusing. To ensure appropriate interpretability of this item, examples of painted lines, such as hopscotch and four-square, were written into the item. Finally, children wanted the word “me” to be removed from the items relating to teacher influence and replaced with “us” as they found this too personal and described how teachers would never single out and assist a single child. Therefore, all teacher-related items with the word “me” were modified to include “us”, such as “Teachers help us with the active games we play at lunchtime” and “Teachers encourage us to be active at lunchtime”.

Specific feedback for the after-school Y-PASS questionnaire

For the after-school questionnaire, participants provided specific feedback on the activity checklist, which was similar to the lunchtime activity checklist. However, in addition, participants noticed that "walking the dog" was included twice in the activity checklist and recommended modifying one of the examples to "playing with animals". This was modified along with the size and colour of the example activity checklist. One participant was confused about the meaning of her response when she provided a negative answer (i.e. "I disagree") to a negatively-phrased item (i.e. "I don't play actively after school…"). These items were reworded to resolve the double negative phrasing, such as "When it is raining, it stops me from playing actively after school". A couple of participants did not understand the item "I am just as coordinated as kids of my age and gender". As this confusion was not across all participants, it was decided to review this with participants in the second pilot test.

5.5.3.2 Pilot study 2

Sixteen participants completed the lunchtime questionnaire and 16 participants completed the after-school questionnaire. The average time of completion was 14.7 (±5.7) minutes (range=5.3 – 25.0 minutes) for the lunchtime questionnaire and 28.2 (±7.0) minutes (range=18.5-40.0 minutes) for the after-school questionnaire.

Feedback forms completed by participants in the second pilot test revealed that 93.8% of participants agreed that the lunchtime questionnaire instructions were easy to understand, with 6.3% reporting that they were not sure. For the after-school questionnaire, 87.5% agree that the instructions were easy to understand and 12.5% were not sure. Participants who identified the "not sure" option may not have read the instructions. This illustrates the need for the administrator to go through the instruction page with all participants, as identified during the first pilot test. For the item relating to ease of use, 87.5% of participants agreed that the lunchtime questionnaire was easy to complete and 12.5% found it difficult to complete. These statistics were the same for the after-school questionnaire. It is unknown what contributed to the difficulty in completing the questionnaire but it can be assumed from the open-ended responses that the length of the questionnaires may have been a contributing factor.

The majority of participants thought the questionnaires contained all the necessary content. For the lunchtime questionnaire, 75.0% of participants thought the questionnaire had everything they wanted in it, 12.5% did not know and 12.5% did not think it had everything they wanted. In relation to the after-school questionnaire, 81.3% of participants thought the questionnaire had everything they wanted in it, 12.5% did not know and 6.3% did not think it had everything they wanted. As the majority of participants in this pilot test did not participate in the initial focus group study (76%), this was to be expected.

In relation to the length of the questionnaires, 62.5% and 43.8% of participants reported that the lunchtime and after-school questionnaires did not take up too much time, whereas 37.5% and 25.0% of participants deemed the questionnaires to be too long, respectively. This was also supported by the open-ended responses, in which participants made the following comments - “It’s takes a long time to finish” and “The after-school one is WAY too long! I didn’t finish it” (*Emphasis written by the participant*).

The majority of the open-ended responses centred on the visual aspects of the questionnaires. For example, a number of participants reported that some of the pictures were not displaying on screen, while one participant wanted more pictures throughout the questionnaire. Almost half of the responses (43%) included comments about enjoyment of completing the questionnaire, such as “It is very good and would be a good quiz for kids” and “The survey was easy to understand and easier to do”.

Following up on the recommendations made during the first pilot test, only a couple of participants agreed with changing the response format to “yes, no, maybe”. As a result, the original response format was maintained. This was consistent with the response format of the LEAP II questionnaire (Saunders, et al., 1997), which was the generic correlate questionnaire used in Study Four (Chapter 7). Another recommendation from the first pilot test was to change the item “I am just as coordinated as kids of my age and gender”.

Participants in the second pilot test did not report any issues with this item and therefore, it remained in its original form.

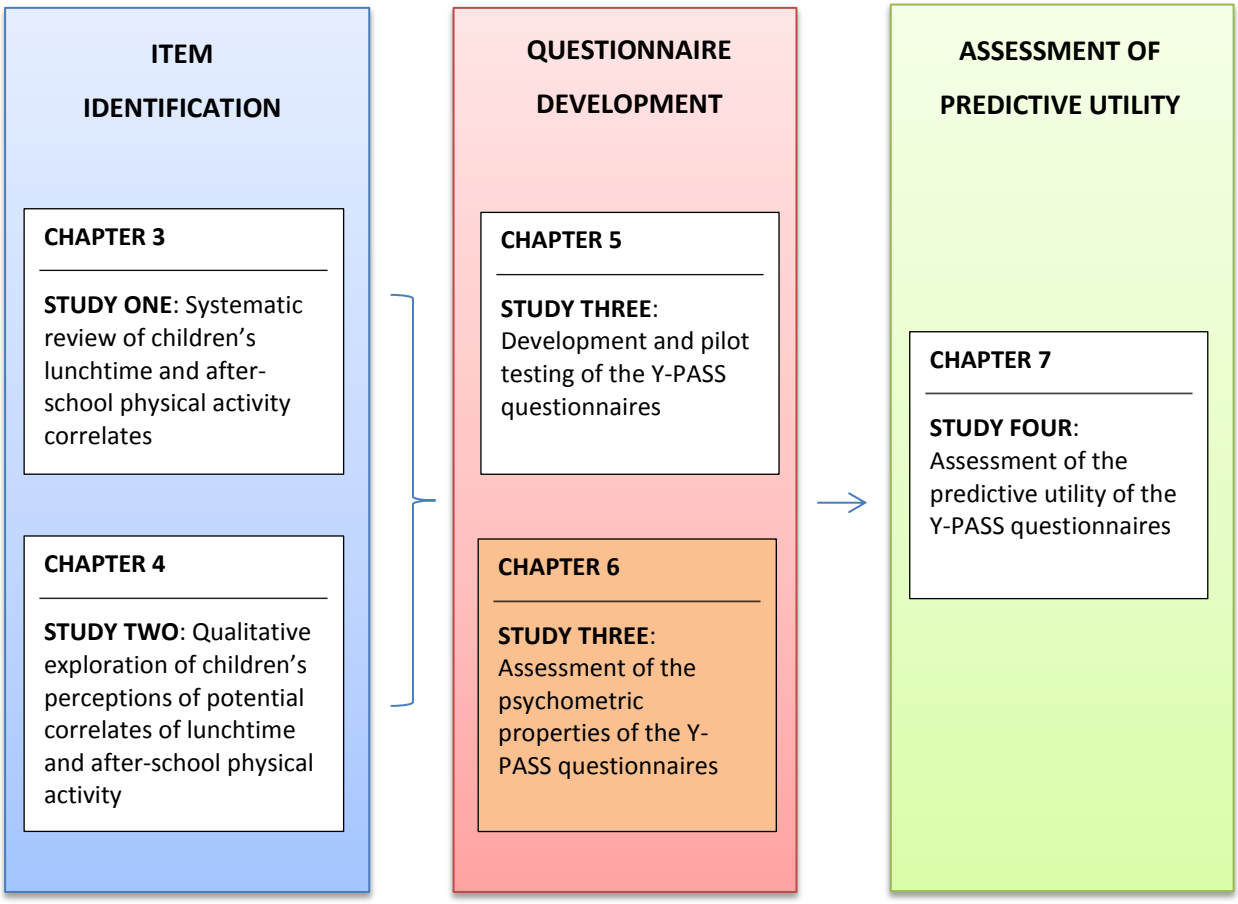
5.5.4 Summary

Based on the overall feedback from both pilot testing phases, modifications were made to the visual aspects of the questionnaires, such as the inclusion of more pictures, using an alternative font, increasing the space between items and changing the colours of headings, to create the third draft of the Y-PASS questionnaires. Even though the length of the questionnaires was identified as an issue, there was no consistency between participants as to which items should be removed. It was decided that items would not be removed from the questionnaires until the factor analysis (see Chapter 6), to ensure that removal of items was based on statistical evidence (i.e. did not contribute to or reduce the overall Cronbach alpha) (Pett, et al., 2003).

The next chapter will discuss the assessment of the psychometric properties of the Y-PASS questionnaires, which was the final step in questionnaire development in this program of research.

CHAPTER 6

Study Three: Assessment of the psychometric properties of the Y-PASS questionnaires



Chapter 6

6 Assessment of the psychometric properties of the Y-PASS questionnaires

Research aim:

To test the psychometric properties of the computer-delivered Y-PASS questionnaire tools.

Chapter 5 described the development of the computer-delivered lunchtime and after-school "Youth Physical Activity survey for Specific Settings" (Y-PASS) questionnaires (self-report questionnaires designed to identify the contextual correlates of physical activity performed during the weekday lunchtime and after-school periods). The development of the Y-PASS questionnaires was informed by a review of the correlate literature (Chapter 3) and findings from focus groups with children in Grades 5, 6 and 7 (Chapter 4).

In order for the Y-PASS correlate questionnaires to be confidently used in the educational, clinical and research settings, reliability and predictive utility need to be assessed. The final step in questionnaire development is the assessment of psychometric properties. Content and face validity of the Y-PASS questionnaires were assessed in Chapter 5. Assessment of factorial validity, internal consistency and test-retest reliability will be the focus of this chapter. In the next chapter, the predictive utility of the Y-PASS questionnaires in identifying predictors of lunchtime and after-school physical activity will be explored, as well as the effectiveness of the context-specific correlate questionnaires in predicting context-specific physical activity compared to a generic correlate questionnaire.

6.1 Factor analysis and item reduction

When developing a new instrument, the internal consistency and validity of the factorial structure should be explored prior to dissemination to the target population (Pett, et al., 2003). Reliability of a factor structure is the extent to which variables within a factor are consistently measuring the same construct and therefore, supports the grouping of the items together (Hair, Anderson, Tatham, & Black, 1998). Reliability (i.e. internal consistency) is typically assessed by Cronbach alpha (Hair, et al., 1998). On the other hand, validity of a factor structure is the extent to which the factors accurately represent the concept under investigation (Hair, et al., 1998). One form of validity that is typically assessed when investigating the factorial structure of a new instrument is construct validity (Portney & Watkins, 2000). This can be assessed by factor analysis and is the extent to which a factor can be shown to exist among several variables measuring different dimensions (Portney & Watkins, 2000).

The factorial structure within a questionnaire can be explored with two main approaches – exploratory factor analysis or confirmatory factor analysis (Hair, et al., 1998; Pett, et al., 2003; Portney & Watkins, 2000). Exploratory factor analysis tends to be used in the early stages of research and explores the interrelationships among sets of variables (Pett, et al., 2003). This approach is also used to refine and reduce a large number of related variables to a more manageable parsimonious set of variables (known as factors) to include in further multivariate analyses (Hair, et al., 1998). Confirmatory factor analysis, on the other hand, is often used later in the research process to confirm specific hypotheses or theories about the underlying structure of a set of variables (Pett, et al., 2003).

Even though the underlying structure of the Y-PASS questionnaires was theoretically informed using the social ecological model, new potential correlates of lunchtime and after-school physical activity were identified and discussed in Chapter 4. Hence, there was a need to conduct an exploratory factor analysis to explore whether or not there was an underlying factor structure among the variables and assess the appropriateness of this structure, rather than using confirmatory factor analysis to test the utility of hypothesised sets of variables with other data (Pett, et al., 2003). Exploratory factor analysis has previously been used in

the development of a school physical activity environment instrument (Robertson-Wilson, et al., 2007); assessing the correlates of school commuting, informal play at school and organised sport, structured exercise and play in leisure time (Ommundsen, et al., 2006); and in the development of a sedentary behaviour change questionnaire (Jago, Baranowski, et al., 2009).

This section will discuss in detail the following processes of exploratory factor analysis to determine a parsimonious factorial structure of the questionnaires (i.e. how items cluster together to create a factor with unique variance) (Costello & Osborne, 2005; Hair, et al., 1998):

- Evaluation of the dataset's Cronbach alpha, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity to determine the appropriateness of conducting an exploratory factor analysis.
- Horn's Parallel Analysis to ascertain initial estimate of the number of factors to extract.
- Factor rotation using Principal Component extraction and Varimax rotation to determine the clustering of questionnaire items into factors and assist in interpreting these factors.
- Refinement of each factor using item reduction (i.e. determining the minimal number of questionnaire items per factor to yield maximum internal consistency with minimum loss of information) (Pett, et al., 2003).
- Generation of factor-based scores for subsequent regression analysis.

Following the exploratory factor analysis and item reduction, the resultant questionnaires (i.e. the fourth draft of the Y-PASS questionnaires) will be used in Study Four.

6.1.1 Methods

6.1.1.1 Participants and sampling

All students in Grades 5, 6 and 7 (n = 817) from the six South Australian schools who took part in the focus groups were invited to take part in this study. These schools were purposively selected and included a rural school, a non-Government single-sex girl's school,

a non-Government single-sex boy's school, a non-Government co-educational school, a high SES Government co-educational school and a low SES Governmental co-educational school (see Appendix 9 for recruitment material sent to the schools and teachers/guardians). Informed consent from a parent or guardian was obtained for 275 participants, giving a response rate of 34%. In accordance with ethics approval, any child who returned a consent form, regardless of consent status, was given a stress ball gift.

Children completed either the lunchtime, after-school or both questionnaires (n = 264 children [146 boys, 118 girls]; mean age = 11.7 ±0.93 years), with 189 participants completing the lunchtime questionnaire and 240 participants completing the after-school questionnaire. Eleven students who provided consent did not complete a questionnaire due to absenteeism on the day of data collection.

There seems to be little consensus in the literature as to the most appropriate sample size for an exploratory factor analysis. A range of recommendations for calculating minimum sample sizes has been proposed, which has contributed to confusion as to which method is the most adequate for achieving precise, stable factorial outcomes (MacCallum, Widaman, Zhang, & Hong, 1999). Recommended minimum sample size has been defined as a function of the number of variables or items (MacCallum, Widaman, Preacher, & Hong, 2001; Nunnally, 1978), the number of parameters being estimated (Jackson, 2001) or as an absolute value (Comrey & Lee, 1992; Tabachnick & Fidell, 2001). According to Costello and Osborne (2005), the most appropriate sample size calculation should be based on a subject to item ratio (e.g. 20 subjects per item), while Tabachnick and Fidell (2001) state that as a general "rule of thumb", the sample size should be at least 300 participants. Comrey and Lee (1992) provide guidelines to assess adequacy of sample sizes (i.e. a sample size of 50 = very poor, 100 = poor, 200 = fair, 300 = good, 500 = very good and 1,000 or more = excellent). Hutcheson and Sofroniou (1999) recommend at least 150 to 300 cases. There is also a significance rule which states that there should be 51 more cases than the number of variables, in order to support chi-square testing (Lawley & Maxwell, 1971). Despite differences in sample size recommendations, it is important to ensure that the sample is

large enough to reduce the effects of sampling error and yield stability in the factorial structure outcomes (Hair, et al., 1998).

Recent reviews of the literature, containing their own simulation studies (Costello & Osborne, 2005; MacCallum, et al., 1999; Velicer & Fava, 1998) have suggested that sample size should not necessarily be governed by a strict rule of thumb. Instead, the minimum sample size is dependent on the nature of the data and the study design, such as the level of communality of variables within a factor and the level of over-determination of factors (i.e. the degree to which a factor is well defined by a sufficient set of variables). In order to have a small sample size, data need to be considered "strong", which is defined as high communality of a factor with several variables loading strongly on each factor (Costello & Osborne, 2005). In some data sets, the level of communality and over-determination may be weaker, requiring larger sample sizes. This can be determined by reviewing the Bartlett's test of sphericity. If the Bartlett's test of sphericity value is significant, this suggests that there is a factor structure inherent in the data (i.e. several variables load strongly on each factor) and it is possible to have a lower than optimal sample size.

In situations where the sample size is not big enough, there is a greater likelihood of errors when defining factor structures (Costello & Osborne, 2005). For example, items can be misplaced on factors or fail to converge onto a factor altogether. In a simulation study with small (2 participants per item) and large (20 participants per item) sample sizes, Costello and Osborne (2005) found that there were more errors in eigenvalues (i.e. the amount of variance in all items that can be explained by a factor) and a higher percentage of cases where the factor loadings were greater than 1.0 (an impossible result) in the study with the smaller sample size compared to the study with the large sample size. Overall, the validity of the factor structure can ultimately be affected by lower than optimal sample sizes and should be carefully considered prior to conducting the factor analysis.

To determine whether or not the sample size estimation was appropriate to establish a factorial structure with minimal sampling error and sufficient stability in the current study, a post hoc judgement was made according to Bartlett's test of sphericity, the level of

communalities and over-determination data (MacCallum, et al., 1999) and the recommended “rules of thumb”.

Based on the Hutcheson and Sofroniou (1999) rule of 150 to 300 and the significance rule of 51 more cases than the number of variables stated by Lawley and Maxwell (1971), the sample size for this study was appropriate to conduct the factor analysis, with the lunchtime questionnaire containing 50 potential variables with a sample size of 189 and the after-school questionnaire containing 109 variables with a sample size of 240. According to Comrey and Lee’s (1992) guidelines for absolute values, the final sample size of the lunchtime questionnaire nearly reached the “fair” guideline of 200 participants, while the sample size for the after-school questionnaire did reach the “fair” guideline. Furthermore, the Bartlett’s test of sphericity produced a significant value, suggesting that there was a factor structure inherent in the data and therefore the sample size was sufficient to reliably estimate correlation coefficients. However, when using the subject to item ratio criteria of ten observations for each item (Hair, et al., 1998), it is acknowledged that the sample size reaches acceptability for the lunchtime sociocultural and the physical environmental subscales only. The remaining subscales do, however, meet the minimal 5:1 subject to item ratio requirement (Hair, et al., 1998) (see Table 6.1).

Table 6.1 Subject to item ratio for each subscale

	Lunchtime (n = 189)	**After-school (n = 240)**
Intrapersonal subscale	7:1	5:1
Sociocultural subscale	21:1	9:1
Physical environmental/policy subscale	14:1	7:1

6.1.1.2 Ethical approval

The study was approved by the University of South Australia Human Research Ethics Committee, Department of Education and Children Services (DECS), the South Australian Commission for Catholic Schools (SACCS) and from the relevant school authorities (see Appendix 2).

6.1.1.3 Y-PASS questionnaire administration

The third draft of the lunchtime and after-school Y-PASS questionnaires were administered to participants in the schools' computer labs during class time. Following a similar administration procedure described in Chapter 5, participants were asked to enter their unique identification code in the space provided on the first web page and then click the "next" button located at the bottom of the page. They were then guided through the rest of the questionnaires by the principal researcher (RMS). Participants were not asked to provide feedback on the questionnaire during this phase.

6.1.1.4 Statistical analysis

It was acknowledged that the theoretically derived structure based on the social ecological model may not emerge in subsequent analyses. Therefore, to avoid confirmation bias, no predefined factor structure was assumed for an initial exploratory factor analysis on the complete pool of Y-PASS items. However, the results of this initial exploratory factor analysis produced uninterpretable factors.

Using a similar approach adopted and reported in a number of questionnaire development studies (Jago, Fox, Page, Brockman, & Thompson, 2009; McMinn et al., 2009; Pirasteh, Hidarnia, Asghari, Faghihzadeh, & Ghofranipour, 2008; Saunders, et al., 1997), items thought to reflect intrapersonal, sociocultural and physical environmental/policy domains were divided into corresponding subscales. The division of items was guided by the literature (Sallis, et al., 2008; Sallis, Prochaska, et al., 2000; Welk, 1999). An exploratory factor analysis was then run on items within each subscale. For the lunchtime Y-PASS, the intrapersonal subscale consisted of 27 items, the sociocultural subscale consisted of nine items and the

physical environmental/policy subscale contained 14 items (see Table 6.2). For the after-school Y-PASS, the intrapersonal subscale consisted of 47 items, the sociocultural subscale consisted of 28 items and the physical environmental/policy subscale contained 34 items (see Table 6.3).

The following steps of the exploratory factor analysis were conducted:

- Evaluation of the dataset's Cronbach alpha, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity for appropriateness of factor analysis.
- Horn's Parallel Analysis to ascertain initial estimate of the number of factors to extract.
- Principal Component extraction to retain the factors.
- Varimax rotation to assist in interpreting the factors.
- Refinement of each factor using item reduction.
- Generation of factor-based scores for subsequent regression analyses.

The findings from the exploratory factor analysis on each subscale are presented below. All exploratory factor analyses were conducted using Statistical Package for the Social Sciences (SPSS) Version 17.0 (SPSS, Chicago, IL) software and STATA Version 11 (StataCorp LP, Texas, USA) software was used to execute the Parallel Analyses.

Table 6.2 Lunchtime subscales: intrapersonal, sociocultural and physical environmental/policy

Subscale	Item	Item reverse coded
Intrapersonal	I can still be active at lunchtime even if I am wearing my school uniform.	
	It is fun to be active at lunchtime.	
	I prefer to watch other kids rather than play active games at lunchtime.	✓
	I like to walk around at lunchtime.	
	I prefer to sit rather than be active at lunchtime.	✓
	I really like doing PE at school.	
	Making up your own game rules makes playing games at lunchtime more fun.	
	I am active at lunchtime because it makes me popular with the other children.	
	I always have the energy to be active at lunchtime.	
	I am active at lunchtime so I can hang out with my friends.	
	There is nothing to do at lunchtime.	✓
	It is 'cool' to be active at lunchtime.	
	I don't play in certain areas of the school yard because I am scared of the other kids.	✓
	I am confident that I can ask my friends to be active with me during lunchtime.	
	I am confident that I can find other kids to be active with at lunchtime even if my friends don't want to.	
	I am confident that I can ask a teacher to get me equipment to play with at lunchtime.	
	I am confident that I can be active at lunchtime even if the space in the playground/oval is limited.	
	I am confident that I can still be active in the school yard even if it is very hot or raining.	
	I am confident that I can still be active at lunchtime even if there are bullies in the school yard.	
	I am confident that I can still be active at lunchtime even if my friends don't want to.	
	I do what my friends do at lunchtime so I don't feel left out.	
	I only play active games if other children/friends organise it.	

Subscale	Item	Item reverse coded
	I play certain games at lunchtime because I think I am good at them.	
	I have the skills I need to be active at lunchtime.	
	I am not good at being active at lunchtime.	✓
	I am just as coordinated as kids of my age and gender.	
Sociocultural	Bullying stops me from being active in the school yard at lunchtime.	✓
	My friends would rather sit and talk at lunchtime.	✓
	I have friends who I am active with at lunchtime.	
	My friends teach me how to play active games at lunchtime.	
	I teach other children how to play active games at lunchtime.	
	Teachers play with us at lunchtime.	
	There is always a teacher who is on yard duty during lunchtime.	
	Teachers help us with the active games we play at lunchtime.	
	Teachers encourage us to be active at lunchtime.	
Physical environmental/policy	We have school rules about where we are allowed to be active at lunchtime.	✓
	Our school has areas that suit the games I want to play at lunchtime.	
	There are too many kids in the playground for me to be active at lunchtime.	✓
	There are lots of shaded areas where I can be active even if it is really hot.	
	There are indoor spaces where I can be active if it is raining.	
	The oval is too dry and hard to play on.	✓
	There is enough grass in the school yard to be active at lunchtime.	
	Our school play area has painted lines on the ground (e.g. hopscotch and 4-square) to help me be active at lunchtime.	
	There are facilities at school, such as playgrounds or ovals, where I can be active at lunchtime.	
	It is hard to be active in our school uniform at lunchtime.	✓
	There is enough equipment available for me to play with at lunchtime.	
	Some school rules keep me from doing the activities I like at lunchtime.	✓
	I have other commitments at lunchtime that keep me from being active, such as meetings and music lessons.	✓

Table 6.3 After-school subscales: intrapersonal, sociocultural, physical environmental/policy

Subscale	Item	Item reverse coded
Intrapersonal	I am scared of strangers in my neighbourhood after school.	✓
	I am scared of dangerous animals in my yard, such as snakes, lizards, dogs or magpies.	✓
	I prefer to be active after school instead of watching TV or playing electronic games.	
	I prefer to watch other kids rather than do organised sports and activities after school.	✓
	I prefer to do homework rather than be active after school.	✓
	It is fun being active after school.	
	Being active after school is the thing I like to do best.	
	I don't enjoy doing an organised sport or activity after school.	✓
	I don't feel like playing actively at home or in the neighbourhood after school.	✓
	I enjoy being part of an organised sport or activity team.	
	I don't feel like doing an organised sport or activity after school.	✓
	Being active after school is boring.	✓
	Being active after school makes me feel good.	
	I am too tired to be active after school.	✓
	I catch a bus or get driven to and from places after school because I can't be bothered walking or riding.	✓
	I walk or ride to and from places after school because I get to hang out with my friends.	
	I do an organised sport or activity after school because I want to improve my skills.	
	I do an organised sport or activity after school because I get to hang out with friends.	
	I do an organised sport or activity after school because I want to meet new people.	
	I am not active after school because I am scared that I will get injured.	✓
	I play in the neighbourhood after school because I get to hang out with my friends.	

Subscale	Item	Item reverse coded
	I play in the neighbourhood after school because I get to meet new people.	
	I ride, walk, skate or scooter to and from places after school because it gets me fit.	
	Playing outside after school keeps me healthy.	
	I do an organised sport or activity after school because I have nothing else to do.	
	I don't participate in some activities after school because it is only a boys'/girls' activity.	✓
	I play actively at home or in the neighbourhood after school because it gives me something to do.	
	I do an organised sport or activity after school because it gets me fit.	
	I am active after school because I don't want to put on weight.	
	I am confident that I can ask my parent or another adult to take me to an organised sport or activity after school.	
	I am confident that I can ask my parent or another adult to take me somewhere I can play actively after school.	
	I am confident that I can be active after school on most days even if I could watch TV or play video games instead.	
	I am confident that I can be active after school on most days even if it is hot or cold outside.	
	I am confident that I can ask friends to be active with me after school on most days.	
	I am confident that I can be active after school on most days even if I have to stay at home.	
	I am confident that I can be active after school on most days even if I am being bullied.	
	I am confident that I can be active after school on most days no matter how busy I am.	
	I ride my bike, skateboard or scooter to and from places after school because I think I am good at it.	
	I play active games after school because I think I am good at them.	
	I do an organised sport or activity after school because I think I am good at it.	
	It is not worth doing an organised sport or activity after school because I am not good at it.	✓
	I don't do an organised sport or activity after school because other kids are better than me.	✓

Subscale	Item	Item reverse coded
	I am just as coordinated as kids of my age and gender.	
	I am shy about how my body looks.	✓
	I really like doing PE at school.	
Sociocultural	My parents think it is safe for me to be active in the neighbourhood after school.	
	My parents think it is safe for me to play in my yard when I am home alone after school.	
	Bullying stops me from being active after school.	✓
	I am not active after school because I have no one to play with.	✓
	My friends encourage me to be active after school.	
	I walk, ride, skate or scooter to and from places with friends after school.	
	My friends tell me I am doing well at sport.	
	I play with friends in the neighbourhood after school.	
	I do an organised sport or activity with friends after school.	
	I have brothers/sisters who play actively with me after school.	
	My parents encourage me to play outside after school.	
	My parents are not home after school to supervise my play.	✓
	My parents make me go outside and play after school.	
	My parents are too busy to play with me after school.	✓
	I always have to tell my parents where I am when I go out after school.	✓
	My parents make me help around the house, which stops me from being active after school.	✓
	If I am going out after school, I always have to be back by a certain time.	✓
	My parents won't let me ride, walk, skate or scooter to and from places after school.	✓
	My family always watch me do an organised sport or activity after school.	
	My parents help me practise sport after school.	
	I don't do an organised sport or activity after school because my parents work late.	✓
	My parents won't let me do an organised sport or activity because I am already doing too many other activities.	✓

Subscale	Item	Item reverse coded
	My parents encourage me to do an organised sport or activity after school.	
	My family tell me I am doing well at my after-school organised sport or activity.	
	We have a rule at home that we have to do an organised sport or activity after school.	
	I am not allowed to do an organised sport or activity after school because my parents are scared that I might get hurt.	✓
	My parents have rules about watching TV and playing electronic games after school.	
Physical environmental/policy	There is somewhere at home where I can play actively after school.	
	My yard is too small for me to be active after school.	✓
	Dog poo on the lawn at home keeps me from being active on the grass after school.	✓
	I play actively in my yard after school because I have a lot of lawn.	
	I don't have to travel far to play with my friends after school.	
	I live too far away to walk, ride, skate or scooter to and from places after school.	✓
	Petrol costs too much to drive to and from places where I can be active after school.	✓
	We do not have enough cars to drive to and from places where I can be active after school.	✓
	It costs too much money to do an organised sport or activity after school.	✓
	There are playgrounds or parks near my house where I can be active after school.	
	I have the right equipment (e.g. a bike lock, helmet or bike) to ride a bike after school.	
	I have the right equipment to do my chosen organised sport or activity after school.	
	It is easy to get to an organised sport or activity after school.	
	There are sport or recreation centres that I can go to after school.	
	There is enough equipment to play actively at home after school.	
	It is safe to play actively near where I live after school.	
	It is safe to play actively in my yard after school.	
	There is heavy traffic in the streets where I live.	✓

Subscale	Item	Item reverse coded
	The roads are safe in my neighbourhood after school.	
	There are not enough traffic lights and crossings in my neighbourhood after school.	✓
	There are dangerous objects in my yard, such as rusty scrap metal.	✓
	When it is raining, it stops me from walking, riding, skating or riding a scooter to and from places after school.	✓
	When it is too hot, it stops me from walking, riding, skating or riding a scooter to and from places after school.	✓
	When it is raining, it stops me from playing actively after school.	✓
	When it is too hot, it stops me from playing actively after school.	✓
	When it is raining, it stops me from doing an organised sport or activity after school.	✓
	When it is too hot, it stops me from doing an organised sport or activity after school.	✓
	I have enough time to play actively at home or in my neighbourhood after school.	
	Homework stops me from playing actively at home or in the neighbourhood after school.	✓
	I have enough time to do an organised sport or activity after school.	
	My school bag(s) is too heavy for me to walk, ride, skate or scooter home after school.	✓
	I don't walk, ride, skate or scooter home from school when I have too many bags to carry.	✓

6.1.2 Results

6.1.2.1 Evaluation of the appropriateness of factor analysis

Data were initially reviewed for appropriateness of factor analysis by exploring the following:

- Cronbach alpha: it is recommended that Cronbach alpha should be between 0.60 to 0.90 (Norman & Streiner, 1994) to proceed with factor analysis. A very high Cronbach alpha (i.e. >0.90) may be an indication of redundancy of one or more items (Terwee et al., 2007).
- Correlation matrix: items need to be correlated with each other with coefficients greater than 0.30 (Tabachnick & Fidell, 2001).
- Bartlett's test of sphericity: this test should be significant (i.e. $p<0.05$) (Pallant, 2011).

- Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy: the KMO measure should be at least 0.60 or greater (Tabachnick & Fidell, 2001).

Examination of the correlation matrix of each subscale revealed that there were some correlation coefficients greater than 0.3 (Pallant, 2011). Subscale Cronbach alphas ranged from 0.61 to 0.88. Bartlett's test of sphericity reached statistical significance ($p<0.000$) and KMO values for the subscales ranged from 0.65 to 0.84, which exceeds the recommended value of 0.60 (Tabachnick & Fidell, 2001) (see Table 6.4). The Cronbach alpha value for the lunchtime sociocultural subscale was just within the recommended range (i.e. 0.60 – 0.90) (Norman & Streiner, 1994), as were the KMO and Bartlett's tests (Pallant, 2011; Tabachnick & Fidell, 2001). Therefore, these values indicate the appropriateness of exploratory factor analysis for the sociocultural subscale as well as the other lunchtime and after-school subscales.

Table 6.4 Cronbach alpha, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity for the intrapersonal, sociocultural and physical environmental/policy subscales of the Y-PASS questionnaires

Subscale	Cronbach alpha	KMO	Bartlett's test
Lunchtime Y-PASS			
Intrapersonal	0.84	0.84	1539 p<0.000
Sociocultural	0.61	0.65	227 p<0.000
Physical environmental/policy	0.70	0.75	438 p<0.000
After-school Y-PASS			
Intrapersonal	0.88	0.84	4356 p<0.000
Sociocultural	0.77	0.74	1765 p<0.000
Physical environmental/policy	0.81	0.70	2070 p<0.000

6.1.2.2 Extraction of factors

To ascertain the initial estimate of the number of factors that appear to represent intrapersonal, sociocultural and physical environmental/policy constructs, Horn's Parallel Analysis (Horn, 1965) was used. There has been considerable criticism in the literature over the individual use of factor extraction methods. For example, Hair et al. (1998) suggest the Kaiser's criterion method (Kaiser, 1960), which retains factors with an eigenvalue of 1.0 or greater, and Cattel's scree test (Cattell, 1966) can greatly under- and over-estimate the number of factors to be retained, depending on the number of items. These methods are not recommended when used individually. A more advanced statistical technique, known as Horn's Parallel Analysis (Horn, 1965), has been shown to be the most accurate and an optimal technique for determining the number of factors to be retained (Lance, Butts, & Michaels, 2006). Parallel Analysis uses a Monte-Carlo technique generating random samples with the same sample size and number of items and computing "expected" eigenvalues (i.e. the amount of variance represented by a factor). The numbers of factors to extract are based on eigenvalues greater than 1.0. Therefore, following recommendations from the literature, a Parallel Analysis was executed to estimate the number of factors for each subscale of the lunchtime and after-school Y-PASS questionnaires.

The following tables present data on the possible number of components or factors that can be extracted for further analysis and their relative explanatory power (expressed as eigenvalues). Only factors with adjusted eigenvalues of greater than 1.0 are considered significant and should be retained for further analysis (1998). Adjusted eigenvalues less than 1.0 indicates that the eigenvalues are insignificant and the corresponding number of factors should not be extracted for factor rotation (1998). For example, Table 6.5 indicates that there are possibly seven factors among the 27 questionnaire items. However, only three factors would be considered significant based on the adjusted eigenvalues (i.e. eigenvalues greater than 1.0). For ease of interpretation, adjusted eigenvalues less than 1.0 (not significant) have been highlighted in red in the following tables.

The estimated number of factors with eigenvalues greater than 1.0 (black text in the following tables) was three for the lunchtime intrapersonal (see Table 6.5), sociocultural (see

Table 6.6) and physical environmental/policy subscales (see Table 6.7), respectively. For the after-school intrapersonal (see Table 6.8), sociocultural (see Table 6.9) and physical environmental/policy (see Table 6.10) subscales, the estimated number of factors to extract was six, four and seven, respectively.

Table 6.5 Lunchtime intrapersonal subscale (27 items)

Component or factor number	Adjusted eigenvalue	Unadjusted eigenvalue	Estimated bias
1	5.69	6.50	0.81
2	2.37	3.03	0.66
3	1.61	2.08	0.47
4	0.82	1.24	0.42
5	0.79	1.18	0.39
6	0.72	1.07	0.34
7	0.68	1.01	0.33

Criterion: retain adjusted components >1

Table 6.6 Lunchtime sociocultural subscale (9 items)

Component or factor number	Adjusted eigenvalue	Unadjusted eigenvalue	Estimated bias
1	1.96	2.35	0.38
2	1.27	1.48	0.21
3	1.03	1.16	0.13

Criterion: retain adjusted components >1

Table 6.7 Lunchtime physical environmental/policy subscale (14 items)

Component or factor number	Adjusted eigenvalue	Unadjusted eigenvalue	Estimated bias
1	2.89	3.42	0.52
2	1.04	1.50	0.45
3	1.02	1.26	0.24
4	0.92	1.10	0.18
5	0.91	1.04	0.13

Criterion: retain adjusted components >1

Table 6.8 After-school intrapersonal subscale (47 items)

Component or factor number	Adjusted eigenvalue	Unadjusted eigenvalue	Estimated bias
1	9.26	10.25	0.99
2	2.66	3.54	0.88
3	1.55	2.31	0.76
4	1.42	2.12	0.70
5	1.12	1.78	0.67
6	1.13	1.77	0.63
7	0.93	1.45	0.52
8	0.85	1.34	0.49
9	0.87	1.32	0.45
10	0.83	1.22	0.39
11	0.78	1.15	0.36
12	0.74	1.04	0.30
13	0.76	1.02	0.26

Criterion: retain adjusted components >1

Table 6.9 After-school sociocultural subscale (28 items)

Component or factor number	Adjusted eigenvalue	Unadjusted eigenvalue	Estimated bias
1	4.17	4.96	0.79
2	1.99	2.59	0.60
3	1.72	2.13	0.41
4	1.32	1.72	0.40
5	0.97	1.35	0.38
6	0.99	1.31	0.32
7	0.96	1.25	0.29
8	0.88	1.09	0.22
9	0.82	1.01	0.19

Criterion: retain adjusted components >1

Table 6.10 After-school physical environmental/policy subscale (34 items)

Component or factor number	Adjusted eigenvalue	Unadjusted eigenvalue	Estimated bias
1	4.35	5.13	0.78
2	1.82	2.50	0.68
3	1.45	2.03	0.58
4	1.42	1.92	0.51
5	1.25	1.71	0.46
6	1.23	1.65	0.42
7	1.17	1.55	0.38
8	0.96	1.27	0.30
9	0.95	1.23	0.28
10	0.92	1.15	0.23
11	0.82	1.00	0.18

Criterion: retain adjusted components >1

6.1.2.3 Factor rotation and interpretation

Following the initial exploration of the number of factors to extract, Principal Component extraction with Varimax rotation was conducted for each subscale separately to identify interpretable factors. As the purpose for conducting the exploratory factor analysis was to determine the underlying structure and identify uncorrelated factors that will be used in subsequent regression and prediction analyses (discussed in Chapter 7), Varimax rotation was deemed most appropriate (Hair, et al., 1998). Items were assigned to a factor if pattern coefficient loadings were above ±0.45 and did not cross-load with a significant loading of ±0.3 or above onto any other factor (Hair, et al., 1998). Hair et al. (1998) suggest these coefficient loadings are considered practically significant. If items did cross-load, the decision of placement with a factor was based on conceptual reasoning (Hair, et al., 1998; Pett, et al., 2003) or these were removed altogether. Items that did not load onto a factor were still retained for further prediction analyses but removed from the model and treated as individual predictor items rather than predictor factors. When an item was removed from the model, analyses were re-run and further refined. Cronbach alpha was retested to determine the internal consistency of the revised subscales and for each individual factor identified. The results of the Principal Component extraction and Varimax rotation analyses are presented below.

6.1.2.3.1 Lunchtime Y-PASS questionnaire

6.1.2.3.1.1 Intrapersonal subscale

The final number of interpretable factors for the intrapersonal subscale was three, which accounted for 48.5% of the explained variance. The internal consistency for this subscale was 0.82 (see Table 6.11). Factor one was labelled “Barrier self-efficacy” and had significant loadings from seven items. This factor accounted for 16.5% of the variance and had an internal consistency of 0.80. Seven items loaded significantly onto the second factor, interpreted as “Perceived self-efficacy”, and accounted for 16.4% of the variance with an internal consistency of 0.77. Factor three, labelled as “Behavioural attitude/belief”, had significant loadings from seven items and accounted for 15.7% of the variance. The internal consistency of this factor was 0.76. The following intrapersonal items either did not load

onto any factor or cross-loaded and were omitted from the model. These items were used as predictor items in the Correlated Components Regression analysis (discussed in Chapter 7).

- I can still be active at lunchtime even if I am wearing my school uniform.
- I like to walk around at lunchtime.
- I really like doing PE at school.
- I always have the energy to be active at lunchtime.
- I am just as coordinated as kids of my age and gender.
- Making up your own game rules makes playing games at lunchtime more fun.

Table 6.11 Factor analysis after rotation (sorted by size) for the lunchtime intrapersonal subscale, rotated component matrix (n=189)

Item	Factor		
	Barrier self-efficacy	Perceived self-efficacy	Behavioural attitude/belief
I am confident that I can find other kids to be active with at lunchtime even if my friends don't want to.	0.78		
I am confident that I can be active at lunchtime even if the space in the playground/oval is limited.	0.73		
I am confident that I can ask a teacher to get me equipment to play with at lunchtime.	0.70		
I am confident that I can still be active at lunchtime even if my friends don't want to.	0.64		
I am confident that I can still be active in the school yard even if it is very hot or raining.	0.63		
I am confident that I can ask my friends to be active with me during lunchtime.	0.61		
I am confident that I can still be active at lunchtime even if there are bullies in the school yard.	0.53		
I prefer to watch other kids rather than play active games at lunchtime.		0.74	
I am not good at being active at lunchtime.		0.72	
I prefer to sit rather than be active at lunchtime.		0.66	
There is nothing to do at lunchtime.		0.60	
It is fun to be active at lunchtime.		0.57	
I don't play in certain areas of the school yard because I am scared of the other kids.		0.56	
I have the skills I need to be active at lunchtime.		0.52	
I am active at lunchtime so I can hang out with my friends.			0.73
I play certain games at lunchtime because I think I am good at them.			0.70
I am active at lunchtime because it makes me popular with the other children.			0.66
I do what my friends do at lunchtime so I don't feel left out.			0.62

Item	Factor		
	Barrier self-efficacy	Perceived self-efficacy	Behavioural attitude/belief
It is 'cool' to be active at lunchtime.			0.57
I play certain games at lunchtime because I want to get extra practice.			0.56
I only play active games if other children/friends organise it.			0.55
Eigenvalue	3.46	3.44	3.29
% variance explained	16.5	16.4	15.7
Cronbach alpha[a]	0.80	0.77	0.76
Total % variance explained			48.5
Total subscale Cronbach alpha[a]			0.82

Notes:
Extraction method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalisation
[a] An acceptable Cronbach alpha is ≥0.6 (Hume, et al., 2006; Norman & Streiner, 1994).

6.1.2.3.1.2 Sociocultural subscale

All items measuring a sociocultural construct loaded significantly onto one of three interpretable factors (see Table 6.12). The internal consistency of this subscale was 0.61 and accounted for 55.4% of the total variance of the factor solution. Three items loaded onto the first factor, which was interpreted as "Peer influence". This factor explained 20.5% of the variance and had an internal consistency of 0.64. Factor two was labelled "Teacher influence" and explained 18.7% of the variance. The internal consistency of this factor was 0.58. The final factor in the sociocultural subscale was "Social barriers". The internal consistency of this factor was 0.32 and it explained 16.2% of the variance.

Table 6.12 Factor analysis after rotation (sorted by size) for the lunchtime sociocultural subscale, rotated component matrix (n=189)

Item	Factor		
	Peer influence	**Teacher influence**	**Social barriers**
I teach other children how to play active games at lunchtime.	0.82		
My friends teach me how to play active games at lunchtime.	0.78		
I have friends who I am active with at lunchtime.	0.61		
Teachers help us with the active games we play at lunchtime.		0.83	
Teachers play with us at lunchtime.		0.80	
Teachers encourage us to be active at lunchtime.		0.47	
There is always a teacher who is on yard duty during lunchtime.			0.70
My friends would rather sit and talk at lunchtime.			0.61
Bullying stops me from being active in the school yard at lunchtime.			0.58
Eigenvalue	1.85	1.68	1.46
% variance explained	20.5	18.7	16.2
Cronbach alpha[a]	0.64	0.58	0.32
Total % variance explained			55.4
Total subscale Cronbach alpha[a]			0.61

Notes:
Extraction method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalisation
[a] An acceptable Cronbach alpha is ≥0.6 (Hume, et al., 2006; Norman & Streiner, 1994).

6.1.2.3.1.3 Physical environmental/policy subscale

The three-factor solution for physical environmental/policy subscale had an internal consistency of 0.69 and accounted for 52.8% of the variance of the factor solution (see Table 6.13). The first factor had three items loading significantly. This factor was interpreted as "Access to facilities/equipment" and accounted for 19.2% of the variance and had an internal consistency of 0.61. "Physical environmental/policy barriers" was identified as the second factor, accounting for 17.8% of the variance with an internal consistency of 0.49. Three items loading significantly onto the "Access to space" factor had an internal consistency of 0.50 and accounted for 15.8% of the variance. The following items were removed from the model because they either cross-loaded onto multiple factors or did not load onto any factor.

- We have school rules about where we are allowed to be active at lunchtime.
- Our school has areas that suit the games I want to play at lunchtime.
- There are facilities at school, such as playgrounds or ovals, where I can be active at lunchtime.

Table 6.13 Factor analysis after rotation (sorted by size) for the lunchtime physical environmental/policy subscale, rotated component matrix (n=189)

Item	Factor		
	Access to facilities/equipment	Physical environmental/policy barriers	Access to space
There are lots of shaded areas where I can be active even if it is really hot.	0.70		
There are indoor spaces where I can be active if it is raining.	0.70		
There is enough equipment available for me to play with at lunchtime.	0.65		
It is hard to be active in our school uniform at lunchtime.		0.67	
The oval is too dry and hard to play on.		0.67	
Some school rules keep me from doing the activities I like at lunchtime.		0.58	
I have other commitments at lunchtime that keep me from being active, such as meetings and music lessons.		0.50	
There is enough space in the school yard for me to be active at lunchtime.			0.84
There is enough grass in the school yard to be active at lunchtime.			0.58
There are too many kids in the playground for me to be active at lunchtime.			0.53
Eigenvalue	1.92	1.78	1.58
% variance explained	19.2	17.8	15.8
Cronbach alpha [a]	0.61	0.49	0.50
Total % variance explained			52.8
Total subscale Cronbach alpha [a]			0.69

Notes:
Extraction method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalisation
[a] An acceptable Cronbach alpha is ≥0.6 (Hume, et al., 2006; Norman & Streiner, 1994).

6.1.2.3.2 After-school Y-PASS questionnaire

6.1.2.3.2.1 Intrapersonal subscale

The items in the intrapersonal subscale loaded significantly onto six factors, as identified by the Parallel Analysis (see Table 6.14). The overall subscale explained 54.1% of the variance and had an internal consistency of 0.86. Factor one and factor two both explored "Behavioural attitudes/beliefs" with factor one specifically targeting organised sports and activities (Cronbach alpha = 0.77; % variance = 11.6) and factor two targeting non-organised activities (Cronbach alpha = 0.81; % variance = 11.1). Six items loaded onto the third factor, which explored aspects of "Support seeking/social norm". The internal consistency of this factor was 0.80 and explained 10.5% of the variance in this subscale. Factor four was labeled "Perceived self-efficacy" and explained 8.2% of the variance. The internal consistency of this factor was 0.70. The "Perceived competence" factor had three items that loaded significantly and explained 7.0% of the variance, with an internal consistency of 0.71. The final factor identified in the intrapersonal subscale was interpreted as a "Perceived barriers" factor, consisting of three items. The internal consistency of this factor was 0.43 and explained 5.6% of the variance. A number of items did not load onto any factor or cross-loaded onto multiple factors and these were removed from the model.

- I wish I could do more organised sports or activities after school than I get a chance to.
- Being active after school is boring.
- I do an organised sport or activity after school because I want to improve my skills.
- I do an organised sport or activity after school because I want to meet new people.
- I ride, walk, skate or scooter to and from places after school because it gets you fit.
- Playing outside after school keeps you healthy.
- I do an organised sport or activity after school because I have nothing else to do.
- I don't participate in some activities after school because it is only a boys'/girls' activity.
- I play actively at home or in the neighbourhood after school because it gives me something to do.
- I do an organized sport or activity after school because it gets you fit.
- I am active after school because I don't want to put on weight.

- I am confident that I can be active after school on most days even if I could watch TV or play video games instead.
- I am confident that I can be active after school on most days even if it is hot or cold outside.
- I am confident that I can be active after school on most days even if I am being bullied.
- I am just as coordinated as kids of my age and gender.
- I am shy about how my body looks.
- I really like doing PE at school.

Table 6.14 Factor analysis after rotation (sorted by size) for the after-school intrapersonal subscale, rotated component matrix (n=240)

Item	Factor					
	Behavioural attitudes/beliefs (organised sports/activities)	Behavioural attitudes/beliefs (non-organised activities)	Barrier self-efficacy	Support seeking/social norm	Perceived competence	Perceived barriers
I don't do an organised sport or activity after school because other kids are better than me.	0.67					
I don't feel like doing an organised sport or activity after school.	0.66					
I enjoy being part of an organised sport or activity team.	0.65					
I don't enjoy doing an organised sport or activity after school.	0.62					
It is not worth doing an organised sport or activity after school because I am not good at it.	0.59					
I am not active after school because I am scared that I will get injured.	0.52					
I prefer to watch other kids rather than do organised sports and activities after school.	0.49					
I prefer to be active after school instead of watching TV or playing electronic games.		0.68				
Being active after school is the thing I like to do best.		0.66				
I catch a bus or get driven to and from places after school because I can't be bothered walking or riding.		0.61				
I don't feel like playing actively at home or in the neighbourhood after school.		0.60				

Item	Factor					
	Behavioural attitudes/beliefs (organised sports/activities)	Behavioural attitudes/beliefs (non-organised activities)	Barrier self-efficacy	Support seeking/social norm	Perceived competence	Perceived barriers
Being active after school makes me feel good.		0.55				
I am too tired to be active after school.		0.54				
It is fun being active after school.		0.53				
I am confident that I can ask my parent or another adult to take me somewhere I can play actively after school.			0.81			
I am confident that I can ask my parent or another adult to take me to an organised sport or activity after school.			0.69			
I am confident that I can be active after school on most days even if I have to stay at home.			0.65			
I am confident that I can be active after school on most days.			0.63			
I am confident that I can ask friends to be active with me after school on most days.			0.62			
I am confident that I can be active after school on most days no matter how busy I am.			0.57			
I play in the neighbourhood after school because I get to hang out with my friends.				0.76		
I walk or ride to and from places after school because I get to hang out with my friends.				0.74		
I play in the neighbourhood after school because I get to meet new people.				0.70		

Item	Factor					
	Behavioural attitudes/beliefs (organised sports/activities)	Behavioural attitudes/beliefs (non-organised activities)	Barrier self-efficacy	Support seeking/social norm	Perceived competence	Perceived barriers
I do an organised sport or activity after school because I get to hang out with friends.				0.58		
I play active games after school because I think I am good at them.					0.86	
I do an organised sport or activity after school because I think I am good at it.					0.80	
I ride my bike, skateboard or scooter to and from places after school because I think I am good at it.					0.56	
I prefer to do homework rather than be active after school.						0.63
I am scared of strangers in my neighbourhood after school.						0.62
I am scared of dangerous animals in my yard, such as snakes, lizards, dogs or magpies.						0.59
Eigenvalue	3.49	3.34	3.15	2.46	2.09	1.69
% variance explained	11.6	11.1	10.5	8.2	7.0	5.6
Cronbach alpha [a]	0.77	0.81	0.80	0.70	0.71	0.43
Total % variance explained						54.1
Total subscale Cronbach alpha [a]						0.86

Notes:

Extraction method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalisation

[a] An acceptable Cronbach alpha is ≥0.6 (Hume, et al., 2006; Norman & Streiner, 1994).

6.1.2.3.2.2 Sociocultural subscale

Four factors emerged in the sociocultural subscale, explaining 49.0% of the variance with an internal consistency of 0.73 (see Table 6.15). Eight items loaded onto the "Social support" factor (Cronbach alpha = 0.77; % variance = 16.1) and four items loaded onto the "Parental barriers" factor (Cronbach alpha = 0.63; % variance = 12.4). The third factor was labeled "License to be active" and explained 12.3% of the variance. The internal consistency of this factor was 0.71. The final factor was interpreted as "Parental rules" and consisted of three items. This factor explained 8.3% of the variance and had an internal consistency of 0.50. The following items did not load onto any of these factors or cross-loaded onto multiple factors, and as a result, were removed from the model.

- Bullying stops me from being active after school.
- I am not active after school because I have no one to play with.
- I have brothers/sisters who play actively with me after school.
- My friends encourage me to be active after school.
- My friends tell me I am doing well at sport.
- My parents are too busy to play with me after school.
- My parents make me help around the house, which stops me from being active after school.
- We have a rule at home that we have to do an organised sport or activity after school.

Table 6.15 Factor analysis after rotation (sorted by size) for the after-school sociocultural subscale, rotated component matrix (n=240)

Item	Factor			
	Social support	Parental barriers	License to be active	Parental rules
My parents help me practise sport after school.	0.77			
My parents play actively with me after school.	0.73			
My family tell me I am doing well at my after-school organised sport or activity.	0.60			
My family always watch me do an organised sport or activity after school.	0.58			
My parents encourage me to play outside after school.	0.56			
My parents encourage me to do an organised sport or activity after school.	0.53			
My parents make me go outside and play after school.	0.50			
I do an organised sport or activity with friends after school.	0.49			
I don't do an organised sport or activity after school because my parents work late.		0.75		
I am not allowed to do an organised sport or activity after school because my parents are scared that I might get hurt.		0.73		
My parents won't let me do an organised sport or activity because I am already doing too many other activities.		0.61		
My parents are not home after school to supervise my play.		0.47		
My parents won't let me ride, walk, skate or scooter to and from places after school.			0.78	
I walk, ride, skate or scooter to and from places with friends after school.			0.73	
My parents think it is safe for me to be active in the neighbourhood after school.			0.72	
I play with friends in the neighbourhood after school.			0.58	
My parents think it is safe for me to play in my yard when I am home alone after school.			0.45	
If I am going out after school, I always have to be back by a certain time.				0.76
I always have to tell my parents where I am when I go out after school.				0.75
My parents have rules about watching TV and playing electronic games after school.				0.53

Item	Factor			
	Social support	Parental barriers	License to be active	Parental rules
Eigenvalue	3.22	2.47	2.46	1.66
% variance explained	16.1	12.4	12.3	8.3
Cronbach alpha [a]	0.77	0.63	0.71	0.50
Total % variance explained				49.0
Total subscale Cronbach alpha [a]				0.73

Notes:

Extraction method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalisation

[a] An acceptable Cronbach alpha is ≥0.6 (Hume, et al., 2006; Norman & Streiner, 1994).

6.1.2.3.2.3 Physical environmental/policy subscale

For the physical environmental/policy subscale, a seven factor solution was identified, explaining 52.6% of the variance (see Table 6.16). The internal consistency of this subscale was 0.78. “Weather”, containing six items, explained 9.8% of the variance and had an internal consistency of 0.75. The second factor was interpreted as “Access to facilities/equipment” and contained eight items (Cronbach alpha = 0.68; % variance = 9.5). “Safety” factor accounted for 7.2% of the variance (Cronbach alpha = 0.63). Factor four was labeled “Access to space” (Cronbach alpha = 0.60; % variance = 7.0), while the fifth factor was labeled “Time commitments” (Cronbach alpha = 0.54; % variance = 7.0). Three items loaded significantly onto the “Financial barriers” factor, explaining 6.8% of the variance and had an internal consistency of 0.64. The final factor of the physical environmental/policy subscale was deciphered as a “School bag” factor. This factor explained 5.4% of the variance and had an internal consistency of 0.54. The following items were removed from the model due to factor loadings of less than 0.45 or cross-loading onto multiple factors. However, these items did remain in the questionnaire as individual predictor items.

- Dog poo on the lawn at home keeps me from being active on the grass after school.
- I have enough time to do an organised sport or activity after school.
- It is safe to play actively near where I live after school.
- There are not enough traffic lights and crossings in my neighbourhood after school.
- There is enough equipment to play actively at home after school.

Table 6.16 Factor analysis after rotation (sorted by size) for the after-school physical environmental/policy subscale, rotated component matrix (n=240)

Item	Factor						
	Weather	Access to facilities/equipment	Safety	Access to space	Time commitments	Financial barriers	School bag
When it is too hot, it stops me from playing actively after school.	0.69						
When it is raining, it stops me from playing actively after school.	0.68						
When it is raining, it stops me from walking, riding, skating or riding a scooter to and from places after school.	0.68						
When it is too hot, it stops me from walking, riding, skating or riding a scooter to and from places after school.	0.67						
When it is too hot, it stops me from doing an organised sport or activity after school.	0.57						
When it is raining, it stops me from doing an organised sport or activity after school.	0.55						
It is easy to get to an organised sport or activity after school.		0.67					
There are playgrounds or parks near my house where I can be active after school.		0.59					
I don't have to travel far to play with my friends after school.		0.58					
There are sport or recreation centres that I can go to after school.		0.55					
I have the right equipment to do my chosen organised sport or activity after school.		0.51					
I do an organised sport or activity because it is close to where I live.		0.49					
I live too far away to walk, ride, skate or scooter to and from places after school.		0.48					

Item	Factor						
	Weather	Access to facilities/equipment	Safety	Access to space	Time commitments	Financial barriers	School bag
I have the right equipment (e.g. a bike lock, helmet or bike) to ride a bike after school.		0.46					
The roads are safe in my neighbourhood after school.			0.74				
There is heavy traffic in the streets where I live.			0.71				
There are dangerous objects in my yard, such as rusty scrap metal.			0.59				
It is safe to play actively in my yard after school.			0.55				
My yard is too small for me to be active after school.				0.79			
I play actively in my yard after school because I have a lot of lawn.				0.72			
There is somewhere at home where I can play actively after school.				0.60			
Homework stops me from doing an organised sport or activity after school.					0.77		
Homework stops me from playing actively at home or in the neighbourhood after school.					0.70		
I have enough time to do an organised sport or activity after school.					0.56		
We do not have enough cars to drive to and from places where I can be active after school.						0.78	
Petrol costs too much to drive to and from places where I can be active after school.						0.76	
It costs too much money to do an organised sport or activity after school.						0.64	
My school bag(s) is too heavy for me to walk, ride, skate or scooter home after school.							0.60
I don’t walk, ride, skate or scooter home from school when I have too many bags to carry.							0.59

Item	Factor						
	Weather	Access to facilities/equipment	Safety	Access to space	Time commitments	Financial barriers	School bag
Eigenvalue	2.85	2.74	2.08	2.02	2.02	1.98	0.56
% variance explained	9.8	9.5	7.2	7.0	7.0	6.8	5.4
Cronbach alpha [a]	0.75	0.68	0.63	0.60	0.54	0.64	0.54
Total % variance explained							52.6
Total subscale Cronbach alpha [a]							0.78

Notes:

Extraction method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalisation

[a] An acceptable Cronbach alpha is ≥0.6 (Hume, et al., 2006; Norman & Streiner, 1994).

6.1.2.4 Item reduction

The internal consistency of a questionnaire is sensitive to the number of items (i.e. the larger the number of items, the higher the Cronbach alpha) (Pallant, 2011; Pett, et al., 2003). However, there is a point where increasing the number of items in a questionnaire does not significantly increase the reliability of the instrument (Pett, et al., 2003). Evaluating the effect of item reduction on Cronbach alpha for each factor within each subscale can be conducted to identify redundant items, refine the factors and reduce the length of the questionnaire while maintaining or even improving internal consistency (Pett, et al., 2003). Item reduction was conducted by calculating the internal consistency and reviewing the change in Cronbach alpha when one item was removed at a time. In addition, the level of consistency among the items (i.e. the correlation of each item with the total factor score and the proportion of variance in a given item that is shared with the other items) were also reviewed to assist in the decision to remove an item from a factor (Pett, et al., 2003). The items that did not contribute significantly to the overall Cronbach alpha of a factor, correlated poorly with the total factor score and had a low proportion of variance shared with the other items in the factor (i.e. poor consistency with the other items) were removed and not included in subsequent analyses. Table 6.17 and 6.18 show the items that were removed from the factors with the corresponding Cronbach alpha for the factor and the overall subscale.

Table 6.17 Items removed from the lunchtime Y-PASS questionnaire

Factor	Cronbach alpha				Items removed
	Before		*After*		
	n	*alpha*	*n*	*alpha*	
Intrapersonal subscale	*21*	*0.82*	*18*	*0.85*	
Barrier self-efficacy	7	0.80	na	na	na
Perceived self-efficacy	7	0.77	6	0.78	• I don't play in certain areas of the school yard because I am scared of the other kids.
Behavioural attitude/belief	7	0.76	5	0.78	• I do what my friends do at lunchtime so I don't feel left out. • I only play active games if other children/friends organise it.
Sociocultural subscale	*9*	*0.61*	*8*	*0.55*	
Peer influence	3	0.64	na	na	na
Teacher influence	3	0.58	2	0.64	• Teachers encourage us to be active at lunchtime.
Social barriers	3	0.32	na	na	na
Physical environmental/policy subscale	*10*	*0.69*	*9*	*0.74*	
Access to facilities/equipment	3	0.61	na	na	na
Physical environmental/policy barriers	4	0.49	3	0.55	• I have other commitments at lunchtime that keep me from being active, such as meetings and music lessons.
Access to space	3	0.50	na	na	na

Notes: na = not applicable (i.e. removal of an item was not necessary).

Table 6.18 Items removed from the after-school Y-PASS questionnaire

Factor	Cronbach alpha				Items removed
	Before		*After*		
	n	*alpha*	*n*	*alpha*	
Intrapersonal subscale	*30*	*0.86*	*26*	*0.85*	
Behavioural attitudes/beliefs (organised sports/activities)	7	0.77	na	na	na
Behavioural attitudes/beliefs (non-organised activities)	7	0.81	6	0.82	• I catch a bus or get driven to and from places after school because I can't be bothered walking or riding.
Barriers self-efficacy	6	0.80	na	na	na
Support seeking/social norm	4	0.70	3	0.70	• I do an organised sport or activity after school because I get to hang out with friends.
Perceived competence	3	0.71	2	0.82	• I ride my bike, skateboard or scooter to and from places after school because I think I am good at it.
Perceived barriers	3	0.43	na	na	na
Sociocultural subscale	*20*	*0.73*	*17*	*0.75*	
Social support	8	0.77	7	0.78	• My parents make me go outside and play after school.
Parental barriers	4	0.63	na	na	na
License to be active	5	0.71	4	0.75	• My parents think it is safe for me to play in my yard when I am home alone after school.
Parental rules	3	0.50	2	0.56	• My parents have rules about watching TV and playing electronic games after school.
Physical environmental/policy subscale	*29*	*0.78*	*27*	*0.78*	
Weather	6	0.75	na	na	na
Access to facilities/equipment	8	0.68	7	0.69	• I do an organised sport or activity because it is close to where I live.
Safety	4	0.63	na	na	na
Access to space	3	0.60	na	na	na
Time commitments	3	0.54	2	0.61	• I have enough time to play actively at home or in my neighbourhood after school.
Financial barriers	3	0.64	na	na	na
School bag	2	0.54	na	na	na

Notes: na = not applicable (i.e. removal of an item was not necessary).

6.1.3 Discussion

Valid and reliable measures of context-specific physical activity correlates for use with children are lacking but are fundamental for exploring and understanding the factors that could be targeted in interventions to promote physical activity. This section of the chapter presented preliminary evidence of the factor structure and internal consistency of six new context-specific physical activity correlate subscales: lunchtime intrapersonal subscale, lunchtime sociocultural subscale, lunchtime physical environment/policy subscale, after-school intrapersonal subscale, after-school sociocultural subscale and the after-school physical environmental/policy subscale. Further refinement of the questionnaires was done using item reduction.

Results from the exploratory factor analysis demonstrated the existence of a factor structure among the Y-PASS questionnaire items, providing evidence for construct validity. For the lunchtime subscales, three factors were identified under each of the intrapersonal, sociocultural and physical environmental/policy subscales. For the after-school subscales, six factors were identified in the intrapersonal subscale, four factors in the sociocultural subscale and seven factors in the physical environmental/policy subscale. Following item reduction, all subscales, except the lunchtime sociocultural subscale (Cronbach alpha = 0.55), demonstrated acceptable internal consistency, which is commonly defined as a Cronbach alpha of ≥0.6 (Hume, et al., 2006; Norman & Streiner, 1994). Within the subscales, however, there were some factors that demonstrated moderate internal consistency. For example, the "Parental rules" factor in the after-school sociocultural subscale and the "Access to space" in the lunchtime physical environment/policy subscale had Cronbach alpha values of 0.56 and 0.50, respectively. This may be due to only two and three items loading onto these factors. Of particular note was the low Cronbach alpha for the "Social barriers" factor in the lunchtime sociocultural subscale (Cronbach alpha = 0.32) and "Perceived barriers" of the after-school intrapersonal subscale (Cronbach alpha = 0.43), with only three items loading onto each of these factors. According to Pallant (2011), the mean inter-item correlation may be a more appropriate statistic to determine internal consistency of factors with a small number of items. The "Social barriers" and "Perceived barriers" factors have mean inter-item correlations of 0.15 and 0.20, respectively, which are in the acceptable range of 0.10 to

0.50 (Nunnally, 1978). In light of this knowledge, future studies using the Y-PASS questionnaires could consider repeating a factor analysis with additional items for the factors with low or moderate Cronbach alpha values, and if the factorial structure is maintained, testing whether this raises the alpha values.

The social ecological model posits that physical activity is subjected to multiple influences (Sallis, et al., 2008), which is reflected in the multi-dimensional factorial structure identified in this study. Similar findings have been found in a number of other studies reporting the factorial structure of newly developed correlate measures (Jago, Fox, et al., 2009; McMinn, et al., 2009; Ommundsen, et al., 2008; Pirasteh, et al., 2008; Saunders, et al., 1997). The inclusion of multiple factors under each subscale increases the level of measurement specificity and may contribute to explaining more variance in children's physical activity behaviour.

In this study, multiple factors measuring different aspects of the sociocultural domain were identified, including aspects of peer, teacher and parental influences. This is supported by findings from Ommundsen et al. (2008) and Pirasteh et al. (2008) who identified similar factors. On the other hand, Saunders et al. (1997) and Robertson-Wilson et al. (2007) only identified a single factor structure for the social subscale, with peer, family and teacher influence collapsed into one factor. The disadvantage of a single factor solution is the inability to assess the specific influence of peers, family or teachers on physical activity separately. Evidence has shown that children do relate differently to different social groups in different settings (Hohepa, et al., 2007; Jago, Fox, et al., 2009; Ommundsen, et al., 2006), suggesting that a multi-dimensional factor structure may be more appropriate, particularly when exploring contextual correlates of physical activity.

The factors identified under the lunchtime and after-school intrapersonal subscales measure different facets of the intrapersonal domain, such as self-efficacy and behavioural attitudes/beliefs. Ommundsen et al. (2008) also explored different dimensions of the intrapersonal domain and identified a two factor solution (i.e. enjoyment and perceived competence). There have been a number of other studies that have explored the factor

structure of an intrapersonal subscale but have only focused on one aspect of this domain. For example, Pirasteh et al. (2008) only explored self-efficacy and found that items only loaded onto one factor. This limits the depth of exploration into the internal psychological processes that influence children's engagement in physical activity. Saunders et al. (1997), on the other hand, also explored the factorial structure of the self-efficacy domain but identified a three factor solution (i.e. support seeking, barriers, positive alternatives), which explores a deeper level of specificity to this factor. In order to obtain an in-depth understanding of why children are active or not active, different dimensions of children's intrapersonal domain should be explored instead of focusing on single dimensions.

The factor structure of a physical environmental/policy subscale has not been explored in detail in the literature (Sallis, et al., 2002). Robertson-Wilson et al. (2007) identified a single factor solution for the physical environment domain, which lumped together items assessing the condition of space and equipment, size of space, access to space, access to equipment and access to physical education classes and organised activities. The issue with collapsing multiple aspects of a domain into one factor is a loss of specificity and an inability to identify the specific environmental aspect that influences physical activity behaviour. In comparison, Hume et al. (2006) and McMinn et al. (2009) explored the psychometric properties of a physical environment scale and concluded that multiple dimensions of the physical environment (e.g. safety, aesthetics, access to facilities, availability of equipment) should be explored when investigating the factors that influence physical activity. The evidence from these studies, along with the multi-factor solution identified from this current exploratory factor analysis, provides support for the need of a range of items that cover different potential physical environmental factors so that all underlying factors are captured.

6.1.3.1 Limitations and strengths

When interpreting the results from this factor analysis, a few limitations need to be acknowledged. Firstly, the sample size did not reach the recommended 10:1 participant to variable ratio for each subscale, as suggested by Hair et al. (1998). Future studies reviewing the factorial structure of the Y-PASS questionnaires should aim to recruit a larger sample size, preferably greater than 300 participants (Tabachnick & Fidell, 2001). The sampling

method chosen for this study was to capture diversity of the school types. However, response rates did differ by school type, with fewer participants consenting from low SES schools compared to high SES schools. This may have resulted in some sampling bias effect in the analyses. Unfortunately, the children who did not provide consent could not be followed up in order to adhere to the ethical approval conditions. The Cronbach alpha values for some of the factors (e.g. the lunchtime "Social barriers", lunchtime "Physical environmental/policy barriers", after-school "Perceived barriers" and after-school "Parental rules") were below the acceptable level of internal consistency [i.e. Cronbach alpha of ≥0.6 (Hume, et al., 2006; Norman & Streiner, 1994)]. This may have been due to the small number of items that loaded onto each of these factors. These factors were not removed from the questionnaires as the mean inter-item correlations did fit in the acceptable range of 0.10 to 0.50 (Nunnally, 1978). Finally, it is recognised that factor analysis is usually conducted without a theoretical framework implied. The initial exploratory factor analysis, with no theoretical framework inferred, produced uninterpretable factors, hence the decision to divide the items into theoretically-based subscales and then conduct an exploratory factor analysis within each subscale. While there is a level of theoretical bias, the resultant factors did fit conceptually with factors commonly identified in studies using a social ecological framework, confirming the appropriateness of imposing a theoretical framework onto the data.

6.1.4 Conclusion

Based on this preliminary reliability and factorial structure evidence, it can be concluded that these newly developed correlate questionnaires could be a useful tool for measuring potential correlates of context-specific physical activity in children aged 10-14 years. The results of the exploratory factor analysis provide further justification for exploring physical activity correlates from a social ecological perspective and demonstrate the importance of developing items that are context specific. Testing the validity and reliability of any newly developed questionnaire is an ongoing process. Therefore, further development and refinement of the Y-PASS questionnaires is recommended, including a confirmatory factor analysis and exploring the inclusion of additional items. However, this is beyond the scope of this chapter.

6.2 Test-retest reliability study

In addition to internal consistency, test-retest reliability also needs to be explored. Test-retest reliability is the ability of the tool to produce repeatable results when administered on separate occasions and is usually assessed by examining the variation in responses across the two time periods (Portney & Watkins, 2000). The time between the two testing periods is crucial. If the time is too short, respondents may remember their answers and repeat them, leading to inflated estimates of reliability. Longer time periods can underestimate the reliability through true changes in a given construct. Studies measuring correlates of physical activity tend to use a one week test-retest time period (Erwin, 2008; Hume, et al., 2006; Pate et al., 2003; Wong, Leatherdale, & Manske, 2006). Therefore, the one-week time period will be applied to this current study so that comparisons can be made with other studies.

As mentioned previously, one of the main aims of this program of research was to compare the predictive utility of the context-specific correlate questionnaires with a generic (i.e. non-context-specific) correlate questionnaire. Generic correlate questionnaires tend to assess typical correlates of children's overall physical activity, such as self-efficacy towards being active, general support from family members and general safety concerns. These correlates have been discussed in more detail in the literature review. Items in generic correlate questionnaires commonly use generic wording with no reference to a time, place or specific type of activity (e.g. "I enjoy being active" compared to "I enjoy being active in the school yard during break times"). The advantage of using generic correlate questionnaires is being able to assess factors of overall physical activity. However, these types of questionnaires may become less useful when the aim is to provide an in-depth understanding of the factors that influence specific types of physical activities being performed at different times of the day and/or in different locations.

The LEAP II questionnaire will be used as the comparative generic correlate questionnaire in the predictive study, described in Chapter 7. This questionnaire was originally designed and tested by Saunders et al. (1997) and further developed for additional studies relating to the Lifestyle Education for Activity Program (LEAP) for an American adolescent sample (Dishman et al., 2004; Dishman, et al., 2005; Dishman, et al., 2002; Motl, et al., 2001; Motl et al., 2002;

Motl, Dishman, Saunders, Dowda, & Pate, 2004; Motl, et al., 2000; Motl, Dishman, Ward, & Saunders, 2005; Motl et al., 2005; Pate et al., 2005; Saunders, Motl, Dowda, Dishman, & Pate, 2004). This questionnaire is designed to measure correlates of free time physical activity, which is considered a generic type of physical activity. The items tend to be worded in a generic format with no indication of the specific time of day, location or the specific type of physical activity behaviour undertaken in free time. However, there are a few exceptions in the items relating to the "environment" factor (e.g. "At home there are enough supplies and pieces of sports equipment to use for physical activity"), "PE enjoyment" (e.g. "How much do you enjoy physical education classes at school?") and "PE and sport participation" (e.g. "During the past 12 months, how many sports teams run by your school did you play on?").

While Cronbach alphas of the pen and paper version of the LEAP II questionnaire have previously been tested for the majority of the subscales (Felton et al., 2002; Motl, Dishman, Saunders, Dowda, & Pate, 2007; Ward et al., 2006), perceived behavioural control, self-motivation, goal setting and physical activity enjoyment do not have any reported reliability data. There are no reported reliability data relevant to an Australian population. In addition, the LEAP II questionnaire was transformed into a computer-delivered version in the current study, for consistency with the Y-PASS questionnaires. Therefore, the aim of this study was to calculate the one week test-retest reliability and Cronbach alpha of the LEAP II questionnaire (which was used in Chapter 7 as the generic correlate questionnaire), as well as the test-retest reliability of the lunchtime and after-school "Youth Physical Activity Survey for Specific Settings" (Y-PASS) questionnaires. As Cronbach alphas of the Y-PASS questionnaires were tested in the exploratory factor analysis (see Table 6.17 and Table 6.18), these were not repeated in this study.

6.2.1 Methods

6.2.1.1 Participants and sampling

Two primary schools were purposively selected and invited to take part in the reliability study (see Appendix 10). These schools were selected to be reflective of the larger sample in the utility study (see Chapter 7) by representing both high and low socio-economic areas

(SES) according to the School Card Register (SCR). The SCR is an indicator of SES at the school level based on the percentage of students in a school whose families receive government support to meet the costs of school attendance (SCR cut-off for low SES = 31.8%; 50th percentile). One hundred and eight participants across Grades 5, 6 and 7 (36 students from each year level) were invited from the two primary schools via letters distributed to the parents through the schools' distribution system. Informed consent and assent were obtained from 67 parents and participating children, respectively. In accordance with ethics approval, any child who returned a consent form, regardless of consent status, was given a stress ball gift. Four children were absent on the days of data collection, resulting in 63 children completing the questionnaires across the two time periods. This sample size is comparable with other test-retest reliability studies (Erwin, 2008; Hume, et al., 2006; Norman, et al., 2005). Complete datasets were obtained from 58% of all children approached for this study.

6.2.1.2 Ethics

The study was approved by the University of South Australia Human Research Ethics Committee, Department of Education and Children Services (DECS) and by the relevant school authorities (see Appendix 2).

6.2.1.3 Measures

6.2.1.3.1 The LEAP II questionnaire

The psychometric properties of the LEAP II questionnaire, such as factorial validity, construct validity, test-retest reliability and Cronbach alpha, have been tested previously in adolescent populations (mean age 13.6 ±0.6 years). The correlates measured in the LEAP II questionnaire are attitude, subjective norms, perceived behavioural control and perceived self-efficacy (Dishman, et al., 2002; Felton, et al., 2002; Motl, et al., 2000); enjoyment (Felton, et al., 2002; Motl, et al., 2001); goal setting (Dishman, et al., 2004); intention (Felton, et al., 2002; Motl, et al., 2002); self-motivation (Motl, Dishman, Felton, & Pate, 2003); social provision (Felton, et al., 2002; Motl, et al., 2004; Ward, et al., 2006); social support (Saunders, et al., 2004; Ward, et al., 2006) and perceived physical environment

(Felton, et al., 2002; Motl, Dishman, Ward, & Saunders, 2005) (see Appendix 13 for a copy of the LEAP II questionnaire). Details of the published psychometric properties of the LEAP II questionnaire are presented in Table 6.19.

Correlates measured by the LEAP II questionnaire

Attitude. There are 22 items in the attitude subscale that relate to beliefs about the consequences of physical activity participation and a corresponding positive or negative evaluation of those beliefs. The belief statement was measured on a 5-point Likert scale from 1 ("Disagree a lot") to 5 ("Agree a lot") and the evaluation statements were rated on a 5-point Likert scale ranging from 1 ("Very bad") to 5 ("Very good"). The attitude item score was formed by the sum of the belief statement score and the corresponding evaluation score (e.g. the score for the item, "It would help me control my weight", plus the score for the corresponding evaluation item, "Controlling my weight is…"). The scale score was the average across all items. Test-retest reliability and Cronbach alpha of the attitude scale is 0.72 (Felton, et al., 2002).

Subjective norms. The subjective norm scale consists of statements of the expectations of others around being physically active and a corresponding "motivation to comply" statement. Both these statements were ranked on a 5-point Likert scale from 1 ("Disagree a lot") to 5 ("Agree a lot"). The subjective norm score was formed by the product of the perceived expectation and motivation to comply item scores and then calculating the average across all items (e.g. the score for the item, "My fellow students think I should be physically active during my free time on most days", plus the score for the corresponding motivation to comply item, "I want to do what my fellow students want me to do"). The reliability of the pen and paper version of this scale has been tested, with test-retest reliability being 0.58 and Cronbach alpha being 0.73 (Felton, et al., 2002).

Perceived behavioural control. Perceived behavioural control is captured by four items pertaining to the ease/difficulty of being physically active. These items were measured on a 5-point Likert scale ranging from 1 ("Very easy") to 5 ("Very difficult"). All items were

reversed coded in the analysis with higher scores reflecting higher levels of perceived behavioural control (Motl, et al., 2002).

Perceived self-efficacy. Fifteen items represent perceived self-efficacy with participants asked to rate their confidence in their ability to be physically active on a 5-point Likert scale (1 = "Disagree a lot" to 5 = "Agree a lot"). Eight of the 15 items specifically focus on perceived self-efficacy in the presence of particular barriers, such as access to TV and video games, poor weather conditions and the need to complete homework. The pen and paper version of this scale has a test-retest reliability of 0.57 (Felton, et al., 2002) and Cronbach alpha of 0.80 (Motl, et al., 2007).

Intention. Intention to be physically active is measured using four items, while specific intentions to be physically active despite specific barriers are measured using nine items. These are rated on a 5-point Likert scale from "Disagree a lot" (1) to "Agree a lot" (5) and have a test-retest reliability of 0.63 (Felton, et al., 2002).

Self-motivation. Twenty items represent self-motivation. This inventory was modified from the original Self-Motivation Inventory for Children (SMI-C) (Biddle et al., 1996) and is ranked on a 4-point Likert scale from 1 ("Very unlike me") to 4 ("Very much like me"). Eleven items (items 1, 2, 4, 8, 9, 10, 14, 15, 17, 18 and 20) are negatively worded and hence reverse coded.

Goal setting. The measure of goal setting is captured by 15 items, while satisfaction with goal setting is measured using one item. Both correlates are ranked on a 5-point Likert scale from 1 ("Disagree a lot") to 5 ("Agree a lot").

Enjoyment. The enjoyment items were modified from the **P**hysical **AC**tivity **E**njoyment **S**cale (PACES) (Dunton, Tscherne, & Rodriguez, 2009; Moore et al., 2009). It contains 16 items using a 5-point Likert scale from 1 ("Disagree a lot") to 5 ("Agree a lot"). One item is included to specifically measure physical education enjoyment. This is also measured on a 5-point

Likert scale from 1 (“PE is very un-enjoyable”) to 5 (“PE is very enjoyable”) and has been shown to have a test-retest reliability of 0.83 (Felton, et al., 2002).

Social provision. The social provisions subscale was modified from the Social Provision Scale (Cutrona & Russell, 1987) and includes 24 items, measured on a 5-point Likert scale (1 = “Disagree a lot” to 5 = “Agree a lot”). Items 2, 3, 9, 10, 14, 15, 18, 19, 21 and 22 are negatively worded and thus reverse coded. The test-retest reliability of the pen and paper version of this subscale has been found to be 0.60-0.64 (Ward, et al., 2006) with a Cronbach alpha of 0.60-0.72 (Felton, et al., 2002).

Social support. Five items relate to social support from family members. Each item is based on the level of support provided by a male adult(s), female adult(s) and other children during a typical week. Response options range from 0 (“None”) to 4 (“Daily”) and are summed to form the data for each of the five items. Test-retest reliability for the pen and paper version of the social support subscale is 0.86 (Ward, et al., 2006) and the internal consistency is 0.81 (Motl, et al., 2007).

Environment. The environment subscale consists of a perceived physical environment factor and an access to physical activity programs factor. The measure of perceived physical environment is assessed by four items, which were found to load onto two correlated factors, access to equipment and neighbourhood safety (Motl, Dishman, Ward, & Saunders, 2005). These items are assessed on a 5-point Likert scale ranging from 1 (“Disagree a lot”) to 5 (“Agree a lot”). Item 4 (“It is difficult to walk or jog in my neighbourhood because of things like traffic, no sidewalks, dogs, or gangs”) is reverse coded. The test-retest reliability for these items range from 0.59 to 0.95 (Felton, et al., 2002), while the internal consistency of the scale range from 0.46 to 0.69 (Motl, et al., 2007). An item relating to access to supervised physical activity programs during after school, on weekends and during the summer is also included in the perceived physical environment subscale. There are no reported psychometric properties of this item. The item is ranked as “don’t know” (0), “no” (1) or “yes” (2). The score for this item is derived from the mean of responses for after

school, on weekends and during the summer to provide an overall score for access to physical activity programs.

PE and sport involvement. PE involvement is measured by two items ("Are you taking physical education now?" and "Did you take physical education in the first half of the school year"). The response scale is a dichotomous "yes" or "no". Sport involvement over the past 12 months is measured by two items ("During the past 12 months, how many sports teams run by your school did you play on?" and "During the past 12 months, how many sports teams run by organisations outside of your school, did you play on?"). Participants have the option of ticking none to three teams.

Table 6.19 Summary of published psychometric properties of the LEAP II questionnaire

Correlate	Number of items	Cronbach alpha	Test-retest reliability
Attitude	22	0.72[a]	0.72[a]
Subjective norms	8	0.73[a]	0.58[a]
Perceived behavioural control	4	NR	NR
Perceived self-efficacy	15	0.80[b]	0.57[a]
Intention	13	NR	0.63[a]
Self-motivation	20	NR	NR
Goal setting	15	NR	NR
Enjoyment	17	NR	0.83[a] (for PE enjoyment only)
Social provision	24	0.60-0.72[a]	0.60-0.64[c]
Social support	5	0.81[b]	0.86[c]
Environment	5	0.59-0.95[b]	0.46-0.69[a]
PE and sport participation	4	NR	NR

Notes:
NR = not reported
[a] (Felton, et al., 2002), [b] (Motl, et al., 2007), [c] (Ward, et al., 2006)

6.2.1.3.2 Lunchtime and after-school Y-PASS questionnaires

The lunchtime and after-school Y-PASS questionnaires contain three subscales, namely the intrapersonal, sociocultural and physical environmental/policy subscales. The development of these Y-PASS questionnaires have been detailed in Chapter 5. All items were measured on a 5-point Likert scale ranging from 1 ("Disagree a lot") to 5 ("Agree a lot"). Where items were reverse coded, these have been specified in Table 6.20 and Table 6.21. Factor-based scores were derived for each factor by summing the responses across the items that represent the factor and then calculating the average (Pett, et al., 2003). This scoring process was comparable to the LEAP II questionnaire to enable consistency and ease of interpretation. For individual predictor items, the score was the response score provided by the participant. Cronbach alpha, assessed in the exploratory factor analysis, for the lunchtime Y-PASS questionnaire ranged from 0.50-0.80 and 0.43-82 for the after-school Y-PASS questionnaire. The factors, items representing each factor and source of items are presented in Table 6.20 and Table 6.21.

6.2.1.4 Data collection procedure

Participants were randomly assigned one of the three computer-delivered correlate questionnaires (i.e. the generic LEAP II questionnaire, the lunchtime Y-PASS questionnaire or the after-school Y-PASS questionnaire) and asked to complete them on the day of data collection and then again a week later to assess test-retest reliability. All computer-delivered questionnaires were administered to participants in the schools' computer labs during school hours, using the same administration techniques on both occasions. Each participant was given a card containing a unique identification code and space to write their name. The principal administrator (RMS) and the assistant loaded the questionnaires onto the school computers and instructed the participants to enter their unique identification code in the space provided and continue through the rest of the questionnaire. During questionnaire administration, the principal administrator and the assistant were available to answer any questions or assist any participant having difficulties.

Table 6.20 List of potential predictor factors and predictor items for Draft Four of the lunchtime Y-PASS questionnaires

Lunchtime Y-PASS	Items	Source of items
Intrapersonal subscale		
Barrier self-efficacy	1. I am confident that I can find other kids to be active with at lunchtime even if my friends don't want to. 2. I am confident that I can be active at lunchtime even if the space in the playground/oval is limited. 3. I am confident that I can ask a teacher to get me equipment to play with at lunchtime. 4. I am confident that I can still be active at lunchtime even if my friends don't want to. 5. I am confident that I can still be active in the school yard even if it is very hot or raining. 6. I am confident that I can ask my friends to be active with me during lunchtime. 7. I am confident that I can still be active at lunchtime even if there are bullies in the school yard.	Items 1, 3, 4, 5, 6: modified from Saunders et al. (1997). Items 2-3: Purposely developed.
Perceived self-efficacy	8. I prefer to watch other kids rather than play active games at lunchtime.* 9. I am not good at being active at lunchtime.* 10. I prefer to sit rather than be active at lunchtime.* 11. There is nothing to do at lunchtime.* 12. It is fun to be active at lunchtime. 13. I have the skills I need to be active at lunchtime.	Item 8: Modified from Ommundsen et al. (2006). Items 9-13: Purposely developed.
Behavioural attitude/belief	14. I am active at lunchtime so I can hang out with my friends. 15. I play certain games at lunchtime because I think I am good at them. 16. I am active at lunchtime because it makes me popular with the other children. 17. It is 'cool' to be active at lunchtime. 18. I play certain games at lunchtime because I want to get extra practice.	Items 14, 15, 17, 18: Purposely developed. Item 16: Modified from Saunders et al. (1997).
Predictor items	19. I can still be active at lunchtime even if I am wearing my school uniform. 20. I like to walk around at lunchtime.	Purposely developed. Purposely developed.

Lunchtime Y-PASS	Items	Source of items
	21. I really like doing PE at school.	Taken directly from Ommundsen et al. (2006).
	22. I always have the energy to be active at lunchtime.	Modified from Saunders et al. (1997).
	23. I am just as coordinated as kids of my age and gender.	Modified from Sallis et al. (2002).
	24. Making up your own game rules makes playing games at lunchtime more fun.	Purposely developed.
Sociocultural subscale		
Peer influence	25. I teach other children how to play active games at lunchtime. 26. My friends teach me how to play active games at lunchtime. 27. I have friends who I am active with at lunchtime.	All items purposely developed.
Teacher influence	28. Teachers help us with the active games we play at lunchtime. 29. Teachers play with us at lunchtime.	All items purposely developed.
Social barriers	30. There is always a teacher who is on yard duty during lunchtime. 31. My friends would rather sit and talk at lunchtime.* 32. Bullying stops me from being active in the school yard at lunchtime.*	All items purposely developed.
Physical environmental/policy subscale		
Access to facilities/equipment	33. There are lots of shaded areas where I can be active even if it is really hot. 34. There are indoor spaces where I can be active if it is raining. 35. There is enough equipment available for me to play with at lunchtime.	All items purposely developed.

Lunchtime Y-PASS	Items	Source of items
Physical environmental/policy barriers	36. It is hard to be active in our school uniform at lunchtime.* 37. The oval is too dry and hard to play on.* 38. Some school rules keep me from doing the activities I like at lunchtime.*	All items purposely developed.
Access to space	39. There is enough space in the school yard for me to be active at lunchtime. 40. There is enough grass in the school yard to be active at lunchtime. 41. There are too many kids in the playground for me to be active at lunchtime.*	All items purposely developed.
Predictor items	42. We have school rules about where we are allowed to be active at lunchtime.*	Purposely developed.
	43. Our school has areas that suit the games I want to play at lunchtime.	Purposely developed.
	44. There are facilities at school, such as playgrounds or ovals, where I can be active at lunchtime.	Purposely developed.
	45. Our school play area has painted lines on the ground (e.g. hopscotch and 4-square) to help me be active at lunchtime.	Purposely developed.

Notes: * = items that are reverse coded.

Table 6.21 List of potential predictor factors and predictor items for Draft Four of the after-school Y-PASS questionnaires

After-school Y-PASS	Items	Source of items
Intrapersonal subscale		
Behavioural attitudes/beliefs (organised sports/activities)	1. I don't do an organised sport or activity after school because other kids are better than me.* 2. I don't feel like doing an organised sport or activity after school.* 3. I enjoy being part of an organised sport or activity team. 4. I don't enjoy doing an organised sport or activity after school.* 5. It is not worth doing an organised sport or activity after school because I am not good at it.* 6. I am not active after school because I am scared that I will get injured.* 7. I prefer to watch other kids rather than do organised sports and activities after school.*	Items 1-6: Purposely developed. Item 7: Modified from Ommundsen et al. (2006).
Behavioural attitudes/beliefs (non-organised activities)	8. I prefer to be active after school instead of watching TV or playing electronic games. 9. Being active after school is the thing I like to do best. 10. I don't feel like playing actively at home or in the neighbourhood after school.* 11. Being active after school makes me feel good. 12. I am too tired to be active after school.* 13. It is fun being active after school.	Items 8, 10 11, 13: Purposely developed. Item 9: Modified from Ommundsen et al. (2006). Item 12: Modified from Sallis et al. (2002).
Barriers self-efficacy	14. I am confident that I can ask my parent or another adult to take me somewhere I can play actively after school. 15. I am confident that I can ask my parent or another adult to take me to an organised sport or activity after school. 16. I am confident that I can be active after school on most days even if I have to stay at home. 17. I am confident that I can be active after school on most days. 18. I am confident that I can ask friends to be active with me after school on most days. 19. I am confident that I can be active after school on most days no matter how busy I am.	Items 14-15: Modified from Saunders et al. (1997). Items 16-19: Taken directly from Motl et al. (2000).

After-school Y-PASS	Items	Source of items
Support seeking/social norm	20. I play in the neighbourhood after school because I get to hang out with my friends. 21. I walk or ride to and from places after school because I get to hang out with my friends. 22. I play in the neighbourhood after school because I get to meet new people.	All items modified from Saunders et al. (1997).
Perceived competence	23. I play active games after school because I think I am good at them. 24. I do an organised sport or activity after school because I think I am good at it.	All items purposely developed.
Perceived barriers	25. I prefer to do homework rather than be active after school.* 26. I am scared of strangers in my neighbourhood after school.* 27. I am scared of dangerous animals in my yard, such as snakes, lizards, dogs or magpies.*	Items 25, 27: Purposely developed. Item 26: Modified from Timperio et al. (2006).
Predictor items	28. I wish I could do more organised sports or activities after school than I get a chance to.	Modified from Ommundsen et al. (2006).
	29. Being active after school is boring.*	Purposely developed.
	30. I do an organised sport or activity after school because I want to improve my skills.	Purposely developed.
	31. I do an organised sport or activity after school because I want to meet new people.	Purposely developed.
	32. I ride, walk, skate or scooter to and from places after school because it gets you fit.	Purposely developed.
	33. Playing outside after school keeps you healthy.	Modified from Robbins et al. (2008).
	34. I do an organised sport or activity after school because I have nothing else to do.	Purposely developed.
	35. I don't participate in some activities after school because it is only a boys'/girls' activity.*	Purposely developed.
	36. I play actively at home or in the neighbourhood after school because it gives me something to do.	Purposely developed.

After-school Y-PASS	Items	Source of items
	37. I do an organised sport or activity after school because it gets you fit.	Purposely developed.
	38. I am active after school because I don't want to put on weight.	Purposely developed.
	39. I am confident that I can be active after school on most days even if I could watch TV or play video games instead.	Taken directly from Motl et al. (2000).
	40. I am confident that I can be active after school on most days even if it is hot or cold outside.	Taken directly from Motl et al. (2000).
	41. I am confident that I can be active after school on most days even if I am being bullied.	Purposely developed.
	42. I am just as coordinated as kids of my age and gender.	Modified from Sallis et al. (2002).
	43. I am shy about how my body looks.*	Purposely developed.
	44. I really like doing PE at school.	Taken directly from Ommundsen et al. (2006).
Sociocultural subscale		
Social support	45. My parents help me practise sport after school. 46. My parents play actively with me after school. 47. My family tell me I am doing well at my after-school organised sport or activity. 48. My family always watch me do an organised sport or activity after school. 49. My parents encourage me to play outside after school. 50. My parents encourage me to do an organised sport or activity after school. 51. I do an organised sport or activity with friends after school.	Items 45, 46, 48, 50: Modified from Ommundsen et al. (2006). Item 47: Modified from Hohepa et al. (2007). Items 49, 51: Purposely developed.

After-school Y-PASS	Items	Source of items
Parental barriers	52. I don't do an organised sport or activity after school because my parents work late.*	Items 52-54: Purposely developed.
	53. I am not allowed to do an organised sport or activity after school because my parents are scared that I might get hurt.*	
	54. My parents won't let me do an organised sport or activity because I am already doing too many other activities.*	Item 54: Modified from Rushovich et al. (2006).
	55. My parents are not home after school to supervise my play.*	
License to be active	56. My parents won't let me ride, walk, skate or scooter to and from places after school.*	Item 56: Purposely developed.
	57. I walk, ride, skate or scooter to and from places with friends after school.	
	58. My parents think it is safe for me to be active in the neighbourhood after school.	Item 57: Modified from Saunders et al. (1997).
	59. I play with friends in the neighbourhood after school.	Item 58: Modified from Timperio et al. (2006).
		Item 59: Modified from Ommundsen et al. (2006).
Parental rules	60. If I am going out after school, I always have to be back by a certain time.*	All items taken directly from Ommundsen et al. (2006).
	61. I always have to tell my parents where I am when I go out after school.*	
Predictor items	62. Bullying stops me from being active after school.*	Purposely developed.
	63. I am not active after school because I have no one to play with.*	Purposely developed.
	64. I have brothers/sisters who play actively with me after school.	Purposely developed.

After-school Y-PASS	Items	Source of items
	65. My friends encourage me to be active after school.	Modified from Saunders et al. (1997).
	66. My friends tell me I am doing well at sport.	Modified from Hohepa et al. (2007).
	67. My parents are too busy to play with me after school.*	Purposely developed.
	68. My parents make me help around the house, which stops me from being active after school.*	Purposely developed.
	69. We have a rule at home that we have to do an organised sport or activity after school.	Purposely developed.
Physical environmental/policy subscale		
Weather	70. When it is too hot, it stops me from playing actively after school.*	All items purposely developed.
	71. When it is raining, it stops me from playing actively after school.*	
	72. When it is raining, it stops me from walking, riding, skating or riding a scooter to and from places after school.*	
	73. When it is too hot, it stops me from walking, riding, skating or riding a scooter to and from places after school.*	
	74. When it is too hot, it stops me from doing an organised sport or activity after school.*	
	75. When it is raining, it stops me from doing an organised sport or activity after school.*	

After-school Y-PASS	Items	Source of items
Access to facilities/equipment	76. It is easy to get to an organised sport or activity after school. 77. There are playgrounds or parks near my house where I can be active after school. 78. I don't have to travel far to play with my friends after school. 79. There are sport or recreation centres that I can go to after school. 80. I have the right equipment to do my chosen organised sport or activity after school. 81. I live too far away to walk, ride, skate or scooter to and from places after school.* 82. I have the right equipment (e.g. a bike lock, helmet or bike) to ride a bike after school.	Item 76, 79-82: Purposely developed. Item 77: Modified from Saunders et al. (1997). Item 78: Modified from Ommundsen et al. (2006).
Safety	83. The roads are safe in my neighbourhood after school. 84. There is heavy traffic in the streets where I live.* 85. There are dangerous objects in my yard, such as rusty scrap metal.* 86. It is safe to play actively in my yard after school.	Items 83-84: Modified from Timperio et al. (2006). Item 85: Purposely developed. Item 86: Modified from Ommundsen et al. (2006).
Access to space	87. My yard is too small for me to be active after school.* 88. I play actively in my yard after school because I have a lot of lawn. 89. There is somewhere at home where I can play actively after school.	All items purposely developed.
Time commitments	90. Homework stops me from doing an organised sport or activity after school.* 91. Homework stops me from playing actively at home or in the neighbourhood after school.*	All items modified from Sallis et al. (2002).

After-school Y-PASS	Items	Source of items
Financial barriers	92. We do not have enough cars to drive to and from places where I can be active after school.* 93. Petrol costs too much to drive to and from places where I can be active after school.* 94. It costs too much money to do an organised sport or activity after school.*	Item 92, 94: Purposely developed. Item 93: Modified from Ommundsen et al. (2006).
School bag	95. My school bag(s) is too heavy for me to walk, ride, skate or scooter home after school.* 96. I don't walk, ride, skate or scooter home from school when I have too many bags to carry.*	All items purposely developed.
Predictor items	97. Dog poo on the lawn at home keeps me from being active on the grass after school.*	Purposely developed.
	98. I have enough time to do an organised sport or activity after school.	Modified from Sallis et al. (2002) .
	99. It is safe to play actively near where I live after school.	Modified from Ommundsen et al. (2006).
	100. There are not enough traffic lights and crossings in my neighbourhood after school.*	Modified from Timperio et al. (2006).
	101. There is enough equipment to play actively at home after school.	Modified from Saunders et al. (1997).

Notes: * = items that are reverse coded.

6.2.1.5 Data reduction

Items that were negatively worded were reverse coded in all of the questionnaires. These items have been identified in Table 6.20 and Table 6.21. The LEAP II questionnaire was scored according to the original protocol (Saunders, et al., 1997). Each item was given a score based on the value selected by the participant. A subscale factor-based score was then obtained by calculating the mean score for all items in a factor.

Similar to the LEAP II questionnaire, factor-based scores for the lunchtime Y-PASS and after-school Y-PASS questionnaires were generated by summing the response score across items that represented the same factor and then calculating the average score (Pett, et al., 2003). Individual predictor item scores were based on the participant's response.

6.2.1.6 Statistical analysis

To test the stability of questionnaires, intraclass correlation coefficients (ICC) were calculated to determine the test-retest reliability. This was the preferred method over other methods, such as Pearson product-moment coefficient of correlation, as it reflects both correlation and agreement between the two measurement time periods (Portney & Watkins, 2000). Cronbach alpha statistical analysis was also conducted for the computer-delivered version of the LEAP II questionnaire to determine internal consistency. Cronbach alpha analysis was not repeated for the Y-PASS questionnaires as this was calculated in the factor analysis. A Cronbach alpha of greater than or equal to 0.6 was interpreted as acceptable (Hume, et al., 2006; Norman & Streiner, 1994). The following guidelines, suggested by Landis and Koch (1977), were used to interpret the test-retest coefficients: 0 – 0.2 (poor), 0.21 – 0.4 (fair), 0.41 – 0.6 (moderate), 0.61 – 0.8 (substantial) and 0.81 – 1.0 (almost perfect) (Altman, 1991). All statistical analyses were conducted in Statistical Package for the Social Sciences (SPSS) Version 19.0 (SPSS, Chicago, IL).

6.2.2 Results

6.2.2.1 Participant characteristics

Twenty-four participants (12 boys, 12 girls) completed the lunchtime Y-PASS questionnaire twice. These participants had a mean age of 11.6 (±0.8) years. Twenty-two participants (9 boys, 13 girls; mean age = 11.4 ±0.9 years) completed the after-school Y-PASS questionnaire. The LEAP II questionnaire was completed by 17 participants (8 boys, 9 girls) with a mean age of 11.7 (±0.9) years. Despite random allocation of questionnaires, the uneven numbers of children completing the after-school Y-PASS questionnaire was due to absenteeism on one of the days of data collection.

6.2.2.2 Test-retest reliability

Results of the test-retest reliability are shown in Table 6.22 for the lunchtime and after-school Y-PASS questionnaires and Table 6.23 for the LEAP II questionnaire. These tables also show the Cronbach alpha for each questionnaire, as assessed during the factor analysis for the Y-PASS questionnaires and in this study for the LEAP II questionnaire. The lunchtime intrapersonal subscale factors demonstrated fair to almost perfect test-retest reliability (ICC = 0.33 – 0.84), with the lowest value recorded for the item "I always have the energy to be active at lunchtime" (ICC = 0.33) and the highest recorded for the predictor factor of "Barriers self-efficacy". The test-retest reliability for the lunchtime sociocultural subscale ranged from 0.57 – 0.70. The variation in test-retest for the lunchtime physical environmental/policy subscale was quite substantial with the item "Our school has areas that suit the games I want to play at lunchtime" demonstrating poor test-retest reliability (ICC = 0.08), with "Access to equipment" demonstrating substantial test-retest reliability (ICC = 0.79). Overall, the median test-retest reliability for the lunchtime Y-PASS questionnaire was 0.63.

For the after-school intrapersonal subscale, the predictor factors demonstrated moderate to almost perfect ICCs ("Support seeking/social norm" = 0.58; "Behavioural attitudes/beliefs for non-organised activities" = 0.93). The majority of the individual intrapersonal predictor items had moderate to substantial test-retest reliability, with the exception of "I ride, walk, skate or scooter to and from places after school because it gets you fit" (ICC = 0.37), "I do an

organised sport or activity after school because I have nothing else to do" (ICC = 0.13) and "I don't participate in some activities after school because it is only a boys'/girls' activity" (ICC = 0.26). The test-retest reliability for the after-school sociocultural subscale ranged from 0.31 ("My parents make me help around the house, which stops me from being active after school") to 0.91 ("Social support"). For the after-school physical environmental/policy subscale, all predictor factors and items demonstrated at least fair test-retest reliability. The highest reliability was found for "Access to facilities/equipment" and "I have enough time to do an organised sport or activity after school" item (ICC = 0.80), with the lowest test-retest reliability for the items "There is enough equipment to play actively at home after school" (ICC = 0.27) and "Dog poo on the lawn at home keeps me from being active on the grass after school" (ICC = 0.38). The median test-retest reliability for the after-school Y-PASS questionnaire was 0.63.

Test-retest reliability coefficients were used to further refine the Y-PASS questionnaires. The following predictor items were removed from the Y-PASS questionnaires due to poor test-retest reliability, "Our school has areas that suit the games I want to play at lunchtime" (ICC = 0.08) and "I do an organised sport or activity after school because I have nothing else to do" (ICC = 0.13). The removal of these predictor items does not affect the findings from the factor analysis because they did not load onto any factor.

Table 6.22 Reliability for the lunchtime and after-school Y-PASS questionnaires

Questionnaire	Factor	Test-retest	Cronbach alpha
Lunchtime Y-PASS (n=25)			
Intrapersonal subscale	Barrier self-efficacy	0.84 (p<0.000)	0.80
	Perceived self-efficacy	0.73 (p<0.000)	0.78
	Behavioural attitude/belief	0.73 (p<0.000)	0.78
	I can still be active at lunchtime even if I am wearing my school uniform.	0.67 (p<0.000)	-
	I like to walk around at lunchtime.	0.39 (p=0.06)	-
	I really like doing PE at school.	0.66 (p<0.000)	-
	I always have the energy to be active at lunchtime.	0.33 (p=0.11)	-
	I am just as coordinated as kids of my age and gender.	0.47 (p=0.02)	-
	Making up your own game rules makes playing games at lunchtime more fun.	0.47 (p=0.02)	-
Sociocultural subscale	Peer influence	0.70 (p<0.000)	0.64
	Teacher influence	0.63 (p=0.001)	0.64
	Social barriers	0.57 (p=0.004)	0.32
Physical environmental/policy subscale	Access to facilities/equipment	0.71 (p<0.000)	0.61
	Physical environmental/policy barriers	0.66 (p<0.000)	0.55
	Access to space	0.60 (p=0.002)	0.50
	We have school rules about where we are allowed to be active at lunchtime.	0.47 (p=0.02)	-
	Our school has areas that suit the games I want to play at lunchtime.	0.08 (p=0.71)	-
	There are facilities at school, such as playgrounds or ovals, where I can be active at lunchtime.	0.46 (p=0.02)	-
	Our school play area has painted lines on the ground (e.g. hopscotch and 4-square) to help me be active at lunchtime.	0.75 (p<0.000)	-

Questionnaire	Factor	Test-retest	Cronbach alpha
After-school Y-PASS (n=22)			
Intrapersonal subscale	Behavioural attitudes/beliefs (organised sports/activities)	0.85 (p<0.000)	0.77
	Behavioural attitudes/beliefs (non-organised activities)	0.93 (p<0.000)	0.82
	Barriers self-efficacy	0.73 (p<0.000)	0.80
	Support seeking/social norm	0.58 (p=0.005)	0.70
	Perceived competence	0.73 (p<0.000)	0.82
	Perceived barriers	0.62 (p=0.002)	0.43
	I wish I could do more organised sports or activities after school than I get a chance to.	0.72 (p<0.000)	-
	Being active after school is boring.	0.63 (p=0.002)	-
	I do an organised sport or activity after school because I want to improve my skills.	0.68 (p=0.001)	-
	I do an organised sport or activity after school because I want to meet new people.	0.55 (p=0.007)	-
	I ride, walk, skate or scooter to and from places after school because it gets you fit.	0.37 (p=0.09)	-
	Playing outside after school keeps you healthy.	0.69 (p<0.000)	-
	I do an organised sport or activity after school because I have nothing else to do.	0.13 (p=0.58)	-
	I don't participate in some activities after school because it is only a boys'/girls' activity.	0.26 (p=0.24)	-
	I play actively at home or in the neighbourhood after school because it gives me something to do.	0.57 (p=0.006)	-
	I do an organised sport or activity after school because it gets you fit.	0.45 (p=0.04)	-
	I am active after school because I don't want to put on weight.	0.65 (p=0.001)	-
	I am confident that I can be active after school on most days even if I could watch TV or play video games instead.	0.48 (p=0.02)	-

Questionnaire	Factor	Test-retest	Cronbach alpha
	I am confident that I can be active after school on most days even if it is hot or cold outside.	0.66 (p=0.001)	-
	I am confident that I can be active after school on most days even if I am being bullied.	0.72 (p<0.000)	-
	I am just as coordinated as kids of my age and gender.	0.80 (p<0.000)	-
	I am shy about how my body looks.	0.69 (p<0.000)	-
	I really like doing PE at school.	0.57 (p=0.005)	-
Sociocultural subscale	Social support	0.91 (p<0.000)	0.78
	Parental barriers	0.55 (p=0.007)	0.63
	License to be active	0.85 (p<0.000)	0.75
	Parental rules	0.77 (p<0.000)	0.56
	Bullying stops me from being active after school.	0.34 (p=0.13)	-
	I am not active after school because I have no one to play with.	0.75 (p<0.000)	-
	I have brothers/sisters who play actively with me after school.	0.41 (p=0.06)	-
	My friends encourage me to be active after school.	0.33 (p=0.13)	-
	My friends tell me I am doing well at sport.	0.60 (p=0.003)	-
	My parents are too busy to play with me after school.	0.58 (p=0.004)	-
	My parents make me help around the house, which stops me from being active after school.	0.31 (p=0.17)	-
	We have a rule at home that we have to do an organised sport or activity after school.	0.40 (p=0.07)	-
Physical environmental/policy subscale	Weather	0.69 (p<0.000)	0.75
	Access to facilities/equipment	0.80 (p<0.000)	0.69
	Safety	0.75 (p<0.000)	0.63
	Access to space	0.75 (p<0.000)	0.60
	Time commitments	0.66 (p=0.001)	0.61

Questionnaire	Factor	Test-retest	Cronbach alpha
	Financial barriers	0.60 (p=0.003)	0.64
	School bag	0.53 (p=0.01)	0.54
	Dog poo on the lawn at home keeps me from being active on the grass after school.	0.38 (p=0.09)	-
	I have enough time to do an organised sport or activity after school.	0.80 (p<0.000)	-
	It is safe to play actively near where I live after school.	0.70 (p<0.000)	-
	There are not enough traffic lights and crossings in my neighbourhood after school.	0.47 (p=0.03)	-
	There is enough equipment to play actively at home after school.	0.27 (p=0.23)	-

Table 6.23 presents the Cronbach alpha and test-retest reliability coefficients for the LEAP II questionnaire. The online version of the LEAP II questionnaire was found to have acceptable Cronbach alpha ranging from 0.51 – 0.94. Test-retest reliability ranged from poor for the "Physical activity enjoyment" factor (ICC = 0.05) to almost perfect for the "Sport participation" factor (ICC = 0.91). The median test-retest reliability for the LEAP II questionnaire was 0.71.

Table 6.23 Reliability of the online LEAP II questionnaire

Questionnaire	Factor	Test-retest	Cronbach alpha
LEAP II questionnaire (n=17)	Perceived self-efficacy	0.71 (p=0.001)	0.89
	Intentions	0.88 (p<0.000)	0.93
	Specific intentions	0.62 (p=0.008)	0.93
	Attitude	0.67 (p=0.004)	0.54
	Subjective norm	0.52 (p=0.03)	0.68
	Perceived behavioural control	0.71 (p=0.001)	0.88
	Social support	0.47 (p=0.06)	0.69
	Perceived physical environment	0.73 (p=0.001)	0.70
	Access to physical activity programs	0.28 (p=0.28)	0.91
	PE enjoyment (1 item)	0.13 (p=0.63)	-
	Sport participation	0.91 (p<0.000)	0.72
	PE participation	0.80 (p<0.000)	0.88
	Social provisions	0.90 (p<0.000)	0.91
	Goal setting	0.80 (p<0.000)	0.94
	Physical activity enjoyment	0.05 (p=0.85)	0.51
	Self-motivation	0.75 (p=0.001)	0.69

6.2.3 Discussion

This study evaluated the test-retest reliability of the lunchtime and after-school Y-PASS questionnaires and the online version of the LEAP II questionnaire in a sample of South Australian children. Cronbach alpha was also calculated for the online LEAP II questionnaire as there were currently no existing reliability data for some of the predictor factors and an Australian population. The results from the reliability testing were used to further refine the Y-PASS questionnaires, with removal of any predictor factor or item demonstrating poor test-retest reliability (i.e. ICC ranging from 0 to 0.20). Overall, following the removal of items with poor test-retest reliability, the remaining factors and items demonstrated fair to almost

perfect test-retest reliability and were deemed appropriate for use in the predictive utility study.

The lunchtime Y-PASS questionnaire ICCs ranged from 0.33-0.84 for the intrapersonal subscale, 0.57-0.70 for the sociocultural subscale and 0.46-0.79 for the physical environmental/policy subscale. The after-school Y-PASS questionnaire demonstrated a slightly larger range of reliability coefficients for the intrapersonal subscale (ICC = 0.26 - 0.93), sociocultural subscale (ICC = 0.31 – 0.91) and the physical environmental/policy subscale (ICC = 0.27 – 0.80). The LEAP II questionnaire also demonstrated acceptable internal consistency (Cronbach alpha = 0.51 – 0.94) and test-retest reliability (ICC = 0.28 – 0.91), except for "PE enjoyment" (ICC = 0.13) and "Physical activity enjoyment" (ICC = 0.05). These items were not removed from this questionnaire, as it was used as a comparative measure in its original form in the subsequent predictive utility study. A comparison of these LEAP II questionnaire reliabilities with other reliability studies will be discussed below.

The test-retest reliability findings for the Y-PASS questionnaires are consistent with other questionnaires measuring conceptually similar correlates. For example, test-retest reliability for self-efficacy ranged from 0.73-0.84 in the current study, which is similar to the test-retest reliability of a self-efficacy variable used in a questionnaire reported by Pirasteh et al. (2008) (Pearson correlation coefficient = 0.68), Pate et al. (2003) (r = 0.76) and Trost et al. (1997) (r = 0.76 – 0.82). Stevens et al. (1999) reported a lower test-retest reliability value for self-efficacy (r = 0.58). However, this was over a 3-6 week test-retest period, compared to the other studies which ranged between 1-2 weeks. In addition, test-retest reliability of attitude variables in the current study (ICC = 0.73-0.93) were comparable with other studies (Godin & Shephard, 1986; Kerner & Kalinski, 2002). Test-retest reliability of "PE enjoyment" ranged from 0.57-0.66, which is slightly higher compared to a study conducted by McKenzie et al. (2004) (r = 0.54 over a 2-week period).

For the sociocultural subscales of the Y-PASS questionnaires, the test-retest reliability range was much larger compared to other studies. This may be due to a larger number and range of social variables measured by the Y-PASS questionnaires. The individual predictor items

tended to have fair to moderate stability over one week, while the predictor factors (consisting of multiple items) tended to have test-retest reliability coefficients that were moderate to excellent. Pirasteh et al. (2008) only measured friend support and family support factors and found a test-retest reliability of 0.56 and 0.54, respectively, across a 2-week period. Pate et al. (2003), Trost et al. (1997) and Saunders et al. (1997) all measured one social influence factor, which was assessed by multiple items, and reported substantial one-year test-retest reliability in all three studies (r = 0.78). A potential reason for such a range in test-retest reliabilities may be that the individual items measured very specific aspects of the sociocultural construct and may change more dramatically from week to week, such as “My parents are too busy to play with me after school”. Children’s thought processes are very concrete and they tend to relate items to immediate experiences, with limited capacity to integrate experiences over time (Borgers, et al., 2000).

The average test-retest reliability across the lunchtime Y-PASS and after-school Y-PASS physical environmental/policy subscales were 0.61 and 0.62, respectively. This is lower than the test-retest reliability reported by Robertson-Wilson et al. (2007) (r = 0.78) but higher than the school environment variable reported by Wong et al. (2006) (kappa = 0.42) and the physical environment factor reported by Pirasteh et al. (2008) (r = 0.38). This is an unusual finding because physical environmental factors should be relatively stable over time. Indeed, individual environmental factors are more likely to change from week to week (e.g. changes in the weight of school bags and dog poo on the lawn at home), which has been supported by the lower test-retest reliability coefficients of the Y-PASS items. However, it is unlikely that school and neighbourhood environments dramatically change in one week (e.g. facilities at school, school policies, traffic lights and crossings in the neighbourhood). This is not supported by the current findings of this study. For example, the items relating to traffic lights and crossings in the neighbourhood and facilities at school had test-retest reliabilities of 0.47 and 0.46, respectively. Hume et al. (2006) and Erwin (2008) also reported weak stability of similar physical environmental factors. It is important to note that the Y-PASS questionnaire items, as well as the questionnaires used in the studies conducted by Hume et al. (2006) and Erwin (2008), assessed children’s perceptions and while the actual environmental factors may not change, it is children’s perceptions of these factors that may change across a week, resulting in lower test-retest reliability. It has been suggested that

changes in perceptions could be related to children's poor understanding of the items, which can lead to contradictory interpretations and lower test-retest reliability (Erwin, 2008).

The LEAP II questionnaire in this study demonstrated acceptable internal consistency and test-retest reliability, with the exception of the "PE enjoyment" item (ICC = 0.13) and the "Physical activity enjoyment" factor (ICC = 0.05). There was quite a contrast between published findings of test-retest reliability for "PE enjoyment" and this study, with Felton et al. (2002) reporting a value of 0.83. Attitude and subjective norms factors were quite similar between previously reported values and the values calculated in the current study (Felton, et al., 2002). Similarly, Cronbach alpha was comparable for "Subjective norms", "Perceived self-efficacy" and "Perceived physical environment". Reasons for differences with the other variables may be explained by the length between testing periods. Previously reported reliability testing for the LEAP II questionnaire has been based on a one-year testing period, whereas this current study assessed the stability of the factors across one week. While long term stability is interesting, it is important to note that it cannot necessarily be considered test-retest reliability and caution should be taken when interpreting the comparisons. The one-year stability testing is really measuring changes in the individual and their circumstances (e.g. physical activity patterns with age and year level), as well as the actual stability of the questionnaire. In addition, previous LEAP II reliability studies have only been conducted with adolescents. The difference in age-related cognitive and literacy development between the participants in the LEAP II studies and participants in the current study may explain the weaker reliability coefficients obtained in the current study. Therefore, caution should be taken when comparing the findings from this current study to previously published results. Further research in assessing the test-retest reliability of the LEAP II questionnaire is needed so that appropriate comparisons can be made between studies.

While the majority of predictor items and factors demonstrated fair to excellent test-retest reliability over a one-week period, there were a few exceptions. Lower test-retest reliability coefficients indicate that there were more responses to a particular item or factor that did not match between time 1 and time 2, potentially resulting in high response error. Reasons

for poor stability of some items and factors in questionnaires over time may be explained by a number of influences. Difference in responses over time may reflect true changes in an individual's behaviour or subjective responses, such as opinions and feelings, which may vary substantially from week to week (Portney & Watkins, 2000; Wong, et al., 2006). These are perhaps affected by the experiences on the day of data collection. For example, the item "Bullying stops me from being active after school" may have been important for a participant during one week but not the other, or the participant's perception of the item "My friends encourage me to be active after school" may have been influenced by the presence of peers during after-school playtime. It has also been suggested that characteristics of the sample, maturity level, changes in respondent's emotional state, differences in the testing situation, recollection of previous answers, and difficulty with understanding items and the construct being tested can all affect how participants respond to items on two different occasions (Pett, et al., 2003). While some of these factors cannot be controlled, such as the characteristics of the sample and maturity level, a number of strategies were implemented during the data collection procedures to minimise the impact of these factors on the final results.

To manage issues with the interpretation of some items, research assistants were available to clarify any items that the participant did not understand. However, it is likely that some participants did not feel comfortable asking for assistance. Interestingly, one Item that continuously needed clarification was "Our school has areas that suit the games I want to play at lunchtime", and this item was found to have poor test-retest reliability and hence removed from the questionnaire. An attempt was made to keep each testing administration as consistent as possible by using the same computers, having the same research assistants available and administering the questionnaires at the same time of day. To avoid recollection of previous answers, the test-retest period was set at one-week, which is a common timeframe for assessing reliability of physical activity correlate questionnaires.

6.3 Summary of Chapters 5 and 6: questionnaire development

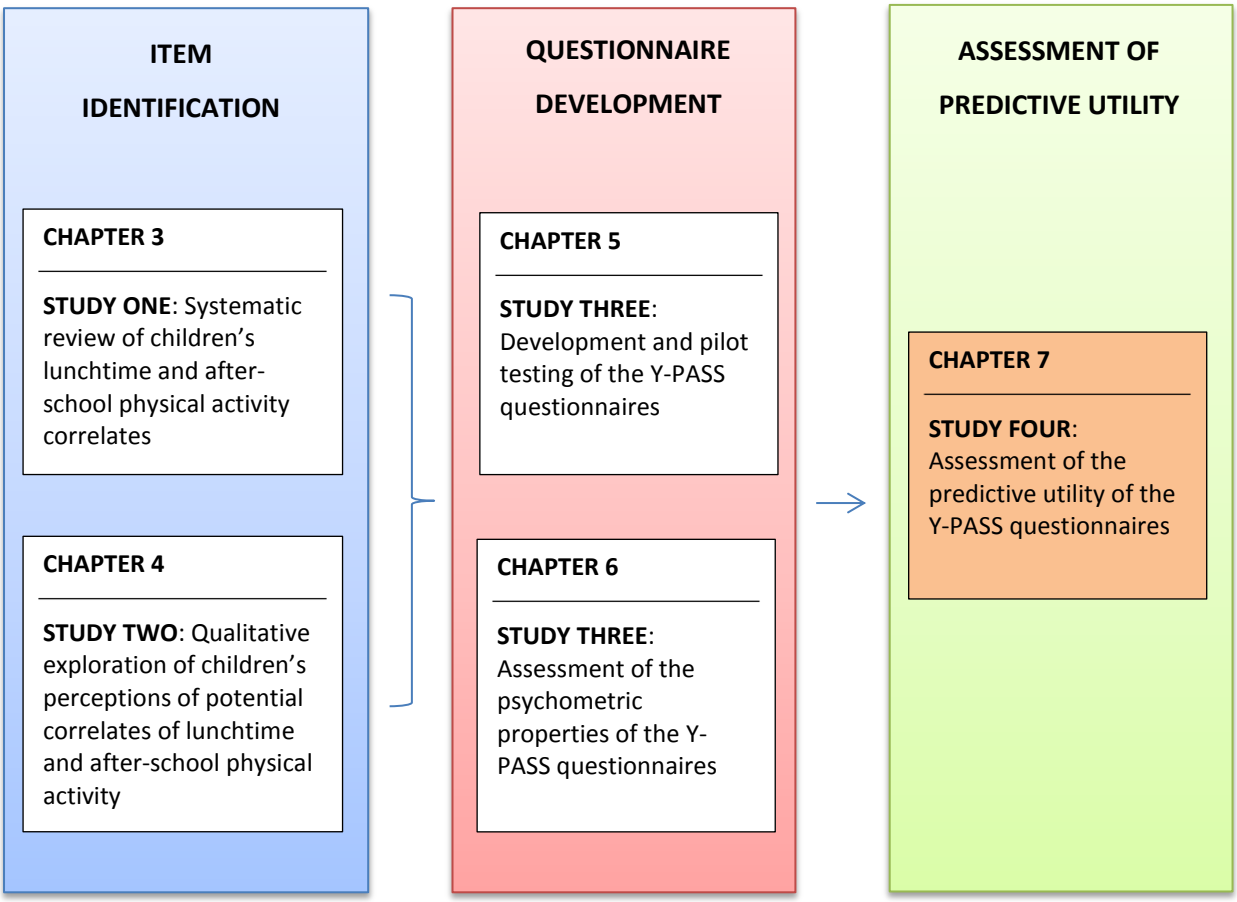
Surveying children does pose distinctive methodological problems. Only when we direct our questions to children themselves will we be able to truly understand their world. As a result, children should be taken seriously and methodological effort should be aimed at improving data quality. When surveying children, special attention should be paid to questionnaire construction and questionnaires should be thoroughly pretested (Borgers, et al., 2000). Chapters 5 and 6 have described in detail the steps taken in the development of the "Youth Physical Activity Survey for Specific Settings" (Y-PASS) to ensure appropriateness of the content, design and usability for use with children.

The lunchtime and after-school Y-PASS questionnaires, each containing three subscales relating to the social ecological model, were developed through focus groups with children aged 10-14 years and a review of the current correlate literature. Items were selected based on contextual relevance to the lunchtime and after-school periods. Face and content validity of the questionnaires were established through an evaluation of the item content by a panel of physical activity and questionnaire development experts. Face validity, including the design, content and usability aspects of the questionnaires, were refined and confirmed through a series of pilot tests with a subsample of the targeted population. Factorial structure and internal consistency of the Y-PASS questionnaires were explored through an exploratory factor analysis. Based on the thorough testing described in these chapters, the fourth draft of the lunchtime and after-school Y-PASS questionnaires was considered to be user friendly, with appropriate validity (face and content validity), internal consistency and test-retest reliability, and suitable for collecting cross-sectional data with a larger sample in Study Four (refer to Appendix 11 for the fourth draft of the lunchtime and after-school Y-PASS questionnaires).

The next chapter will explore the effectiveness of the context-specific correlate questionnaires versus a generic correlate questionnaire in predicting context-specific physical activity and describe in detail the predictors of children's lunchtime and after-school physical activity.

CHAPTER 7

Study Four: Assessment of the predictive utility of the Y-PASS questionnaires



Chapter 7

7 Assessment of the predictive utility of the Y-PASS questionnaires

Research aim:

1. To compare the effectiveness of context-specific questionnaires against a generic correlate questionnaire in predicting children's lunchtime and after-school physical activity.
2. To identify the intrapersonal, sociocultural and physical environmental/policy predictors of children's lunchtime and after-school physical activity.

7.1 Introduction

To advance research on the promotion of children's physical activity, it is important to identify the primary correlates that influence physical activity behaviour. Many studies have focused on understanding children's overall or habitual physical activity or specific intensity of activity (such as MVPA) in order to gain a general understanding of why some children are more active than others (Sallis, Prochaska, et al., 2000). Investigating the activity patterns across the day and within different contexts may help to better explain daily activity patterns and may provide important clues about the influence of different contexts on physical activity (Giles-Corti, et al., 2005).

Limited research has been conducted on physical activity occurring in different locations and at different times of the day. There is some evidence in the international literature of correlates of specific behaviours, such as active transport, organised sports and leisure activity (Ommundsen, et al., 2006; Spink, et al., 2006; Wiehe et al., 2008). However, these tend to be researched in isolation with limited or no consideration for the context of the

behaviour (i.e. when and where the behaviour is performed) (Hohepa, 2008). Activity behaviours differ according to the time of day or the environment in which the activity takes place (Mota, et al., 2003; Ommundsen, et al., 2006). For example, leisure activity may differ in the school context compared to the home context. By exploring these types of behaviours without considering context, we may be potentially adding to the already confusing picture of children's physical activity. Taking a context-specific approach with a time of day focus enables the exploration of correlates of a specific behaviour in a specific context, thus providing a much clearer understanding of the influences of children's physical activity behaviour.

As discussed previously (section 2.5 and 2.6), the school, home and neighbourhood contexts offer opportunities for children to be active, with a significant portion of time available for children to engage in leisure activity away from compulsory school curriculum time (Wiehe, et al., 2008). It has recently been suggested by the Robert Wood Johnson Foundation (2007) that the aggregation of school break times provides the single biggest opportunity to impact on children's physical activity levels. Furthermore, given that the physical activity guidelines state that children should accumulate 60 minutes of MVPA each day, the after-school period alone provides an opportunity for children to obtain all of their recommended daily activity. However, it is important to note that with opportunity for activity also comes opportunity for sedentary behaviours. There is concern that children are not maximising these opportunities to be active and are therefore at greater risk of poorer health outcomes. Children who engage in multiple physical activity behaviours across different contexts (such as school, home and neighbourhood contexts) typically achieve higher levels of activity, often reaching or exceeding recommended levels of activity (Giles-Corti & Donovan, 2003). Therefore, it is important to explore the biological, intrapersonal, sociocultural and physical environmental/policy influences on children's decisions to be active.

As highlighted in the introduction chapter, questionnaires can be assessed on a spectrum of specificity, from generic (i.e. no reference to a time, place or behaviour) to context-specific (i.e. reference to one or more aspects of time, place and behaviour). It is important that questionnaires contain items for correlates that are consistently found to be associated with

or are considered to be important to context-specific physical activity under investigation (Masse, et al., 2002). Due to the paucity of evidence of correlates of lunchtime and after-school physical activity, as shown by the systematic review (see Chapter 3), clear meaningful conclusions cannot been drawn on the influences of children's physical activity occurring during the lunchtime and after-school periods. Research of context-specific physical activity is hampered by the use of correlate measurement tools with poor or no reported psychometric properties, the use of measurement tools that contain generically worded items, such as "I enjoy being active", or measurement tools that assess correlates that are not specific or relevant to context-specific physical activity under investigation (e.g. behaviour-specific, time-specific or location-specific physical activity).

To advance work in this area, there was a need to develop a correlate measurement tool specifically geared towards the lunchtime and after-school contexts. The "Youth Physical Activity Survey for Specific Settings" (Y-PASS) correlate measurement tools developed specifically for this study differed from existing tools in three ways:

- The Y-PASS questionnaires focused on two time-specific physical activity contexts (i.e. physical activity occurring during the lunchtime period and the after-school period)
- The items in the Y-PASS questionnaires were context-specific (i.e. made reference to the specific context, for example "I like to walk around at lunchtime" and "I have enough time to do an organised sport or activity after school")
- Children's perceptions, captured from talking directly to children in a previous chapter, were used in conjunction with existing evidence to develop the Y-PASS questionnaires.

Chapter 4 reported children's perceptions of the important correlates of their lunchtime and after-school physical activity behaviours. Along with evidence from the current literature (Chapter 3), these potential correlates were incorporated into the Y-PASS correlate questionnaires that not only address time-specific behaviours (such as after-school active transport, organised sports and activities, non-organised activities and lunchtime play), but also the location (such as school, neighbourhood, home). Chapter 5 described the development of these questionnaires, along with content and face validity. Additional

psychometric testing, including the factorial structure, internal consistency of the factors, and the test-retest reliability of the questionnaires, were reported in Chapter 6 in readiness for use in this current study. This study contributed to the pool of evidence that already exists in the international literature by evaluating the utility of the Y-PASS questionnaires in predicting children's lunchtime and after-school physical activity and comparing the Y-PASS questionnaires to a commonly used generic correlate questionnaire, the LEAP II questionnaire.

7.2 Study aims and design

There were two main aims to this study:

1. To compare the effectiveness of the context-specific Y-PASS questionnaires against the generic LEAP II questionnaire in predicting children's lunchtime and after-school physical activity.
2. To identify the intrapersonal, sociocultural and physical environmental/policy predictors of children's lunchtime and after-school physical activity.

A cross-sectional, correlational study design was used. This type of research design is an efficient way of screening potential correlates that might influence context-specific physical activity behaviour (Sallis, Owen, et al., 2000).

Ethical approval for the study was obtained from the University of South Australia Human Research Ethics Committee, Department of Education and Children Services (DECS), the South Australian Commission for Catholic Schools (SACCS) and from the relevant school authorities (see Appendix 2).

7.3 Methods

7.3.1 Participants and sampling

A list of South Australian schools was stratified and divided into bands according to the 'School Card Register' (SCR) (0-19, 20-39, 40-59 and 60-100%). Remote and special schools

were removed from the list due to low enrolment rates, differences in predictors of physical activity associated with disability, and limited ability to self-report. A random sampling method (Portney & Watkins, 2000) was used to select four schools from each SCR band for inclusion into the study. This method was chosen to ensure that a representative sample was identified from different socio-economic areas. A person, independent to the study, randomly sampled the schools. There was no replacement of schools that did not consent to being involved due to the target sample size being reached.

A recruitment letter was sent to school principals in March 2011, and followed up with a phone call. School principals who gave consent were asked to identify potential classes that could be invited to participate. Purposive sampling was then used to recruit children in Grades 5, 6 and 7, who were aged between 10 and 14 years (i.e. all children in the identified classes were invited to take part in the study) (Portney & Watkins, 2000). At least two weeks before commencing the study, the principal administrator (RMS) visited the schools and discussed the project with the identified classes. Packages containing an information sheet and consent form were sent home to parents of potential participants (see Appendix 14). Children who wanted to take part and had parental consent were asked to return the consent form directly to the teacher. These were collected on the first day of data collection. In accordance with ethics approval, any child who returned a consent form, regardless of consent status, was given a stress ball gift.

7.3.1.1 Power analysis

Published regression models tend to explain approximately 15% of the total explained variance in physical activity (Ommundsen, et al., 2006). Therefore, the required sample size for this study was calculated to enable statistical power to explain at least 15%. To detect 15% of the variance with a power of 0.8 and a significance level of 0.05 for a maximum of 46 potential predictors, a sample size of 228 was required. To allow for incomplete data, it has been recommended an additional 10% be sampled (Lewis, 2006), which increased the target sample size to 251.

7.3.2 Instruments

7.3.2.1 Generic correlate questionnaire: LEAP II questionnaire

The LEAP II questionnaire was used as the generic correlate questionnaire (see Appendix 13). This is a commonly used correlate questionnaire in the literature. To control for delivery mode across all correlate measurement tools, the LEAP II questionnaire was delivered as an electronic questionnaire. As demonstrated in Chapter 6, the LEAP II questionnaire has acceptable internal consistency (Cronbach alpha = 0.51 – 0.94), but mixed test-retest reliability (ICC = 0.05 – 0.91). The correlates with poor test-retest reliability were "Access to physical activity programs" (ICC = 0.28), "PE enjoyment" (ICC = 0.13) and "Physical activity enjoyment" (ICC = 0.05). These items were not removed because the predictive utility of the questionnaire in its original form needed to be tested. See Chapter 6 for a full description of the correlates measured in this survey.

7.3.2.2 Context-specific correlate questionnaires: lunchtime Y-PASS and after-school Y-PASS questionnaires

The Y-PASS questionnaires measure specific correlates of lunchtime and after-school physical activity, which were informed by children's perceptions and the extant literature (see Appendix 11). The lunchtime questionnaire contains 44 items and the after-school questionnaire contains 100 items that address different components of the social ecological model. These are aggregated into three subscales (i.e. intrapersonal, sociocultural and physical environmental/policy). Each item in the questionnaire is measured on a 5-point Likert scale, with 1 = Disagree a lot, 2 = Disagree a little, 3 = Neither disagree nor agree, 4 = Agree a little, and 5 = Agree a lot. The Y-PASS questionnaires are scored using an average factor-base score for each factor and response score for each individual predictor item. For specific details of reliabilities, refer to Chapter 6.

7.3.2.2.1 Lunchtime Y-PASS questionnaire

The intrapersonal subscale of the lunchtime questionnaire measures "Barrier self-efficacy" (e.g. confidence to overcome barriers) (seven items), "Perceived self-efficacy" (e.g. perceived competence) (six items) and "Behavioural attitude/belief" (five items). An

additional six individual predictor items are also included in the intrapersonal subscale. The Cronbach alpha of this subscale ranges from 0.78-0.80, with a test-retest reliability of 0.33-0.84. Items with low reliabilities were “I really like doing PE at school” (ICC = 0.33) and “I like to walk around at lunchtime” (ICC = 0.39).

The sociocultural subscale contains three factors: “Peer influence” (three items); “Teacher influence” (two items); and “Social barriers” (three items). The reliability for this subscale ranges from 0.32-0.64 for Cronbach alpha and 0.57-0.70 for test-retest reliability. The item with a low internal consistency was “Social barriers” (Cronbach alpha = 0.32). The inter-item correlation for this factor (0.15) was within the acceptable range of 0.10 to 0.50 (Nunnally, 1978).

The physical environmental/policy subscale measures “Access to facilities/equipment” (three items), “Physical environmental/policy barriers” (three items) and “Access to space” (three items). Three individual predictor items are also included in this subscale, relating to school policy, provision of facilities and painted markings. Cronbach alpha for this subscale ranges from 0.50-0.61 with a test-retest reliability of 0.46-0.75.

7.3.2.2.2 After-school Y-PASS questionnaire

The after-school intrapersonal subscale contains six factors: “Behavioural attitudes/beliefs about organised sports and activities” (seven items), “Behavioural attitudes/beliefs about non-organised sports and activities” (six items), “Barrier self-efficacy” (six items), “Support seeking/social norm” (three items), “Perceived competence” (two items), and “Perceived barriers” (three items). An additional 17 predictor items that did not load onto a factor in the factor analysis were also included in the intrapersonal subscale. Internal consistency of the intrapersonal subscale is 0.43-0.82, with a test-retest reliability of 0.26-0.93. The items with the lowest test-retest reliabilities included “I don’t participate in some activities after school because it is only a boys’/girls’ activity” (ICC = 0.26) and “I ride, walk, skate or scooter to and from places after school because it gets you fit” (ICC = 0.37). “Perceived barriers” had the lowest internal consistency (Cronbach alpha = 0.43).

The sociocultural subscale contains the factors: “Social support” (seven items), “Parental barriers” (four items), “License to be active” (four items), and “Parental rules” (two items). Eight individual predictor items are also in the sociocultural subscale measuring components such as bullying, sibling/family influence and peer influence. Cronbach alpha for this subscale ranges from 0.56-0.78 and a test-retest reliability of 0.31-0.91. Items with fair test-retest reliability were “My parents make me help around the house, which stops me from being active after school” (ICC = 0.31), “My friends encourage me to be active after school” (ICC = 0.33) and “Bullying stops me from being active after school” (ICC = 0.34).

The physical environmental/policy subscale contains seven factors: “Weather” (six items), “Access to facilities and equipment” (seven items), “Safety” (four items), “Access to space” (three items), “Time commitments” (two items), “Financial barriers” (three items), and “School bag” (two items). An additional five predictor items are included in this subscale. This subscale has acceptable reliability (Cronbach alpha = 0.54-0.75; ICC = 0.27-0.80). The items with the lowest test-retest reliability were “There is enough equipment to play actively at home after school” (ICC = 0.27) and “Dog poo on the lawn at home keeps me from being active on the grass after school” (ICC = 0.38).

7.3.2.3 Objective physical activity measurement

Lunchtime and after-school physical activity was objectively measured with the ActiGraph GT3X and GT3X+ accelerometers (ActiGraph, LLC; Fort Walton Beach, FL). ActiGraph accelerometers are small lightweight (GT3X: 3.8 x 3.7 x 1.8 cm, 27 g; GT3X+: 4.6 x 3.3 x 1.5 cm, 19 g) devices designed to detect normal human movement and activities in a free-living environment. A piezoelectric beam inside the monitor detects body acceleration and directional movement. The generated electric charge is filtered and converted to a count value over a user-specified cycle period, known as an epoch (Trost, McIver, & Pate, 2005). The GT3X and GT3X+ models measure human movement on three axes. The vertical axis data can be analysed separately and is most commonly used in children’s physical activity research. A recent unpublished study confirmed that the vertical axis output was

comparable across the GT3X and GT3X+ models (personal communication with Stewart Trost 17/06/2011).

The ActiGraph accelerometers are the most widely used motion sensors in studies involving children and adolescents (Trost, et al., 2005) and have become the preferred choice of objective method for measuring free-living activity in children and adolescents (Troiano, 2005; Trost, 2001). Due to the unique time-sampling capabilities, accelerometers are particularly useful in determining time-specific physical activity (Rowlands, 2007). The majority of previous studies using accelerometers with youth have commonly set monitors to average data over a 1-minute epoch (Trost, et al., 2005). However, due to the sporadic, intermittent nature of children's activity, particularly in activities of higher intensity (Bailey et al., 1995; Trost, 2001; Welk, et al., 2000), researchers have acknowledged that a 1-minute epoch may misclassify and underestimate children's physical activity behaviour and are now recommending the use of shorter epoch lengths, such as 15 seconds (Nilsson, et al., 2002; Trost, et al., 2005). For this study, the epoch length was set at 15 seconds. A 5 day data collection protocol was also used. Justification for this protocol is discussed below. The GT3X and GT3X+ models are the newest versions of the ActiGraph accelerometers and there are currently few published reliability and validity data for children. However, the GT3X has recently been validated against oxygen consumption in children and found to be comparable to an earlier model (i.e. GT1M) for classification of time spent in intensity categories (Hanggi, Phillips, & Rowlands, 2012). The Actigraph GT1M model has also been shown to have acceptable validity for quantifying physical activity in children and adolescents (Phillips, Parfitt, & Rowlands, 2012; Trost, Loprinzi, Moore, & Pfeiffer, 2011).

7.3.2.3.1 Protocol for the number of days to be measured

The number of days to reliably capture habitual physical activity in children is typically set at about five days, including at least one weekend day (Esliger, Copeland, Barnes, & Tremblay, 2005; Rowlands, 2007). However, due to the specific purpose of this study in identifying predictors of lunchtime and after-school physical activity, the number of days required to capture typical lunchtime and after-school behaviour was calculated. In addition, the number of days required to capture typical weekday MVPA was also calculated so that a

description of the participants' daily physical activity profile can be identified in the predictive study. The minimum number of days of accelerometer data required for this was determined using pilot accelerometer data collected by the current PhD candidate (RMS) prior to the predictive study and will be described below.

Accelerometer data were collected from South Australian children in 2006. South Australian children (n = 152, 72 boys and 80 girls; mean age = 12.1 +/- 0.7 years) were asked to wear the 7164 model accelerometers for seven consecutive days. Children with five valid school days were retained for the analysis, resulting in a sample of seventy children (42 boys and 28 girls; mean age = 13.0 +/- 0.97 years). Post-hoc analyses indicate this sample size is appropriate to estimate the required number of valid days to reliably assess typical context-specific physical activity. For boys, the confidence limits were 0.84-0.94 for lunchtime and 0.78-0.92 for after-school. The confidence limits for girls were 0.82-0.95 for lunchtime and 0.76-0.93 for after-school. A valid day was defined as containing ten hours of 'wear time' (Masse et al., 2005). 'Non-wear time' was defined as 20-minute epochs of consecutive zeros (Esliger, et al., 2005). Freedson cut-points, converted to counts per 15 seconds, were used to classify MVPA (Freedson, Pober, & Janz, 2005; Freedson et al., 1997). To determine the minimum number of days of monitoring required to accurately reflect typical weekday physical activity, intraclass correlations (ICC) and the mean absolute difference (MAD) were calculated between one to four day subset averages and the five school weekday averages for total day MVPA, lunchtime MVPA and after-school MVPA. The specific times for lunchtime play and end of school were collected from school personnel. After school was defined as the time from the end of school until 6:00 pm. ICCs were used to determine the number of days required to achieve precision of 80%. This approach is used to reduce the random error that enters into the data (e.g. days with sport practices and days without, and days with school activities, such as PE lessons, and days without) so that the 'true mean' of physical activity can be understood (Ridley, Olds, Hands, Larkin, & Parker, 2009). According to the pilot data, at least two days of valid data are required for both boys and girls to reliably predict typical lunchtime MVPA (ICC = 0.90, SD = 0.02 boys; ICC = 0.90, SD = 0.03 girls) and total day MVPA (ICC = 0.84, SD = 0.02 boys; ICC = 0.86, SD = 0.03 girls). These findings are slightly different from a U.K. study in that only 1 day of monitoring was found to be representative of typical MVPA during school break time (Ridgers, Stratton, Clark,

Fairclough, & Richardson, 2006). For after-school MVPA, both boys and girls need a minimum of three days of valid accelerometer data (ICC = 0.86, SD = 0.02 boys; ICC = 0.89, SD = 0.03 girls). These data highlight that lunchtime behaviour is more consistent compared to after-school behaviour and therefore, require fewer days to capture typical lunchtime behaviour. To ensure that at least two days of valid lunchtime and three days of valid after-school data were captured in the current study, children were asked to wear the accelerometer for five days.

7.3.2.4 Anthropometry measures

Height and weight of the participants were measured by a same-sex researcher using protocols of the International Society for the Advancement of Kinanthropometry (ISAK) (Marfell-Jones, Olds, Stewart, & Carter, 2006). Specific measurement guidelines identified by the South Australian Department of Education for Children's Services were also observed to preserve the privacy and well-being of participants (i.e. the measurer must be the same sex as the participant, a teacher or school staff member must be present, and the space where the measurement occurs must not be visible to other participants).

Prior to measurement, participants were asked to remove their shoes and remain in light indoor clothing. An Invicta Height Measure stadiometer (Invicta Plastics Ltd, Leicester, U.K.) was used to measure height to the nearest 1 mm. Participants were asked to stand upright, with arms hanging by their sides, feet together and heels, buttocks and upper part of the back touching the upright scale. The head was placed in the Frankfort plane (i.e. the notch above the ear canal to the lower border of the orbit of the eye is parallel to the floor and perpendicular to the vertical backboard) (Marfell-Jones, et al., 2006). Participants were instructed to take and hold a deep breath while the measurement was taken. Weight was measured to the nearest 0.1 kg using Tanita HD332 portable electronic scales (Tanita Corp, Japan). All equipment was calibrated before use. The measurements were used to calculate body mass index (BMI). Each participant was categorised as thin, normal weight, overweight or obese according to the definitions developed by Cole et al. (2000; 2007). BMI z-scores were calculated using the U.S. Centre for Disease Control and Prevention reference

standards (Centers for Disease Control and Prevention, 2010), and used in subsequent analyses.

7.3.2.5 Demographic measures

Each questionnaire used in this study contained eight items addressing demographic characteristics, including name of school, year level, sex, date of birth, country of birth, Aboriginal or Torres Strait Islander status, suburb and postcode of residence. These items were based on the demographic questions used in the New South Wales Schools Physical Activity and Nutrition Survey (SPANS) study (Booth, et al., 2006). Children's age was defined as their decimal age, using their date of birth and the day of data collection. Residential postcodes were used to determine the SEIFA (Socio-Economic Index for Areas) score, an index developed by the Australian Bureau of Statistics (ABS) to identify SES levels (Australian Bureau of Statistics, 2006). The nation-wide average SEIFA score is 1000, with a standard deviation of 100 (Australian Bureau of Statistics, 2006).

7.3.2.6 Activity checklist

Activity checklists of 20 lunchtime activities and 30 after-school activities were included in the corresponding Y-PASS questionnaires to provide an activity profile of the participants in this study (Stanley, et al., 2011). While these data do not contribute directly to the aims of the research, it was included in the methodology to provide contextual meaning to the correlates identified during the specific time periods. Participants were asked to identify the main activities they engage in during the specific time period (i.e. lunchtime or after school) and how often they do those activities in a usual week. Frequency responses included "1 day a week", "2-3 days a week" and "4-5 days a week". If the activity was not on the list, space was provided for participants to identify these activities.

7.3.3 Data collection procedure

Data collection occurred during Terms 1 and 2 of the 2011 school year and was carried out by the principal administrator (RMS) and research assistants. Data collection occurred on a Monday, Wednesday and Friday during one week to spread out and ease the administration burden.

One questionnaire was administered on the Monday morning prior to recess during school hours. The accelerometers were also handed out to the children during this session and they were instructed on how to wear them and how to fill in the logsheets (the detailed protocol is discussed below) (see Appendix 15). Teachers were given posters containing a 'Remember to wear your activity monitor' reminder message to place around the classroom. On the Wednesday, the children completed another questionnaire during school hours and height and weight was measured. The principal administrator and assistant returned on the Friday when the children completed the final questionnaire. Accelerometers were collected from the children after their lunchtime on the Friday and downloaded to a computer for further analysis. Questionnaire administration was randomised to control for the effects of the order in which the tools were administered. For example, children may be more aware of physical activity after wearing an accelerometer for a number of days, which may inflate their reporting of physical activity factors on the Friday.

The following protocol was used to administer each questionnaire:

- Questionnaires were administered to each participant on a school computer in the school's computer lab.
- Each participant was given a card with a unique identification code and space to write their name. This enabled the matching of multiple data sources.
- A page containing definition of terms was handed out to each participant prior to starting the questionnaire.
- The principal administrator and the assistant loaded the questionnaires onto the school computers by entering the questionnaire hyperlink.
- Once the web page containing the questionnaires was uploaded onto the computer, participants were instructed to enter their unique identification code in the space

provided on the first web page and then click the “next” button located at the bottom of the page.

- The principal administrator read out a standardised script, guiding the participants through the initial pages of the questionnaires (see Appendix 12).
- The principal administrator and assistant were available to clarify any questions or assist participants who were having difficulties.

The following protocol was used to set up and distribute the accelerometers:

- Accelerometers were initialised using ActiLife (Version 5.4) software (ActiGraph, Pensacola, FL) following the manufacturer’s specifications (ActiGraph, 2011).
- Before initialising, the devices were fully charged by connecting the device to a standard USB port. The start date was set for the day when the devices were handed out to the children, starting at 8.30 am. A stop time was not selected.
- Epoch length was set at 15 seconds. For the GT3X+ models, the sampling rate was set at 30 Hz so that data could be compared to the GT3X model (personal communication with Stewart Trost 17/06/2011).
- Participants were fitted with an accelerometer, which was placed on an elastic belt and secured around the waist over the right hip. Each accelerometer had a sticker to mark the top of the device and children were instructed to be aware that the accelerometer should be placed with the sticker on top.
- Participants had the option to wear the accelerometer over or under clothing.
- Each participant was provided with an information sheet detailing how to wear the accelerometer and a logsheet where they could document the time they removed the accelerometer and put it back on, as well as the reason for removing the accelerometer (see Appendix 15).
- Participants were asked to wear the accelerometer for the five school days and were encouraged to wear them while sleeping. This was to increase wear compliance only and to ensure children met the criteria of at least two valid lunchtime periods and three valid after-school periods.

7.3.4 Data reduction and cleaning

7.3.4.1 Accelerometer data cleaning and reduction

The protocols for accelerometer data reduction and cleaning vary considerably across studies with no consensus on the most appropriate method (Esliger, et al., 2005; Rowlands, 2007). Periods of non-wear time, which is operationalised as consecutive zero counts, fluctuate from bouts of 10 minutes (Trost, Rosenkranz, & Dzewaltowski, 2008), 30 minutes (Sirard, Kubik, Fulkerson, & Arcan, 2008) and 60 minutes of consecutive zeros (Pfeiffer, Dowda, McIver, & Pate, 2009). Esliger et al. (2005) conducted a study on 115 children aged 8 – 13 years and assessed the mean length of the longest bout of motionless data. They found that the average length of the longest bout of motionless data was 17.5 minutes (± 1.54 minutes), suggesting that data containing 20 or more consecutive minutes of zeros should be excluded as this is deemed biologically implausible. In terms of the upper limit of accelerometer counts per minute, which is biologically plausible, Esliger et al. (2005) suggest that counts per minute equal to or greater than 15,000 should be flagged as 'unusual' and beyond human capacity. This measure was based on data from 94 children aged 8 – 13 years, in which the mean maximum count value was found to be 11,555 ± 1148 counts per minute, proposing that anything greater than 15,000 counts per minutes is most likely impossible to obtain for this age group.

For this study, accelerometer data cleaning and reduction were conducted using a customised software program developed by Deakin University, Melbourne, Australia. Only school weekday data on the vertical axis were examined. The lunchtime period was defined as minutes in school-defined playtime occurring during the main break (typically during the middle of the day), and did not include the time designated for eating. The after-school period was defined as the time from end of school until 6.00 pm. The school times for each school (i.e. the start of school, the start and end of eating time for the lunchtime period, the start and end of playtime for the lunch period, and the end of school as signalled by the school bell) were collected from school personnel on the first day of data collection and the required time periods were entered into the software program in order to extract the accelerometer data specific to these time periods for each individual participant. Missing accelerometer data were not imputed from the logsheet data based on the findings from a

review by Esliger et al. (2005), who concluded that the duration of non-wear time obtained by diaries is ambiguous in the majority of cases. Using diary data to impute missing accelerometer data also compromises the objectivity of this measurement technique. As the accelerometers were collected from the children after lunchtime on the Friday, data recorded after the designated lunchtime on the final day were discarded.

Based on the recommendations from studies using accelerometry described above, the accelerometer data for this study were screened for non-wear time using the 20 minutes of consecutive zero criterion and setting the acceptable upper limit of 15,000 counts per minute. For lunchtime and after-school periods to be considered valid, children were required to produce counts for at least 50% of a lunchtime period and after-school period (Ridgers, Timperio, Crawford, & Salmon, 2012). Children were required to have at least two days of valid lunchtime data and three days of valid after-school data to reliably capture typical lunchtime and after-school MVPA. For a valid school week, children were required to have at least two whole days with a minimum of ten hours of wear time to reliably capture daily total MVPA.

For datasets that met the validation criteria, the accelerometer activity counts were summarised into an intuitively meaningful outcome of percentage of time in MVPA, which was calculated as time spent in MVPA divided by the monitored wear time during the lunchtime or after-school periods and multiplied by 100, and averaged over valid days. Based on a recent study simultaneously comparing cut-points for identifying physical activity intensities (Trost, et al., 2011), the age-specific Freedson cut-points were used to classify MVPA, using a 4 MET definition (Freedson, et al., 2005). This cut-point classification exhibited significantly better classification accuracy for MVPA compared to Puyau, Treuth and Mattocks' cut-points (Trost, et al., 2011) and is commonly used in other accelerometry studies with children (Chung, Skinner, Steiner, & Perrin, 2012; Trost, et al., 2008; Wickel & Eisenmann, 2007). It is acknowledged that use of user-derived cut-points adds a layer of error to the data but this was considered the most appropriate approach to produce a more meaningful physical activity outcome.

The age-specific MVPA cut-points used in this study were as follows:

- Age 10 = 1910 counts per minute
- Age 11 = 2059 counts per minute
- Age 12 = 2220 counts per minute
- Age 13 = 2393 counts per minute.

A number of other accelerometer outcomes were calculated in order to describe the activity patterns of this sample. These included the average accelerometer wear time per valid day (i.e. to check wear time compliance) and the minutes children engaged in MVPA during lunchtime and after-school periods per valid day. Reporting the minutes in MVPA enables the findings to be explored in relation to public health recommendations for physical activity in children (Reilly et al., 2008). The relative contribution of lunchtime and after-school physical activity to the physical activity daily recommendations and daily weekday MVPA was also calculated as a proportion using average time in lunchtime or after-school MVPA for valid days, as a percentage of total time in MVPA during school days.

7.3.4.2 Activity checklist data reduction

Responses to the activity checklists were initially checked for missing responses or duplication of activities in the same time period. Duplicate activities and any activity that had a missing activity or frequency response were deleted. Total frequency of activity participation was calculated as the number of children reporting the activity multiplied by how often they engaged in the activity. The activity list was then ranked according to total frequency.

7.3.4.3 Imputation of missing questionnaire data

Despite attempts to minimise item non-response through the use of an online format and setting a "response required" rule during the design of the online questionnaires, there were still missing responses across all questionnaires. The extent and pattern of item non-responses are important considerations when deciding if data imputation is appropriate because this can impact on the validity of research findings (Fox-Wasylyshyn & El-Masri, 2005). The lunchtime questionnaire had one missing response from one participant, the

after-school questionnaire had four missing responses from three participants and the LEAP II questionnaire contained the highest number of missing responses (702 missing responses from 107 participants from a total of 75,075 responses), equating to less than 1% of all responses. The missing responses were at random with no general pattern across the responses. Reasons for missing data were unknown but it may have been due to software glitches in the Survey Gizmo system (Widgix, 2005-2010).

The literature provides a range of guidelines for what constitutes 'extensive missingness', for which data imputation is not appropriate. Cohen and Cohen (1983) report that data imputation should not be applied to variables that contain greater than 10% missing data, while Raymond and Roberts (1987) recommend higher estimates of 40% of missing data on a specific item. Prior to data imputation, the responses in this study were scanned to identify any item with less than 25% incomplete responses per item. No items were excluded from data imputation. 'Hot deck' imputation was conducted on items with incomplete responses – a commonly used procedure which assigns a value for a missing item based on the responses from comparable respondents in the sample (i.e. respondents reflecting similar demographic and response characteristics) (Andridge & Little, 2010; Fox-Wasylyshyn & El-Masri, 2005). The hot deck method has been found to be the most accurate data imputation technique, according to one study comparing six different data imputation techniques (Hawthorne & Elliott, 2005).

7.3.4.4 Questionnaire scoring

Specific details on how to score the Y-PASS and LEAP II questionnaires have been described in Chapters 5 and 6. In summary, negatively worded items were reversed coded (see Table 6.20 and Table 6.21 for the items that needed to be reverse coded). Scores were derived for each factor by summing the responses across the items that represent the factor and then calculating the average (Pett, et al., 2003). For individual predictor items, the score was the response score provided by the participant.

7.3.5 Data analysis

The Statistical Package for the Social Sciences (SPSS) Version 19.0 (SPSS, Chicago, IL) and XLSTAT (Addinsoft SARL, Germany) were used to conduct analyses. Demographic, accelerometer and activity checklist data were initially analysed using descriptive statistics (means, standard deviations and frequencies). As schools had different lunchtime lengths and end of school times, the percentage of lunchtime and after-school MVPA (% MVPA) was used as the dependent variable, rather than minutes of lunchtime and after-school MVPA to standardise across all schools. It has been suggested that physical activity behaviours may be sex-specific, (Jago, et al., 2005) therefore, analyses were conducted for boys and girls separately.

Clustering at the school level was checked prior to analyses by testing the variance in lunchtime and after-school physical activity among schools. No significant difference in physical activity levels was found among schools and therefore, controlling for clustering in schools in the analyses was not required (Hair, et al., 1998).

Multicollinearity of factors in each questionnaire [i.e. when one factor is correlated with a set of other factors (Hair, et al., 1998)] was tested using the Variance Inflation Factor (VIF) score (see Appendix 16). The threshold for VIF was set at five (Hair, et al., 1998). Ideally, the independent context-specific variables should be highly correlated with the context-specific physical activity outcome variable, but not among each other (Hair, et al., 1998). If multicollinearity between independent variables does exist, it (1) reduces the potential predictive power of any single independent variable and the total variance explained, (2) inflates the shared variance with lower levels of unique variance and (3) makes the prediction equation unstable. These consequences impact on the generalisability and interpretability of the predictive equation. Multicollinearity between independent variables was found in the after-school Y-PASS questionnaire, which violates the assumptions for Multiple Regression analysis (Hair, et al., 1998). Therefore, Correlated Components Regression for linear regression models (CCR-LM) was chosen as a more appropriate statistical analysis test for assessing the predictive utility of the Y-PASS and LEAP II

questionnaires and identifying a predictor equation for context-specific physical activity (Magidson, 2010). A description of this test is provided below.

CCR-LM is an extension of Partial Least Squares (PLS), in which *n* predictors are formed into components that are uncorrelated. However, in CCR-LM the components may be correlated, which is more realistic (Magidson, 2010). Cross-validation is used to determine the optimal number of components to be kept for analysis. The *k* components (where $k < n$) identified from the cross-validation become the predictors. Each component is a weighted average of all the original *n* predictors. An additional advantage of CCR-LM is its use of regularisation, which is a technique applied to reduce the confounding effect of correlated factors to achieve reliable predictions (i.e. reduce the instability of prediction and lower the mean squared error of prediction when correlation between factors is evident) (Magidson, 2010). In CCR-LM, *k* components are chosen using a step-down approach to maximise R^2 and the best overall predictors are retained, resulting in a final prediction equation, which is more interpretable and better predicts the dependent outcome variable. CCR has been shown to outperform PLS, Principal Component Regression, Lasso and Step-down procedures when multicollinearity exists between independent variables (Magidson, 2010).

To account for potential interrelationships among the predictor variables (Portney & Watkins, 2000), multivariate analysis using CCR-LM was conducted on both the Y-PASS questionnaires and LEAP II questionnaire to derive four prediction equations (i.e. lunchtime Y-PASS, after-school Y-PASS, lunchtime LEAP II, after-school LEAP II) and to determine how much variance is explained by the prediction equations. Unlike more common multivariate approaches, such as Multiple Regression analysis, model building using CCR-LM commences with all variables. As a result, preliminary univariate analyses between the potential physical activity predictor factors and predictor items were not required (Portney & Watkins, 2000) but have been presented in Appendix 17. M-fold cross-validation was used to test the generalisability of the prediction equations (Hair, et al., 1998). Finally, to determine the effectiveness of the Y-PASS questionnaires in predicting context-specific physical activity when compared to the generic LEAP II questionnaire, R^2 scores for each model were statistically compared using tolerance intervals. Tolerance intervals were chosen due to the

different sample sizes for the Y-PASS and the LEAP II questionnaires. Unlike a confidence interval, which is a range of scores that should contain the population mean, a tolerance interval is a range of scores that, with a specified level of confidence, contains a specific proportion of the population R^2 values (Krishnamoorthy & Mathew, 2009). For this study, a tolerance interval was calculated (i.e. 99% of the participant scores fall within the identified score range with a 99% level of confidence). The tolerance interval score ranges were then compared for the Y-PASS and LEAP II questionnaires. In all analyses, statistical significance was set at an alpha level of 0.05.

7.4 Results

The following results section will present data on the participants of the study, the physical activity levels and types of activities performed during the lunchtime and after-school periods, followed by the predictors of lunchtime and after-school physical activity and the predictive capacity of the Y-PASS and LEAP II questionnaires.

7.4.1 Participants

7.4.1.1 Response rates

For this study, 16 schools were invited to take part and ten agreed to participate (response rate of 63%). Within the ten schools, 789 children were invited to take part and 477 provided consent (average consent rate = 60%; range of consent rates per school = 40% – 96%). The number of children who completed the study was 435 (40 were absent on the days of data collection and two participants withdrew from the study part way through the data collection period). Not all of the participants had valid datasets. In order to be included in the analysis, participants needed to have at least one valid dataset consisting of one questionnaire along with the corresponding time-specific accelerometer data (e.g. participants needed to have a valid lunchtime Y-PASS questionnaire and valid lunchtime accelerometer data). A total of 423 participants provided at least one valid dataset. Details of the number of valid datasets used in the analyses are presented in Table 7.1.

Table 7.1 Summary of valid datasets used in analyses

	Number of valid datasets included in analyses	Percentage of total sample who had valid datasets (n = 423)
Lunchtime Y-PASS and lunchtime accelerometer data	410	97%
After-school Y-PASS and after-school accelerometer data	387	91%
LEAP II questionnaire and lunchtime accelerometer data	404	96%
LEAP II questionnaire and after-school accelerometer data	385	91%

7.4.1.2 Demographic characteristics

The demographic characteristics of the whole sample are presented in Table 7.2, as well as for boys and girls separately.

Table 7.2 Demographic characteristics of the sample

	Boy (n = 200)		**Girl (n = 223)**		**Total (n = 423)**	
Age [mean (SD)] Range		11.72 (0.78) 10.1-13.3		11.74 (0.81) 10.2-13.5		11.73 (0.80) 10.1-13.5
Grade level	n	%	n	%	n	%
Grade 5	51	26.0	59	27.0	110	26.0
Grade 6	84	42.0	88	40.0	172	41.0
Grade 7	65	33.0	76	34.0	141	33.0
Socio-economic status	n	%	n	%	n	%
Low SES (SEIFA ≤973)	103	52.0	118	53.0	221	52.0
High SES (SEIFA >973)	97	48.0	105	47.0	202	48.0
SEIFA [mean (SD)] Range		971.6 (75.9) 788-1121		965.4 (79.7) 788-1136		968.3 (77.9) 788-1136
BMI Classification	n	%	n	%	n	%
Thin	12	6.0	10	4.5	22	5.2
Normal	131	65.5	155	69.5	286	67.6
Overweight	39	19.5	41	18.4	80	18.9
Obese	10	5.0	11	4.9	21	5.0
Missing data	8	4.0	6	2.7	14	3.3

7.4.2 Activity profile for whole sample

7.4.2.1 Objective measurement of physical activity

Valid lunchtime accelerometer data were obtained from 423 participants (200 boys, 223 girls), with 402 participants (186 boys, 216 girls) having valid after-school accelerometer data. Valid whole weekday accelerometer data were obtained from 410 participants (192 boys, 218 girls), with the boys spending an average of 67.0 (SD = 22.4) minutes in daily MVPA and girls spending an average of 62.0 (SD = 22.0) minutes. There were no statistically significant differences found in age, SES status and weight status between participants who were included in the study and those who were excluded based on the number of valid days. The recommended guideline of at least 60 minutes of MVPA per day was reached by 53% of the total sample (40% of boys, 54% of girls). The mean (SD) values for the lunchtime and after-school accelerometry data are presented in Table 7.3. The contribution of lunchtime and after-school physical activity to daily MVPA and recommended levels of MVPA per day are also presented. Overall, results show that boys were more active than girls during both the lunchtime and after-school periods. The average number of minutes children spent in MVPA during lunchtime was 9.9 minutes (boys = 12.5 minutes; girls = 7.6 minutes) and 19.7 minutes during the after-school period (boys = 22.1 minutes; girls = 17.5 minutes). The lunchtime period contributed 17% toward the recommended 60 minutes of MVPA, whereas the after-school period contributed 33%. When these two periods are combined, children obtained approximately 50% of the recommended daily physical activity levels, with boys being slightly higher (58%) than girls (42%).

Table 7.3 Descriptive details of accelerometer data for different time periods

	Boy (lunchtime n = 200; after-school n = 186; whole day = 192)	Girl (lunchtime n = 223; after-school n = 216; whole day n = 218)	Total (lunchtime n = 423; after-school n = 402; whole day n = 410)
Average wear time during lunchtime (SD), range (minutes)	36.1 (5.9), 28.8 – 45.0	35.8 (5.8), 27.8 – 45.0	36.0 (5.8), 27.8 – 45.0
Average wear time during the after-school period (SD), range (minutes)	163.3 (9.9), 132.7 – 190.0	164.3 (9.4), 131.5 – 190.0	163.8 (9.6), 131.5 – 190.0
Average daily minutes spent in MVPA (SD), range (minutes)	67.0 (22.4), 18.9 – 126.5	62.0 (22.0), 14.4 – 128.5	64.4 (22.3), 14.4 – 128.5
Proportion of lunchtime spent in MVPA (%)	34.7 (14.0)	21.3 (9.8)	27.6 (13.7)
Proportion of the after-school period spent in MVPA (%)	13.5 (7.2)	10.6 (5.6)	11.9 (6.5)
Proportion of a whole weekday in MVPA (%)	7.3 (2.6)	6.8 (2.5)	7.1 (2.6)
Contribution of lunchtime MVPA to daily MVPA (%)	21.1 (12.3)	13.3 (6.6)	16.9 (10.4)
Contribution of after-school MVPA to daily MVPA (%)	35.9 (24.2)	31.3 (21.1)	33.4 (22.7)
Contribution of lunchtime and after-school MVPA combined to daily MVPA (%)	57.1 (31.7)	44.4 (24.3)	50.2 (28.6)
Contribution of lunchtime MVPA to recommended daily physical activity (%)	20.9 (9.2)	12.6 (6.1)	16.5 (8.8)
Contribution of after-school MVPA to recommended daily physical activity (%)	36.9 (20.1)	29.2 (15.7)	32.8 (18.3)
Contribution of lunchtime and after-school MVPA combined to recommended daily physical activity (%)	57.8 (23.6)	41.9 (18.6)	49.3 (22.5)

7.4.2.2 Activity checklists

The activity checklists were used to provide contextual information about the types of activities children typically engaged in during the lunchtime and after-school periods (Stanley, et al., 2011). Table 7.4 and Table 7.5 show the top ten most frequent activities reported by participants for the lunchtime and after-school periods (i.e. the number of children reporting the activity, multiplied by how often they engaged in the activity) (see Appendix 18 for a complete list of activities reported). For lunchtime, children reported engaging in 40 different types of activities. The top five activities were similar across boys and girls. Interestingly, girls reported sitting as the most frequent activity, while boys reported running/jogging. Children reported 69 different after-school activities. The top five activities were slightly different for boys and girls during the after-school period, with boys engaging in more MVPA activities, as classified by the Compendium of Energy Expenditures for Youth (Ridley, Ainsworth, & Olds, 2008), compared to girls. However, the most frequent activity reported by both boys and girls was watching TV (boys = 74% of total sample, girls = 81% of total sample).

7.4.2.3 Summary of activity profile

Using the Compendium of Energy Expenditures for Youth (Ridley, et al., 2008), eight of the top ten lunchtime activities were classified as MVPA for both boys and girls. During the after-school period, four of the top ten after-school activities reported by both boys and girls were considered MVPA. This is reflected in the objective measurement of physical activity, with girls and boys engaging in a larger proportion of their lunchtime in MVPA (boys = 35% of lunchtime in MVPA; girls = 21% of lunchtime in MVPA) compared to the after-school period (boys = 14% of the after-school period in MVPA; girls = 11% of the after-school period in MVPA).

Table 7.4 The top ten most reported lunchtime activities

GIRLS (n = 219)				BOYS (n = 191)			
Activity	**n**	**%**	**Total frequency**	**Activity**	**n**	**%**	**Total frequency**
Sitting (e.g. eating, talking to friends, lunchtime meetings, writing, reading)	172	78.5	87376	**Running/jogging**	125	65.4	45500
Walking around the school yard	176	80.4	86592	**Mucking around outdoors in the school yard**	121	63.4	39809
Mucking around outdoors in the school yard	157	71.7	74261	**Walking around the school yard**	126	66.0	38934
Running/jogging	138	63.0	49818	**Football (Australian/Gaelic/American)**	100	52.4	27400
Chasey/tag/tips/tiggy	138	63.0	41814	**Chasey/tag/tips/tiggy**	108	56.5	25272
Playing on playground equipment (e.g. monkey bars)	93	42.5	16740	Sitting (e.g. eating, talking to friends, lunchtime meetings, writing, reading)	93	48.7	23157
Computer work (e.g. typing, internet)	88	40.2	16456	Computer work (e.g. typing, internet)	90	47.1	17460
Netball	86	39.3	15136	**Soccer (field/indoor)**	83	43.5	16434
Dodgeball/poisonball/brandy/speedball	92	42.0	13892	**Dodgeball/poisonball/brandy/speedball**	98	51.3	15778
Skipping/jump rope	70	32.0	9240	**Hand tennis/foursquare**	66	34.6	9570

Notes: Bolded activities are considered MVPA (≥3METs) based on 'moderate' MET values (Ridley, et al., 2008). The MET ranges are based on the energy expenditure of activities which may be performed at varying intensities (e.g. light, medium or hard, or in different body positions, such as lying, sitting and standing).
Total frequency was calculated as the number of children reporting the activity, multiplied by the number of bouts of activity they engaged in.
% = the number of girls/boys reporting the activity divided by the total number of girls/boys, multiplied by 100.

Table 7.5 The top ten most reported after-school activities

Girls (n = 208)				Boys (n = 179)			
Activity	**n**	**%**	**Total frequency**	**Activity**	**n**	**%**	**Total frequency**
Studying, homework or writing	169	81.3	81796	Watching TV	132	73.7	52140
Watching TV	169	81.3	81796	**Mucking around outdoors**	113	63.1	37177
Dressing and undressing	142	68.3	74692	**Running/jogging**	116	64.8	36308
Sitting (e.g. Talking/eating/reading)	152	73.1	71288	Computer console games (e.g. playstation/xbox/handheld)	126	70.4	35658
Mucking around indoors (walk/run)	153	73.6	64719	Studying, homework or writing	107	59.8	33812
Packing/unpacking bag	135	64.9	60615	**Mucking around indoors (walk/run)**	105	58.7	31920
Mucking around outdoors	146	70.2	58838	Packing/unpacking bag	95	53.1	31065
Feeding or caring for pets/farm animals	133	63.9	57855	**Walking**	101	56.4	30704
Walking	135	64.9	53730	Riding in a car/truck	98	54.7	29498
Riding in a car/truck	125	60.1	51125	Sitting (e.g. Talking/eating/reading)	98	54.7	29400

Notes: Bolded activities are considered MVPA (≥3METs) based on 'moderate' MET values (Ridley, et al., 2008). The MET ranges are based on the energy expenditure of activities which may be performed at varying intensities (e.g. light, medium or hard, or in different body positions, such as lying, sitting and standing).
Total frequency was calculated as the number of children reporting the activity, multiplied by the number of bouts of activity they engaged in.
% = the number of girls/boys reporting the activity divided by the total number of girls/boys, multiplied by 100.

7.4.3 Predictors of lunchtime and after-school physical activity

To explore the multivariate relationships between potential correlates and lunchtime and after-school physical activity, four Correlated Component Regression (CCR) analyses were conducted (lunchtime Y-PASS variables and lunchtime physical activity, LEAP II questionnaire variables and lunchtime physical activity, after-school Y-PASS variables and after-school physical activity, and LEAP II questionnaire variables and after-school physical activity). The predictors, unstandardised regression coefficients, R^2 values and the cross-validation R^2 values for the total models, along with tolerance intervals, are presented for boys' and girls' physical activity in the tables. Standardised regression coefficients are presented in the figures for a graphical presentation of the strongest predictors of context-specific physical activity. Bar charts were used to present the standardised regression coefficients for ease of interpretation. All predictor variables (except age, BMI and SEIFA) were measured on a 5-point Likert scale (1 = Disagree a lot, 2 = Disagree a little, 3 = Neither disagree nor agree, 4 = Agree a little, and 5 = Agree a lot). The results for the lunchtime and after-school Y-PASS questionnaires are presented first, followed by the results for the LEAP II questionnaire. Please note, a number of items were reverse coded to ensure associations were in the same direction for ease of interpretation.

7.4.3.1 Lunchtime Y-PASS questionnaire for predicting lunchtime physical activity

From the 21 potential Y-PASS predictors entered into the regression model, six predictors of lunchtime physical activity were identified for boys, explaining 25% of the variance, and nine predictors were identified for girls, explaining 17% of the variance. As can be seen in Table 7.6, boys and girls are influenced by different factors at lunchtime. Figure 7.1 clearly demonstrates the relative importance of each predictor of lunchtime physical activity for boys and girls. "Enjoyment of walking around at lunchtime" was the strongest negative predictor (β = -0.32) for boys, followed by "Painted lines on the ground in the school play area" (β = -0.23) and "Age" (β = -0.20). The positive predictors of boys' lunchtime MVPA were "Peer influence" (β = 0.19), "SEIFA" (β = 0.19) and "Behavioural attitudes and beliefs" (β = 0.14). For girls, lunchtime physical activity was also strongly negatively associated with "Enjoyment of walking around at lunchtime" (β = -0.11) but was positively associated with "Perceived self-efficacy" (β = 0.10). The next strongest predictors for girls during lunchtime

were “Peer influence” (β = 0.10), “Age” (β = -0.09), “Enjoyment of PE” (β = 0.08), “Confidence to overcome physical activity barriers”, such as limited play space, bullies in the school yard, poor weather conditions (β = 0.07), and “Access to facilities and equipment” (β = 0.07). “I can still be active at lunchtime even if I am wearing my school uniform” (β = 0.07) and “Always having energy to be active at lunchtime” (β = 0.06) were also identified as significant predictors for girls.

Table 7.6 Results of the CCR analyses to explain lunchtime physical activity in boys (n=186) and girls (n=215) using the lunchtime Y-PASS questionnaire

Predictor	Unstandardised coefficients	R-squared	Cross-validation R-squared (tolerance interval)
Boys			
Age	-3.57	0.25	0.16 (0.10-0.22)
SEIFA	0.03		
Behavioural attitude/belief	2.84		
I like to walk around at lunchtime.	-3.69		
Peer influence	3.61		
Our school play area has painted lines on the ground (e.g. hopscotch and 4-square) to help me be active at lunchtime.	-2.58		
Girls			
Age	-1.13	0.17	0.12 (0.09-0.15)
Barrier self-efficacy	1.14		
Perceived self-efficacy	1.63		
I can still be active at lunchtime even if I am wearing my school uniform.	0.57		
I like to walk around at lunchtime.	-0.97		
I really like doing PE at school.	0.93		
I always have the energy to be active at lunchtime.	0.62		
Peer influence	1.27		
Access to facilities/equipment	0.78		

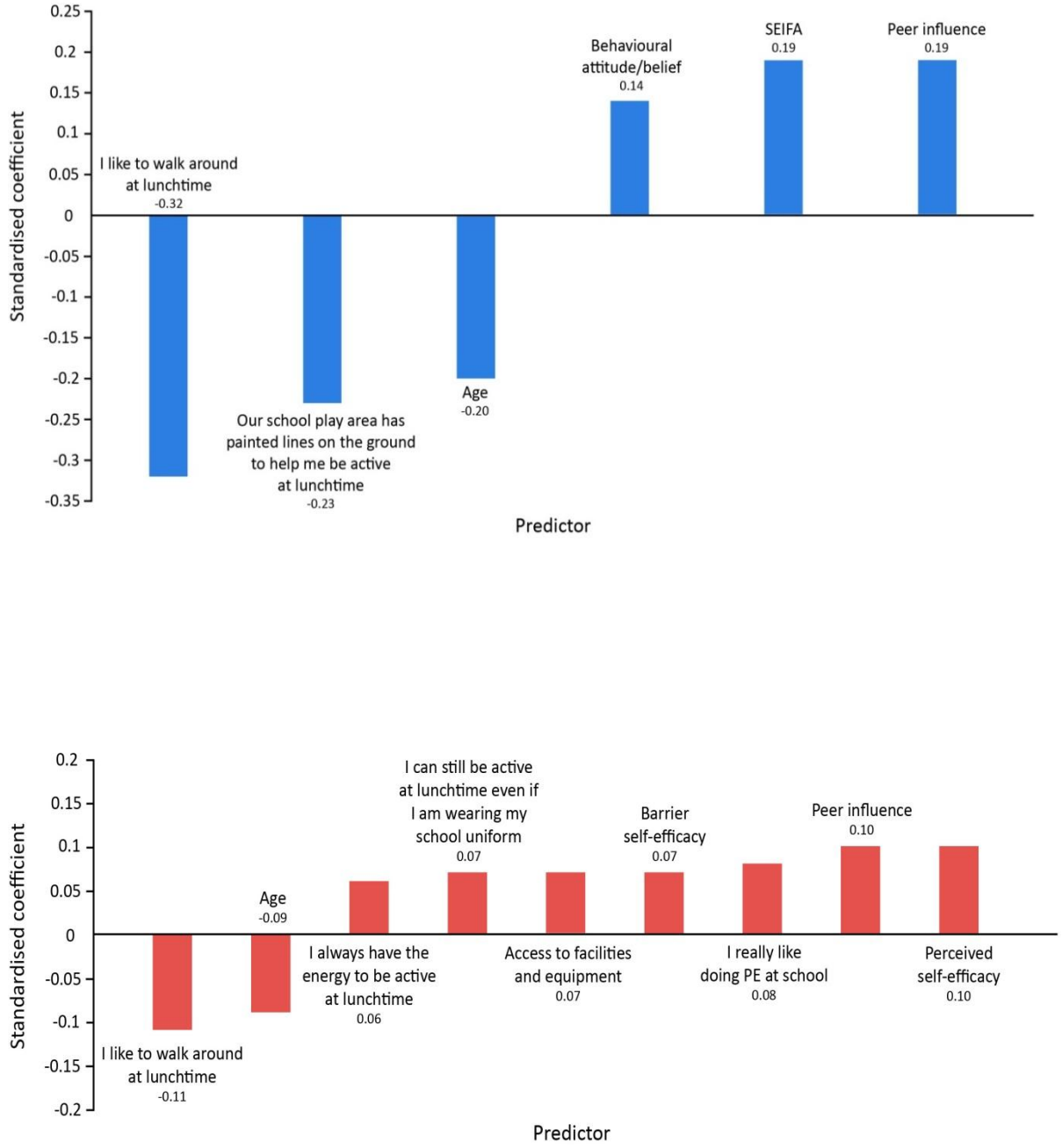


Figure 7.1 Standardised coefficients for the Y-PASS predictors of lunchtime physical activity in boys (blue) and girls (red)

7.4.3.2 After-school Y-PASS questionnaire for predicting after-school physical activity

Results of the CCR analysis for boys' and girls' after-school physical activity are presented in Table 7.7. The prediction model for boys accounted for 20% of the variance. All the predictors were positively associated with after-school physical activity and were of relatively similar importance (β = 0.04 – 0.06) (see Figure 7.2). Of the predictors identified in the model, the most important predictor for boys' after-school physical activity was "Social support" and the least important predictors were "Perceived competence" and "Access to facilities and equipment". The predictors "I am not active after school because I have no one to play with" and "Perceived barriers" were reverse coded and therefore are interpreted as follows: boys who have no-one to play with after school are less active than boys who do have someone to play with, and boys who identify being scared of strangers, dangerous animals and prefer doing homework rather than being active are less active compared to boys who do not recognise these as barriers to being active after school. For girls, "I do an organised sport or activity after school because it gets you fit" was identified as the only important predictor from the after-school Y-PASS questionnaire (presented in Figure 7.2), explaining 7% of the variance of objectively measured after-school physical activity.

Table 7.7 Results of the CCR analyses to explain after-school physical activity in boys (n=179) and girls (n=208) using the after-school Y-PASS questionnaire

Predictor	Unstandardised coefficients	R-squared	Cross-validation R-squared (tolerance interval)
Boys			
Behavioural attitudes/beliefs (organised sports/activities)	0.53	0.20	0.15 (0.12-0.18)
Behavioural attitudes/beliefs (non-organised activities)	0.51		
Barriers self-efficacy	0.47		
Support seeking/social norm	0.33		
Perceived competence	0.31		
Perceived barriers	0.39		
I do an organised sport or activity after school because I want to improve my skills.	0.30		
I do an organised sport or activity after school because I want to meet new people.	0.27		
I do an organised sport or activity after school because it gets you fit.	0.30		
Social support	0.50		
I am not active after school because I have no one to play with.	0.34		
Weather	0.39		
Access to facilities/equipment	0.43		
I have enough time to do an organised sport or activity after school.	0.30		
Girls			
I do an organised sport or activity after school because it gets you fit.	1.55	0.07	0.04 (0.00-0.08)

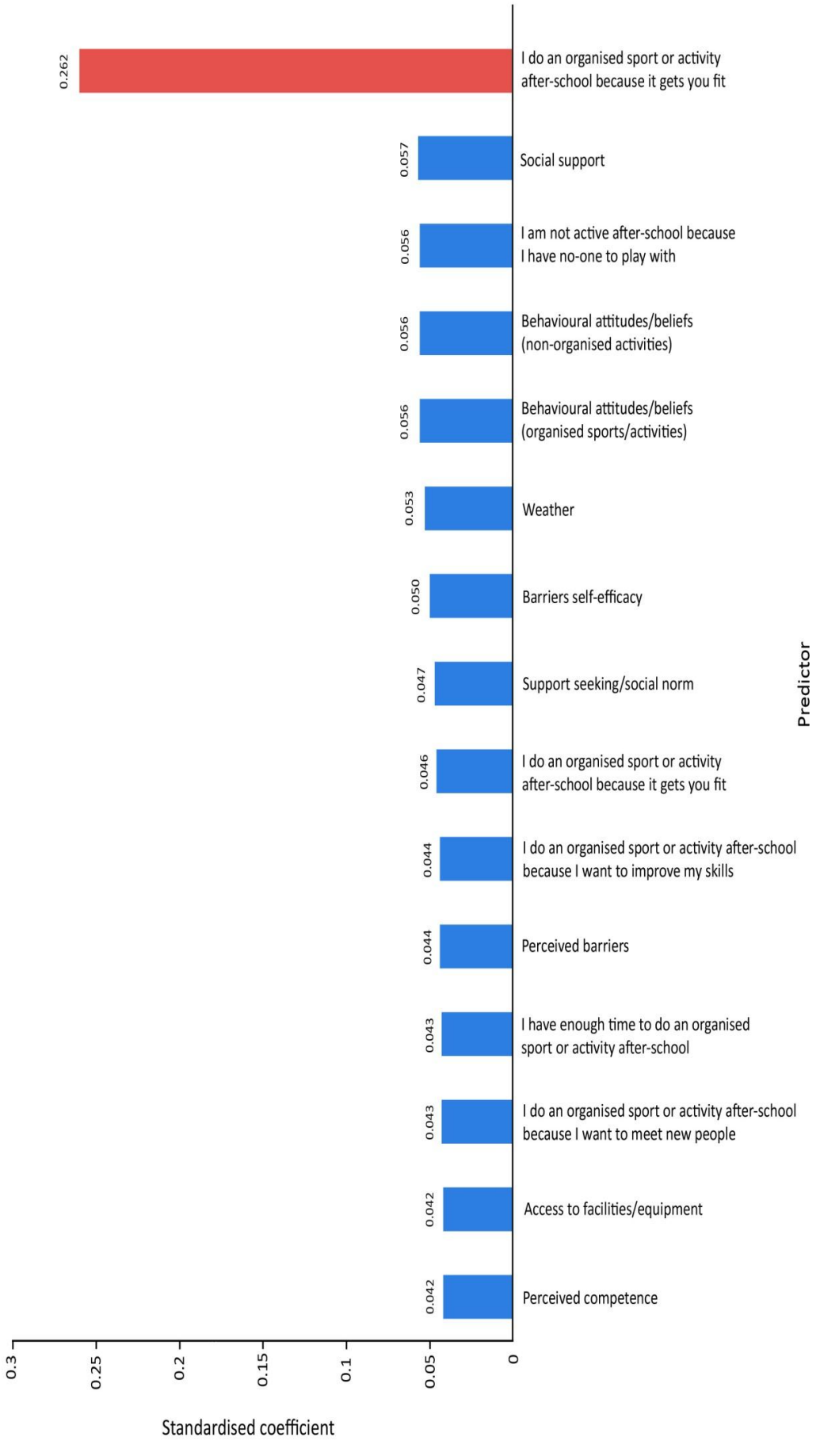


Figure 7.2 Standardised coefficients for the Y-PASS predictors of after-school physical activity in boys (blue) and girls (red)

The important predictors of lunchtime and after-school physical activity as measured by the Y-PASS questionnaires and the amount of variance explained by the prediction models have been identified using CCR analysis. To determine if the Y-PASS questionnaires explained more variance in comparison to a generic correlate questionnaire, the results from the CCR analysis conducted on the potential predictors measured by the LEAP II questionnaire are presented below.

7.4.3.3 LEAP II questionnaire for predicting lunchtime physical activity

As shown in Table 7.8, a relationship between the predictors measured by the LEAP II questionnaire and lunchtime physical activity was only found for "Age" in boys and "PE enjoyment" in girls. "Age" was negatively correlated with lunchtime physical activity in boys (β = -0.27), explaining 8% of the variance. "PE enjoyment" explained 6% of the variance and had a positive relationship with girls' lunchtime physical activity (β = 0.24). The standardised regression coefficients for both boys and girls are presented in Figure 7.3.

Table 7.8 Results of the CCR analyses to explain lunchtime physical activity in boys (n=196) and girls (n=208) using the LEAP II questionnaire

	Predictor	Unstandardised coefficients	R-squared	Cross-validation R-squared (tolerance interval)
Boys				
Age		-5.28	0.08	0.07 (0.04-0.10)
Girls				
PE enjoyment		2.34	0.06	0.05 (0.02-0.08)

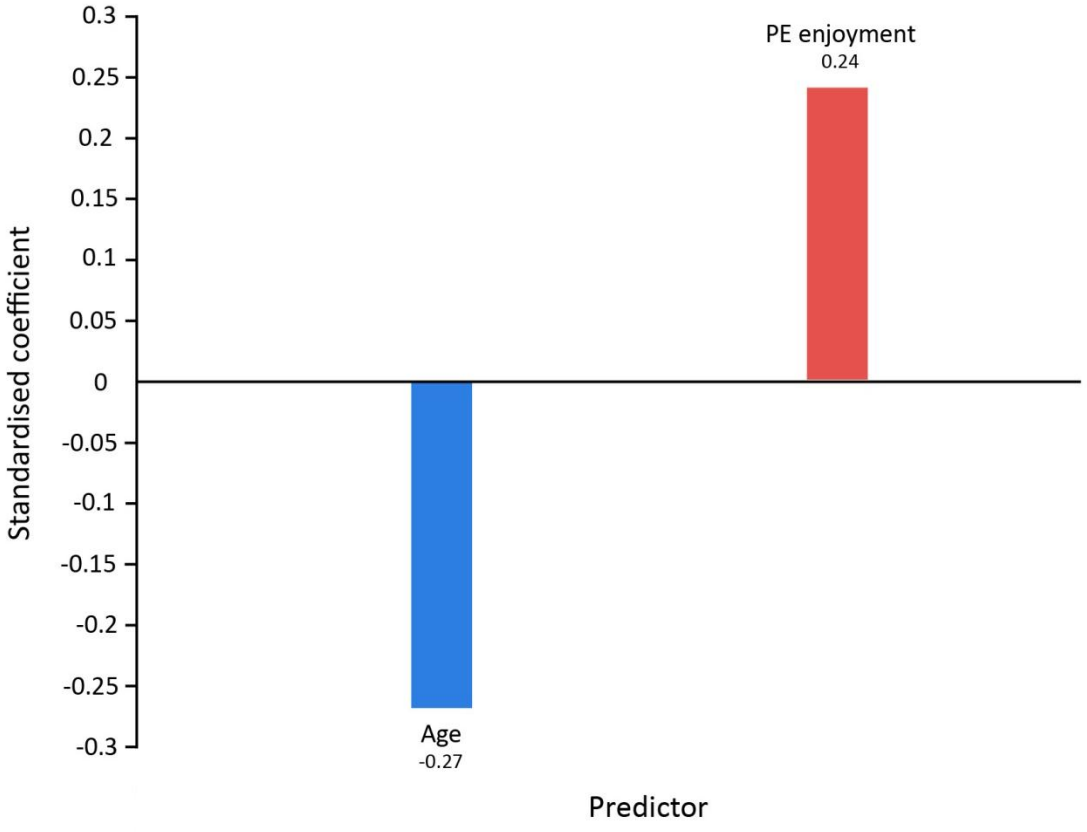


Figure 7.3 Standardised coefficients for the LEAP II questionnaire predictors of lunchtime physical activity in boys (blue) and girls (red)

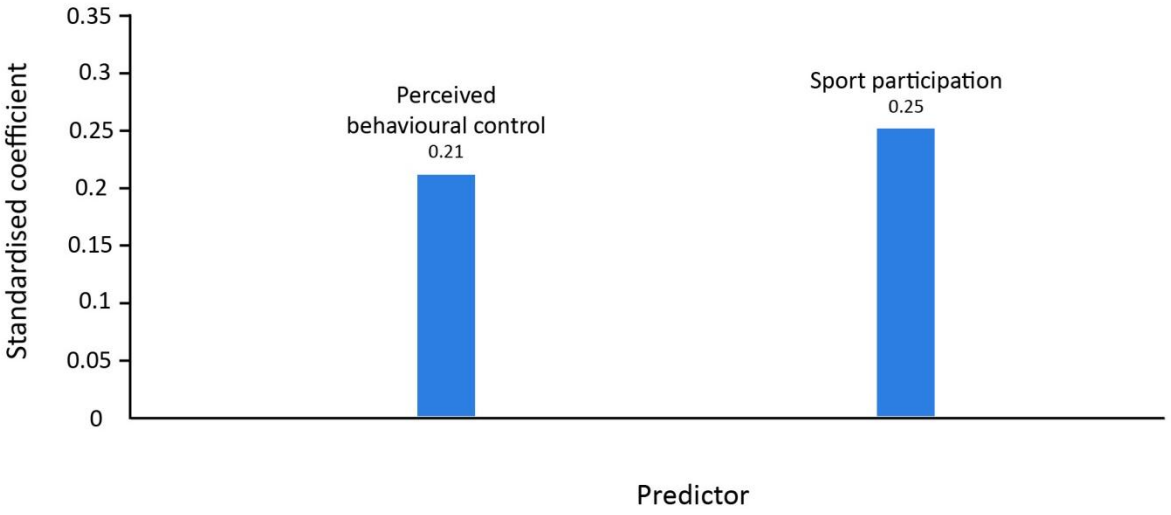
7.4.3.4 LEAP II questionnaire for predicting after-school physical activity

The LEAP II questionnaire appears to be more appropriate for predicting after-school physical activity compared to lunchtime physical activity as revealed by the amount of variance explained in each context. In Table 7.9, the most important predictors of boys' after-school physical activity were "Perceived behavioural control" (β = 0.21) and "Sports participation" (i.e. the more sport teams boys participated in the more active they were, β = 0.25). The prediction equation explained 11% of the variance in boys' after-school physical activity. For girls, "Age" (β = -0.19) was negatively associated with after-school physical activity, whereas "Intention" (β = 0.13), "Perceived behavioural control" (β = 0.13) and "Sport participation" (β = 0.34) were positively associated with after-school physical activity (see Table 7.9). This model explained 23% of after-school physical activity. Figure 7.4 shows

the standardised regression coefficients and indicates that “Sport participation” was the strongest predictor for both boys’ and girls’ after-school physical activity.

Table 7.9 Results of the CCR analyses to explain after-school physical activity in boys (n=185) and girls (n=200) using the LEAP II questionnaire

Predictor	Unstandardised coefficients	R-squared	Cross-validation R-squared (tolerance interval)
Boys			
Perceived behavioural control	1.83	0.11	0.07 (0.03-0.11)
Sport participation	1.85		
Girls			
Age	-1.46	0.23	0.19 (0.16-0.22)
Intention	1.01		
Perceived behavioural control	1.16		
Sport participation	2.62		



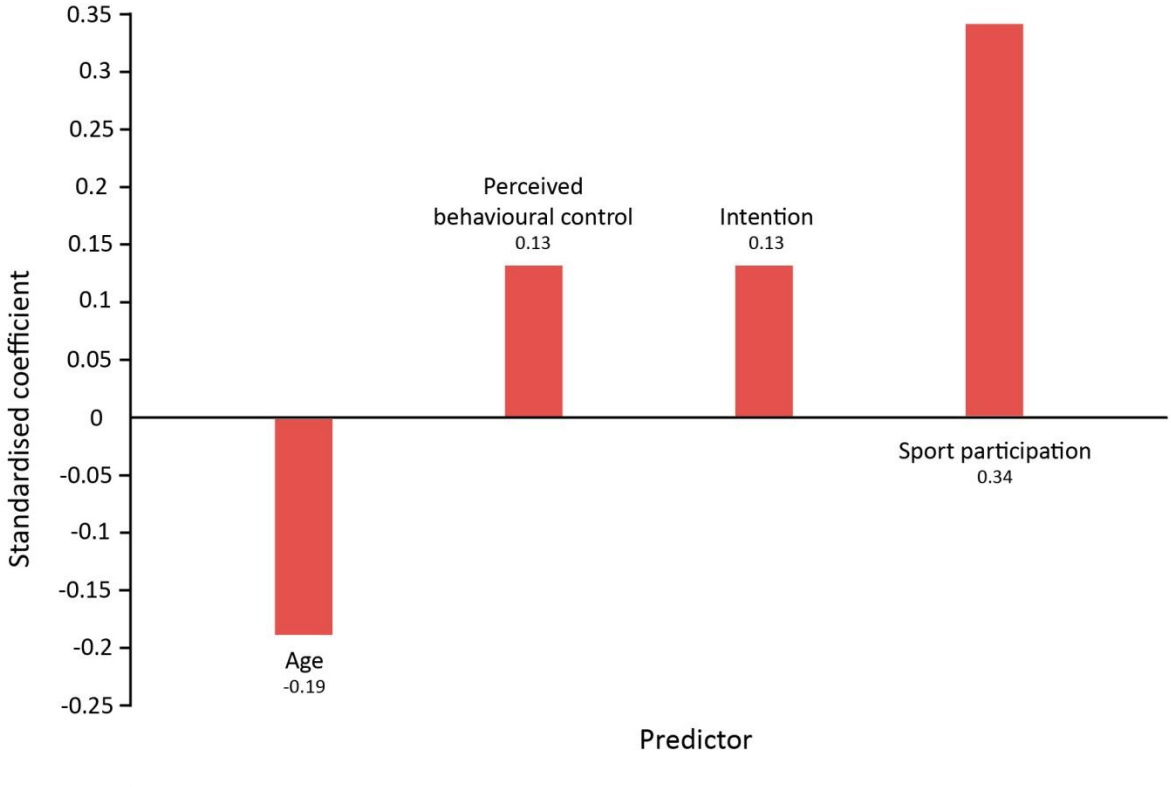


Figure 7.4 Standardised coefficients for the LEAP II questionnaire predictors of after-school physical activity in boys (blue) and girls (red)

7.4.4 Comparison of the predictive utility of the Y-PASS questionnaires and the LEAP II questionnaire

In order to compare the predictive utility of the two types of questionnaires, the effect sizes of each questionnaire using R^2 values, were compared. Tolerance intervals (i.e. a 99% confidence that 99% of the R^2 values fall between the calculated ranges) were calculated to enable a direct comparison between the R^2 values. Comparison of the Y-PASS and LEAP II questionnaires' tolerance intervals provides good evidence that the amount of lunchtime and after-school physical activity variance explained is statistically different between the Y-PASS and the LEAP II questionnaires for both boys and girls (i.e. the tolerance intervals for the Y-PASS questionnaires do not overlap with the LEAP II questionnaire, indicating that they are statistically different). Tolerance intervals for the predictive utility of Y-PASS and LEAP II questionnaires were: 0.10-0.22 (Y-PASS) and 0.04-0.10 (LEAP II) for boys' lunchtime physical activity, and 0.09-0.15 (Y-PASS) and 0.02-0.08 (LEAP II) for girls' lunchtime physical activity. For after-school physical activity, the tolerance intervals for the predictive utility of Y-PASS and LEAP II questionnaires were: 0.12-0.18 (Y-PASS) and 0.03-0.11 (LEAP II) for boys and 0.00-0.08 (Y-PASS) and 0.16-0.22 (LEAP II) for girls.

As can be seen in Figure 7.5, the lunchtime Y-PASS questionnaire outperformed the LEAP II questionnaire in predicting lunchtime physical activity for both boys (lunchtime Y-PASS questionnaire $R^2 = 0.25$ versus LEAP II questionnaire $R^2 = 0.08$) and girls (lunchtime Y-PASS questionnaire $R^2 = 0.17$ versus LEAP II questionnaire $R^2 = 0.06$). Furthermore, the lunchtime Y-PASS questionnaire explained more variance in lunchtime physical activity for boys compared to girls. The amount of variance in lunchtime physical activity predicted by the LEAP II questionnaire was relatively similar for boys and girls. Compared to the LEAP II questionnaire, after-school physical activity was predicted better by the after-school Y-PASS questionnaire for boys (after-school Y-PASS questionnaire $R^2 = 0.20$ versus LEAP II questionnaire $R^2 = 0.11$) but not for girls (after-school Y-PASS questionnaire $R^2 = 0.07$ versus LEAP II questionnaire $R^2 = 0.23$). The after-school Y-PASS questionnaire was more effective at predicting after-school physical activity for boys compared to girls, whereas the LEAP II questionnaire predicted more variance in after-school physical activity for girls compared to boys.

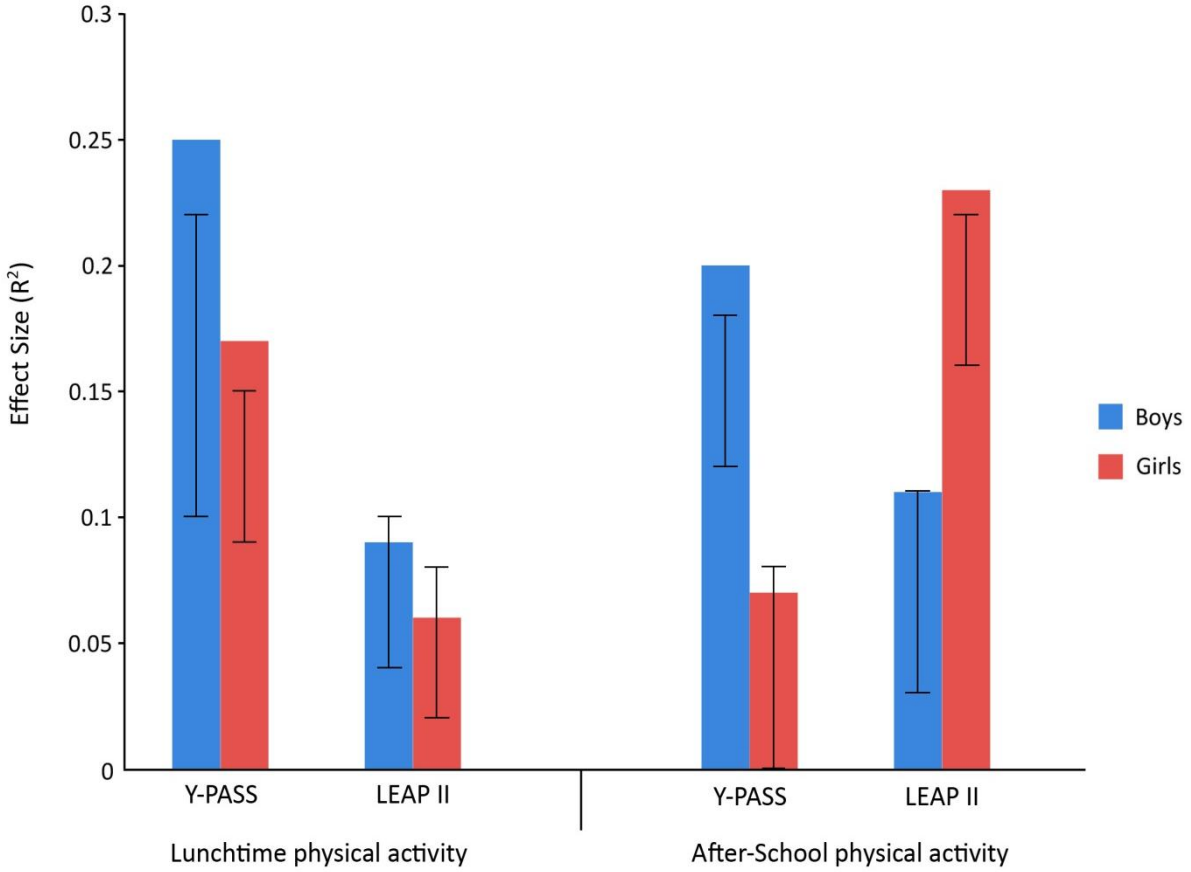


Figure 7.5 Effect size (R^2) of the questionnaires for predicting context-specific physical activity (tolerance intervals are represented by the error bars)

7.5 Discussion

Obtaining a better understanding of the correlates of children's physical activity in different contexts has been identified as a key research area for advancing the physical activity field (Giles-Corti, et al., 2005). The results from this study provide important insights into the most effective methods for measuring correlates of context-specific physical activity (i.e. context-specific measurement versus generic measurement), predictors of boys' and girls' objectively measured lunchtime and after-school physical activity, as well as boys' and girls' lunchtime and after-school physical activity patterns and behaviours. There were three key findings from this study:

1. The Y-PASS correlate questionnaires are more effective than the LEAP II questionnaire at predicting boys' and girls' physical activity in the lunchtime context and boys' physical activity in the after-school context, but not girls' after-school physical activity. Also, the Y-PASS correlate questionnaires are generally more effective at predicting physical activity that occurs in more structured contexts, such as lunchtime, compared to diverse, less structured contexts, such as after school.
2. Different factors are associated with physical activity among boys and girls, and between lunchtime and after-school periods, as measured by the Y-PASS questionnaires and the LEAP II questionnaire.
3. Boys are more active than girls in both the lunchtime and the after-school periods, as measured by ActiGraph accelerometers.

The discussion will explore these findings in more detail and will be structured as follows: the predictive utility of the Y-PASS questionnaires and the LEAP II questionnaire will be reviewed. The predictors of lunchtime and after-school physical activity, as identified by the Y-PASS questionnaires, will then be discussed followed by a discussion of the predictors identified by the LEAP II questionnaire. A discussion of the physical activity behaviours of children in this study will then be undertaken, followed by a summary of the strengths and limitations of the study. The discussion will culminate with practical implications of the study's findings and future research recommendations.

7.5.1 Predictive utility of a context-specific correlate questionnaire and a generic correlate questionnaire

The primary purpose of this thesis was to improve the prediction of children's physical activity by introducing greater specificity to physical activity correlate measurement. To test this concept, the current study compared the predictive utility of two types of questionnaires, context-specific worded questionnaires and a generic worded questionnaire.

Overall, the findings from this study suggest that prediction of context-specific lunchtime and after-school physical activity behaviour can be improved using context-specific correlate

questionnaires rather than a generic correlate questionnaire, except for girls' after-school physical activity. The prediction equations of the lunchtime Y-PASS questionnaire explained 25% of boys' lunchtime physical activity and 17% of girls' lunchtime physical activity. This is quite high compared to the after-school period (boys = 20% variance explained; girls = 7% variance explained), suggesting that context-specific questionnaires are particularly effective in more structured homogenous contexts (e.g. the lunchtime context) compared to more diverse contexts. Unfortunately, one of the limitations of using CCR analysis to identify the prediction equation is it does not provide the separate contributions of demographic, intrapersonal, sociocultural or physical environmental/policy correlates to the overall explained variance of physical activity. Therefore, the amount of variance accounted for by each domain could not be determined.

A notable finding was the low amount of variance of after-school physical activity explained by the Y-PASS prediction equation for girls (7%). This is consistent with the correlate literature, in which girls' physical activity is largely unexplained by current theories (Brodersen, Steptoe, Williamson, & Wardle, 2005; Lubans et al., 2012; Trost, Pate, Dowda, et al., 2002). Despite developing a targeted social cognitive model for girls' physical activity, Lubans et al. (2012) were able to explain only 5% of the variance in girls' physical activity, with only self-efficacy, school environment and physical self-worth having significant associations with accelerometer counts. Similarly, behavioural models used in a study by Trost et al. (2002), only accounted for 10% and 5% of White and African-American girls' physical activity, respectively. In comparison, the LEAP II questionnaire was able to explain 23% of girls' after-school physical activity. It is unclear why girls' physical activity cannot be explained by current theories and further exploration is warranted. However, one possible explanation as to why the LEAP II questionnaire explained more variance in girls' after-school physical activity compared to the Y-PASS questionnaire is it includes "Sports participation", which is a subset measure of overall physical activity. This is a modifiable behaviour and interventions could adopt strategies to increase girls' sport participation.

The amount of variance explained in the current study appears to be quite low in comparison to other lunchtime and after-school physical activity studies (see Table 7.10).

Only three specific studies have reported the amount of variance explained in context-specific physical activity [two lunchtime studies (Ommundsen, et al., 2006; Sallis, et al., 2001) and one after-school study (Ommundsen, et al., 2006)]. Using direct observation to assess physical environmental correlates of lunchtime physical activity, Sallis et al. (2001) explained 59% and 42% of boys' and girls' lunchtime physical activity, respectively. Ommundsen et al. (2006) also explained quite a substantial amount of variance in comparison to the current study (i.e. 55% compared to 17-25% of lunchtime physical activity, and 44% compared to 7-20% of after-school physical activity).

A possible explanation for the difference in explained variance between the current study and other studies (Ommundsen, et al., 2006; Sallis, et al., 2001) may be the use of the same type of measurement to assess both the correlates and physical activity. Sallis et al. (2001) used direct observation and Ommundsen et al. (2006) used self-report to assess both the physical environmental correlates and lunchtime physical activity. In the current study, physical activity was objectively measured, while self-report was used to assess context-specific correlates. The use of direct observation to objectively assess correlates and physical activity can greatly reduce measurement error, resulting in stronger associations and highlighting the potential importance of using direct observation in assessing environmental correlates. In addition, using self-report methods to measure both correlates and physical activity (known as shared method variance) may result in inflated correlations, and hence increased explained variance (Lubans, et al., 2012; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003; Trost, et al., 1999). For example, children who over-report their self-reported physical activity may tend to over-report or exaggerate their scores of predictors. This results in high physical activity scores matching high predictor scores. On the other hand, children who do not perceive physical activity as important might under-report their physical activity levels, as well as the predictors. The consequences of systematic over or under-reporting are inflated correlations in the data and larger total explained variance (Trost, et al., 1999). Correlations between objectively measured physical activity and self-reported correlates tend to be weaker (Dishman, Dunn, Sallis, Vandenberg, & Pratt, 2010; Lubans, et al., 2012), which may explain this study's lower explained variance compared to the previous studies. Similar to the current study, Dishman et al. (2010) and Lubans et al. (2012) found that correlations between objectively measured physical activity and self-reported correlates

were much lower than previous studies using self-report measures of physical activity. Future research could consider incorporating a subjective measure of physical activity behaviour as a comparator and explore the relative difference in the strengths of associations and variance of physical activity explained.

Table 7.10 Specificity characteristics of measures used in lunchtime and after-school physical activity studies

Study	Country	Components of the social ecological model addressed	Correlate tool (generic/specific)	Type of measurement	Correlate identification	Physical activity outcome	Type of measurement	Variance explained
LUNCHTIME								
THIS STUDY (Y-PASS)	Australia	All	Specific	Self-report	Systematic review and focus groups	Specific	Objective (accelerometry)	25% (boys) 17% (girls)
THIS STUDY (LEAP II questionnaire)	Australia	All	Generic	Self-report	Researcher-derived	Specific	Objective (accelerometry)	8% (boys) 6% (girls)
(Ommundsen, et al., 2006)	Norway	All	Specific	Self-report	Researcher-derived	Specific	Self-report (PAQ-C)	55%
(Sallis, et al., 2001)	U.S.	Physical environment	Specific	Direct observation (SOPLAY)	NR	Specific	Direct observation (SOPLAY)	59% (boys) 42% (girls)
AFTER SCHOOL								
THIS STUDY (Y-PASS)	Australia	All	Specific	Self-report	Systematic review and focus groups	Specific	Objective (accelerometry)	20% (boys) 7% (girls)
THIS STUDY (LEAP II questionnaire)	Australia	All	Generic	Self-report	Researcher-derived	Specific	Objective (accelerometry)	11% (boys) 23% (girls)
(Ommundsen, et al., 2006)	Norway	All	Specific	Self-report	Researcher-derived	Specific	Self-report (PAQ-C)	15% (active transport) 44% (leisure time activity)

Notes: PAQ-C = Physical Activity Questionnaire for Children; SOPLAY = System for Observing Play and Leisure Activity in Youth; NR = not reported

Specific correlate measures are defined as those that make reference to a specific time of the day within any item and may include items that are domain- or location-specific with reference to the time of day. A specific physical activity outcome refers to physical activity occurring in a specific time period. Generic correlate measures are defined as those that make no reference to a specific time of the day, type of activity or a specific location in which the activity occurs.

There was a high proportion of unexplained variance in models derived from the context-specific Y-PASS questionnaires. This was particularly noticeable for girls' after-school physical activity. There are a number of possible reasons for this:

(1) The Y-PASS questionnaires are not capturing all the correlates that are important to children's context-specific physical activity, despite a thorough investigation of the current literature and talking directly to children. The limited amount of variance explained by the girls' Y-PASS questionnaire compared to the LEAP II questionnaire provides some initial evidence that not all important correlates were considered in the Y-PASS questionnaire (i.e. the LEAP II questionnaire included "Intention", "Perceived behavioural control" and "Sports participation", which were not present in the Y-PASS questionnaire). It is acknowledged that the "Sports participation" variable is a subjective measure of behaviour and was moderately correlated with after-school physical activity. Additionally, the after-school Y-PASS questionnaire included correlate items for specific types of activities occurring in the after-school context (i.e. active transport, organised sports and non-organised activities) and it is possible that not all the appropriate correlates were included for each of these activities.

(2) Some of the correlates may act as moderators or mediators of relationships between other correlates and physical activity. For example, self-efficacy may mediate the relationship between social support and physical activity or age may moderate the relationships between other correlates and physical activity. This was not assessed or accounted for in the current study and may impact on the strength of the association and the variance explained (Baranowski, et al., 1998; Bauman, et al., 2002).

(3) Only perceptions of environmental correlates were assessed and not actual or true measures of environmental correlates (Ball, et al., 2008). As discussed previously, intrapersonal correlates cannot be objectively measured, and therefore, perceptions can only be assessed. Perceptions of environmental correlates and objectively measured environmental correlates can be considered as two different constructs and assessing both may in fact increase the variance explained.

(4) The predictive utility of a questionnaire is reliant on the presence of variation in the intrapersonal, sociocultural and physical environmental/policy correlates assessed (Ajzen & Fishbein, 1980). It may be that there was limited variability in the correlates

explored and therefore, only small amounts of variance could be explained. For example, in Australia, the school playground setting tends to be quite structured and relatively homogenous across schools, with little variation in aspects such as the number and length of school break times, the presence of play spaces (including bitumen areas and grassed fields) and loose and fixed equipment, and the presence of teacher supervision (Mathews, Malakellis, Sanigorski, Kremer, & Swinburn, 2008). In the current dataset, limited variability was demonstrated in the scores for the presence of activity promoting play spaces (mean score = 4.6 [SD = 0.74]), with 86.9% of boys and 90.9% of girls agreeing with this correlate. Similarly, the presence of teacher supervision also demonstrated limited variability in the current dataset, with a mean score of 4.7 (SD = 0.66) and the majority of boys (90.1%) and girls (95.4%) agreeing with the correlate item. This means that all children are exposed to similar environmental opportunities and therefore, these environmental correlates are less likely to explain the variation in children's physical activity.

These findings demonstrate that there is still further research to be undertaken in predicting children's context-specific physical activity and this study provides a platform for the development of future studies. The next section will discuss the predictors that contribute to the overall explained variance of lunchtime and after-school physical activity.

7.5.2 Predictors of lunchtime and after-school physical activity

To understand why certain predictors of lunchtime and after-school physical activity have been identified in the prediction equations for boys and girls, it is important to acknowledge the characteristics of the lunchtime and after-school contexts. Diversity in physical activity contexts and the activities performed in these contexts can make physical activity difficult to predict. Also, correlates that exhibit limited variability among participants of a study will tend not to be identified in prediction equations (Ajzen & Fishbein, 1980). This does not imply that the factor is unimportant, but that the factor does not explain variance in physical activity behaviour in this sample. These are some of the problems with correlate research and may partly contribute to the equivocal picture in the literature (Sallis, Prochaska, et al., 2000). The lunchtime and after-school periods were chosen specifically, not only because

they are two critical periods of a school day when children can engage in physical activity, but also because they represent varying levels of context diversity in regards to the physical and sociocultural environments. In other words, the lunchtime period can be characterised as being relatively homogenous and the after-school period can be considered heterogeneous.

Predictors of lunchtime and after-school physical activity were assessed by two different types of questionnaires. The first type was the computer-delivered context-specific Y-PASS questionnaire. This differed from the second type of questionnaire, the LEAP II questionnaire, in that:

- it was specifically designed to capture correlates that were potentially pertinent to the lunchtime and after-school time periods
- it used context-specific worded items
- it contained correlates which were identified by children as being important in the context under investigation.

The following section will discuss sex differences in the predictors of lunchtime and after-school physical activity as assessed by these two different types of questionnaires. A summary of these predictors is presented in Table 7.11.

Table 7.11 A summary of the primary predictors of children's lunchtime and after-school physical activity

Lunchtime		
Boys	**Y-PASS**	**LEAP II questionnaire**
Predictors of lunchtime physical activity	• "I like to walk around at lunchtime" (-) • "Our school play area has painted lines on the ground to help me be active at lunchtime" (-) • "Age" (-) • "Behavioural attitude/belief" (+) • "SEIFA" (+) • "Peer influence" (+)	• "Age" (-)
Variance explained	25%	8%
Girls		
Predictors of lunchtime physical activity	• "I like to walk around at lunchtime" (-) • "Age" (-) • "I always have the energy to be active at lunchtime" (+) • "I can still be active at lunchtime even if I am wearing my school uniform" (+) • "Access to facilities and equipment" (+) • "Barrier self-efficacy" (+) • "I really like doing PE at school" (+) • "Peer influence" (+) • "Perceived self-efficacy" (+)	• "PE enjoyment" (+)
Variance explained	17%	6%

After school		
Boys	**Y-PASS**	**LEAP II questionnaire**
Predictors of after-school physical activity	• "Perceived competence" (+) • "Access to facilities/equipment" (+) • "I do an organised sport or activity after school because I want to meet new people" (+) • "I have enough time to do an organised sport or activity after school" (+) • "Perceived barriers" (+) • "I do an organised sport or activity after school because I want to improve my skills" (+) • "I do an organised sport or activity after school because it gets you fit" (+) • "Support seeking/social norm" (+) • "Barriers self-efficacy" (+) • "Weather" (+) • "Behavioural attitudes/beliefs (organised sports/activities)" (+) • "Behavioural attitudes/beliefs (non-organised activities)" (+) • "I am not active after school because I have no one to play with" (+) • "Social support" (+)	• "Perceived behavioural control" (+) • "Sport participation" (+)
Variance explained	20%	11%
Girls	**Y-PASS**	**LEAP II questionnaire**
Predictors of after-school physical activity	• "I do an organised sport or activity after school because it gets you fit" (+)	• "Age" (-) • "Perceived behavioural control" (+) • "Intention" (+) • "Sport participation" (+)
Variance explained	7%	23%

Notes: "+" = positive association with context-specific physical activity; "-" = negative association with context-specific physical activity

7.5.2.1 Predictors of lunchtime physical activity

The results from the lunchtime Y-PASS questionnaire show that boys' and girls' physical activity are influenced differently during the lunchtime period. Predictors were identified in all domains of the social ecological model and will be discussed in more detail below.

Intrapersonal predictors

The strongest Y-PASS predictor for both boys and girls was "I like to walk around at lunchtime" and this item was negatively associated with the percentage of lunchtime spent in MVPA. In this context, walking around the school yard may have not reached the MVPA threshold. The negative association identified for this item in the current study can potentially be explained by the lower physical activity levels of children who agreed with this statement. Children who enjoyed walking around at lunchtime spent less time in MVPA during lunchtime (i.e. 24% of lunchtime in MVPA) compared to children who disagreed with this statement (i.e. 37% of lunchtime in MVPA). It could be that these children may have a preference for engaging in lower intensity activities rather than more vigorous activities, such as football, chasey or soccer. Furthermore, walking around at lunchtime may be an opportunity for children to engage in other important health promoting activities, such as eating or socialising with friends, which are more difficult to perform during more vigorous activities. This should not necessarily be discouraged because it is important that children have a balance between lower intensity, health promoting activities and more vigorous activities across the different contexts, while still aiming to meet the recommended physical activity guidelines (Rodger & Ziviani, 2006).

Enjoyment of PE at school was also identified as a strong intrapersonal predictor for girls, but not for boys, by the Y-PASS questionnaire. While this predictor may seem unusual for lunchtime physical activity, previous research has found that PE enjoyment is associated with physical activity behaviour in other contexts (Cox, Smith, & Williams, 2008; Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003; Ommundsen, et al., 2006; Shen, McCaughtry, & Martin, 2007). These studies posit that children who enjoy activities and are self-determined will transfer behaviours from one context to other contexts (Cox, et al., 2008; Hagger, et al., 2003; Shen, et al., 2007). PE lessons also provide an important opportunity for children to

develop motor skills. It may be that children who enjoy PE lessons are more likely to have better motor skills, and better motor skills may facilitate engagement in other activities outside of the PE context, particularly more organised activities (Okely, Booth, & Patterson, 2001). Alternatively, it is feasible that children who enjoy PE lessons are just more motivated to be active and enjoy all types of physical activities. Previous studies have provided some insights into how to promote PE enjoyment. Barr-Anderson et al. (2008) found that enhancing girls' self-efficacy and perceived benefits of physical activity, and providing a supportive environment that promotes gender equality, can potentially increase PE enjoyment. Other studies have shown that providing a range of gender appropriate activity choices within the PE curriculum can greatly enhance enjoyment (Mageau & Vallerand, 2003; Standage, Duda, & Ntoumanis, 2006). There has been growing interest in providing single-sex PE classes compared to coeducational PE classes in schools. Kaey (2007) attributed lower participation rates among girls to the masculinisation of the PE curriculum, while Wright (1999) found girls to be highly influenced by bullying and teasing from their male peers. These factors were found to influence girls' enjoyment of PE. Ollis and Meldrum (2009) suggest that single-sex PE settings allow girls to freely participate in PE and enhance feelings of comfort without embarrassment. Increasing enjoyment and providing an optimal learning environment in PE lessons has important implications for promoting physical activity in other contexts, particularly for girls who have lower activity levels. This should be a consideration in the development of physical activity interventions, school programming, curriculum development and policy development.

In this study, "I can still be active at lunchtime even if I am wearing my school uniform" was positively associated with girls' lunchtime MVPA. This is supported by the findings from the focus groups in Study Two, in which this correlate was discussed more by girls than boys. An explanation for this finding could be that girls who are more active at lunchtime do not perceive the school uniform as an issue, while girls who are not active at lunchtime do perceive the school uniform as a barrier to being active. During the focus group discussions, girls reported that having to wear school dresses and heavy school shoes deterred them from engaging in more physically active games, such as kicking a football or playing basketball (Stanley, Boshoff, et al., 2012a). Further exploration into the influence of different types of school uniforms worn by the children (e.g. dresses versus shorts/trousers and t-

shirts, heavy school shoes versus sneakers) on physical activity would yield a more in-depth understanding of this predictor and could potentially lead to important changes in the school uniform policy. Changing the school uniform to be more conducive to engaging in physical activity may potentially change the less active children's negative perceptions of the school uniform and facilitate their engagement in lunchtime play.

Sociocultural predictors

The most important sociocultural predictor for lunchtime physical activity, identified for both boys and girls by the lunchtime Y-PASS questionnaire, was "Peer influence". The items that formed this factor were all related to positive peer influences, such as "I have friends who I am active with at lunchtime". Children who perceived having more positive peer influences were more active at lunchtime. This is not surprising in the lunchtime context. Ecological models postulate that influences most proximal to the target group will have the strongest effect on the desired behaviour (Sallis, et al., 2008; Spence & Lee, 2003), hence the identification of peer influence in the lunchtime physical activity prediction equation rather than teacher influence. To date, no other lunchtime specific studies have assessed the relationship of peer influence with children's lunchtime physical activity (see Chapter 3). However, evidence of positive associations does exist with adolescents (Hohepa, et al., 2007; Ommundsen, et al., 2006). In these studies, peer support emerged as an important correlate of lunchtime physical activity. The findings from the current study are therefore an important contribution to the literature on children's lunchtime physical activity and attest to the value of strengthening peer relationships and peer group dynamics, which may lead to greater persistence in engaging in physical activities during free time.

Physical environmental/policy predictors

Very few physical environmental/policy variables were identified as predictors of children's lunchtime physical activity. This may be due to the homogeneity of physical environments across schools. Factors lacking variability will not appear in prediction equations because they tend not to explain the variance in physical activity. Of the physical environmental/policy factors entered in the prediction models, "Access to facilities and equipment" was found to be an important Y-PASS predictor for girls but not for boys. This is

surprising as girls and boys are exposed to the same facilities and equipment. It could be that girls are more reliant on facilities and equipment to be active compared to boys. The "Access to facilities and equipment" predictor variable consisted of items assessing access to indoor play space, shaded areas in the school yard and access to equipment. Previous studies assessing these aspects of the physical environment have shown mixed results. A Canadian study assessing access to indoor play spaces found no association with lunchtime physical activity (Nichol, et al., 2009). Access to shaded areas has not previously been assessed in the lunchtime period with children, however, Timperio et al. (2008) explored this correlate in the after-school period and found a positive association with girls' after-school MVPA. Access to equipment has been explored more widely in the lunchtime context. Willenberg et al. (2010) reported a positive association between fixed equipment, such as playground equipment, and moderate physical activity but no association with loose equipment, such as balls and skipping ropes. Conversely, Ridgers et al. (2010) found that children engaged in more moderate physical activity when they had access to loose equipment, compared to children who had no access to loose equipment. The different types of equipment were not specified in the current study. This is an important distinction to make when exploring the importance of specificity in physical activity research and deserves further attention in future studies.

The perception of whether painted lines on the ground helped children be active at lunchtime was negatively associated with boys' lunchtime MVPA, as assessed by the Y-PASS questionnaire. This finding is in contrast with previous cross-sectional observation studies reporting positive associations (Parrish, Russell, & Yeatman, 2009; Willenberg, et al., 2010) and no associations (Ridgers, Fairclough, et al., 2010) with lunchtime physical activity behaviour. While children may have perceived this environmental feature as helping them be active, they might actually spend the majority of the lunchtime waiting for their turn due to the popularity of activities requiring painted lines in schools (e.g. handball and hopscotch). Based on evidence from observational studies (Hovell, et al., 1978; McKenzie, et al., 1997), Wechsler et al. (2000) concluded that children spend approximately half of their lunch break engaging in physical activities, while the remaining time is spent waiting for a turn or observing others. Another possible explanation for the negative association with lunchtime MVPA could be related to access to play space. While boys may perceive that painted lines help them be active, the actual space available may be quite small. Harten et

al. (2008), a study also conducted in South Australian schools, found that when play space dimensions were reduced by a square metre per child, boys' energy expenditure decrease by 0.2%.

7.5.2.2 Predictors of after-school physical activity

The predictors of after-school physical activity present a very different picture to the lunchtime context. As with the lunchtime period, boys and girls were influenced differently in the after-school period. Boys' after-school MVPA was weakly influenced by a much larger range of Y-PASS correlates across all domains of the social ecological model, except the demographic domain. However, only one correlate was identified in explaining girls' after-school MVPA, which was an unexpected finding.

Intrapersonal predictors

An intrapersonal predictor retained in the Y-PASS model for girls and boys was "I do an organised sport or activity after school because it gets you fit". This item was purposely developed for the Y-PASS questionnaire because it was perceived to be one of the most important factors that influenced after-school physical activity by both boys and girls in the focus groups (see Chapter 4). Interestingly, this was the only predictor identified in the whole model for girls, explaining 7% of the variance of girls' after-school MVPA. This finding suggests that children who engage in sport and value fitness outcomes from sport are more likely to be active. Again, it needs to be highlighted that this item incorporates the outcome variable and only children who do an organised sport or activity will agree with this statement, suggesting a bias towards active children. In addition to this predictor item, other beliefs about organised sports and activities, including improving skills and meeting new people, also predicted after-school MVPA for boys. Based on these findings, it could be suggested that boys see more advantages to organised sports and activities compared to girls. Studies have found that all these factors are strong motivators for engaging in organised sports. McCullagh et al. (1993) conducted a study with a group of children from a soccer league who ranked fitness and improvement of skills as the most important motivators for engaging in sport, with meeting new people as the second most important motivator. Educating children about the positive socialisation and fitness benefits of

engaging in physical activities, such as sport, could be an important strategy for increasing children's physical activity.

Sociocultural predictors

The strongest predictors for boys' after-school activity levels, as assessed by the after-school Y-PASS questionnaire, were related to social influences, including "Social support" and "I am not active after school because I have no-one to play with". "I am not active after school because I have no-one to play with" also includes part of the outcome variable (i.e. "I am not active") and therefore, it is not surprising that it has a strong negative association with after-school physical activity (note that this item was reverse coded). This means that boys who are active will disagree with this statement regardless of whether they are active individually or with friends. The majority of the items in the "Social support" factor were focused around support from parents for organised sports and activities and non-organised activities, with only one item relating to support from peers. Children aged 10-14 years are still relatively dependent on their parents to facilitate and reinforce physical activity behaviours (Sallis, Prochaska, et al., 2000), hence this finding is expected. The inclusion of only one peer support item in this factor does not mean that peer support is less important than parental support. It just happened to be the only item that loaded onto the "Social support" factor in the factor analysis described in Chapter 6. In two context-specific studies, Hohepa et al. (2007) and Ommundsen et al. (2006) also found that support from parents and peers were key predictors of children's after-school physical activity. There has been a suggestion that physical activity behaviours of significant others, such as peers and parents, are a major influence on a child's physical activity through role modelling or direct encouragement (Moore et al., 1991). The findings from the current study also show that children who perceive their parents as role models and receive direct encouragement from parents and peers have higher after-school physical activity levels. It would be interesting to extend data collection in future studies to assess activity patterns of significant others.

Physical environmental/policy predictors

In the after-school period, more physical environmental factors were identified as strong predictors of boys' MVPA compared to the lunchtime period. This may be explained by the

heterogeneity of the after-school context, as discussed in the literature review (Ajzen & Fishbein, 1980). No physical environmental predictors were identified for girls' after-school MVPA using the Y-PASS questionnaire.

The items that formed the "Weather" factor were all negatively worded and subsequently reverse coded for analysis. The interpretation of the findings suggest that the finer the weather (in regards to moderate temperatures and minimal rainfall), the more MVPA boys engaged in, whereas the more extreme the weather (i.e. hot temperatures and rainfall) the less MVPA boys engaged in. This may be because finer weather is more conducive to outdoor play and previous evidence shows that children who spend more time outdoors are more active (Brockman, et al., 2010; Burdette & Whitaker, 2005; Sallis, Prochaska, et al., 2000). This finding was also identified in a study by Patnode et al. (2010), who found a positive association between temperature and boys' physical activity but no association with girls' physical activity. Brodersen et al. (2005) also found differences by sex between weather-related variables and children's physical activity. Interestingly, this study showed negative associations between boys' physical activity and air temperature but no association with rain (Brodersen, et al., 2005). The "Weather" factor in the current study was a composition of items relating to both temperature and rainfall, which prevents the identification of associations with distinct types of weather variables. As weather is not a modifiable factor, strategies to increase children's after-school physical activity should include providing access to appropriate indoor and outdoor spaces where children can be active or teaching children how to dress appropriately for different types of weather.

7.5.2.3 Summary of the predictors identified by the LEAP II questionnaire

There were some differences in the predictors identified by the Y-PASS questionnaires compared to the LEAP II questionnaire prediction equations due to differences in the correlates assessed and items used. Some predictors, however, did correspond between the Y-PASS and LEAP II questionnaires (see Table 7.11).

Overall, the generic LEAP II questionnaire does not provide any multi-dimensional insights into influences on boys' and girls' lunchtime physical activity, whereas the context-specific Y-PASS questionnaire is far more informative in that, in addition to "Age" and "PE enjoyment" (as identified by the LEAP II questionnaire), the Y-PASS questionnaire provides information in relation to other intrapersonal, sociocultural and physical environmental/policy predictors. This suggests that a context-specific questionnaire may be more appropriate in understanding the multi-dimensionality of boys' and girls' lunchtime physical activity.

In comparison to the lunchtime period, more variables were identified in the LEAP II questionnaire prediction equations for boys' and girls' after-school physical activity. The findings show that boys and girls were influenced differently during the after-school period. In the LEAP II model for after-school physical activity, the intrapersonal predictors identified included "Perceived behavioural control" (for boys and girls) and "Intention" (for girls only). "Perceived behavioural control" refers to the perception of the ease or difficulty of performing the behaviour of interest (Ajzen, 1991) and is influenced by a person's internal factors, such as skills, abilities and willpower, and external factors, such as time, opportunity and dependence on others (Craig, Goldberg, & Dietz, 1996). Even though the after-school Y-PASS questionnaire did not contain correlates defined as "Perceived behavioural control", it did contain correlates that were a direct measure of a person's perceptions of internal factors, such as "Perceived competence" and "Barrier self-efficacy", and external factors, such as "Access to facilities/equipment" and "Weather". These factors reflect aspects of "Perceived behavioural control". It could therefore be concluded that the Y-PASS questionnaire and the LEAP II questionnaire do have some concordance in the predictors of after-school physical activity.

"Sport participation" assessed by the LEAP II questionnaire was identified as the strongest predictor of boys' and girls' after-school physical activity. This variable was not assessed by the Y-PASS questionnaires. The strength of association was stronger in girls compared to boys. This could mean that girls who play sport obtain a higher proportion of their total physical activity from sport, whereas boys may acquire a higher proportion of their daily physical activity from other activities. Previous research has found that organised sports are

an important context where children, particularly girls, can obtain a large proportion of their daily physical activity (Biddle, et al., 2005; Vilhjalmsson & Kristjansdottir, 2003). In addition, this correlate is a measure of behaviour and therefore, a strong relationship with the physical activity outcome variable is expected. Evidence from cross-sectional studies assessing the relationship between sport participation and overall physical activity provides some initial support for sport participation as a predictor of physical activity. Harrison et al. (2003) conducted a cross-sectional study with more than 50,000 adolescents and found that adolescents who participated in sports were more likely to be active than non-participants. Similarly, Katzmarzyk and Malina (1998) found that children aged 12-14 years who engaged in sports had larger total daily energy expenditure, as well as larger MVPA, compared to children who did not participate in sports. It is clear from this evidence that promoting participation in sports, particularly in the after-school period, is an important intervention strategy for increasing children's physical activity behaviour.

No social correlates were identified as predictors by the LEAP II questionnaire in the current study, even though social variables were identified as important correlates of children's after-school physical activity by the Y-PASS questionnaire. A similar finding was reported in other LEAP studies, in which social variables appeared to be weak predictors of adolescent girls' MVPA (Motl, et al., 2002; Saunders, et al., 2004). The social variables included in the LEAP II questionnaire included a "Social provisions" correlate, a "Social support" correlate focusing only on family support, and a "Subjective norm" correlate, which consisted of items relating to expectations of others around being physically active and motivation to comply to these expectations. It was surprising that the "Social support" correlate was not identified as a predictor of after-school physical activity, as children tend to rely on their family to be able to attend after-school activities, such as providing the transport and money to pay for activities and the necessary equipment/uniforms.

It was suggested previously that the more heterogeneous a context, the more likely environmental correlates would be identified in prediction equations. However, no environmental correlates were identified by the LEAP II questionnaire for both boys and girls. The lack of environmental correlates identified as predictors of after-school physical

activity may be due to the questionnaire itself and how it was analysed. Environmental correlates were not the focus of the LEAP II questionnaire. Instead, the focus was on psychosocial correlates. Only four environmental items were included to form the "physical environment" factor. Each item addressed a different aspect of the physical environment, namely access to loose equipment, access to physical activity facilities, and neighbourhood safety (two items). The use of a composite factor score could also explain why the environmental correlates were not identified (Motl, et al., 2007). This prevents the identification of a relationship between each unique environmental correlate and physical activity. The Y-PASS questionnaire provides some initial evidence that other environmental correlates may be important in predicting after-school physical activity, particularly in boys, such as the weather and time availability, and therefore more environmental items specific to the context under investigation should be considered in future studies using the LEAP II questionnaire.

7.5.3 Physical activity behaviour during the lunchtime and after-school periods

Although it was not one of the main aims of this study, investigating the physical activity behaviours of children during the lunchtime and after-school periods has provided some interesting insights into the relative importance of these time periods in a school day. Physical activity was assessed using accelerometers, which addresses one of the main limitations of current correlate studies assessing context specificity (Hohepa, et al., 2007, 2009; Leslie, et al., 2010; Ommundsen, et al., 2006; Pate, et al., 1997; Saunders, et al., 1997). These studies have used self-report measures of physical activity with varied psychometric properties, limiting confidence in the outcomes. In the current study, contextual information on the types of activities performed during the lunchtime and after-school periods was obtained from the activity checklists. The findings from this analysis show that despite having two periods that present an opportunity for physical activity during a school day, a large proportion of children are still relatively inactive.

Overall, only 53% of the sample met the daily recommended physical activity guidelines for Australian children (Department of Health and Ageing, 2004), with boys having a lower compliance with the guidelines compared to girls (40% of boys, 54% of girls). This is not

consistent with the majority of the objective physical activity literature (e.g. Chung, et al., 2012; Tudor-Locke, et al., 2006). This may be the result of lower physical activity motivation of the boys who did participate in the study or that girls were more active at other times of the day compared to boys, resulting in a greater proportion of girls meeting the recommended physical activity guidelines. Boys engaged in larger proportions of MVPA during both lunchtimes (35% of lunchtime) and after-school periods (14% of the after-school period) compared to girls (21% of lunchtime; 11% of the after-school period), with the difference between boys and girls being similar between the two periods (equating to approximately 5 minutes). This sex difference is consistent with other lunchtime studies (Jones, et al., 2010; Ridgers, et al., 2005; Ridgers, et al., 2007a, 2007b; Verstraete, et al., 2006) and after-school studies (Brockman, et al., 2010; Jago, et al., 2005; Mota, et al., 2003), which used accelerometers as the objective physical activity measurement.

In relation to the actual proportion of time spent in MVPA for boys and girls, this is relatively comparable to the average value found in the literature, in which children spend approximately 30% of their lunchtime in MVPA and 12% of their after-school time in MVPA (see Table 7.12 and Table 7.13). This shows that relative to the time available for physical activity, children's physical activity during lunchtime is quite high compared to after school, highlighting that the after-school period is a critical window for intervention. This also illustrates the importance of the lunchtime period for physical activity opportunity. The accelerometry data are supported by data from the activity checklists. Considering the types of activities children engage in during these different time periods, boys and girls reported playing more active games during lunchtime (80% of the top ten activities), such as running/jogging, football, chasey and skipping, and more sedentary or light activities during the after-school period (60% of the top ten after-school activities were classed as sedentary or light activities), such as watching TV, playing computer games, homework and riding in a car/truck. The differences in time spent in MVPA and the different activities children engage in across the time periods indicate that children have different priorities and preferences in different environments, and varied access to different types of activities during lunchtime and after school. This suggests a need to target physical activity and health messages and develop different interventions that are time-period specific.

Table 7.12 Contribution of lunchtime MVPA to daily physical activity levels and physical activity recommendations

Author	Country	Physical activity measure	Lunchtime in MVPA (%)		Contribution of lunchtime MVPA to daily physical activity (%)		Contribution of lunchtime MVPA to physical activity recommendations (%)[a]	
			Boys	Girls	Boys	Girls	Boys	Girls
THIS STUDY	Australia	Accelerometer	35	21	21	13	21	13
(Ridgers, et al., 2005)	U.K.	Accelerometer	33	25	-	-	47	35
(Mota, et al., 2005)	Portugal	Accelerometer	15	19	7	8	15	19
(Verstraete, et al., 2006)	Belgium	Accelerometer	57	44	-	-	68	50
(Ridgers, et al., 2007b)	U.K.	Accelerometer	32	24	-	-	-	-
(Wickel & Eisenmann, 2007)	U.S.	Accelerometer	45	-	16	-	30	-
(Ridgers, et al., 2009)	Hungary	Accelerometer	25	17	13	11	32	22
(Jones, et al., 2010)	U.K.	Accelerometer	15	10	-	-	30	20
(Ridgers, et al., 2007a)	U.K.	Accelerometer	32	24	-	-	43	33
(Beighle, et al., 2006)	U.S.	Pedometer	78	63	-	-	20	16
(Tudor-Locke, et al., 2006)	U.S.	Pedometer	-	-	15	16	27	24
(Loucaides, et al., 2009)	Cyprus	Pedometer	-	-	-	-	9	9
(Brusseau, et al., 2011)	U.S.	Pedometer	-	-	13	12	20	18

Author	Country	Physical activity measure	Lunchtime in MVPA (%)		Contribution of lunchtime MVPA to daily physical activity (%)		Contribution of lunchtime MVPA to physical activity recommendations (%)[a]	
			Boys	Girls	Boys	Girls	Boys	Girls
(Ridgers, et al., 2007b)	U.K.	Heart rate	33	25	-	-	-	-
(Stratton, et al., 2007)	U.K.	Heart rate	30	23	-	-	43	33
(Stratton & Mullan, 2005)	U.K.	Heart rate	41	35	-	-	17	15
(Ridgers & Stratton, 2005)	U.K.	Heart rate	31	24	-	-	43	34
(Fjørtoft, Lofman, & Halvorsen Thoren, 2010)	Norway	Heart rate	64	57	-	-	43	38
(Jennings-Aburto, et al., 2009)	Mexico	Direct observation	43	36	-	-	22	18
(Waring, et al., 2007)	U.K.	Direct observation	14	8	-	-	17	10
MEDIAN			33	25	13	12	30	21

Notes: "-" Cannot be calculated due to limited details provided

[a] The recommended physical activity guidelines are based on the 60 minutes of at least moderate physical activity a day or 12000 steps (girls) and 15000 steps (boys) [BMI-referenced physical activity cut-points] criteria (Tudor-Locke, et al., 2004)

Table 7.13 Contribution of after-school MVPA to daily physical activity levels and physical activity recommendations

Author	Country	Physical activity measure	After-school time in MVPA (%)		Contribution of after-school MVPA to daily physical activity (%)		Contribution of after-school MVPA to physical activity recommendations (%)[a]	
			Boys	Girls	Boys	Girls	Boys	Girls
THIS STUDY	Australia	Accelerometer	14	11	36	31	37	29
(Mota, et al., 2003)	Portugal	Accelerometer	22	12	29	25	67	37
(Jago, et al., 2005)	U.S.	Accelerometer	6	1	47	27	23	5
(Brockman, et al., 2010)	U.K.	Accelerometer	7	5	26	27	20	15
(Veitch, et al., 2006)	Australia	Accelerometer	-	-	21	21	44	34
(Tudor-Locke, et al., 2006)	U.S.	Pedometer	-	-	48	48	52	49
(Beighle, et al., 2006)	U.S.	Pedometer	23	20	-	-	48	48
MEDIAN			15	9	29	27	46	36

Notes: "-" Cannot be calculated due to limited details provided

[a] The recommended physical activity guidelines are based on the 60 minutes of at least moderate physical activity a day or 12000 steps (girls) and 15000 steps (boys) [BMI-referenced physical activity cut-points] criteria (Tudor-Locke, et al., 2004)

7.5.4 Strengths and limitations

A particular strength of this study was the large and geographically diverse sample. In addition, the data were stratified by sex and sex-specific analyses were conducted. The findings showed that specific sex differences exist, which highlights the need for more sensitive correlate measures and supports current literature (Trost et al., 1996). Another strength of the study was the use of an objective measure of physical activity and a multi-dimensional theoretical framework to explore the influences of physical activity behaviour.

A number of limitations to this study, however, need to be acknowledged as these may influence the interpretation of the study's results. Firstly, the cross-sectional nature of this study precludes the evaluation of any causal relationships with context-specific physical activity behaviour and the identification of factors that initiate change in physical activity behaviour. Secondly, although random sampling was conducted to obtain a representative sample of schools in different SES areas, it is possible that the number of school selected was not necessarily proportional to the distribution of schools within each SCR band, thus potentially over representing low or high SES areas. In addition, classes within each school were not randomly selected, therefore potentially reducing the generalisability of the findings. Thirdly, a number of the predictors identified from the Y-PASS and the LEAP II questionnaires encapsulate some of the physical activity outcome variable. This may mean that only children engaging in the specific type of physical activity in question will have an opinion and be able to respond appropriately to the item. For example, one of the items in the Y-PASS questionnaire was "I do an organised sport or activity after school because it gets you fit". Similarly, the LEAP II questionnaire includes a similar factor related to "Sports participation". Children may disagree with these types of statements because they do not participate in the specific type of activity, or they may participate in the specific activity but disagree with the motivation for participating. It is important to keep this in mind when interpreting the strength of relationship of these types of items with context-specific physical activity.

This study assessed the perceptions of children in regards to environmental correlates, rather than objective measures of these correlates. Previous research has found that

perceived environmental correlates are more predictive of behaviour and therefore, appear to be more important than 'actual' environmental correlates (Maddison et al., 2009; Prins, et al., 2009; Scott, et al., 2007). However, it is acknowledged that relying only on perceptions can potentially result in an incorrect estimation of the true associations between the environmental correlates and physical activity behaviour. Furthermore, children may misreport their perceptions, resulting in systematic biases in the results. For example, children with low self-efficacy may have distorted perceptions of their social and physical environments (Ball, et al., 2008). Future studies investigating relationships between correlates and physical activity should not only collect data on children's perceptions, but should also consider collecting objective data of correlates where possible. Another limitation of the study was that biological maturation was not assessed or controlled (Mirwald, Baxter-Jones, Bailey, & Beunen, 2002). Studies have shown that physical activity of children aged 10-14 years is confounded by variability in biological maturation (Machado Rodrigues et al., 2010; Mirwald, et al., 2002). Future studies should control for maturation status, which can be predicted by assessing sitting height, height, body mass and chronological age (Mirwald, et al., 2002).

While accelerometers are advantageous in reducing proxy and participant reporting bias, there are important technological and methodological limitations of the device that need to be acknowledged. The placement of the accelerometer on the hip reduces the ability to accurately assess movement of the arms and additional energy expenditure of carrying loads while moving (Esliger, et al., 2005). Furthermore, accelerometers are limited in their ability to pick up movement while cycling (Esliger, et al., 2005). The GT3X ActiGraphs are not waterproof and therefore children are required to remove the monitor when engaging in water-based activities, such as swimming and showering (Esliger, et al., 2005). Finally, the choice of averaging epochs, using specific cut-point thresholds, decisions about the minimum wear time required and the sampling period can all affect the strength of association between correlates and physical activity behaviour (Masse, et al., 2005; Trost, et al., 2011). Despite these limitations, the accelerometer is frequently used in this research field and provides a feasible method for measuring physical activity in children. The use of accelerometers to objectively measure physical activity was a strength of this study and was appropriate for addressing the study aims. Data reduction methods commonly applied in

published studies have been used where possible to maximise the utility and comparability with other studies.

7.5.5 Practical implications and future recommendations

In light of the results from this study, there are a number of practical implications and avenues for future research. To my knowledge, this is the only study that has assessed the predictors of children's time-specific physical activity in all domains of the social ecological model, using an objective measure of time-specific physical activity in congruence with a psychometrically tested time-specific correlate measure.

There is some reluctance in making major intervention recommendations based on the current findings due to a large percentage of variance unexplained (Baranowski, et al., 1998). However, the findings from this study could potentially be used by schools, health promoters and policy makers to inform the development of appropriately targeted lunchtime and after-school physical activity interventions or modify existing policies to address the identified barriers and facilities of lunchtime and after-school physical activity. Examples of potential strategies could include changing uniform policies to allow children to wear a uni-sex physical education uniform during the lunchtime period or altering the school uniform design to be practical and allow ease of movement, modifying PE lessons to reflect gender equality in the activities chosen and increase children's sense of choice, ensuring lunchtime and after-school interventions focus on strengthening peer relationships and peer group dynamics, and targeting engagement in after-school organised sports and activities.

It is important that the messages presented for promoting lunchtime and after-school physical activity be tailored for each context and sex because this study has clearly demonstrated that boys and girls are influenced differently in different physical activity contexts. The use of a "one size fits all" approach will not necessarily capture or influence the primary correlates of each context. Furthermore, these findings can be used to refine existing correlate measures and models of physical activity behaviour that are to be used in future studies of children's context-specific physical activity. Studies wanting to assess the

correlates of physical activity behaviour need to understand the characteristics of the context under investigation before choosing a 'type' of correlate measurement. For example, a generic 'off the shelf' questionnaire appears to be an appropriate tool to assess broad, more variable contexts, such as after-school physical activity. However, if the physical activity context is very structured and homogeneous with unique characteristics, effort needs to be taken to ensure the correlate measure is specifically targeted to the particular context under investigation.

To address the limitations of this study and extend current research in this area, a number of recommendations have been proposed. These recommendations may assist in increasing the amount of explained variance and improving our understanding of children's physical activity behaviour. It appears that the predictive utility of the after-school Y-PASS questionnaire is not as effective as the lunchtime Y-PASS, suggesting that there is a need for either increased specificity congruence between the Y-PASS questionnaire and the physical activity outcome or the need for further exploration into other correlates not assessed in the current study. Future studies could break down the after-school period into exploring the correlates of different types of behaviours occurring during this period separately, such as after-school active transport, after-school organised sports and activities and after-school non-organised activities, rather than trying to explore correlates of all these types of behaviours in the one questionnaire, as was done in the current study for practicability purposes. This will allow for a much more in-depth exploration of the different types of behaviours occurring in the after-school time period. In addition to exploring children's perceptions, objective measurement of the environmental correlates could also be included. Direct observation or school audits would be appropriate methods to use in the assessment of environmental correlates.

Physical activity was defined in this study by the intensity and the time period in which it occurred. A limitation of using a single outcome variable, such as minutes in MVPA, is the inability to discriminate between participants who spend time just above the moderate threshold compared to those who spend more time in vigorous physical activity. Instead of using a single outcome variable (e.g. MVPA), future studies could use a spectrum of energy

expenditures. When using accelerometry, counts per minute during the specified time frame can be estimated as a continuous outcome variable, rather than minutes in different activity intensities. A number of other methods can be used to estimate energy expenditure, such as doubly labelled water and direct calorimetry; however, these methods are often expensive and impractical for use with large populations of children. An alternative more practical method could be the use of time use methodologies, such as the Multimedia Activity Recall for Children and Adults (MARCA) (Ridley, et al., 2006). These tools can capture the contextual information, such as the exact types of activities, along with the corresponding energy expenditure value as classified by the Compendium of Energy Expenditures for Youth (Ridley, et al., 2008).

Prior to the development of interventions using the findings from this study, the confounding and moderating variables should be identified, as these can impact on the effectiveness of an intervention (Baranowski, et al., 1998; Bauman, et al., 2002). Some of the items in the Y-PASS and LEAP II questionnaires do encompass some of the outcome variable. Even though the wording of these items were guided by children and experts in the field, future studies could consider refining the questionnaire items to ensure that they are purely assessing the correlate and not the dependent variable. Finally, future studies could consider conducting prospective designs to provide an understanding of the causal relationships of context-specific correlates on context-specific physical activity.

7.6 Conclusion

The lunchtime and after-school time periods are two critical windows in a school day for children to accumulate their recommended physical activity levels. However, the results from this study show that children are only spending a small portion of these time periods in MVPA and only half are meeting the recommended physical activity guidelines. It is important to have a clear, meaningful picture of what is influencing children's physical activity during these periods so that interventions can be developed that target the most important predictors and the distinct needs of boys and girls. This study has provided evidence of the most important predictors of both boys' and girls' physical activity occurring at lunchtime and after school and demonstrated the effectiveness of context-specific

correlate questionnaires in predicting children's context-specific physical activity compared to a generic questionnaire, except in girls' after-school physical activity. Using a context-specific approach has improved our capacity to identify the unique features of physical activity behaviour in specific contexts and underscores the potential value of using specific conceptual frameworks in understanding and examining children's physical activity. However, there is still a lot of variance not explained by the context-specific questionnaires and warrants attention in future research. Future studies need to focus on using more accurate measures of lunchtime and after-school physical activity behaviour, exploring new factors that may influence physical activity behaviours in the lunchtime and after-school periods and refining context-specific correlate measures. Such evidence will assist in developing future initiatives targeting the promotion of physical activity in the lunchtime and after-school specific contexts.

CHAPTER 8

Conclusion

Chapter 8

8 Conclusion

It is important that children engage in appropriate levels and types of physical activities to improve and maintain their health and well-being. Children's physical activity occurs in a number of different contexts that when amalgamated, contributes to their overall levels of physical activity. The lunchtime and after-school contexts are two important but characteristically unique periods of the day where children have an opportunity to engage in physical activity (Beighle, et al., 2006; Mota, et al., 2003). However, evidence shows that children are not engaging in adequate levels of physical activity during these periods, which may be contributing to the concerns over the number of children failing to achieve the overall recommended levels of activity (Fisher, Reilly, et al., 2005; Hinkley, et al., 2008; Sallis, Prochaska, et al., 2000). Efforts to increase physical activity levels during these periods have had modest success at best (Salmon, et al., 2007; Van Sluijs, et al., 2007). It has been proposed that the implementation of a "one size fits all" approach may be limiting the effectiveness of these initiatives because they are not targeting the most important correlates of physical activity in these particular contexts (Thomas, 2006). As a result, it was highlighted in the introduction that there is a need to explore children's physical activity patterns during these periods and the correlates that influence their activity. This information can be used to predict physical activity and inform future intervention efforts.

At the conception of this thesis very few studies had explored the correlates of children's lunchtime and after-school physical activity. A review of the literature, reported in the introduction chapter, showed that the majority of evidence available centred on children's habitual physical activity or specific types of physical activity, such as active transport and organised sports, without defining the time of day in which these behaviours are performed. Studies applying these correlates to predict physical activity tend to explain only modest amounts of variance, which raises a number of concerns as to the relevance of these

correlates in specifically defined contexts and highlights a very important gap in the literature.

In light of this gap in the current literature, the primary purpose of this thesis was to improve the prediction of children's physical activity behaviour, exploring specifically the lunchtime and after-school contexts. It has been proposed that increasing specificity of correlate research can improve prediction and our understanding of physical activity, and thus potentially improve the effectiveness of interventions. A brief review of the current literature on the correlates of lunchtime and after-school physical activity presented in the introduction demonstrated that, of the few studies that exist, the majority of them lacked measurement congruence between the correlate and physical activity outcome, which may influence the study's predictive capacity. There were no known measures which: assessed correlates at all levels of the social ecological model, contained specifically worded items for the lunchtime and after-school periods, and assessed correlates which have been conceptualised by children. Furthermore, there were no studies that tested the specificity concept in the lunchtime and after-school time periods. Therefore, two key questions were proposed to address the gaps in the literature and contribute to the current body of evidence.

1. Do context-specific correlate questionnaires predict context-specific physical activity better than generic correlate questionnaires?
2. What are the intrapersonal, sociocultural and physical environmental/policy predictors of children's physical activity occurring in the lunchtime and after-school contexts?

To answer these questions, there was a need to develop correlate measures specific to the lunchtime and after-school contexts. Four related studies were implemented, with each study contributing evidence toward the development and testing of the context-specific correlate questionnaires and building on the previous study (see Figure 8.1). The following section will summarise the main findings of each study and discuss these in reference to the original aims of the thesis and how it has contributed to the current literature. In light of the thesis findings, implications for correlate research are discussed and potential avenues for future research are proposed.

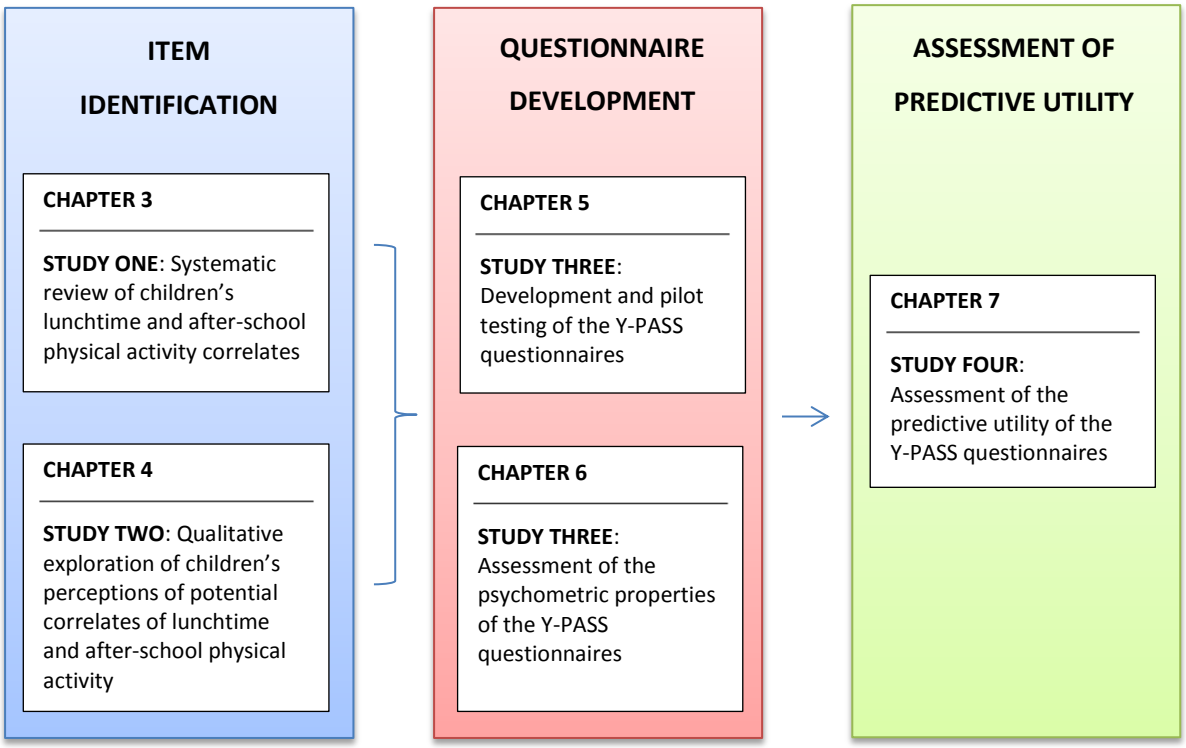


Figure 8.1 Studies implemented toward the development and testing of the Y-PASS questionnaires

8.1 Summary of the main findings

8.1.1 *Study One: systematic review of the correlates of children's lunchtime and after-school physical activity*

The first step in the questionnaire development was to identify potential content for inclusion in the questionnaires. No systematic review had been conducted on the correlates of lunchtime and after-school physical activity from a multi-factorial perspective prior to this study. Therefore, there was nothing to inform the development of the questionnaires. Study One was a systematic review of the current quantitative literature to identify intrapersonal, sociocultural and physical environmental/policy correlates of children's lunchtime and after-school physical activity. The findings from this review demonstrated a paucity of high quality evidence and lack of clarity in this area and further justified the importance of focusing on the lunchtime and after-school physical activity contexts. Sex and age, with boys and

younger children more active, were consistently associated with higher levels of lunchtime physical activity in two or more studies, and family affluence, access to a gym, access to four or more physical activity programs and the condition of a playing field were all associated with lunchtime physical activity in only one study. Access to loose and fixed equipment, playground markings, size of and access to play space and the length of lunchtime were all positively associated with changes in lunchtime physical activity in intervention studies. Sex (with boys more active), younger age, lower body mass index (for girls), lower TV viewing/playing video games, and greater access to facilities were associated with higher levels of after-school physical activity in two or more studies. Parental supervision was negatively associated with girls' after-school physical activity in one study. This review is a significant contribution to the literature because it is the first to provide an overview of the current evidence for influences on children's lunchtime and after-school physical activity from a multi-dimensional perspective.

8.1.2 Study Two: qualitative exploration of children's perceptions of potential correlates of lunchtime and after-school physical activity

Study Two was a descriptive qualitative study conducted with children to identify their perceptions of the factors that influence children's lunchtime and after-school physical activity. This study was developed to supplement the findings from the systematic review to ensure that all possible factors were identified prior to developing questionnaire items. Due to the considerable lack of evidence identified in the systematic review, particularly in relation to intrapersonal and sociocultural correlates, it was clear that there was a need to better understand the correlates. Talking to children provided more in-depth contextual insights into factors that are rarely considered in the quantitative correlate literature, as well as the relative importance of factors in the different contexts. The factors perceived to be most important in the lunchtime period included:

- perceived competence
- behavioural attitudes/beliefs/feelings about physical activity (e.g. improving skills, hanging out with friends, something to do/nothing to do, making up game rules and activity preferences)
- enjoyment

- peer influence (someone/friends to play with, no-one to play with, bullying/teasing and peer acceptance/social norm)
- teacher influence (teacher barriers and teacher support)
- access to and suitability of space
- access to programs/facilities
- access to equipment
- weather
- school uniform
- time constraints
- school rules

The most important factors influencing children's after-school physical activity, as perceived by children included:

- perceived competence
- enjoyment
- parental influence
- peer influence
- safety in the neighbourhood and home settings
- travel distance to and from places in the neighbourhood
- weather
- time available for active pursuits

This qualitative study builds on previous quantitative research by providing important contextual information about factors, which was essential in the development of the context-specific correlate questionnaires. Furthermore, the qualitative study identified sociocultural and intrapersonal factors of lunchtime and after-school physical activity that have not previously been explored in quantitative studies. The limitation of existing correlate questionnaires is that they are often developed from a generic perspective (i.e. no reference to a time, place or specific type of activity) and focus on a narrow set of adult-inferred correlates. Very few correlate questionnaires have been developed in collaboration with children. Incorporating these qualitative findings into developing context-specific correlate

questionnaires ensures a better match with children's actual experiences in these contexts, and thus potentially improves the reliability, validity and appropriateness of data obtained.

The use of both quantitative and qualitative methodologies has enriched the understanding of the potential influences of children's lunchtime and after-school physical activity and sets this study apart from the existing literature. The findings from both these studies have contributed evidence toward one of the key questions of this thesis; "What are the intrapersonal, sociocultural and physical environmental/policy predictors of lunchtime and after-school physical activity?" Interestingly, some correlates were identified in both the systematic review and the focus group discussions, such as access to programs and facilities, access to and suitability of space (also referred to as condition of a space) and access to equipment, while others were only identified in the focus groups (e.g. peer influence, teacher influence, weather, school uniform, bullying/teasing) or the systematic review (e.g. TV viewing/playing video games, sex, age, body mass index, access to after-school facilities). This clearly highlights the importance of using both methodologies because it not only confirmed the importance of factors but also uncovered new insights into additional factors, thus ensuring all potential factors of physical activity behaviour were identified (Masse, et al., 2002).

8.1.3 Study Three: development of the Y-PASS questionnaires

The pool of potential correlates identified from the systematic review and the focus group discussions was transformed into context-specific items for the computer-delivered lunchtime and after-school "Youth Physical Activity Survey for Specific Settings" (Y-PASS) and pilot tested in Study Three. The Y-PASS questionnaires contained three subscales relating to the different domains of the social ecological model (intrapersonal, sociocultural and physical environmental/policy domains). Many existing correlate questionnaires either do not demonstrate appropriate psychometric properties or do not report these, which is fundamental to understanding the correlates that could be targeted in physical activity interventions. Face and content validity were established through an evaluation of item content by a panel of physical activity and questionnaire development experts. Furthermore, the face validity, including the design, content and usability aspects, was refined and

confirmed through a series of pilot tests with a subsample of the target population. Factorial structure and internal consistency were explored through an exploratory factor analysis. All subscales demonstrated acceptable internal consistency (Cronbach alpha = 0.78 – 0.85), except for the lunchtime sociocultural subscale, which demonstrated moderate internal consistency (Cronbach alpha = 0.75). Furthermore, there were some factors within the subscales that did not exhibit strong internal consistency. This may have been due to the small number of items loading onto these factors and is an acknowledged limitation of the study. Test-retest reliability of the questionnaires was assessed to determine the internal stability. After the removal of items with poor test-retest reliability, the remaining factors and items demonstrated fair to almost perfect test-retest reliability (ICC = 0.26 – 0.93) and were deemed appropriate for use in a larger sample of children.

In order to test whether the concept of increasing specificity of correlate measurement improved prediction of context-specific physical activity, the LEAP II questionnaire was identified as the comparable generic correlate questionnaire. However, at the conception of this study, there were no existing reliability data for some of the correlates and no reliability data for an Australian population. The LEAP II questionnaire exhibited acceptable internal consistency (Cronbach alpha = 0.51 – 0.94) and test-retest reliability (ICC = 0.28 – 0.91), except for the PE enjoyment (ICC = 0.13) and physical activity enjoyment factors (ICC = 0.05). These findings were not comparable to existing literature and may be due to the differences in methodologies between the studies.

8.1.4 Study Four: assessment of the predictive utility of the Y-PASS questionnaires

This program of research culminated with Study Four, which addressed the two key research objectives:

(1) Comparing the effectiveness of the Y-PASS questionnaires versus the LEAP II questionnaire in predicting children's lunchtime and after-school physical activity.
(2) Identifying the predictors of lunchtime and after-school physical activity by examining the relationship between objectively measured lunchtime and after-school physical activity and context-specific correlates, as assessed by the Y-PASS questionnaires, and generic correlates, as assessed by the LEAP II questionnaire.

Three key findings emerged from this study. Firstly, it has previously been proposed that increasing the specificity of correlate research might improve prediction and understanding of physical activity occurring in specific contexts (Ajzen & Fishbein, 1980; Giles-Corti, et al., 2005). The findings from this study showed that the context-specific Y-PASS questionnaires outperformed the generic LEAP II questionnaire in explaining the variance in physical activity for boys at lunchtime (25% variance explained versus 8%), for girls at lunchtime (17% versus 6%), for boys after school (20% versus 11%), but not for girls after school (7% versus 23%). This provides some support that context-specificity of correlate measurement is important in more structured homogenous contexts compared to more diverse contexts. However, there is still a large proportion of variance unexplained by the context-specific questionnaires. According to Baranowski et al. (1998), any model of physical activity behaviour must account for at least 30% or more variance before interventions can be successfully developed. Therefore, there is a need for further research in this area, as well as continued refinement of context-specific questionnaires before interventions are developed based on these results.

Secondly, the findings from this study showed that boys and girls were influenced differently during the lunchtime and after-school periods and the predictors identified were dependent on the type of correlate questionnaire used. The predictors of boys' lunchtime physical activity, assessed using the context-specific Y-PASS, were "I like to walk around at lunchtime", "Our school play area has painted lines on the ground to help me be active at lunchtime" and "Age", which had negative associations with lunchtime physical activity, and "Behavioural attitude/belief", "SEIFA" and "Peer influence", which were positively associated with lunchtime physical activity. These predictors explained 25% of the variance. In comparison, "Age" was the only predictor of boys' lunchtime physical activity when assessed using the generic LEAP II questionnaire and was negatively associated with lunchtime physical activity, explaining only 8% of the variance. For girls, "I like to walk around at lunchtime" and "Age" were negatively associated with lunchtime physical activity and "I always have the energy to be active at lunchtime", "I can still be active at lunchtime even if I am wearing my school uniform", "Access to facilities and equipment", "Barrier self-

efficacy", "I really like doing PE at school", "Peer influence" and "Perceived self-efficacy" were positive predictors of lunchtime physical activity, explaining 17% of the variance. When using the LEAP II questionnaire, "PE enjoyment" (positive association) was identified as the only predictor and explained only 6% of the variance.

The predictors of after-school physical activity differed between boys and girls. The predictors of boys' after-school physical activity from the Y-PASS questionnaire were "Perceived competence", "Access to facilities/equipment", "I do an organised sport or activity after school because I want to meet new people", "I have enough time to do an organised sport or activity after school", "Perceived barriers","I do an organised sport or activity after school because I want to improve my skills", "I do an organised sport or activity after school because it gets you fit", "Support seeking/social norm", "Barriers self-efficacy", "Weather", "Behavioural attitudes/beliefs (organised sports/activities)", "Behavioural attitudes/beliefs (non-organised activities)", "I am not active after school because I have no one to play with" and "Social support", which were all positively associated with after-school physical activity. This model explained 20% of the variance of after-school physical activity. Only two positive predictors were identified using the LEAP II questionnaire ("Perceived behavioural control" and "Sports participation") and only explained 11% of the variance. For girls, the predictors identified from the LEAP II questionnaire explained more variance in after-school physical activity than the Y-PASS questionnaire. The prediction equation of generic correlates ("Age", "Perceived behavioural control", "Intention" and "Sports participation") explained 23% of girls' after-school physical activity, compared to 7% by the context-specific prediction equation, which only contained the predictor "I do an organised sport or activity after school because it gets you fit".

Finally, boys engaged in larger proportions of MVPA during lunchtime and after-school periods compared to girls, which is consistent with existing evidence. In addition, children spent on average 30% of their lunchtime in MVPA and 12% of their after-school time in MVPA, highlighting that the after-school period is potentially a critical window for future intervention initiatives and the lunchtime period is an important context where children are active. These quantitative findings are congruent with the types of activities children

reported engaging in. During the lunchtime period, 80% of the top ten lunchtime activities were classified as MVPA, including running/jogging, football, chasey and skipping, whereas only 40% of the top ten after-school activities were considered MVPA. The majority of the top ten after-school activities were considered sedentary or light activities, including watching TV, playing computer games, homework and riding in a car/truck. From this evidence, it can be concluded that children have different priorities, activity preferences and access to different types of activities in different physical activity contexts and therefore, physical activity research and health messages need to be specifically targeted for different time periods.

8.1.5 Summary

Overall, this thesis has added to correlate research and our understanding of children's context-specific physical activity, which has been identified as a priority area in the behavioural epidemiology framework. There is very limited published evidence for the correlates of children's lunchtime and after-school physical activity, particularly around the intrapersonal and sociocultural influences, a shortcoming highlighted by the systematic review. The focus group discussions and the predictive utility study have contributed additional insights into the potential influences on lunchtime and after-school physical activity from a multi-dimensional perspective. In particular, the findings from the predictive utility study contribute important evidence of intrapersonal and sociocultural correlates of lunchtime physical activity, which have not previously been explored in the current literature. The use of correlate questionnaires that assesses all domains of the social ecological model, contains specifically worded items, and assesses correlates which have been identified by talking to children and reviewing existing evidence, have proven to be effective in improving prediction of physical activity occurring in structured contexts. However, using context-specific correlate questionnaires in unstructured, heterogeneous contexts, such as the after-school context, still requires further exploration.

As identified in the introduction chapter, the only other known study that has explored context-specific physical activity from a social ecological perspective was conducted by Ommundsen et al. (2006). This current thesis has extended Ommundsen et al.'s (2006)

research by addressing a number of methodological limitations acknowledged in the study, including:

- the conduct of a systematic review of the correlate literature to identify evidence of correlates of lunchtime and after-school physical activity
- the identification of predictors perceived to be important by children and that are relevant to the Australian context
- the design of context-specific questionnaires (containing context-specific worded items) to identify time-specific differences in the correlates of lunchtime and after-school physical activity
- the implementation of an exploratory factor analysis to verify the factorial validity of the perceived correlates
- assessment of differences in correlates between boys and girls based on recommendations from previous physical activity correlate research (Sallis, Prochaska, et al., 2000; Van Der Horst, et al., 2007)
- the use of objective measurement to quantify lunchtime and after-school physical activity
- the demonstration of the effectiveness of increasing specificity of correlate research in the areas of children's lunchtime and after-school physical activity.

Despite addressing the main limitations of the Ommundsen et al. (2006) study, the amount of variance explained did not exceed the explained variance reported by Ommundsen et al. (2006). This may be due to the use of self-report to measure both the physical activity outcome and correlates, meaning that there is potential for systematic over-reporting of the correlates and outcome variable (Trost, et al., 1999). Shared method variance is variance that is attributed to the method used, rather than the construct under investigation (Podsakoff, et al., 2003). The consequence of using common methods to assess both the independent and dependent variables may result in inflated correlations with physical activity and increase the total variance explained (Podsakoff, et al., 2003; Trost, et al., 1999). The sample and contexts investigated by Ommundsen et al. (2006) may have exhibited greater variability, which is needed to explain variance in behaviours. Alternatively, the questionnaire used by Ommundsen et al. (2006) may just be more effective at predicting

children's context-specific physical activity. Future research could explore and compare the predictive utility of these two questionnaires when assessing context-specific physical activity.

It is important that children use both periods of the day, rather than just one period, to engage in physical activity. Children can obtain approximately 50% of their recommended daily MVPA during the lunchtime and after-school periods combined, with the potential for this percentage to increase with targeted context-specific interventions. There has been much debate on whether children compensate for increased activity during different periods of the day. This is commonly referred to as the 'activity-stat' hypothesis. In this situation it could be argued that increasing activity during lunchtime and after school may mean that children reduce their activity during other periods of the day, such as before school or in the evenings. The evidence that does exist in the current literature is mixed. An intervention study by Dale et al. (2000) found that children who were exposed to restricted activity opportunities during the school day did not increase their activity after school to compensate for loss of activity. Other observational studies, however, have identified that children do compensate for increased activity during one time by decreasing activity during another time period, suggesting a genetically defined biological set-point, or 'activity-stat' (Fremeaux et al., 2011; Wilkin, Mallam, Metcalf, Jeffery, & Voss, 2006). Alternatively, there has been some cross-sectional evidence of a positive physical activity association with children who actively commute. A number of studies have found that children who actively commute to and from school, such as cycling or walking, are significantly more active overall compared to children who are driven to and from school (Cooper, Andersen, Wedderkopp, Page, & Froberg, 2005; Sirard & Slater, 2008), which does not support the 'activity-stat' hypothesis.

Despite uncertainty surrounding the 'activity-stat' hypothesis (Reilly, 2011), physical activity promotion is still regarded as a public health priority and the benefits of engaging in physical activity should not be underestimated (Biddle & Mutrie, 2008; Pate, et al., 1995; Warburton, et al., 2006). Opportunities still need to be presented to children in numerous contexts across a day so that they can reach their recommended levels of physical activity.

Interventions during the lunchtime and particularly the after-school periods should encourage active play (Brockman, et al., 2010) and focus on restricting sedentary opportunities, which can potentially reduce opportunities for more active pursuits (Stanley, et al., 2011).

8.2 Implications and future research

In the course of this research, a number of important implications have arisen. Practical implications have already been discussed in each chapter for each of the studies and therefore, will not be repeated here. Instead, the focus for this section will be on the implications relating to more general aspects of correlate theory, which should be considered in future correlate research in order to advance the correlate field.

1. *Inclusion of outcomes as predictors*

The way in which questions are asked is critical when assessing correlates. Unfortunately, many questionnaires, including the Y-PASS questionnaires developed as part of this research, contain questions which encapsulated some of the outcome variable. For example, asking a child whether or not he/she agrees with the statement, "I do an organised sport or activity after school because it keeps me fit", assumes that he/she actually engages in organised sport or activities after school and therefore, we are partly assessing actual behaviour. Furthermore, the responses obtained from these types of questions will be biased towards children who engage in these physical activity behaviours. It is true that children who do not engage in specific physical activity behaviours can disagree with such a statement but it is also true that those children who do engage in specific physical activity behaviours can also disagree with this statement, as they may do an organised sport or activity after school but not for the reason of keeping fit. This makes it difficult to interpret the findings. There is a fine line between whether actual behaviour or actual behaviour as a predictor is being assessed.

Using outcomes as predictors has significant implications when assessing strength of relationships. In situations where a questionnaire item includes both a correlate and an

outcome as a correlate (such as “I do an organised sport or activity after school because it keeps me fit”), the relationship between the predictor and the physical activity outcome will undoubtedly be strong. The strength of the relationship may not actually be because the predictor (e.g. “it keeps me fit”) and physical activity has a strong relationship but because the outcome included as a predictor has a strong relationship with the physical activity outcome. Future studies assessing correlates of physical activity behaviour need to focus on the purpose of the questions used. Furthermore, a number of these types of statements (i.e. includes both a correlate and part of the outcome) could be considered ‘double-barrelled’ statements and it has been identified that children aged 10-13 years have difficulty comprehending these. These types of items were developed in the initial stages of the development of the Y-PASS to reflect responses from the focus groups and recommendations from the expert panel, hence the reason for inclusion in the Y-PASS questionnaires. However, this issues associated with ‘double-barrelled’ statements was highlighted following the interpretation of the findings and is acknowledged as a limitation of the Y-PASS questionnaires. Future studies looking to refine the Y-PASS questionnaires could consider rewording these items. For example, instead of wording a statement, “I ride, walk, skate or scooter to and from places after school because it gets me fit”, it could be reworded to be de-personalised and single-barrelled, “Riding, walking, skating or scootering to and from places after school gets children fit”.

2. *Variability of environments/contexts being studied*

Variability of environments or contexts being studied is an important consideration when assessing the prediction of physical activity behaviour. To identify predictors of physical activity behaviour, there needs to be variability in the correlates in order to discriminate between respondents with different behaviours. In standardised environments, such as the school environment, physical environmental correlates may not be discovered as predictors because of lack of variability. In Australia, the majority of schools are relatively similar in regards to physical environmental factors, such as school facilities and weather, compared to other countries, such as the United States. This could potentially explain why fewer physical environmental correlates were identified in this study compared to previous studies, of which a high proportion were conducted in the United States and United Kingdom, and why

there is inconsistency in associations found within the literature (Sallis, Prochaska, et al., 2000). This does not negate the importance of these variables, but just means all respondents are exposed to similar conditions and the variables do not explain physical activity variation. Therefore, inferences made are applicable only for the environments and populations researched and should not be generalised to other contexts. Future studies could consider developing sampling frames to ensure maximum variability in the environments and contexts explored, which has been highlighted in previous studies (Giles-Corti, et al., 2005; Saelens, Sallis, Black, & Chen, 2003).

3. *Diversity of activity options*

The implication of diversity of activity options within a context has also been highlighted by this research. Greater diversity of activity options is likely to lead to lower coefficients of determination, thereby reducing explained variance. This may be why the coefficients of determination were higher for lunchtime than for after-school physical activity. During the after-school period, children are generally exposed to a much wider range of activities, such as organised sports and activities, active transport, and screen-based activities, compared to the lunchtime period. This is also supported by the results from the activity checklist used in the Y-PASS questionnaires. When defining a specific physical activity context by location and time, it is difficult to minimise the diversity of activity options, unless the physical activity context is defined as a particular activity, performed in a specific location at a specific time of day. Future research could focus on further increasing specificity beyond what this research has explored, and examine the influence of reduced activity diversity on the predictive capacity of the physical activity ecological model.

4. *Children's interpretation of items*

When developing new correlate questionnaires, it is necessary to explore how children interpret the correlate items. The item, "Our school play area has painted lines on the ground (e.g. hopscotch and 4-square) to help me be active at lunchtime" is a good example from the lunchtime Y-PASS questionnaire of why it is necessary to explore children's understanding of the items. The findings from this study showed a negative relationship between this item and lunchtime physical activity. It could be argued that schools do not

have painted lines or the painted lines do not facilitate children's play. Based on the findings, however, it is unclear how children interpreted this item. This highlights the importance of interpreting correlates through the eyes of children. Strategies that could be employed by future researchers to explore children's interpretations of correlates include in-depth or cognitive interviewing (De Leeuw, et al., 2004). While pilot tests were conducted in this research to test whether children understood the items, the focus was not necessarily on the actual interpretation of the items. Due to the length of the questionnaires and the limited time available, in-depth exploration of the interpretation of every single item could not be achieved and is an acknowledged limitation of the research. Exploring children's interpretation of items should be a priority when developing or refining questionnaires because it greatly affects the interpretability of the findings.

5. Perceived versus objective measures of correlates

An important issue related to the study of correlates of physical activity behaviour is the measurement of environmental correlates (i.e. whether environmental correlates should be objectively measured or if perceptions of environmental correlates should be assessed). Generally, objective measurement has been viewed as being intrinsically more valid than perceptions. However, children may perceive correlates differently, even if they are exposed to the same 'objective' environment. For example, a person who is more motivated to be physically active may perceive more opportunities to be active or be more knowledgeable about available opportunities compared to someone who is less motivated. Previous research has found that perceptions are more predictive of behaviour and therefore, appear to be more important than 'actual' environmental factors (Maddison, et al., 2009; Prins, et al., 2009; Scott, et al., 2007). It has also been suggested that perceptions of environmental correlates and the objective environment are actually two different constructs. For example, previous studies have shown a considerable mismatch between perceived environmental factors and objectively measured environmental factors, suggesting that they are much less related than people think (Ball, et al., 2008; Kirtland et al., 2003). The perception of the environment could be considered an intrapersonal correlate, and as a result is more proximal to the person and has a stronger influence on physical activity behaviour (Sallis, et al., 2008; Spence & Lee, 2003). Nevertheless, the objective environment is still important

because perceptions of environment are likely to be the result of an interpretation and cognitive process of what actually exists. Better insights into the differences between perceived and objective environments and their association with children's physical activity behaviour are necessary because they could have important consequences for intervention development. One of the main challenges in correlate research is to determine how to manipulate or change perceptions for positive behavioural change. This is an important issue and is worthy of further exploration in future research.

6. Factors versus individual items

Amalgamating individual correlate items to form factors is common practice in correlate research (Rhodes, Plotnikoff, & Spence, 2004). The formation of factors and the use of a summative scoring system are often theoretically driven (i.e. items assumed to relate to or have the same underlying concept are aggregated) but is also carried out for practicable purpose, such as reducing the sample size required and the number of factors for analysis. In doing this, however, there is a risk of losing important contextual precision of the correlates, which may actually have unique associations with physical activity. As the focus of correlate research is to explain as much variance in physical activity as possible, broadly defined factors may not explain as much variance as individual correlates, which may have independent associations with physical activity. Even though factors may exhibit high internal consistency and uni-dimensionality in standard statistical tests, such as factor analysis, there is a chance that the factor is multi-dimensional. Using structural equation modelling, Rhodes et al. (2004) found that 'uni-dimensional' factors formed by factor analysis were in fact multi-dimensional, supporting this hypothesis. A good example from this current research was the after-school Y-PASS "Social support" factor. This factor contained items relating to both parental support and peer support. Even though the internal consistency of this factor was relatively strong (Cronbach alpha = 0.78), this factor represents two very distinct sources of support. However, it could not be determined whether peers and/or parents were important to children's after-school physical activity using the factor-based scoring system.

As stated by Rhodes et al. (2004), it could be argued that analysing correlates at the individual correlate level challenges the theoretical parsimony that has taken decades to develop and introduces multicollinearity issues into statistical analysis. While the importance of this is acknowledged, the reality is current models are not very effective at explaining children's physical activity and there is a need for investigating alternative methods to improve prediction of physical activity. Factors, in particular a factor-based scoring system, were used in the Y-PASS questionnaires to reflect the same approach adopted by the LEAP II questionnaire and enable comparison of the predictive utility of each questionnaire. Exploration of the relationship between individual correlates and physical activity is a potential next step and way forward in improving our understanding of the correlates that influence children's physical activity. This will ultimately assist in the development of more targeted interventions and contribute to refining existing physical activity theories and models.

7. Specificity in correlate research

Even though previous research (Giles-Corti, et al., 2005; Humpel, et al., 2004; Ommundsen, et al., 2006) and this current research have provided initial support for increasing specificity in correlate research to improve physical activity prediction, there is still a question of the level of specificity required when assessing correlates and predicting physical activity behaviour. It could be argued that more specificity may in fact be self-defeating, in that there is a greater chance of little variation in the correlates and therefore, less chance of improving physical activity prediction. This is particularly true for environmental correlates. The importance of variation in correlate research has been discussed above. The other issue relating to increasing specificity is the potential for increased measurement burden on respondents and the lack of generalisability of the findings. While increasing the level of specificity is important for understanding children's physical activity behaviour, behavioural models and interventions can not be modified to suit every individual child. Future research should focus on maintaining an appropriate balance between specificity, measurement burden, variation in correlates and physical activity levels, while still aiming to improve physical activity prediction and maintain usefulness of the findings.

8.3 Final conclusion

In light of a number of limitations in the current correlate literature, the poor prediction of physical activity and modest performance of physical activity interventions, there has been a call for a conceptual shift in how we conduct correlate research (Nichol, et al., 2009; Owen, et al., 2000). Increasing specificity of correlate research and physical activity research will be fundamental to improving our understanding and prediction of physical activity behaviours. However, due to a large amount of variance unexplained, it is clear that there is still a substantial amount of research still needed before interventions are designed based on the current findings. Research needs to continue to explore emerging variables that might assist in explaining additional variance in specific physical activity behaviours, such as the inclusion of objective measures of environmental correlates, school policy changes and technology advancements. This thesis has revealed some important correlate research implications, with a view of contributing to the continuing and evolving conceptual development of correlate theory.

REFERENCES

ActiGraph. (2011). ActiLife 5 - User's Manual. Pensacola, FL: ActiGraph.

Adkins, S., Sherwood, N. E., Story, M., & Davis, M. (2004). Physical activity among African-American girls: the role of parents and the home environment. *Obesity Research, Suppl 12*, s38-s45.

Aeffect Inc. (2000). Review of literature to support development of the Youth Media Campaign. Atlanta, Georgia: Department of Health and Human Services, Centers for Disease Control and Prevention.

Ahlport, K. N., Linnan, L., Vaughn, A., Evenson, K. R., & Ward, D. S. (2008). Barriers to and facilitators of walking and bicycling to school: formative results from the non-motorized travel study. *Health Education and Behavior, 35*(2), 221-244.

Ajzen, I. (1988). *Attitudes, personality and behavior*. Milton Keynes: Open University Press.

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes, 57*, 179-211.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behaviour*. NJ: Prentice-Hall.

Allender, S., Cowburn, G., & Foster, C. (2006). Understanding participation in sport and physical activity among children and adults: a review of qualitative studies. *Health Education Research, 21*(6), 826-835.

Altman, D. (1991). *Practical statistics for medical research*. London, UK: Chapman & Hall.

Andersen, L. B., Harro, M., Sardinha, L. B., Froberg, K., Ekelund, U., Brage, S., & Anderssen, S. A. (2006). Physical activity and clustered cardiovascular risk in children: a cross-sectional study (The European Youth Heart Study). *Lancet, 368*(9532), 299-304.

Andridge, R. R., & Little, R. J. (2010). A review of hot deck imputation for survey non-response. *International Statistical Review, 78*(1), 40-64.

Annesi, J. J., Faigenbaum, A. D., Westcott, W. L., Smith, A., Unruh, J. L., & Hamilton, F. (2007). Effects of the Youth Fit For Life protocol on physiological, mood, self-appraisal, and voluntary physical activity changes in African American preadolescents: contrasting after-school care and physical education formats. *International Journal of Clinical Health Psychology, 7*(3), 641-659.

Atkin, A. J., Gorely, T., Biddle, S. J., Cavill, N., & Foster, C. (2011). Interventions to promote physical activity in young people conducted in the hours immediately after school: a systematic review. *International Journal of Behavioral Medicine, 18*(3), 176-187.

Atkin, A. J., Gorely, T., Biddle, S. J., Marshall, S. J., & Cameron, N. (2008). Critical hours: physical activity and sedentary behavior of adolescents after school. *Pediatric Exercise Science, 20*(4), 446-456.

Australian Bureau of Statistics. (1995). Australian social trends. Canberra.

Australian Bureau of Statistics. (1999). Australian social trends. Canberra.

Australian Bureau of Statistics. (2001). Australian social trends. Canberra.

Australian Bureau of Statistics. (2006). Information paper: an introduction to Socio-Economic Indexes for Areas (SEIFA). Canberra, Australia.

Australian Research Council. (2008). Descriptions of designated National research priorities and associated priority goals. Retrieved from http://www.arc.gov.au/about_arc/national_research_priorities.htm

Bailey, R. C., Olson, J., Pepper, S. L., Porszasz, J., Barstow, T. J., & Cooper, D. M. (1995). The level and tempo of children's physical activities: an observational study. *Medicine and Science in Sports and Exercise, 27*(7), 1033-1041.

Ball, K., Jeffery, R. W., Crawford, D. A., Roberts, R. J., Salmon, J., & Timperio, A. F. (2008). Mismatch between perceived and objective measures of physical activity environments. *Preventive Medicine, 47*(3), 294-298.

Bandura, A. (1986). *Social foundations of thought and action: a social-cognitive theory*. New Jersey: Prentice Hall.

Baranowski, T. (1988). Validity and reliability of self report measures of physical activity: an information-processing perspective. *Research Quarterly for Exercise and Sport, 59*(4), 314-327.

Baranowski, T., Anderson, C., & Carmack, C. (1998). Mediating variable framework in physical activity interventions. How are we doing? How might we do better? *American Journal of Preventive Medicine, 15*(4), 266-297.

Baranowski, T., Lin, L. S., Wetter, D. W., Resnicow, K., & Hearn, M. D. (1997). Theory as mediating variables: why aren't community interventions working as desired? *Annals of Epidemiology, 7*(Suppl 1), s89-s95.

Barlow, S. E. (2007). Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics, 120*(Suppl 4), s164-s192.

Barr-Anderson, D. J., Neumark-Sztainer, D., Schmitz, K. H., Ward, D. S., Conway, T. L., Pratt, C., . . . Pate, R. R. (2008). But I like PE: factors associated with enjoyment of physical education class in middle school girls. *Research Quarterly for Exercise and Sport, 79*(1), 18-27.

Barros, R. M., Silver, E. J., & Stein, R. E. K. (2009). School recess and group classroom behavior. *Pediatrics, 123*(2), 431-436.

Bates, H. (2006). Daily physical activity for children and youth: a review and synthesis of the literature. Alberta, Canada: Alberta Education.

Bauer, K. W., Yang, Y. W., & Austin, S. B. (2004). "How can we stay healthy when you're throwing all of this in front of us?" Findings from focus groups and interviews in middle schools on environmental influences on nutrition and physical activity. *Health Education Behavior, 31*(1), 34-46.

Bauman, A. E., Sallis, J. F., Dzewaltowski, D. A., & Owen, N. (2002). Toward a better understanding of the influences on physical activity: the role of determinants, correlates, causal variables, mediators, moderators, and confounders. *American Journal of Preventive Medicine, 23*(Suppl 2), 5-14.

Becker, M. H., Haefner, D. P., Kasl, S. V., Kirscht, J. P., Maiman, L. A., & Rosenstock, I. M. (1977). Selected psychosocial models and correlates of individual health-related behaviors. *Medical care, 15*(Suppl 5), 27-46.

Beighle, A., Morgan, C. F., Le Masurier, G., & Pangrazi, R. P. (2006). Children's physical activity during recess and outside of school. *Journal of School Health, 76*(10), 516-520.

Bell, A. (2007). Designing and testing questionnaires for children. *Journal of Research in Nursing, 12*(5), 461-469.

Biddle, S., Akande, D., Armstrong, N., Ashcroft, M., Brooke, R., & Goudas, M. (1996). The Self-Motivation Inventory modified for children: evidence on psychometric properties and its use in physical exercise. *International Journal of Sport Psychology, 27*, 237-250.

Biddle, S., & Mutrie, N. (2008). *Psychology of physical activity: determinants, well-being and interventions* (2nd ed.). New York: Routledge.

Biddle, S., Sallis, J., & Cavill, N. (1998). *Young and active? Young people and health-enhancing physical activity - evidence and implications*. London: Health Education Authority.

Biddle, S. J., Gorely, T., Marshall, S. J., Murdey, I., & Cameron, N. (2004). Physical activity and sedentary behaviours in youth: issues and controversies. *The Journal of the Royal Society for the Promotion of Health, 124*(1), 29-33.

Biddle, S. J., Gorely, T., & Stensel, D. J. (2004). Health-enhancing physical activity and sedentary behaviour in children and adolescents. *Journal of Sports Science, 22*(8), 679-701.

Biddle, S. J., Markland, D., Gilbourne, D., Chatzisarantis, N. L., & Sparkes, A. C. (2001). Research methods in sport and exercise psychology: quantitative and qualitative issues. *Journal of Sports Science, 19*(10), 777-809.

Biddle, S. J. H., Whitehead, S. H., O'Donovan, T. M., & Nevill, M. E. (2005). Correlates of participation in physical activity for adolescent girls: a systematic review of recent literature. *Journal of Physical Activity and Health, 2*(4), 423-434.

Blades, M., Blaut, J. M., Darvizeh, Z., Elguea, S., Sowden, S., Soni, D., . . . Uttal, D. (1998). A cross-cultural study of young children's mapping abilities. *Transactions of the Institute of British Geographers, 23*(2), 269-277.

Blignault, I., & Ritchie, J. (2009). Revealing the wood and the trees: reporting qualitative research. *Health Promotion Journal of Australia, 20*(2), 140-145.

Booth, M., & Okely, A. (2005). Promoting physical activity among children and adolescents: the strengths and limitations of school-based approaches. *Health Promotion Journal of Australia, 16*(1), 52-54.

Booth, M., Okely, A., Denney-Wilson, E., Hardy, L., Yang, B., & Dobbins, T. (2006). NSW Schools Fitness and Physical Activity Survey (SPANS) 2004: Full Report. Sydney: New South Wales Department of Health.

Booth, M. L., Okely, A. D., Chey, T. N., & Bauman, A. (2002). The reliability and validity of the Adolescent Physical Activity Recall Questionnaire. *Medicine and Science in Sports Exercise, 34*(12), 1986-1995.

Boreham, C., & Riddoch, C. (2001). The physical activity, fitness and health of children. *Journal of Sports Science, 19*(12), 915-929.

Borgers, N., de Leeuw, E., & Hox, J. (2000). Children as respondents in survey research: cognitive development and response quality. *Bulletin de Methodologie Sociologique, 66*, 60-75.

Borgers, N., & Hox, J. (2001). Item nonresponse in questionnaire research with children. *Journal of Official Statistics, 17*(2), 321-335.

Borgers, N., Hox, J., & Sikkel, D. (2003). Response quality in survey research with children and adolescents: the effect of labelled response options and vague quantifiers. *International of Public Opinion Research, 15*(1), 83-94.

Boufous, S., Finch, C., & Bauman, A. (2004). Parental safety concerns – a barrier to sport and physical activity in children? *Australian and New Zealand Journal of Public Health, 28*(5), 482-486.

Bowden, A., Fox-Rushby, J. A., Nyandieka, L., & Wanjau, J. (2002). Methods for pre-testing and piloting survey questions: illustrations from the KENQOL survey of health-related quality of life. *Health Policy Planning, 17*(3), 322-330.

Boyle, D. E., Marshall, N. L., & Robeson, W. W. (2003). Gender at play: fourth-grade girls and boys on the playground. *American Behavioral Scientist, 46*(10), 1326-1345.

Boynton, P. M., & Greenhalgh, T. (2004). Selecting, designing, and developing your questionnaire. *British Medical Journal, 328*(7451), 1312-1315.

Breinbauer, C. (2005). *Youth: choices and change. Promoting healthy behaviors in adolescents*. Washington, DC: Pan American Health Organization.

Brockman, R., Jago, R., & Fox, K. R. (2010). The contribution of active play to the physical activity of primary school children. *Preventive Medicine, 51*(2), 144-147.

Brodersen, N. H., Steptoe, A., Williamson, S., & Wardle, J. (2005). Sociodemographic, developmental, environmental, and psychological correlates of physical activity and sedentary behavior at age 11 to 12. *Annals of Behavioral Medicine, 29*(1), 2-11.

Bronfenbrenner, U. (1994). *Ecological models of human development* (Vol. 3). Oxford: Elsevier.

Brownson, R. C., Boehmer, T. K., & Luke, D. A. (2005). Declining rates of physical activity in the United States: what are the contributors? *Annual Review of Public Health, 26*(1), 421-443.

Brunton, G., Thomas, J., Harden, A., Rees, R., Kavanagh, J., Oliver, S., . . . Oakley, A. (2005). Promoting physical activity amongst children outside of physical education classes: a systematic review integrating intervention studies and qualitative studies. *Health Education Journal, 64*(4), 323-338.

Brusseau, T. A., Kulinna, P. H., Tudor-Locke, C., Ferry, M., van der Mars, H., & Darst, P. W. (2011). Pedometer-determined segmented physical activity patterns of fourth- and fifth-grade children. *Journal of Physical Activity and Health, 8*(2), 279-286.

Brustad, R. (1993). Who will go out and play? Parental and psychological influences on children's attraction to physical activity. *Pediatric Exercise Science, 5*, 210-223.

Buliung, R. N., Mitra, R., & Faulkner, G. (2009). Active school transportation in the Greater Toronto area, Canada: an exploration of trends in space and time (1986–2006). *Preventive Medicine, 48*(6), 507-512.

Bundy, A. C., Naughton, G., Tranter, P., Wyver, S., Baur, L., Schiller, W., . . . Brentnall, J. (2011). The Sydney playground project: popping the bubblewrap - unleashing the power of play: a cluster randomized controlled trial of a primary school playground-based intervention aiming to increase children's physical activity and social skills. *BMC Public Health, 11*, 680.

Burdette, H. L., & Whitaker, R. C. (2005). Resurrecting free play in young children: looking beyond fitness and fatness to attention, affiliation, and affect. *Archives of Pediatrics and Adolescent Medicine, 159*(1), 46-50.

Burdette, H. L., Whitaker, R. C., & Daniels, S. R. (2004). Parental report of outdoor playtime as a measure of physical activity in preschool-aged children. *Archives of Pediatrics and Adolescent Medicine, 158*(4), 353-357.

Bushnell, D. M., Martin, M. L., & Parasuraman, B. (2003). Electronic versus paper questionnaires: a further comparison in persons with asthma. *Journal of Asthma, 40*(7), 751-762.

Cale, L., & Harris, J. (2006). Interventions to promote young people's physical activity: issues, implications and recommendations for practice. *Health Education Journal, 65*(4), 320-337.

Carver, A., Salmon, J., Campbell, K., Baur, L., Garnett, S., & Crawford, D. (2005). How do perceptions of local neighborhood relate to adolescents' walking and cycling? *American Journal of Health Promotion, 20*(2), 139-147.

Carver, A., Timperio, A., & Crawford, D. (2008a). Perceptions of neighborhood safety and physical activity among youth: the CLAN study. *Journal of Physical Activity and Health, 5*(3), 430-444.

Carver, A., Timperio, A., & Crawford, D. (2008b). Playing it safe: the influence of neighbourhood safety on children's physical activity--a review. *Health Place, 14*(2), 217-227.

Casey, M. M., Eime, R. M., Payne, W. R., & Harvey, J. T. (2009). Using a socioecological approach to examine participation in sport and physical activity among rural adolescent girls. *Qualitative Health Research, 19*(7), 881-893.

Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Report, 100*(2), 126-131.

Cattell, R. B. (1966). The scree test for the number of factors. *Multivariate Behavioral Research, 1*, 245-276.

Cavill, N., Biddle, S., & Sallis, J. (2001). Health enhancing physical activity for young people: statement of the United Kingdom expert consensus conference. *Pediatric Exercise Science, 13*(1), 12-25.

Centers for Disease Control and Prevention. (2010). CDC table for calculated body mass index values for selected heights and weights for ages 2 to 20. Retrieved from http://www.cdc.gov/nccdphp/dnpa/bmi/00binaries/bmi-tables.pdf

Chung, A. E., Skinner, A. C., Steiner, M. J., & Perrin, E. M. (2012). Physical activity and BMI in a nationally representative sample of children and adolescents. *Clinical pediatrics, 51*(2), 122-129.

Cohen, D. A., Scribner, R. A., & Farley, T. A. (2000). A structural model of health behavior: a pragmatic approach to explain and influence health behaviors at the population level. *Preventive Medicine, 30*(2), 146-154.

Cohen, J., & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences* (2 ed.). Hillsdale, NJ: Erlbaum.

Cole, T. J., Bellizzi, M. C., Flegal, K. M., & Dietz, W. H. (2000). Establishing a standard definition for child overweight and obesity worldwide: international survey. *British Medical Journal, 320*(7244), 1240.

Cole, T. J., Flegal, K. M., Nicholls, D., & Jackson, A. A. (2007). Body mass index cut offs to define thinness in children and adolescents: international survey. *British Medical Journal, 335*(7612), 194.

Colucci, E. (2007). "Focus groups can be fun": the use of activity-oriented questions in focus group discussions. *Qualitative Health Research, 17*(10), 1422-1433.

Combes, B. (2006). *Techno savvy or techno oriented: Who are the net generation?* Paper presented at the Asia-Pacific Conference on Library and Information Education and Practice, Singapore.

Commonwealth of Australia. (2003). *Healthy Weight 2008, Australia's future: the national action agenda for children and young people and their families*. Canberra, Australia.

Commonwealth of Australia. (2004). *Australia's physical activity recommendations for 5-12 year olds*. Canberra, Australia: Retrieved from http://www.health.gov.au/internet/wcms/publishing.nsf/content/phd-physical-activity-kids-pdf-cnt.htm/$FILE/kids_phys.pdf.

Commonwealth of Australia. (2008). *2007 National Children's Nutrition and Physical Activity Survey*. Canberra, Australia: Commonwealth of Australia.

Comrey, A. L., & Lee, H. B. (1992). *A first course in factor analysis*. Hillsdale, New Jersey: Larence Erlbaum.

Cooper, A. R., Andersen, L. B., Wedderkopp, N., Page, A. S., & Froberg, K. (2005). Physical activity levels of children who walk, cycle, or are driven to school. *American Journal of Preventive Medicine, 29*(3), 179-184.

Costello, A., & Osborne, J. (2005). Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. *Practical Assessment Research and Evaluation, 10*(7), 9. Retrieved from http://www.pareonline.net/pdf/v10n7.pdf

Cox, A. E., Smith, A. L., & Williams, L. (2008). Change in physical education motivation and physical activity behavior during middle school. *Journal of Adolescent Health, 43*(5), 506-513.

Craig, S., Goldberg, J., & Dietz, W. H. (1996). Psychosocial correlates of physical activity among fifth and eighth graders. *Preventive Medicine, 25*(5), 506-513.

Cutrona, C. E., & Russell, D. W. (1987). The provisions of social relationships and adaptation to stress. *Advances in Personal Relationships, 1*, 37-67.

Dale, D., Corbin, C. B., & Dale, K. S. (2000). Restricting opportunities to be active during school time: do children compensate by increasing physical activity levels after school? *Research Quarterly for Exercise and Sport, 71*(3), 240-248.

Dale, D., Welk, G., & Matthews, C. (2002). Methods for assessing physical activity and challenges for research. In G. Welk (Ed.), *Physical Activity Assessments for Health-Related Research*. Champaign: Human Kinetics Publishers, Inc.

Danubio, M. E., & Sanna, E. (2008). Secular changes in human biological variables in Western countries: an updated review and synthesis. *Journal of Anthropology Science, 86*, 91-112.

Darbyshire, P. (2000). Guest Editorial: from research on children to research with children. *Neonatal, Paediatric and Child Health Nursing, 3*(1), 2-3.

Darbyshire, P., MacDougall, C., & Schiller, W. (2005). Multiple methods in qualitative research with children: more insight or just more? *Qualitative Research, 5*(4), 417-436.

Darbyshire, P., Schiller, W., & MacDougall, C. (2005). Extending new paradigm childhood research: meeting the challenges of including younger children. *Early Child Development and Care, 175*(6), 467-472.

Davison, K. K., & Lawson, C. T. (2006). Do attributes in the physical environment influence children's physical activity? A review of the literature. *International Journal of Behavioral Nutrition and Physical Activity, 3*, 19.

Davison, K. K., Werder, J. L., & Lawson, C. T. (2008). Children's active commuting to school: current knowledge and future directions. *Preventing Chronic Disease, 5*(3), 100.

De Leeuw, E., Borgers, N., & Smits, A. (2004). Pretesting questionnaires for children and adolescents. In S. Presser, J. M. Rothgeb, M. P. Couper, J. T. Lessler, E. Martin, J. Martin & E. Singer (Eds.), *Methods for testing and evaluating survey questionnaires*. Hoboken, NJ, USA: John Wiley & Sons, Inc.

De Vaus, D. (2002). *Surveys in social research* (5th ed.). St Leonards, Australia: Allen and Unwin.

de Vet, E., de Ridder, D. T., & de Wit, J. B. (2011). Environmental correlates of physical activity and dietary behaviours among young people: a systematic review of reviews. *Obesity Review, 12*(5), 130-142.

Dean, J., & Stain, H. J. (2007). The impact of drought on the emotional well-being of children and adolescents in rural and remote New South Wales. *Journal of Rural Health, 23*(4), 356-364.

Department of Health, Physical Activity, Health Improvement, & Protection. (2011). Start Active, Stay Active. A report on physical activity for health from the four home countries' Chief Medical Officers. London: Department of Health.

Department of Health and Ageing. (2004). Active kids are healthy kids: Australia's physical activity recommendations for 5-12 year olds. Canberra, Australia: Commonwealth of Australia.

Depoy, E., & Gitlin, L. (1998). *Introduction to research: understanding and applying multiple strategies (2nd Ed)*. St Louis: Mosby Inc.

DeVellis, R. F. (2003). *Scale development: theory and applications* (Vol. 26). Thousand Oaks, CA.: Sage Publications.

Dillman, D. A., & Smyth, J. D. (2007). Design effects in the transition to web-based surveys. *American Journal of Preventive Medicine, 32*(Suppl 5), s90-s96.

DiLorenzo, T. M., Stucky-Ropp, R. C., Vander Wal, J. S., & Gotham, H. J. (1998). Determinants of exercise among children. II. A longitudinal analysis. *Preventive Medicine, 27*(3), 470-477.

Dishman, R. K. (1994). The measurement conundrum in exercise adherence research. *Medicine and Science in Sports Exercise, 26*(11), 1382-1390.

Dishman, R. K., Darracott, C. R., & Lambert, L. T. (1992). Failure to generalize determinants of self-reported physical activity to a motion sensor. *Medicine and Science in Sports Exercise, 24*(8), 904-910.

Dishman, R. K., Dunn, A. L., Sallis, J. F., Vandenberg, R. J., & Pratt, C. A. (2010). Social-cognitive correlates of physical activity in a multi-ethnic cohort of middle-school girls: two-year prospective study. *Journal of Pediatric Psychology, 35*(2), 188-198.

Dishman, R. K., Motl, R. W., Saunders, R., Felton, G., Ward, D. S., Dowda, M., & Pate, R. R. (2004). Self-efficacy partially mediates the effect of a school-based physical-activity intervention among adolescent girls. *Preventive Medicine, 38*(5), 628-636.

Dishman, R. K., Motl, R. W., Saunders, R., Felton, G., Ward, D. S., Dowda, M., & Pate, R. R. (2005). Enjoyment mediates effects of a school-based physical activity intervention. *Medicine and Science in Sports Exercise, 37*(3), 478-487.

Dishman, R. K., Motl, R. W., Saunders, R. P., Dowda, M., Felton, G., Ward, D. S., & Pate, R. R. (2002). Factorial invariance and latent mean structure of questionnaires measuring social-cognitive determinants of physical activity among black and white adolescent girls. *Preventive Medicine, 34*(1), 100-108.

Dockett, S., & Perry, B. (1999). Starting school: what do the children say? *Early Child Development and Care, 159*(1), 107-119.

Dowda, M., McKenzie, T. L., Cohen, D. A., Scott, M. M., Evenson, K. R., Bedimo-Rung, A. L., . . . Almeida, M. (2007). Commercial venues as supports for physical activity in adolescent girls. *Preventive Medicine, 45*, 163-168.

Dumith, S. C., Gigante, D. P., Domingues, M. R., & Kohl, H. W., 3rd. (2011). Physical activity change during adolescence: a systematic review and a pooled analysis. *International Journal of Epidemiology, 40*(3), 685-698.

Duncan, M., Spence, J., & Mummery, W. K. (2005). Perceived environment and physical activity: a meta-analysis of selected environmental characteristics. *International Journal of Behavioral Nutrition and Physical Activity, 2*(1), 11.

Dunn, A. L., Trivedi, M. H., & O'Neal, H. A. (2001). Physical activity dose-response effects on outcomes of depression and anxiety. *Medicine and Science in Sports Exercise, 33*(Suppl 6), s587-s597.

Dunton, G. F., Berrigan, D., Ballard-Barbash, R., Graubard, B. I., & Atienza, A. A. (2009). Environmental influences on exercise intensity and duration in a U.S. time use study. *Medicine and Science in Sports Exercise, 41*(9), 1698-1705.

Dunton, G. F., Liao, Y., Intille, S., Wolch, J., & Pentz, M. A. (2011). Physical and social contextual influences on children's leisure-time physical activity: an ecological momentary assessment study. *Journal of Physical Activity and Health, 8*(Suppl 1), s103-s108.

Dunton, G. F., Tscherne, J., & Rodriguez, D. (2009). Factorial validity and gender invariance of the physical activity enjoyment scale (PACES) in older adolescents. *Research Quarterly for Exercise and Sport, 80*(1), 117-121.

Durant, N., Kerr, J., Harris, S., Saelens, B., Norman, G. J., & Sallis, J. (2009). Environmental and safety barriers to youth physical activity in neighborhood parks and streets: reliability and validity. *Pediatric Exercise Science, 21*(1), 86-99.

Dwyer, J. J. M., Allison, K. R., Goldenberg, E. R., Fein, A. J., Yoshida, K. K., & Boutilier, M. A. (2006). Adolescent girls' perceived barriers to participation in physical activity. *Adolescence, 41*(161), 75-89.

Eiðsdóttir, S., Kristjánsson, Á. L., Sigfúsdóttir, I. D., & Allegrante, J. P. (2008). Trends in physical activity and participation in sports clubs among Icelandic adolescents. *European Journal of Public Health, 18*(3), 289-293.

Eisenmann, J. (2003). Secular trends in variables associated with the metabolic syndrome of North American children and adolescents: a review and synthesis. *American Journal of Human Biology, 15*(6), 786-794.

Eisenmann, J., Katzmarzyk, P., & Tremblay, M. S. (2004). Leisure-time physical activity levels among Canadian adolescents, 1981-1998. *Journal of Physical Activity and Health, 1*(2), 154-162.

Elder, J. P., Lytle, L., Sallis, J. F., Young, D. R., Steckler, A., Simons-Morton, D., . . . Ribisl, K. (2007). A description of the social-ecological framework used in the Trial of Activity for Adolescent Girls (TAAG). *Health Education Research, 22*(2), 155-165.

Epstein, L. H., Paluch, R. A., Coleman, K. J., Vito, D., & Anderson, K. (1996). Determinants of physical activity in obese children assessed by accelerometer and self-report. *Medicine and Science in Sports Exercise, 28*(9), 1157-1164.

Erwin, H. E. (2008). Test-retest reliability of a preadolescent environmental access to physical activity questionnaire. *Journal of Physical Activity and Health, 5*(Suppl 1), s62-s72.

Erwin, H. E., Abel, M. G., Beighle, A., & Beets, M. W. (2011). Promoting children's health through physically active math classes: a pilot study. *Health Promotion Practice, 12*(2), 244-251.

Esliger, D. W., Copeland, J., Barnes, J., & Tremblay, M. S. (2005). Standardizing and optimizing the use of accelerometer data for free-living physical activity monitoring. *Journal of Physical Activity and Health, 3*, 366-383.

Espelage, D. L., & Swearer, S. M. (2003). Research on school bullying and victimization: what have we learned and where do we go from here? *School Psychology Review, 32*(3), 365-383.

Euling, S. Y., Herman-Giddens, M. E., Lee, P. A., Selevan, S. G., Juul, A., SÃ¸rensen, T. I. A., . . . Swan, S. H. (2008). Examination of US puberty-timing data from 1940 to 1994 for secular trends: panel findings. *Pediatrics, 121*(Suppl 3), s172-s191.

Evenson, K. R., Birnbaum, A. S., Bedimo-Rung, A. L., Sallis, J. F., Voorhees, C. C., Ring, K., & Elder, J. P. (2006). Girls' perception of physical environmental factors and transportation: reliability and association with physical activity and active transport to school. *International Journal of Behavioral Nutrition and Physical Activity, 3*.

Fairclough, S. J., Butcher, Z. H., & Stratton, G. (2007). Whole-day and segmented-day physical activity variability of northwest England school children. *Preventive Medicine, 44*(5), 421-455.

Felton, G. M., Dowda, M., Ward, D. S., Dishman, R. K., Trost, S. G., Saunders, R., & Pate, R. R. (2002). Differences in physical activity between black and white girls living in rural and urban areas. *Journal of School Health, 72*(6), 250.

Ferreira, I., van der Horst, K., Wendel-Vos, W., Kremers, S., van Lenthe, F., & Brug, J. (2007). Environmental correlates of physical activity in youth - a review and update. *Obesity Review, 8*(2), 129-154.

Findlay, L. C., Garner, R. E., & Kohen, D. E. (2010). Patterns of children's participation in unorganized physical activity. *Research Quarterly for Exercise and Sport, 81*(2), 133-142.

Fisher, A., Reilly, J. J., Kelly, L. A., Montgomery, C., Williamson, A., Paton, J. Y., & Grant, S. (2005). Fundamental movement skills and habitual physical activity in young children. *Medicine and Science in Sports Exercise, 37*(4), 684-688.

Fisher, E. B., Brownson, C. A., O'Toole, M. L., Shetty, G., Anwuri, V. V., & Glasgow, R. E. (2005). Ecological approaches to self-management: the case of diabetes. *American Journal of Public Health, 95*(9), 1523-1535.

Fjørtoft, I., Kristoffersen, B., & Sageie, J. (2009). Children in schoolyards: tracking movement patterns and physical activity in schoolyards using global positioning system and heart rate monitoring. *Landscape and Urban Planning, 93*(3–4), 210-217.

Fjørtoft, I., Lofman, O., & Halvorsen Thoren, K. (2010). Schoolyard physical activity in 14-year-old adolescents assessed by mobile GPS and heart rate monitoring analysed by GIS. *Scandinavian Journal of Public Health, 38*(Suppl 5), s28-s37.

Flesch, R. (1948). A new readability yardstick. *Journal of Applied Psychology, 32*(3), 221-233.

Fox-Wasylyshyn, S. M., & El-Masri, M. M. (2005). Handling missing data in self-report measures. *Research in Nursing and Health, 28*(6), 488-495.

Frazer, L., & Lawley, M. (2000). *Questionnaire design and administration*. Milton, Queensland: John Wiley & Sons Australia, Ltd.

Freedson, P., Pober, D., & Janz, K. F. (2005). Calibration of accelerometer output for children. *Medicine and Science in Sports and Exercise, 37*(Suppl 11), s523-s530.

Freedson, P. S. F., Sirard, J., Debold, E., Pate, R. F., Dowda, M., Trost, S., & Sallis, J. F. (1997). Calibration of the Computer Science and Applications, Inc (CSA) accelerometer. *Medicine and Science in Sports and Exercise, 29*(Suppl 5), s45.

Freeman, K. (1997). Increasing African Americans' participation in higher education: African American high-school students' perspectives. *The Journal of Higher Education, 68*(5), 523-550.

Fremeaux, A. E., Mallam, K. M., Metcalf, B. S., Hosking, J., Voss, L. D., & Wilkin, T. J. (2011). The impact of school-time activity on total physical activity: the activitystat hypothesis (EarlyBird 46). *International Journal of Obesity, 35*(10), 1277-1283.

Fulton, J., Burgeson, G., Perry, G., Sherry, B., Galuska, D., Alexander, M., . . . Caspersen, C. J. (2001). Assessment of physical activity and sedentary behaviour in pre-school age children: priorities for research. *Pediatric Exercise Science, 13*(2), 113-126.

Garcia, A. W., Pender, N. J., Antonakos, C. L., & Ronis, D. L. (1998). Changes in physical activity beliefs and behaviors of boys and girls across the transition to junior high school. *Journal of Adolescent Health, 22*(5), 394-402.

Giles-Corti, B., & Donovan, R. J. (2003). Relative influences of individual, social environmental, and physical environmental correlates of walking. *American Journal of Public Health, 93*(9), 1583-1589.

Giles-Corti, B., & King, A. C. (2009). Creating active environments across the life course: "thinking outside the square". *British Journal of Sports Medicine, 43*(2), 109-113.

Giles-Corti, B., Timperio, A., Bull, F., & Pikora, T. (2005). Understanding physical activity environmental correlates: increased specificity for ecological models. *Exercise Sports Science Review, 33*(4), 175-181.

Godin, G., & Shephard, R. (1986). Psychosocial factors influencing intentions to exercise of young students from Grades 7 to 9. *Research Quarterly for Exercise and Sport, 57*(1), 41-52.

Google. (2009). Google Earth: Google.

Gordon-Larsen, P., McMurray, R. G., & Popkin, B. M. (2000). Determinants of adolescent physical activity and inactivity patterns. *Pediatrics, 105*(6), 83.

Greenbaum, T. (1998). *The handbook for focus group research*. Thousand Oaks, California: SAGE Publications, Inc.

Gustafson, S. L., & Rhodes, R. E. (2006). Parental correlates of physical activity in children and early adolescents. *Sports Medicine, 36*(1), 79-97.

Haerens, L., Craeynest, M., Deforche, B., Maes, L., Cardon, G., & De Bourdeaudhuij, I. (2009). The contribution of home, neighbourhood and school environmental factors in explaining physical activity among adolescents. *Journal of Environment and Public Health, 2009*, 1-10.

Hager, R. L. (2006). Television viewing and physical activity in children. *Journal of Adolescent Health, 39*(5), 656-661.

Hagger, M. S., Chatzisarantis, N. L. D., Culverhouse, T., & Biddle, S. J. H. (2003). The processes by which perceived autonomy support in physical education promotes leisure-time physical activity intentions and behavior: a trans-contextual model. *Journal of Educational Psychology, 95*, 784-795.

Hair, J., Anderson, R., Tatham, R., & Black, W. (1998). *Multivariate data analysis (5th Ed)*. New Jersey: Prentice-Hall Inc.

Hanggi, J. M., Phillips, L. R., & Rowlands, A. V. (2012). Validation of the GT3X ActiGraph in children and comparison with the GT1M ActiGraph. *Journal of Science and Medicine in Sport*.

Hardy, L. L., Booth, M. L., & Okely, A. D. (2007). The reliability of the Adolescent Sedentary Activity Questionnaire (ASAQ). *Preventive Medicine, 45*(1), 71-74.

Hardy, L. L., Okely, A. D., Dobbins, T. A., & Booth, M. L. (2008). Physical activity among adolescents in New South Wales (Australia): 1997 and 2004. *Medicine and Science in Sports Exercise, 40*(5), 835-841.

Harrell, J. S., Gansky, S. A., Bradley, C. B., & McMurray, R. G. (1997). Leisure time activities of elementary school children. *Nursing Research, 46*(5), 246-253.

Harrell, J. S., McMurray, R. G., Baggett, C. D., Pennell, M. L., Pearce, P. F., & Bangdiwala, S. I. (2005). Energy costs of physical activities in children and adolescents. *Medicine and Science in Sports and Exercise, 37*(2), 329-336.

Harris, J. (1994). Physical education in the national curriculum: is there enough time to be effective? *British journal of physical education, 25*, 34-38.

Harrison, P. A., & Narayan, G. (2003). Differences in behavior, psychological factors, and environmental factors associated with participation in school sports and other activities in adolescence. *Journal of School Health, 73*(3), 113-120.

Harten, N. (2005). *The impact of spatial density and the configuration of space on children's movement.* (Unpublished doctoral dissertation). University of South Australia, Adelaide.

Harten, N., Olds, T., & Dollman, J. (2008). The effects of gender, motor skills and play area on the free play activities of 8-11 year old school children. *Health Place, 14*(3), 386-393.

Harvey, S. B., Hotopf, M., Øverland, S., & Mykletun, A. (2010). Physical activity and common mental disorders. *The British Journal of Psychiatry, 197*(5), 357-364.

Haug, E., Torsheim, T., Sallis, J. F., & Samdal, O. (2010). The characteristics of the outdoor school environment associated with physical activity. *Health Education Research, 25*(2), 248-256.

Haug, E., Torsheim, T., & Samdal, O. (2008). Physical environmental characteristics and individual interests as correlates of physical activity in Norwegian secondary schools: the health behaviour in school-aged children study. *International Journal of Behavioral Nutrition and Physical Activity, 5*.

Hawthorne, G., & Elliott, P. (2005). Imputing cross-sectional missing data: comparison of common techniques. *The Australian and New Zealand journal of psychiatry, 39*(7), 583-590.

Hills, A. P., King, N. A., & Armstrong, T. P. (2007). The contribution of physical activity and sedentary behaviours to the growth and development of children and adolescents: implications for overweight and obesity. *Sports Medicine, 37*(6), 533-545.

Hinkley, T., Crawford, D., Salmon, J., Okely, A. D., & Hesketh, K. (2008). Preschool children and physical activity a review of correlates. *American Journal of Preventive Medicine, 34*(5), 435-441.

Hohepa, M. (2008). *Prevalence, perceptions, and correlates of physical activity among youth in New Zealand.* (Unpublished doctoral dissertation). Auckland University of Technology, Auckland.

Hohepa, M., Schofield, G., & Kolt, G. S. (2006). Physical activity: what do high school students think? *Journal of Adolescent Health, 39*(3), 328-336.

Hohepa, M., Scragg, R., Schofield, G., Kolt, G. S., & Schaaf, D. (2007). Social support for youth physical activity: importance of siblings, parents, friends and school support across a segmented school day. *International Journal of Behavioral Nutrition and Physical Activity, 4*, 54.

Hohepa, M., Scragg, R., Schofield, G., Kolt, G. S., & Schaaf, D. (2009). Associations between after-school physical activity, television use, and parental strategies in a sample of New Zealand adolescents. *Journal of Physical Activity and Health, 6*(3), 299-305.

Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika, 30*, 179-185.

Hovell, M. F., Bursick, J. H., Sharkey, R., & McClure, J. (1978). An evaluation of elementary students' voluntary physical activity during recess. *Research quarterly, 49*(4), 460-474.

Hoyos Cillero, I., & Jago, R. (2010). Systematic review of correlates of screen-viewing among young children. *Preventive Medicine, 51*(1), 3-10.

Humbert, M. L., Chad, K. E., Bruner, M. W., Spink, K. S., Muhajarine, N., Anderson, K. D., . . . Gryba, C. R. (2008). Using a naturalistic ecological approach to examine the factors influencing youth physical activity across Grades 7 to 12. *Health Education Behavior, 35*(2), 158-173.

Humbert, M. L., Chad, K. E., Spink, K. S., Muhajarine, N., Anderson, K. D., Bruner, M. W., . . . Gryba, C. R. (2006). Factors that influence physical activity participation among high- and low-SES youth. *Qualitative Health Research, 16*(4), 467-483.

Hume, C., Ball, K., & Salmon, J. (2006). Development and reliability of a self-report questionnaire to examine children's perceptions of the physical activity environment at home and in the neighbourhood. *International Journal of Behavioral Nutrition and Physical Activity, 3*, 16.

Hume, C., Salmon, J., & Ball, K. (2005). Children's perceptions of their home and neighborhood environments, and their association with objectively measured physical activity: a qualitative and quantitative study. *Health Education Research, 20*(1), 1-13.

Humpel, N., Owen, N., Leslie, E., Marshall, A. L., Bauman, A. E., & Sallis, J. F. (2004). Associations of location and perceived environmental attributes with walking in neighborhoods. *American Journal of Health Promotion, 18*(3), 239-242.

Hutcheson, G., & Sofroniou, N. (1999). *The multivariate social scientist: introductory statistics using generalized linear models*. Thousand Oaks, CA: Sage Publications.

Ingram, D. K. (2000). Age-related decline in physical activity: generalization to nonhumans. *Medicine and Science in Sports and Exercise, 32*(9), 1623-1629.

Irving, H. M., Adlaf, E. M., Allison, K. R., Paglia, A., Dwyer, J. J., & Goodman, J. (2003). Trends in vigorous physical activity participation among Ontario adolescents, 1997-2001. *Canadian Journal of Public Health. Revue Canadienne de Sante Publique, 94*(4), 272-274.

Jackson, D. M. (2001). Sample size and number of parameter estimates in maximum likelihood confirmatory factor analysis: a Monte Carlo investigation. *Structural Equation Modeling, 8*(2), 205-223.

Jago, R., Anderson, C. B., Baranowski, T., & Watson, K. (2005). Adolescent patterns of physical activity: differences by gender, day, and time of day. *American Journal of Preventive Medicine, 28*(5), 447-452.

Jago, R., & Baranowski, T. (2004). Non-curricular approaches for increasing physical activity in youth: a review. *Preventive Medicine, 39*(1), 157-163.

Jago, R., Baranowski, T., Watson, K., Bachman, C., Baranowski, J. C., Thompson, D., . . . Moe, E. (2009). Development of new physical activity and sedentary behavior change self-efficacy questionnaires using item response modeling. *International Journal of Behavioral Nutrition and Physical Activity, 6*.

Jago, R., Brockman, R., Fox, K. R., Cartwright, K., Page, A. S., & Thompson, J. L. (2009). Friendship groups and physical activity: qualitative findings on how physical activity is initiated and maintained among 10-11 year old children. *International Journal of Behavioral Nutrition and Physical Activity, 6*.

Jago, R., Fox, K., Page, A., Brockman, R., & Thompson, J. (2009). Development of scales to assess children's perceptions of friend and parental influences on physical activity. *International Journal of Behavioral Nutrition and Physical Activity, 6*(1), 67.

Janssen, I. (2007). Physical activity guidelines for children and youth. *Canadian Journal of Public Health. Revue Canadienne de Sante Publique, 98*(Suppl 2), s109-s121.

Janssen, I., & LeBlanc, A. (2010). Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *International Journal of Behavioral Nutrition and Physical Activity, 7*(1), 40-56.

Jarrett, O. S., Maxwell, D., Dickerson, C., Hoge, P., Davies, G., & Yetley, A. (1998). Impact of recess on classroom behavior: group effects and individual differences. *Journal of Educational Research, 92*(2), 121-126.

Jeffery, R. W. (2004). How can Health Behavior Theory be made more useful for intervention research? *International Journal of Behavioral Nutrition and Physical Activity, 1*(1), 10.

Jennings-Aburto, N., Nava, F., Bonvecchio, A., Safdie, M., Gonzalez-Casanova, I., Gust, T., & Rivera, J. (2009). Physical activity during the school day in public primary schools in Mexico City. *Salud publica de Mexico, 51*(2), 141-147.

Jones, N. R., Jones, A., van Sluijs, E. M. F., Panter, J., Harrison, F., & Griffin, S. J. (2010). School environments and physical activity: the development and testing of an audit tool. *Health Place, 16*(5), 776-783.

Kaiser, H. F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement, 20*, 141-151.

Karsten, L. (2005). It all used to be better? Different generations on continuity and change in urban children's daily use of space. *Children's Geographies, 3*(3), 275-290.

Katzmarzyk, P., & Malina, R. M. (1998). Contribution of organized sports participation to estimated daily energy expenditure in youth. *Pediatric Exercise Science, 10*(4), 378-386.

Keay, J. (2007). Learning from other teachers: gender influences. *European physical education review, 13*(2), 209-227.

Kennedy, C., Kools, S., & Krueger, R. (2001). Methodological considerations in children's focus groups. *Nursing Research, 50*(3), 184-187.

Kerner, M. S., & Kalinski, M. I. (2002). Scale construction for measuring adolescent boys' and girls' attitudes, beliefs, perception of control, and intention to engage in leisure-time physical activity. *Perceptual and Motor Skills, 95*(1), 109-117.

Kesaniemi, A., Riddoch, C. J., Reeder, B., Blair, S. N., & Sorensen, T. (2010). Advancing the future of physical activity guidelines in Canada: an independent expert panel interpretation of the evidence. *International Journal of Behavioral Nutrition and Physical Activity, 7*, 41.

Kimiecik, J. C., & Harris, A. T. (1996). What is enjoyment? A conceptual/definitional analysis with implications for sport and exercise psychology. *Journal of Sport and Exercise Psychology, 18*, 247-263.

King, A. C., Stokols, D., Talen, E., Brassington, G. S., & Killingsworth, R. (2002). Theoretical approaches to the promotion of physical activity: forging a transdisciplinary paradigm. *American Journal of Preventive Medicine, 23*(Suppl 2), 15-25.

Kirtland, K. A., Porter, D. E., Addy, C. L., Neet, M. J., Williams, J. E., Sharpe, P. A., . . . Ainsworth, B. E. (2003). Environmental measures of physical activity supports: perception versus reality. *American Journal of Preventive Medicine, 24*(4), 323-331.

Klesges, R. C., Eck, L. H., Mellon, M. W., Fulliton, W., Somes, G. W., & Hanson, C. L. (1990). The accuracy of self-reports of physical activity. *Medicine and Science in Sports and Exercise, 22*(5), 690-697.

Kohl, H. W., 3rd, & Hobbs, K. E. (1998). Development of physical activity behaviors among children and adolescents. *Pediatrics, 101*(3 Pt 2), 549-554.

Kohl, H. W., Fulton, J., & Caspersen, C. J. (2000). Assessment of physical activity among children and adolescents: a review and synthesis. *Preventive Medicine, 31*, s54-s76.

Kowalski, K. C., Crocker, P. R., & Faulkner, R. A. (1997). Validation of the Physical Activity Questionnaire for Older Children. *Pediatric Exercise Science, 9*(2), 174-186.

Kowalski, K. C., Crocker, P. R. E., & Kowalski, N. P. (1997). Convergent validity of the Physical Activity Questionnaire for Adolescents. *Pediatric Exercise Science, 9*, 342-352.

Krishnamoorthy, K., & Mathew, T. (2009). *Statistical tolerance regions: theory, applications, and computation*. New Jersey, USA: John Wiley and Sons, Inc.

Krueger, R. (1998). *Developing questions for focus groups* (Vol. Focus Group Kit 3). Thousand Oaks, California: SAGE Publications, Inc.

Krueger, R., & Casey, M. (2000). *Focus groups: a practical guide for applied research*. Thousand Oaks: Sage Publications Ltd.

Laakso, L., Telama, R., Nupponen, H., Rimpelä, A., & Pere, L. (2008). Trends in leisure time physical activity among young people in Finland, 1977—2007. *European physical education review, 14*(2), 139-155.

Lance, C. E., Butts, M. M., & Michaels, L. C. (2006). The sources of four commonly reported cutoff criteria: what did they really say? *Organizational Research Methods, 9*(2), 202–220.

Landis, J. R., & Koch, G. G. (1977). An application of hierarchical kappa-type statistics in the assessment of majority agreement among multiple observers. *Biometrics, 33*(2), 363-374.

Lansdown, G. (2001). Promoting children's participation in democratic decision making. Italy: UNICEF Innocenti Research Centre.

Lawley, D. N., & Maxwell, A. E. (1971). *Factor analysis as a statistical method*. London: Butterworth and Co.

Leatherdale, S. T., Manske, S., Faulkner, G., Arbour, K., & Bredin, C. (2010). A multi-level examination of school programs, policies and resources associated with physical activity among elementary school youth in the PLAY-ON study. *International Journal of Behavioral Nutrition and Physical Activity, 7*(1), 6.

Leslie, E., Kremer, P., Toumbourou, J. W., & Williams, J. W. (2010). Gender differences in personal, social and environmental influences on active travel to and from school for Australian adolescents. *Journal of Science and Medicine in Sport, 13*(6), 597-601.

Lewis, A. (1992). Group child interviews as a research tool. *British Educational Research Journal, 18*(4), 413-421.

Lewis, N. (2006). *The predictive utility of the youth physical activity promotion model in South Australian youth.* (Unpublished honours dissertation). University of South Australia, Adelaide.

Lewis, N., Dollman, J., & Dale, M. (2007). Trends in physical activity behaviours and attitudes among South Australian youth between 1985 and 2004. *Journal of Science and Medicine in Sport, 10*(6), 418-427.

Loucaides, C. A., Jago, R., & Charalambous, I. (2009). Promoting physical activity during school break times: piloting a simple, low cost intervention. *Preventive Medicine, 48*(4), 332-334.

Lourenço, O., & Machado, A. (1996). In defense of Piaget's theory: a reply to 10 common criticisms. *Psychological Review, 103*(1), 143-164.

Lowry, R., Wechsler, H., Kann, L., & Collins, J. (2001). Recent trends in participation in physical education among US high school students. *Journal of School Health, 71*(4), 145-152.

Lubans, D. R., Boreham, C. A., Kelly, P., & Foster, C. E. (2011). The relationship between active travel to school and health-related fitness in children and adolescents: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity, 8*, 5.

Lubans, D. R., Okely, A. D., Morgan, P. J., Cotton, W., Puglisi, L., & Miller, J. (2012). Description and evaluation of a social cognitive model of physical activity behaviour tailored for adolescent girls. *Health Education Research, 27*(1), 115-128.

MacCallum, R. C., Widaman, K. F., Preacher, K. J., & Hong, S. (2001). Sample size in factor analysis: the role of model error. *Multivariate Behavioral Research, 36*(4), 611-637.

MacCallum, R. C., Widaman, K. F., Zhang, S., & Hong, S. (1999). Sample size in factor analysis. *Psychological Methods, 4*(1), 84-99.

MacDougall, C., Schiller, W., & Darbyshire, P. (2004). We have to live in the future. *Early Child Development and Care, 174*(4), 369-387.

MacDougall, C., Schiller, W., & Darbyshire, P. (2009). What are our boundaries and where can we play? Perspectives from eight to ten year old Australian metropolitan and rural children. *Early Child Development and Care, 179*(2), 189-204.

Machado Rodrigues, A. M., Coelho e Silva, M. J., Mota, J., Cumming, S. P., Sherar, L. B., Neville, H., & Malina, R. M. (2010). Confounding effect of biologic maturation on sex differences in physical activity and sedentary behavior in adolescents. *Pediatric Exercise Science, 22*(3), 442-453.

Maddison, R., Vander Hoorn, S., Jiang, Y., Ni Mhurchu, C., Exeter, D., Dorey, E., . . . Turley, M. (2009). The environment and physical activity: the influence of psychosocial, perceived, and built environmental factors. *International Journal of Behavioral Nutrition and Physical Activity, 6*(1), 19.

Mageau, G. A., & Vallerand, R. J. (2003). The coach-athlete relationship: a motivational model. *Journal of Sports Science, 21*(11), 883-904.

Magidson, J. (2010). *Correlated Component Regression: a prediction/classificaiton methodology for possibly many features.* Paper presented at the American Statistical Association, Belmont, MA.

Mahar, M. T., Murphy, S. K., Rowe, D. A., Golden, J., Shields, A. T., & Raedeke, T. D. (2006). Effects of a classroom-based program on physical activity and on-task behavior. *Medicine and Science in Sports Exercise, 38*(12), 2086-2094.

Maher, C., Williams, M., Olds, T., & Lane, A. (2007). Physical and sedentary activity in adolescents with cerebral palsy. *Developmental Medicine and Child Neurology, 49*(6), 450-457.

Mangunkusumo, R. T., Duisterhout, J. S., de Graaff, N., Maarsingh, E. J., de Koning, H. J., & Raat, H. (2006). Internet versus paper mode of health and health behavior

questionnaires in elementary schools: asthma and fruit as examples. *Journal of School Health, 76*(2), 80-86.

Marfell-Jones, M., Olds, T., Stewart, A., & Carter, L. (2006). *International standards for the anthropometric assessment*. Potchefstroom, RSA: North-West University.

Mark, A. E., & Janssen, I. (2009). Influence of bouts of physical activity on overweight in youth. *American Journal of Preventive Medicine, 36*(5), 416-421.

Martin, J. J., & McCaughtry, N. (2008). Using social cognitive theory to predict physical activity in inner-city African American school children. *Journal of Sport and Exercise Psychology, 30*(4), 378-391.

Masse, L. C., Dassa, C., Gauvin, L., Giles-Corti, B., & Motl, R. (2002). Emerging measurement and statistical methods in physical activity research. *American Journal of Preventive Medicine, 23*(Suppl 2), s44-s55.

Masse, L. C., Fuemmeler, B. F., Anderson, C. B., Matthews, C. E., Trost, S. G., Catellier, D. J., & Treuth, M. (2005). Accelerometer data reduction: a comparison of four reduction algorithms on select outcome variables. *Medicine and Science in Sports and Exercise, 37*(Suppl 11), s544-s554.

Mathews, L., Malakellis, M., Sanigorski, A. M., Kremer, P., & Swinburn, B. A. (2008). Nutrition and Physical Activity in Children and Adolescents. *Sentinel Site Series*. Barwon-South Western Region, Victoria: Department of Human Services.

McCullagh, P., Matzkanin, K. T., Shaw, S. D., & Maldonado, M. (1993). Motivation for participation in physical activity: a comparison of parent-child perceived competencies and participation motives. *Pediatric Exercise Science, 5*(3), 224-233.

McDonald, N. C. (2007). Active transportation to school: trends among U.S. schoolchildren, 1969–2001. *American Journal of Preventive Medicine, 32*(6), 509-516.

McKay, H. A., MacLean, L., Petit, M., MacKelvie-O'Brien, K., Janssen, P., Beck, T., & Khan, K. M. (2005). "Bounce at the Bell": a novel program of short bouts of exercise improves proximal femur bone mass in early pubertal children. *British Journal of Sports Medicine, 39*(8), 521-526.

McKenna, J., Foster, L. J., & Page, A. (2004). Exploring recall of physical activity in young people using qualitative interviewing. *Pediatric Exercise Science, 16*(1), 5-14.

McKenzie, T. L., Nader, P. R., Strikmiller, P. K., Yang, M., Stone, E. J., Perry, C. L., . . . Kelder, S. H. (1996). School physical education: effect of the child and adolescent trial for cardiovascular health. *Preventive Medicine, 25*(4), 423-431.

McKenzie, T. L., Sallis, J. F., Elder, J. P., Berry, C. C., Hoy, P. L., Nader, P. B., . . . Broyles, S. L. (1997). Physical activity levels and prompts in young children at recess: a two-year study of a bi-ethnic sample. *Research Quarterly for Exercise and Sport, 68*(3), 195-202.

McKenzie, T. L., Sallis, J. F., Prochaska, J. J., Conway, T. L., Marshall, S. J., & Rosengard, P. (2004). Evaluation of a two-year middle-school physical education intervention: M-SPAN. *Medicine and Science in Sports and Exercise, 36*(8), 1382-1388.

McMinn, A. M., van Sluijs, E. M., Harvey, N. C., Cooper, C., Inskip, H. M., Godfrey, K. M., & Griffin, S. J. (2009). Validation of a maternal questionnaire on correlates of physical activity in preschool children. *International Journal of Behavioral Nutrition and Physical Activity, 6*, 81.

McMinn, A. M., van Sluijs, E. M., Wedderkopp, N., Froberg, K., & Griffin, S. J. (2008). Sociocultural correlates of physical activity in children and adolescents: findings from the Danish arm of the European Youth Heart study. *Pediatric Exercise Science, 20*(3), 319-332.

Meadmore, D., & Symes, C. (1997). Keeping up appearances: uniform policy for school diversity? *British Journal of Educational Studies, 45*(2), 174-186.

Merrell, K., Gueldner, B., Ross, S., & Isava, D. (2008). How effective are school bullying intervention programs? A meta-analysis of intervention research. *School Psychology Quarterly, 23*(1), 26-42.

Microsoft Corporation. (2012). Microsoft Office imagery. New South Wales, Australia: Microsoft.

Mirwald, R. L., Baxter-Jones, A. D., Bailey, D. A., & Beunen, G. P. (2002). An assessment of maturity from anthropometric measurements. *Medicine and Science in Sports and Exercise, 34*(4), 689-694.

Moore, J. B., Yin, Z., Hanes, J., Duda, J., Gutin, B., & Barbeau, P. (2009). Measuring enjoyment of physical activity in children: validation of the Physical Activity Enjoyment Scale. *Journal of Applied Sport Psychology, 21*, 116-129.

Moore, L. L., Lombardi, D. A., White, M. J., Campbell, J. L., Oliveria, S. A., & Ellison, R. C. (1991). Influence of parents' physical activity levels on activity levels of young children. *Journal of Pediatrics, 118*(2), 215-219.

Morgan, D. (1998). *Planning focus groups* (Vol. Focus Group Kit 2). Thousand Oaks, California: SAGE Publications, Inc.

Morgan, M., Gibbs, S., Maxwell, K., & Britten, N. (2002). Hearing children's voices: methodological issues in conducting focus groups with children aged 7-11 years. *Qualitative Research, 2*(1), 5-20.

Morrow, V. (2001). Using qualitative methods to elicit young people's perspectives on their environments: some ideas for community health initiatives. *Health Education Research, 16*(3), 255-268.

Morrow, V. (2003). "No ball games": children's views of their urban environments. *Journal of Epidemiology and Community Health, 57*(4), 234.

Mota, J., Santos, P., Guerra, S., Ribeiro, J., & Duarte, J. (2003). Patterns of daily physical activity during school days in children and adolescents. *American Journal of Human Biology, 15*(4), 547-553.

Mota, J., Silva, P., Santos, M. P., Ribeiro, J. C., Oliveira, J., & Duarte, J. A. (2005). Physical activity and school recess time: differences between the sexes and the relationship between children's playground physical activity and habitual physical activity. *Journal of Sports Science, 23*(3), 269-275.

Motl, R. W., Dishman, R. K., Felton, G., & Pate, R. R. (2003). Self-motivation and physical activity among black and white adolescent girls. *Medicine and Science in Sports and Exercise, 35*(1), 128-136.

Motl, R. W., Dishman, R. K., Saunders, R., Dowda, M., Felton, G., & Pate, R. R. (2001). Measuring enjoyment of physical activity in adolescent girls. *American Journal of Preventive Medicine, 21*(2), 110-117.

Motl, R. W., Dishman, R. K., Saunders, R. P., Dowda, M., Felton, G., Ward, D. S., & Pate, R. R. (2002). Examining social-cognitive determinants of intention and physical activity among black and white adolescent girls using structural equation modeling. *Health Psychology, 21*(5), 459-467.

Motl, R. W., Dishman, R. K., Saunders, R. P., Dowda, M., & Pate, R. R. (2004). Measuring social provisions for physical activity among adolescent black and white girls. *Educational and Psychological Measurement, 64*(4), 682-706.

Motl, R. W., Dishman, R. K., Saunders, R. P., Dowda, M., & Pate, R. R. (2007). Perceptions of physical and social environment variables and self-efficacy as correlates of self-reported physical activity among adolescent girls. *Journal of Pediatric Psychology, 32*(1), 6-12.

Motl, R. W., Dishman, R. K., Trost, S. G., Saunders, R. P., Dowda, M., Felton, G., . . . Pate, R. R. (2000). Factorial validity and invariance of questionnaires measuring social-cognitive determinants of physical activity among adolescent girls. *Preventive Medicine, 31*(5), 584-594.

Motl, R. W., Dishman, R. K., Ward, D. S., & Saunders, R. P. (2005). Perceived physical environment and physical activity across one year among adolescent girls: self-efficacy as a possible mediator? *Journal of Adolescent Health, 37*(5), 403-408.

Motl, R. W., Dishman, R. K., Ward, D. S., Saunders, R. P., Dowda, M., Felton, G., & Pate, R. R. (2005). Comparison of barriers self-efficacy and perceived behavioral control for explaining physical activity across 1 year among adolescent girls. *Health Psychology, 24*(1), 106-111.

Mulvihill, C., Rivers, K., & Aggleton, P. (2000a). A qualitative study investigating the views of primary-age children and parents on physical activity. *Health Education Journal, 59*(2), 166-179.

Mulvihill, C., Rivers, K., & Aggleton, P. (2000b). Views of young people towards physical activity: determinants and barriers to involvement. *Health Education Journal, 100*(5), 190-199.

Nader, P. R., Bradley, R. H., Houts, R. M., McRitchie, S. L., & O'Brien, M. (2008). Moderate-to-vigorous physical activity from ages 9 to 15 years. *Journal of the American Medical Association, 300*(3), 295-305.

National Association for Sport and Physical Education. (2004). *Physical activity for children: a statement of guidelines for children ages 5-12* (2 ed.). Reston, VA: NASPE Publications.

National Health and Medical Research Council. (1997). Acting on Australia's weight: a strategic plan for the prevention of overweight and obesity. New South Wales, Australia: Commonwealth of Australia.

National Health and Medical Research Council. (2001). Human research ethics handbook: commentary on the national statement on ethical conduct in research involving humans. Canberra, Australia: Commonwealth of Australia.

National Health and Medical Research Council. (2003). *Clinical practice guidelines for the management of overweight and obesity in children and adolescents*. Canberra, Australia: Commonwealth of Australia.

Neumark-Sztainer, D., Story, M., Perry, C., & Casey, M. A. (1999). Factors influencing food choices of adolescents: findings from focus-group discussions with adolescents. *Journal of American Dietetic Association, 99*(8), 929-937.

New Zealand Ministry of Health. (2010). New Zealand physical activity guidelines: children and young people (5-18 years). Retrieved from http://www.moh.govt.nz/moh.nsf/indexmh/activity-guidelines

Nichol, M. E., Pickett, W., & Janssen, I. (2009). Associations between school recreational environments and physical activity. *Journal of School Health, 79*(6), 247-254.

Nilsson, A., Ekelund, U., Yngve, A., & Sjöström, M. (2002). Assessing physical activity among children with accelerometers using different time sampling intervals and placements. *Pediatric Exercise Science, 14*, 87-96.

Norman, G. J., Sallis, J. F., & Gaskins, R. (2005). Comparability and reliability of paper- and computer-based measures of psychosocial constructs for adolescent physical activity and sedentary behaviors. *Research Quarterly for Exercise and Sport, 76*(3), 315-323.

Norman, G. R., & Streiner, D. L. (1994). *Biostatistics: the bare essentials*. St Louis: People's Medical Publishing House.

Norton, K., Dollman, J., Klanarong, S., & Robertson, I. (2001). Kid's sport. Who's playing what? *Sport Health, 19*, 12.

Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York, USA: McGraw-Hill.

O'Dea, J. A. (2003). Why do kids eat healthful food? Perceived benefits of and barriers to healthful eating and physical activity among children and adolescents. *Journal of American Dietetic Association, 103*(4), 497-501.

Okely, A. D., Booth, M. L., & Patterson, J. W. (2001). Relationship of physical activity to fundamental movement skills among adolescents. *Medicine and Science in Sports and Exercise, 33*(11), 1899-1904.

Olds, T., Wake, M., Patton, G., Ridley, K., Waters, E., Williams, J., & Hesketh, K. (2009). How do school-day activity patterns differ with age and gender across adolescence? *Journal of Adolescent Health, 44*(1), 64-72.

Ollis, D., & Meldrum, K. (2009). Girls talking about girls' issues: the importance of girls-only health and physical education in promoting well-being *Redress, 18*(1), 21-30.

Ommundsen, Y., Klasson-Heggebo, L., & Anderssen, S. A. (2006). Psycho-social and environmental correlates of location-specific physical activity among 9- and 15- year-old Norwegian boys and girls: the European Youth Heart Study. *International Journal of Behavioral Nutrition and Physical Activity, 3*, 32.

Ommundsen, Y., Page, A., Ku, P. W., & Cooper, A. R. (2008). Cross-cultural, age and gender validation of a computerised questionnaire measuring personal, social and environmental associations with children's physical activity: the European Youth Heart Study. *International Journal of Behavioral Nutrition and Physical Activity, 5*, 29.

Osborne, J., & Collins, S. (2001). Pupils' views of the role and value of the science curriculum: a focus-group study. *International Journal of Science Education, 23*(5), 441-467.

Owen, N., Leslie, E., Salmon, J., & Fotheringham, M. J. (2000). Environmental determinants of physical activity and sedentary behavior. *Exercise Sports Science Review, 28*(4), 153-158.

Pallant, J. (2011). *SPSS Survival Manual* (4 ed.). Australia: Allen & Unwin.

Papaioannou, A. (1994). Development of a questionnaire to measure achievement orientations in physical education. *Research Quarterly for Exercise and Sport, 65*(1), 11-20.

Parent, A., Teilmann, G., Juul, A., Skakkebaek, N. E., Toppari, J., & Bourguignon, J. (2003). The timing of normal puberty and the age limits of sexual precocity: variations around the world, secular trends, and changes after migration. *Endocrine Reviews, 24*(5), 668-693.

Parrish, A., Russell, K., & Yeatman, H. (2009). School playground environments: what factors influence children's activity? *British Journal of School Nursing, 4*, 6-9.

Pate, R. R., Freedson, P. S., Sallis, J. F., Taylor, W. C., Sirard, J., Trost, S. G., & Dowda, M. (2002). Compliance with physical activity guidelines: prevalence in a population of children and youth. *Annals of Epidemiology, 12*(5), 303-308.

Pate, R. R., Pratt, M., Blair, S. N., Haskell, W. L., Macera, C. A., Bouchard, C., . . . et al. (1995). Physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *Journal of the American Medical Association, 273*(5), 402-407.

Pate, R. R., Saunders, R. P., Ward, D. S., Felton, G., Trost, S. G., & Dowda, M. (2003). Evaluation of a community-based intervention to promote physical activity in youth: lessons from Active Winners. *American Journal of Health Promotion, 17*(3), 171-182.

Pate, R. R., Trost, S. G., Felton, G. M., Ward, D. S., Dowda, M., & Saunders, R. (1997). Correlates of physical activity behavior in rural youth. *Research Quarterly for Exercise and Sport, 68*(3), 241-248.

Pate, R. R., Ward, D. S., Saunders, R. P., Felton, G., Dishman, R. K., & Dowda, M. (2005). Promotion of physical activity among high-school girls: a randomized controlled trial. *American Journal of Public Health, 95*(9), 1582-1587.

Patnode, C. D., Lytle, L. A., Erickson, D. J., Sirard, J. R., Barr-Anderson, D., & Story, M. (2010). The relative influence of demographic, individual, social, and environmental factors on physical activity among boys and girls. *International Journal of Behavioral Nutrition and Physical Activity, 7*, 79.

Patton, M. (2002). *Qualitative Research and Evaluation Methods* (3rd ed.). Thousand Oaks, California: Sage Publications, Inc.

Pearce, P. F., Harrell, J. S., & McMurray, R. G. (2008). Middle-school children's understanding of physical activity: "If you're moving, you're doing physical activity". *Journal of Pediatric Nursing, 23*(3), 169-182.

Pearce, P. F., Williamson, J., Harrell, J. S., Wildemuth, B. M., & Solomon, P. (2007). The children's computerized physical activity reporter: children as partners in the design and usability evaluation of an application for self-reporting physical activity. *Computers Informatics Nursing, 25*(2), 93-105.

Pellegrini, A. D., & Davis, P. D. (1993). Relations between children's playground and classroom behaviour. *British Journal of Educational Psychology, 63 (Pt 1)*, 88-95.

Pellegrini, A. D., & Smith, P. K. (1998). Physical activity play: the nature and function of a neglected aspect of playing. *Child Development, 69*(3), 577-598.

Peterson-Sweeney, K. (2005). The use of focus groups in pediatric and adolescent research. *Journal of Pediatric Health Care, 19*(2), 104-110.

Pett, M., Lackey, N., & Sullivan, J. (2003). *Making sense of factor analysis: the use of factor analysis for instrument development in health care research*. Thousand Oaks, California: SAGE Publications.

Pfeiffer, K. A., Dowda, M., McIver, K. L., & Pate, R. R. (2009). Factors related to objectively measured physical activity in preschool children. *Pediatric Exercise Science, 21*(2), 196-208.

Phillips, L. R., Parfitt, G., & Rowlands, A. V. (2012). Calibration of the GENEA accelerometer for assessment of physical activity intensity in children. *Journal of Science and Medicine in Sport*.

Piaget, J. (1929). *Introduction to the child's conception of the world*. New York: Harcourt.

Pirasteh, A., Hidarnia, A., Asghari, A., Faghihzadeh, S., & Ghofranipour, F. (2008). Development and validation of psychosocial determinants measures of physical activity among Iranian adolescent girls. *BMC Public Health, 8*(1), 150.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879-903.

Portney, L., & Watkins, M. (2000). *Foundations fo Clinical Research: Applications to Practice*. New Jersey, USA: Prentice-Hall Inc.

Poulsen, A. A., & Ziviani, J. (2004). Health enhancing physical activity: factors influencing engagement patterns in children. *Australian Occupational Therapy Journal, 51*, 69-79.

Pratt, M., Macera, C. A., & Blanton, C. (1999). Levels of physical activity and inactivity in children and adults in the United States: current evidence and research issues. *Medicine and Science in Sports and Exercise, 31*(Suppl 11), s526-s533.

Presser, S., Couper, M. P., Lessler, J. T., Martin, E., Martin, J., Rothgeb, J. M., & Singer, E. (2004). Methods for testing and evaluating survey questions. *Public Opinion Quarterly, 68*(1), 109-130.

Prins, R. G., Oenema, A., Van Der Horst, K., & Brug, J. (2009). Objective and perceived availability of physical activity opportunities: differences in associations with physical activity behavior among urban adolescents. *International Journal of Behavioral Nutrition and Physical Activity, 6*, 70.

Prochaska, J. J., Rodgers, M. W., & Sallis, J. F. (2002). Association of parent and peer support with adolescent physical activity. *Research Quarterly for Exercise and Sport, 73*(2), 206-210.

Prochaska, J. O., & DiClement, C. C. (1983). Stages and processes of self-change in smoking: towards an integrative model of change. *Journal of Consulting and Clinical Psychology, 51*, 390-395.

Prout, A. (2001). Representing children: reflections on the Children 5-16 Programme. *Children and Society, 15*(3), 193-201.

Prout, A. (2002). Researching children as social actors: an introduction to the Children 5-16 Programme. *Children and Society, 16*(2), 67-76.

Pugliese, J., & Tinsley, B. (2007). Parental socialization of child and adolescent physical activity: a meta-analysis. *Journal of Family Psychology, 21*(3), 331-343.

Puyau, M. R., Adolph, A. L., Vohra, F. A., & Butte, N. F. (2002). Validation and calibration of physical activity monitors in children. *Obesity Research, 10*(3), 150-157.

Ramstetter, C. L., Murray, R., & Garner, A. S. (2010). The crucial role of recess in schools. *Journal of School Health, 80*(11), 517-526.

Raymond, M. R., & Roberts, D. M. (1987). A comparison of methods for treating incomplete data in selection research. *Educational and Psychological Measurement in Physical Education and Exercise Science, 47*, 13–26.

Reilly, J. J. (2011). Can we modulate physical activity in children. *International Journal of Obesity, 35*(10), 1266-1269.

Reilly, J. J., Penpraze, V., Hislop, J., Davies, G., Grant, S., & Paton, J. Y. (2008). Objective measurement of physical activity and sedentary behaviour: review with new data. *Archives of Disease in Childhood, 93*(7), 614-619.

Reynolds, K. D., Killen, J. D., Bryson, S. W., Maron, D. J., Taylor, C. B., Maccoby, N., & Farquhar, J. W. (1990). Psychosocial predictors of physical activity in adolescents. *Preventive Medicine, 19*(5), 541-551.

Rhodes, R. E., Plotnikoff, R. C., & Spence, J. C. (2004). Creating parsimony at the expense of precision? Conceptual and applied issues of aggregating belief-based constructs in physical activity research. *Health Education Research, 19*(4), 392-405.

Riddoch, C. (1998). Relationships between physical activity and physical health in young people. *Young and active? Young people and health-enhancing physical activity - evidence and implications* (pp. 17-48). London: Health Education Authority.

Ridgers, N. D., Fairclough, S. J., & Stratton, G. (2010). Variables associated with children's physical activity levels during recess: The A-CLASS project. *International Journal of Behavioral Nutrition and Physical Activity, 7*.

Ridgers, N. D., & Stratton, G. (2005). Physical activity during school recess: the Liverpool Sporting Playgrounds Project. *Pediatric Exercise Science, 17*(3), 281-290.

Ridgers, N. D., Stratton, G., Clark, E., Fairclough, S. J., & Richardson, D. J. (2006). Day-to-day and seasonal variability of physical activity during school recess. *Preventive Medicine, 42*(5), 372-374.

Ridgers, N. D., Stratton, G., & Fairclough, S. J. (2005). Assessing physical activity during recess using accelerometry. *Preventive Medicine, 41*(1), 102-107.

Ridgers, N. D., Stratton, G., & Fairclough, S. J. (2006). Physical activity levels of children during school playtime. *Sports Medicine, 36*(4), 359-371.

Ridgers, N. D., Stratton, G., Fairclough, S. J., & Twisk, J. W. (2007a). Children's physical activity levels during school recess: a quasi-experimental intervention study. *International Journal of Behavioral Nutrition and Physical Activity, 4*, 19.

Ridgers, N. D., Stratton, G., Fairclough, S. J., & Twisk, J. W. (2007b). Long-term effects of a playground markings and physical structures on children's recess physical activity levels. *Preventive Medicine, 44*(5), 393-397.

Ridgers, N. D., Stratton, G., & McKenzie, T. L. (2010). Reliability and validity of the System for Observing Children's Activity and Relationships during Play (SOCARP). *Journal of Physical Activity and Health, 7*(1), 17-25.

Ridgers, N. D., Timperio, A., Crawford, D., & Salmon, J. (2012). Five-year changes in school recess and lunchtime and the contribution to children's daily physical activity. *British Journal of Sports Medicine, 46*(10), 741-746.

Ridgers, N. D., Toth, M., & Uvacsek, M. (2009). Physical activity levels of Hungarian children during school recess. *Preventive Medicine, 49*(5), 410-412.

Ridley, K. (2005). *The Multimedia Activity Recall for Children and Adolescents (MARCA): Development and Validation.* (Unpublished doctoral dissertation). University of South Australia, Adelaide.

Ridley, K., Ainsworth, B. E., & Olds, T. S. (2008). Development of a compendium of energy expenditures for youth. *International Journal of Behavioral Nutrition and Physical Activity, 5*, 45.

Ridley, K., Dollman, J., & Olds, T. (2001). Development and validation of a Computer Delivered Physical Activity Questionnaire (CDPAQ) for children. *Pediatric Exercise Science, 13*(1), 35-46.

Ridley, K., Olds, T., Hands, B., Larkin, D., & Parker, H. (2009). Intra-individual variation in children's physical activity patterns: implications for measurement. *Journal of Science and Medicine in Sport, 12*(5), 568-572.

Ridley, K., & Olds, T. S. (2008). Assigning energy costs to activities in children: a review and synthesis. *Medicine and Science in Sports and Exercise, 40*(8), 1439-1446.

Ridley, K., Olds, T. S., & Hill, A. (2006). The Multimedia Activity Recall for Children and Adolescents (MARCA): development and evaluation. *International Journal of Behavioral Nutrition and Physical Activity, 3*, 10-21.

Ries, A. V., Voorhees, C. C., Gittelsohn, J., Roche, K. M., & Astone, N. M. (2008). Adolescents' perceptions of environmental influences on physical activity. *American Journal of Health Behavior, 32*(1), 26-39.

Robbins, L. B., Wu, T. Y., Sikorskii, A., & Morley, B. (2008). Psychometric assessment of the Adolescent Physical Activity Perceived Benefits and Barriers Scales. *Journal of Nursing Measurement, 16*(2), 98-112.

Robert Wood Johnson Foundation. (2007). Recess Rules. New Jersey, USA: Robert Wood Johnson Foundation.

Robertson-Wilson, J., Levesque, L., & Holden, R. R. (2007). Development of a questionnaire assessing school physical activity environment. *Measurement in Physical Education and Exercise Science, 11*(2), 93-107.

Rodger, S., & Ziviani, J. (2006). *Occupational Therapy with children: understanding children's occupations and enabling participation*. Oxford, United Kingdom: Blackwell Publishing Ltd.

Rothman, A. J. (2004). "Is there nothing more practical than a good theory?": Why innovations and advances in health behavior change will arise if interventions are used to test and refine theory. *International Journal of Behavioral Nutrition and Physical Activity, 1*(1), 11.

Rowlands, A. V. (2007). Accelerometer assessment of physical activity in children: an update. *Pediatric Exercise Science, 19*(3), 252-266.

Rushovich, B. R., Voorhees, C. C., Davis, C. E., Neumark-Sztainer, D., Pfeiffer, K. A., Elder, J. P., . . . Marino, V. G. (2006). The relationship between unsupervised time after school and physical activity in adolescent girls. *International Journal of Behavioral Nutrition and Physical Activity, 3*, 20-29.

Ryan-Wenger, N. M., & Walsh, M. (1994). Children's perspectives on coping with asthma. *Pediatric Nursing, 20*(3), 224-228.

Saelens, B. E., Sallis, J. F., Black, J. B., & Chen, D. (2003). Neighborhood-based differences in physical activity: an environment scale evaluation. *American Journal of Public Health, 93*(9), 1552-1558.

Sallis, J., & Owen, N. (1999). *Physical Activity and Behavioural Medicine*. Thousand Oaks, CA: Sage.

Sallis, J., Owen, N., & Fisher, E. (2008). Ecological models of health behaviour. In K. Glanz, B. Rimer, K. Viswanath & C. Orleans (Eds.), *Health behaviour and health education: theory, research, and practice.* (pp. 465-485). San Francisco: Jossey-Bass Publishers.

Sallis, J., & Saelens, B. (2000). Assessment of physical activity by self-report: status, limitations, and future directions. *Research Quarterly for Exercise and Sport, 71*(2), 1-14.

Sallis, J., Taylor, W., & Dowda, M. (2002). Correlates of vigorous physical activity for children in Grades 1 through 12: comparing parent-reported and objectively measured physical activity. *Pediatric Exercise Science, 14*(1), 30-44.

Sallis, J. F. (2000). Age-related decline in physical activity: a synthesis of human and animal studies. *Medicine and Science in Sports and Exercise, 32*(9), 1598-1600.

Sallis, J. F., Conway, T. L., Prochaska, J. J., McKenzie, T. L., Marshall, S. J., & Brown, M. (2001). The association of school environments with youth physical activity. *American Journal of Public Health, 91*(4), 618-620.

Sallis, J. F., McKenzie, T. L., Alcaraz, J. E., Kolody, B., Faucette, N., & Hovell, M. F. (1997). The effects of a 2-year physical education program (SPARK) on physical activity and fitness in elementary school students. *American Journal of Public Health, 87*(8), 1328-1334.

Sallis, J. F., McKenzie, T. L., Kolody, B., Lewis, M., Marshall, S., & Rosengard, P. (1999). Effects of health-related physical education on academic achievement: project SPARK. *Research Quarterly for Exercise and Sport, 70*(2), 127-134.

Sallis, J. F., Owen, N., & Fotheringham, M. J. (2000). Behavioral epidemiology: a systematic framework to classify phases of research on health promotion and disease prevention. *Annals of Behavioral Medicine, 22*(4), 294-298.

Sallis, J. F., Prochaska, J. J., & Taylor, W. C. (2000). A review of correlates of physical activity of children and adolescents. *Medicine and Science in Sports and Exercise, 32*(5), 963-975.

Sallis, J. F., Prochaska, J. J., Taylor, W. C., Hill, J. O., & Geraci, J. C. (1999). Correlates of physical activity in a national sample of girls and boys in Grades 4 through 12. *Health Psychology, 18*(4), 410-415.

Sallis, J. F., Simons-Morton, B. G., Stone, E. J., Corbin, C. B., Epstein, L. H., Faucette, N., . . . Taylor, W. C. (1992). Determinants of physical activity and interventions in youth. *Medicine and Science in Sports and Exercise, 24*(Suppl 5), 248-257.

Salmon, J., Booth, M. L., Phongsavan, P., Murphy, N., & Timperio, A. (2007). Promoting physical activity participation among children and adolescents. *Epidemiology Reviews, 29*, 144-159.

Salmon, J., & Timperio, A. (2007). Prevalence, trends and environmental influences on child and youth physical activity. *Medicine and Sports Science, 50*, 183-199.

Salmon, J., Timperio, A., Cleland, V., & Venn, A. (2005). Trends in children's physical activity and weight status in high and low socio-economic status areas of Melbourne, Victoria, 1985-2001. *Australian and New Zealand Journal of Public Health, 29*(4), 337-342.

Samitz, G., Egger, M., & Zwahlen, M. (2011). Domains of physical activity and all-cause mortality: systematic review and dose–response meta-analysis of cohort studies. *International Journal of Epidemiology, 40*(5), 1382-1400.

Sandelowski, M. (2000). Whatever happened to qualitative description? *Research in Nursing and Health, 23*(4), 334-340.

Saunders, R. P., Motl, R. W., Dowda, M., Dishman, R. K., & Pate, R. R. (2004). Comparison of social variables for understanding physical activity in adolescent girls. *American Journal of Health Behavior, 28*(5), 426-436.

Saunders, R. P., Pate, R. R., Felton, G., Dowda, M., Weinrich, M. C., Ward, D. S., . . . Baranowski, T. (1997). Development of questionnaires to measure psychosocial influences on children's physical activity. *Preventive Medicine, 26*(2), 241-247.

Schaben, J. A., Welk, G., R, J.-M., & Hensley, L. (2006). The predictive utility of the Children's Physical Activity Correlates (CPAC) Scale across multiple grade levels. *Journal of Physical Activity and Health, 3*, 59-69.

Scott, J. (1997). Children as respondents: methods for improving data quality. In L. Lyberg (Ed.), *Survey measurement and process quality* (pp. 331-350). New York, USA: Wiley.

Scott, M. M., Evenson, K. R., Cohen, D. A., & Cox, C. E. (2007). Comparing perceived and objectively measured access to recreational facilities as predictors of physical activity in adolescent girls. *Journal of Urban Health, 84*(3), 346-359.

Scruggs, P., Beveridge, S., & Watson, D. (2003). Increasing children's school time physical activity using structured fitness breaks. *Pediatric Exercise Science, 15*(2), 156-169.

Shen, B., McCaughtry, N., & Martin, J. (2007). The influence of self-determination in physical education on leisure-time physical activity behavior. *Research Quarterly for Exercise and Sport, 78*(4), 328-338.

Sickmund, M., Synder, H., & Poe-Yamagata, E. (1997). Juvenile offenders and victims: 1997 update on violence - statistics summary. Washington, DC: Office of Juvenile Justice and Delinquency Prevention.

Simpson, L., Douglas, S., & Schimmel, J. (1998). Tween consumers: catalog clothing purchase behavior. *Adolescence, 33*(131), 637-644.

Sirard, J. R., Kubik, M. Y., Fulkerson, J. A., & Arcan, C. (2008). Objectively measured physical activity in urban alternative high school students. *Medicine and Science in Sports and Exercise, 40*(12), 2088-2095.

Sirard, J. R., & Pate, R. R. (2001). Physical activity assessment in children and adolescents. *Sports Medicine, 31*(6), 439-454.

Sirard, J. R., & Slater, M. E. (2008). Walking and bicycling to school: a review. *American Journal of Lifestyle Medicine, 2*(5), 372-396.

Sjolie, A. N., & Thuen, F. (2002). School journeys and leisure activities in rural and urban adolescents in Norway. *Health Promotion International, 17*(1), 21-30.

Smith, A., & Biddle, S. (2008). *Youth physical activity and sedentary behavior: challenges and solutions*. Champaign, IL: Human Kinetics.

Sothern, M. S., Loftin, M., Suskind, R. M., Udall, J. N., & Blecker, U. (1999). The health benefits of physical activity in children and adolescents: implications for chronic disease prevention. *European Journal of Pediatrics, 158*(4), 271-274.

Spence, J. C., & Lee, R. E. (2003). Toward a comprehensive model of physical activity. *Psychology of Sport Exercise, 4*, 7-24.

Spink, K. S., Shields, C. A., Chad, K., Odnokon, P., Muhajarine, N., & Humbert, L. (2006). Correlates of structured and unstructured activity among sufficiently active youth

and adolescents: a new approach to understanding physical activity. *Pediatric Exercise Science, 18*(2), 203-215.

Spinks, A. B., Macpherson, A. K., Bain, C., & McClure, R. J. (2007). Compliance with the Australian national physical activity guidelines for children: relationship to overweight status. *Journal of Science and Medicine in Sport, 10*(3), 156-163.

Sport and Recreation New Zealand. (2003). *SPARC Trends. Trends in participation in sport and active leisure 1997-2001*. Auckland, New Zealand.

Standage, M., Duda, J. L., & Ntoumanis, N. (2006). Students' motivational processes and their relationship to teacher ratings in school physical education: a self-determination theory approach. *Research Quarterly for Exercise and Sport, 77*(1), 100-110.

Stanley, R., Ridley, K., & Olds, T. (2011). The type and prevalence of activities performed by Australian children during the lunchtime and after school periods. *Journal of Science and Medicine in Sport, 14*(3), 227-232.

Stanley, R. M., Boshoff, K., & Dollman, J. (2012a). A qualitative exploration of the "critical window": factors affecting Australian children's after school physical activity. *Journal of Physical Activity and Health, 9*, 33-41.

Stanley, R. M., Boshoff, K., & Dollman, J. (2012b). Voices in the playground: a qualitative exploration of the barriers and facilitators of lunchtime play. *Journal of Science and Medicine in Sport, 15*(1), 44-51.

Stanley, R. M., Ridley, K., & Dollman, J. (2012). Correlates of children's time-specific physical activity: a review of the literature. *International Journal of Behavioral Nutrition and Physical Activity, 9*(1), 50.

Stanton, J. M., & Rogelberg, S. G. (2001). Using internet/intranet web pages to collect organizational research data. *Organizational Research Methods, 4*, 199-216.

StataCorp LP. STATA (Version 11). Texas, USA: StataCorp LP.

Stellino, M. B., Sinclair, C. D., Partridge, J. A., & King, K. M. (2010). Differences in children's recess physical activity: recess activity of the week intervention. *Journal of School Health, 80*(9), 436-444.

Stevens, J., Cornell, C. E., Story, M., French, S. A., Levin, S., Becenti, A., . . . Reid, R. (1999). Development of a questionnaire to assess knowledge, attitudes, and behaviors in American Indian children. *American Journal of Clinical Nutrition, 69*(4), 773-781.

Stokols, D. (1996). Translating social ecological theory into guidelines for community health promotion. *American Journal of Health Promotion, 10*(4), 282-298.

Stone, E. J., McKenzie, T. L., Welk, G. J., & Booth, M. L. (1998). Effects of physical activity interventions in youth: review and synthesis. *American Journal of Preventive Medicine, 15*(4), 298-315.

Stratton, G. (2000). Promoting children's physical activity in primary school: an intervention study using playground markings. *Ergonomics, 43*(10), 1538-1546.

Stratton, G., & Mullan, E. (2005). The effect of multicolor playground markings on children's physical activity level during recess. *Preventive Medicine, 41*(5-6), 828-833.

Stratton, G., Ridgers, N. D., Fairclough, S. J., & Richardson, D. J. (2007). Physical activity levels of normal-weight and overweight girls and boys during primary school recess. *Obesity, 15*(6), 1513-1519.

Streiner, D., & Norman, G. R. (1995). *Health measurement scales: a practical guide to their development and use* (2nd ed.). New York: Oxford University Press Inc.

Streiner, D., & Norman, G. R. (2008). *Health measurement scales: a practical guide to their development and use* (4th ed.). New York: Oxford University Press Inc.

Strong, W. B., Malina, R. M., Blimkie, C. J., Daniels, S. R., Dishman, R. K., Gutin, B., . . . Trudeau, F. (2005). Evidence based physical activity for school-age youth. *Journal of Pediatrics, 146*(6), 732-737.

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics* (4th ed.). Boston: Allyn & Bacon.

Telford, A., Salmon, J., Jolley, D., & Crawford, D. (2004). Reliability and validity of physical activity questionnaires for children: The Children's Leisure Activities Study Survey (CLASS). *Pediatric Exercise Science, 16*, 64-78.

Terwee, C. B., Bot, S. D., de Boer, M. R., van der Windt, D. A., Knol, D. L., Dekker, J., . . . de Vet, H. C. (2007). Quality criteria were proposed for measurement properties of health status questionnaires. *Journal of Clinical Epidemiology, 60*(1), 34-42.

Theunissen, N. C. M., & Tates, K. (2004). Models and theories in studies on educating and counseling children about physical health: a systematic review. *Patient Education and Counseling, 55*(3), 316-330.

Thomas, H. (2006). Obesity prevention programs for children and youth: why are their results so modest? *Health Education Research, 21*(6), 783-795.

Thomas, J., & Nelson, J. (1996). Descriptive Research. In J. Thomas, J. Nelson & S. Silverman (Eds.), *Research methods in physical activity* (pp. 313-342). Champaign, United States: Human Kinetics.

Thompson, A. M., Baxter-Jones, A. D., Mirwald, R. L., & Bailey, D. A. (2003). Comparison of physical activity in male and female children: does maturation matter? *Medicine and Science in Sports and Exercise, 35*(10), 1684-1690.

Timperio, A., Ball, K., Salmon, J., Roberts, R., Giles-Corti, B., Simmons, D., . . . Crawford, D. (2006). Personal, family, social, and environmental correlates of active commuting to school. *American Journal of Preventive Medicine, 30*(1), 45-51.

Timperio, A., Crawford, D., Telford, A., & Salmon, J. (2004). Perceptions about the local neighborhood and walking and cycling among children. *Preventive Medicine, 38*(1), 39-47.

Timperio, A., Giles-Corti, B., Crawford, D., Andrianopoulos, N., Ball, K., Salmon, J., & Hume, C. (2008). Features of public open spaces and physical activity among children: findings from the CLAN study. *Preventive Medicine, 47*(5), 514-518.

Timperio, A., Salmon, J., Telford, A., & Crawford, D. (2005). Perceptions of local neighbourhood environments and their relationship to childhood overweight and obesity. *International Journal of Obesity, 29*(2), 170-175.

Tourangeau, R., & Rasinski, K. (1988). Cognitive processes underlying context effects in attitude measurement. *Psychological Bulletin, 103*, 299-314.

Troiano, R. P. (2005). A timely meeting: objective measurement of physical activity. *Medicine and Science in Sports and Exercise, 37*(11), s487-s489.

Trost, S. (2004). *Discussion paper for the development of recommendations for children's and youth's participation in health promoting physical activity (No. 3704)*. Canberra, Australia: Commonwealth of Australia.

Trost, S., Morgan, A., Saunders, R., Felton, G., Ward, D., & Pate, R. (2000). Children's understanding of the concept of physical activity. *Pediatric Exercise Science, 12*(3), 293-299.

Trost, S. G. (2001). Objective measurement of physical activity in youth: current issues, future directions. *Exercise Sports Science Review, 29*(1), 32-36.

Trost, S. G., Kerr, L. M., Ward, D. S., & Pate, R. R. (2001). Physical activity and determinants of physical activity in obese and non-obese children. *International Journal of Obesity and Related Metabolic Disordors, 25*(6), 822-829.

Trost, S. G., Loprinzi, P. D., Moore, R., & Pfeiffer, K. A. (2011). Comparison of accelerometer cut-points for predicting activity intensity in youth. *Medicine and Science in Sports and Exercise, 43*(7), 1360-1368.

Trost, S. G., McIver, K. L., & Pate, R. R. (2005). Conducting accelerometer-based activity assessments in field-based research. *Medicine and Science in Sports and Exercise, 37*(Suppl 11), s531-s543.

Trost, S. G., Owen, N., Bauman, A. E., Sallis, J. F., & Brown, W. (2002). Correlates of adults' participation in physical activity: review and update. *Medicine and Science in Sports and Exercise, 34*(12), 1996-2001.

Trost, S. G., Pate, R. R., Dowda, M., Saunders, R., Ward, D. S., & Felton, G. (1996). Gender differences in physical activity and determinants of physical activity in rural fifth grade children. *Journal of School Health, 66*(4), 145-150.

Trost, S. G., Pate, R. R., Dowda, M., Ward, D. S., Felton, G., & Saunders, R. (2002). Psychosocial correlates of physical activity in White and African-American girls. *Journal of Adolescent Health, 31*(3), 226-233.

Trost, S. G., Pate, R. R., Sallis, J. F., Freedson, P. S., Taylor, W. C., Dowda, M., & Sirard, J. (2002). Age and gender differences in objectively measured physical activity in youth. *Medicine and Science in Sports and Exercise, 34*(2), 350-355.

Trost, S. G., Pate, R. R., Saunders, R., Ward, D. S., Dowda, M., & Felton, G. (1997). A prospective study of the determinants of physical activity in rural fifth-grade children. *Preventive Medicine, 26*(2), 257-263.

Trost, S. G., Pate, R. R., Ward, D. S., Saunders, R., & Riner, W. (1999). Correlates of objectively measured physical activity in preadolescent youth. *American Journal of Preventive Medicine, 17*(2), 120-126.

Trost, S. G., Rosenkranz, R. R., & Dzewaltowski, D. (2008). Physical activity levels among children attending after-school programs. *Medicine and Science in Sports and Exercise, 40*(4), 622-629.

Trost, S. G., Saunders, R., & Ward, D. S. (2002). Determinants of physical activity in middle school children. *American Journal of Health Behavior, 26*(2), 95-102.

Trost, S. G., Sirard, J. R., Dowda, M., Pfeiffer, K. A., & Pate, R. R. (2003). Physical activity in overweight and nonoverweight preschool children. *International Journal Obesity and Related Metabolic Disorders, 27*(7), 834-839.

Tucker, P., Irwin, J. D., Gilliland, J., He, M., Larsen, K., & Hess, P. (2009). Environmental influences on physical activity levels in youth. *Health Place, 15*(1), 357-363.

Tudor-Locke, C., Lee, S. M., Morgan, C. F., Beighle, A., & Pangrazi, R. P. (2006). Children's pedometer-determined physical activity during the segmented school day. *Medicine and Science in Sports and Exercise, 38*(10), 1732-1738.

Tudor-Locke, C., Pangrazi, R. P., Corbin, C. B., Rutherford, W. J., Vincent, S. D., Raustorp, A., . . . Cuddihy, T. F. (2004). BMI-referenced standards for recommended pedometer-determined steps/day in children. *Preventive Medicine, 38*(6), 857-864.

Tuorila, H., & Pangborn, R. M. (1988). Prediction of reported consumption of selected fat-containing foods. *Appetite, 11*(2), 81-95.

Twisk, J. W. (2001). Physical activity guidelines for children and adolescents: a critical review. *Sports Medicine, 31*(8), 617-627.

U.S. Department of Health and Human Services. (1996). Physical activity and health: a report of the Surgeon General. Atlanta: U.S Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion.

U.S. Department of Health and Human Services. (2008). Physical Activity Guidelines Advisory Committee Report. Washington, DC.

United Nations. (1989). *Convention on the rights of the child* Geneva.

Van Der Horst, K., Paw, M. J., Twisk, J. W., & Van Mechelen, W. (2007). A brief review on correlates of physical activity and sedentariness in youth. *Medicine and Science in Sports and Exercise, 39*(8), 1241-1250.

Van Hattum, M., & De Leeuw, E. (1999). A disk by mail survey of pupils in primary schools: data quality and logistics. *Journal of Official Statistics, 15*(3), 413-429.

Van Sluijs, E. M., McMinn, A. M., & Griffin, S. J. (2007). Effectiveness of interventions to promote physical activity in children and adolescents: systematic review of controlled trials. *British Medical Journal, 335*(7622), 703.

Veitch, J., Cleland, V., Salmon, J., Hume, C., Timperio, A., & Crawford, D. (2006). Children's and adolescents' physical activity during the critical window: summary report. Melbourne, Australia: Deakin University.

Veitch, J., Salmon, J., & Ball, K. (2008). Children's active free play in local neighborhoods: a behavioral mapping study. *Health Education Research, 23*(5), 870-879.

Velicer, W. F., & Fava, J. L. (1998). Affects of variable and subject sampling on factor pattern recovery. *Psychological Methods, 3*(2), 231-251.

Verloigne, M., Van Lippevelde, W., Maes, L., Brug, J., & De Bourdeaudhuij, I. (2012). Family- and school-based correlates of energy balance-related behaviours in 10-12-year-old children: a systematic review within the ENERGY (EuropeaN Energy balance Research to prevent excessive weight Gain among Youth) project. *Public Health Nutrition*, 1-16.

Verstraete, S. J. M., Cardon, G. M., De Clercq, D. L. R., & De Bourdeaudhuij, I. M. M. (2006). Increasing children's physical activity levels during recess periods in elementary schools: the effects of providing game equipment. *European Journal of Public Health, 16*(4), 415-419.

Vilhjalmsson, R., & Kristjansdottir, G. (2003). Gender differences in physical activity in older children and adolescents: the central role of organized sport. *Social Science and Medicine, 56*(2), 363-374.

Vilhjalmsson, R., & Thorlindsson, T. (1998). Factors related to physical activity: a study of adolescents. *Social Science and Medicine, 47*(5), 665-675.

Vu, M. B., Murrie, D., Gonzalez, V., & Jobe, J. B. (2006). Listening to girls and boys talk about girls' physical activity behaviors. *Health Education Behavior, 33*(1), 81-96.

Warburton, D. E. R., Nicol, C. W., & Bredin, S. S. D. (2006). Health benefits of physical activity: the evidence. *Canadian Medical Association Journal, 174*(6), 801-809.

Ward, D. S., Dowda, M., Trost, S. G., Felton, G. M., Dishman, R. K., & Pate, R. R. (2006). Physical activity correlates in adolescent girls who differ by weight status. *Obesity, 14*(1), 97-105.

Waring, M., Warburton, P., & Coy, M. (2007). Observation of children's physical activity levels in primary school: is the school an ideal setting for meeting government activity targets? *European physical education review, 13*(1), 25-40.

Wechsler, H., Devereaux, R. S., Davis, M., & Collins, J. (2000). Using the school environment to promote physical activity and healthy eating. *Preventive Medicine, 31*(2), s121-s137.

Weintraub, D. L., Tirumalai, E. C., Haydel, K. F., Fujimoto, M., Fulton, J. E., & Robinson, T. N. (2008). Team sports for overweight children: the Stanford Sports to Prevent Obesity Randomized Trial (SPORT). *Archives of Pediatrics and Adolescent Medicine, 162*(3), 232-237.

Weisner, K. K. (2002). Reading, writing, and gaining weight in North Carolina schools. *North Carolina Medical Journal, 63*(6), 308-311.

Welk, G. (1999). The Youth Physical Activity Promotion Model: a conceptual bridge between theory and practice. *Quest, 15*, 5-23.

Welk, G. (2002). *Physical activity assessments for health-related research*. Champaign, IL: Human Kinetics Publishers, Inc.

Welk, G. J., Corbin, C. B., & Dale, D. (2000). Measurement issues in the assessment of physical activity in children. *Research Quarterly for Exercise and Sport, 71*(Suppl 2), s59-s73.

Weston, A., Petosa, R., & Pate, R. (1997). Validation of an instrument for measurement of physical activity in youth. *Medicine and Science in Sports and Exercise, 29*(1), 138-143.

Whitehead, S., & Biddle, S. (2008). Adolescent girls' perceptions of physical activity: a focus group study. *European physical education review, 14*(2), 243-262.

Whiteman, D., & Green, A. (1997). Wherein lies the truth? Assessment of agreement between parent proxy and child respondents. *International Journal of Epidemiology, 26*(4), 855-859.

Whitt-Glover, M. C., Taylor, W. C., Floyd, M. F., Yore, M. M., Yancey, A. K., & Matthews, C. E. (2009). Disparities in physical activity and sedentary behaviors among US children and adolescents: prevalence, correlates, and intervention implications. *Journal of public health policy, 30* (Suppl 1), s309-s334.

Wickel, E. E., & Eisenmann, J. C. (2007). Contribution of youth sport to total daily physical activity among 6- to 12-yr-old boys. *Medicine and Science in Sports and Exercise, 39*(9), 1493-1500.

Widgix, L. (2005-2010). SurveyGizmo (S16). Boulder, CO: Widgix.

Wiehe, S. E., Hoch, S. C., Liu, G. C., Carroll, A. E., Wilson, J. S., & Fortenberry, J. D. (2008). Adolescent travel patterns: pilot data indicating distance from home varies by time of day and day of week. *Journal of Adolescent Health, 42*(4), 418-420.

Wilkin, T. J., Mallam, K. M., Metcalf, B. S., Jeffery, A. N., & Voss, L. D. (2006). Variation in physical activity lies with the child, not his environment: evidence for an 'activitystat' in young children (EarlyBird 16). *International Journal of Obesity, 30*(7), 1050-1055.

Willenberg, L. J., Ashbolt, R., Holland, D., Gibbs, L., MacDougall, C., Garrard, J., . . . Waters, E. (2010). Increasing school playground physical activity: a mixed methods study combining environmental measures and children's perspectives. *Journal of Science and Medicine in Sport, 13*(2), 210-216.

Williams, A., & Bedward, J. (2002). Understanding girls' experience of physical education: relational analysis and situated learning. In D. Penney (Ed.), *Gender and Physical Education: Contemporary issues and future directions*. London: Routledge

Wilson, D. K., Friend, R., Teasley, N., Green, S., Reaves, I. L., & Sica, D. A. (2002). Motivational versus social cognitive interventions for promoting fruit and vegetable intake and physical activity in African American adolescents. *Annals of Behavioral Medicine, 24*(4), 310-319.

Wilson, D. K., Williams, J., Evans, A., Mixon, G., & Rheaume, C. (2005). Brief report: a qualitative study of gender preferences and motivational factors for physical activity in underserved adolescents. *Journal of Pediatric Psychology, 30*(3), 293-297.

Wong, S. L., Leatherdale, S. T., & Manske, S. R. (2006). Reliability and validity of a school-based physical activity questionnaire. *Medicine and Science in Sports and Exercise, 38*(9), 1593-1600.

World Health Organisation. (2000). Obesity: preventing and managing the global epidemic. Report of a WHO consultation. *World Health Organization Technical Report Series, 894*, i-xii, 1-253.

World Health Organisation. (2004). Global strategy on diet, physical activity and health. Geneva, Switzerland: World Health Organisation.

World Health Organisation. (2010). Global recommendations on physical activity for health. Geneva, Switzerland: World Health Organisation.

Wright, J. (1999). Changing gendered practices in Physical Education: working with teachers. *European physical education review, 5*(3), 181-197.

Wu, T. Y., Ronis, D. L., Pender, N., & Jwo, J. L. (2002). Development of questionnaires to measure physical activity cognitions among Taiwanese adolescents. *Preventive Medicine, 35*(1), 54-64.

Yu, C. C., Sung, R. Y., So, R. C., Lui, K. C., Lau, W., Lam, P. K., & Lau, E. M. (2005). Effects of strength training on body composition and bone mineral content in children who are obese. *Journal of Strength and Conditioning Research, 19*(3), 667-672.

Zimic, S. (2009). Not so 'techno-savvy': challenging the stereotypical images of the 'Net generation'. *Digital Culture and Education*.

Ziviani, J., Wadley, D., Ward, H., Macdonald, D., Jenkins, D., & Rodger, S. (2008). A place to play: socioeconomic and spatial factors in children's physical activity. *Australian Occupational Therapy Journal, 55*(1), 2-11.

APPENDICES

Appendix 1: Methodology quality assessment of studies included in the systematic review

Table 1 Quality assessment of methodology of cross-sectional studies

Study	Eligibility/ inclusion criteria (reported)[1]	Randomly selected	Valid measure of PA[2]	Valid and/or reliable measure of correlate[3]	Power calculations	Potential confounding variables accounted for in analyses	Potential confounders clearly described[4]	Description of setting stated[5]	Score (out of 8)	Score percentage
SCHOOL BREAK TIME STUDIES										
Haug et al., 2010	+	-	-	-	-	+	+	+	4	50
Nichol et al., 2009	+	?	-	-	-	+	+	?	3	37.5
Haug et al., 2008	+	?	-	?	-	+	+	-	3	37.5
Willenberg et al., 2010	+	-	-	+	-	-	-	+	3	37.5
Ridgers et al., 2010	+	-	+	+	-	+	+	+	6	75
Jones et al., 2010	+	-	+	+	-	-	-	+	4	50
Harten et al., 2008	+	+	+	+	-	-	-	+	5	62.5

Study	Eligibility/ inclusion criteria (reported)[1]	Randomly selected	Valid measure of PA[2]	Valid and/or reliable measure of correlate[3]	Power calculations	Potential confounding variables accounted for in analyses	Potential confounders clearly described[4]	Description of setting stated[5]	Score (out of 8)	Score percentage
AFTER SCHOOL STUDIES										
Saunders et al., 1997	+	-	+	+	-	-	-	+	4	50
Adkins et al., 2004	-	-	+	+	-	-	-	+	3	37.5
Leslie et al., 2010	+	+	-	?	-	+	+	+	5	62.5
Tucker et al., 2009	+	-	+	-	-	+	+	+	5	62.5
Rushovich et al., 2006	+	+	+	+	-	+	+	+	7	87.5
Pate et al., 1997	+	-	+	+	-	+	+	+	6	75
Scott et al., 2007	+	?	+	-	-	+	+	+	5	62.5
Dowda et al., 2007	+	?	+	?	-	+	+	+	5	62.5
Hager et al., 2006	?	-	+	-	-	+	+	+	4	50
Timperio et al., 2008	+	-	+	+	-	-	-	+	4	50

Notes: '+' = yes, '-' = no, '?' = not sufficiently described; PA = physical activity

[1] Positive if selection of children and/or schools is clearly reported

[2] Positive if validation of measures of physical activity was reported or referred to and relevant for population of study (appropriate reference provided).

[3] Positive if psychometric properties of correlate measures was reported or referred to and relevant for population of study (appropriate reference provided).

[4] Positive if the confounding variables are identified **and** it is explicitly described how these data were collected (e.g. break duration collected by x) **or** used in the analyses (e.g. age in years)

[5] Characteristics of the school break time/after school period must be clearly reported (e.g. length of time, location)

Quality assessment items for intervention studies

A: Key baseline characteristics are presented separately for treatment groups (age, and one relevant physical activity outcome); and for cluster randomised controlled trials and controlled trials (positive if baseline outcomes were statistically tested and results of tests were provided).

B: Randomisation procedure clearly and explicitly described and adequately carried out (generation of allocation sequence, allocation concealment and implementation).

C: Validated measures of physical activity (validation in same age group reported and/or cited).

D: Physical activity assessed a minimum of 6 months after pre-test.

E: Potential confounders accounted for in physical activity (e.g. baseline score, group/cluster, age, duration of play time).

F: Summary results for each group and treatment effect (difference between groups) and its precision (e.g. 95% confidence interval).

G: Power calculation reported, and the study was adequately powered to detect hypothesized relationships.

H: Timing of measures comparable between intervention and control groups (need to describe explicitly).

Table 2 Quality assessment of methodology of intervention studies

Study	A	B	C	D	E	F	G	H	Score (out of 8)	Score percentage
Loucaides et al., 2009	+	- (schools only randomly assigned to group but not explicit)	+	- (4 weeks)	-	- (no confidence intervals reported)	-	+	3	38
Stratton and Mullan, 2005	+	- (children randomised, not schools)	-	- (3-4 months)	+ (play duration, BMI)	? (no confidence intervals reported)	-	+	3	38
Verstraete et al., 2006	+	? (school randomly sampled and then randomly assigned to group but procedure not described)	+	- (3 months)	-	+	-	+	4	50
Ridgers et al., 2007	+	-	+	+	+	+	-	+	6	75
Harten et al., 2007	+	n/a (Not a CT, pretest-posttest)	+	n/a	-	-	-	n/a	2/5	40

Notes: + = present; - = absent; ? = inadequately described; n/a = not applicable; CT = controlled trial; BMI = body mass index

Appendix 2: Ethics approval letters

Ethics approval was obtained from the University of South Australia Human Research Ethics Committee, Department of Education and Children Services (DECS), the South Australian Commission for Catholic Schools (SACCS).

From: Alice Granger
Sent: Thursday, 19 March 2009 2:05 PM
To: Stanley; Stanley, Rebecca Megan - starm002
Cc: James Dollman; Kobie Boshoff; kate.ridley@flinders.edu.au
Subject: Ethics protocol P370/08 "The development of a questionnaire to measure the predictors of lunchtime and after school physical activity in children"

Dear Rebecca,

Re: Ethics protocol P370/08 "The development of a questionnaire to measure the predictors of lunchtime and after school physical activity in children"

Thank you for providing the amendments and/or additional information requested by the Deputy Chairperson of the University's Human Research Ethics Committee (email dated 9th January 2009). I am pleased to advise that your protocol has been granted ethics approval and meets the requirements of the National Statement on Ethical Conduct in Human Research.

Please regard this email as formal notification of approval.

Please note that research can only commence at the locations where organisation approval was been received and forwarded to HREC. You cannot commence the research at other organisations until you have sent the approval letter to HREC for their records. Ethics approval is always made on the basis of a number of conditions detailed in the attachment; it is important that you are familiar with, and abide by, these conditions. It is also essential that you conduct all research according to UniSA guidelines, which can be found at http://www.unisa.edu.au/res/ethics/default.asp
Please note, if your project is a clinical trial you are required to register it in a publicly accessible trials registry prior to enrolment of the first participant (eg Australian New Zealand Clinical Trials Registry http://www.anzctr.org.au/Survey/UserQuestion.aspx) as a condition of ethics approval.

Best wishes for your research.

Alice Granger
Compliance Officer Research and Innovation Services
University of South Australia
Mawson Lakes Campus
Tel: 08 8302 3523
email: alice.granger@unisa.edu.au

Government of South Australia
Department of Education and Children's Services

Community and Tertiary Liaison
Education Centre
Level 15/31 Flinders Street
Adelaide 5000
South Australia

Tel: 8226 2154
Fax: 8226 1815

DECS CS/09/0922.1

19 February 2009

Dear Principal/Director/Site Manager

The research project titled "*Measuring factors that influence lunchtime & after school physical activity in children*" conducted by *Ms Rebecca Stanley* from the *University of South Australia* has been reviewed centrally and granted approval for access to DECS sites. However, the researcher will still need your agreement to proceed with this research at your site.

Once approval has been given at the local level, it is important to ensure that the researchers fulfil their responsibilities in obtaining informed consent as agreed, that individuals' confidentiality is preserved, and that safety precautions are in place.

Researchers are encouraged to provide feedback to sites used in their research, and you may want to make this one of the conditions for accessing your site. To ensure maximum benefits to DECS, researchers are also asked to supply the department with a copy of their final report, which will be circulated to interested staff and then made available to DECS educators for future reference.

Please contact Elena Basmayor on (08) 8226 2154 for further clarification if required, or to obtain a copy of the final report.

Yours sincerely

Wendy Bruce
DIRECTOR
COMMUNITY AND TERTIARY LIAISON



Catholic Education Centre
116 George Street Thebarton SA 5031
PO Box 179 Torrensville Plaza South Australia 5031
Telephone: (08) 8301 6600
Facsimile: (08) 8301 6611
ISD: 61 8 8301 6600
Email: director@ceo.adl.catholic.edu.au
www.cesa.catholic.edu.au

H:\LEN O'BRIEN\RESEARCH\2009\STANLEY R UNISA PHYS ACTIVITY IN CHILDREN JAN 09.DOC

Ms Rebecca Stanley
PhD Candidate
University of South Australia
School of Health Sciences
GPO Box 2471
ADELAIDE SA 5001

Dear Ms Stanley

Thank you for your letter of 19 January 2009 in which you seek permission to conduct research in Catholic schools in connection with the project *Measuring factors that influence lunchtime and after school physical activity in children*. I understand that the aim of the research is to improve the prediction of children's PA behaviour by developing and trialling a computer-delivered predictor questionnaire.

In the normal course, permission of the Principal of each school in which you wish to conduct research is required. Research in Catholic schools is granted on the basis that individual students, schools and the Catholic sector itself is not specifically identified in published research data and conclusions.

Approval is also contingent upon the following conditions, i.e. that:

- a copy of the questionnaire has been provided to the Principal
- the permission of parents and teachers has been obtained
- the research complies with the ethics proposal of the University
- the research complies with any provisions under the Privacy Act that may require adherence by you as researcher in gathering and reporting data
- no comparison between schooling sectors is made
- the researcher should be under visual supervision by a member of the school's staff during the questionnaire and height/weight measurement periods
- sector requirements relating to child protection and police checks are met by researchers:
    - where researchers obtain information in relation to a student which suggests or indicates abuse, this information must be immediately conveyed to the Director of Catholic Education SA
    - all researchers and assistants, who in the course of the research interact in any way with students, are required to undertake a police check.

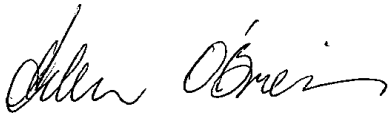
Information with regard to obtaining police clearance can be accessed at the website address:

www.police.sa.gov.au

Researchers should forward a certified copy of their National Police Certificate, which has been issued within the last three months, to the Catholic Archdiocese of Adelaide Police Check Unit at the Catholic Diocesan Centre, GPO Box 1364, Adelaide SA 5001. The Police Check Unit will then post a clearance letter to the researcher. This letter should be provided to the Principal of each school.

Please accept my very best wishes for the research process.

Yours sincerely



HELEN O'BRIEN
ASSISTANT DIRECTOR – CATHOLIC EDUCATION SA

23 January 2009

Appendix 3: Recruitment material for the focus group study

[DATE]

[ADDRESS]

Dear [insert name of principal],

Participation in a PhD Study

I am currently doing my PhD at the University of South Australia in which I am developing a questionnaire that will provide information on the factors that influence children's lunchtime play and after school physical activity in South Australia. I was wondering if the school would consider taking part in my study. Further information is provided in the letter attached. I am very happy to discuss this with you if you require.

Yours sincerely,



Rebecca Stanley

PhD Candidate

University of South Australia

School of Health Sciences

Measuring factors that influence lunchtime and after school physical activity in children

Dear (principal – will be named personally),

I am doing my PhD at the University of South Australia in which I am developing a questionnaire that will provide information on the factors that influence children's lunchtime play and after school physical activity in South Australia. The development of this questionnaire will provide health promoters with the information required to develop physical activity programs that will promote children's physical activity behaviour. This will be achieved in three separate studies.

Your school is invited to participate in the first two studies. The first study will involve running focus groups with children to find out the reasons why children are active or not active during lunchtime and after school. This will occur in Term 1. The information from the focus groups will be used to develop the computer-delivered questionnaire. To ensure that the questionnaire is appropriate, the second study will involve pilot testing it with a group of children, which will occur during Term 3.

What are the benefits to the school?

Group data for participating children in your school will be provided. The information obtained from the questionnaire can be used by the school to identify the factors that are preventing the children from being active and develop physical activity programs that address these barriers.

Who will be involved?

Focus Groups: Nine (female children/male children) across Years 5, 6 and 7 will be invited to participate in separate focus groups.

Pilot Study: Twelve children from each year level in Years 5, 6 and 7 will be invited to complete the computer-delivered questionnaire for the pilot study.

What is involved?

Focus Groups: The focus group for (girls/boys) will be conducted at the school during a convenient time identified by the school. The focus groups will last for approximately an hour and a half with a break in between. At the focus groups:

The participants will be asked to complete two activities about their lunchtime and after school physical activity.

The participants will be asked to provide information about the factors that influence their lunchtime activity and after school activities.

The discussion and activities will be fun and informal.

The discussions will be audio-taped and this will be explained to the parents/guardians and the participants before consent is given.

Pilot Study: Participants will be asked to complete the computer-delivered questionnaire, which will measure the factors that influence lunchtime and after school physical activity in Term 3 2009. It is anticipated that the questionnaire will only take between 30-40 minutes to complete. We are aiming to get 200 participants across South Australia.

What will be asked of the school?

Focus Groups

A school staff member will be asked to identify nine (girls/boys) across from Years 5, 6 and 7 who would feel comfortable participating in focus groups.

One and a half hours of class time will be required for each focus group. It can be negotiated that the time be split before and after a break time. Focus groups will be conducted during Term 1 2009.

Pilot Study

Classroom teachers will be asked to identify twelve children from each year level from Years 5, 6 and 7 who would be interested in completing the computer-delivered questionnaire.

The school will be asked to allow students to access computers to complete the questionnaire during an arranged time.

Approximately 30 minutes of class time will be needed to complete the questionnaire. This will occur during Term 3 2009

I expect that total class time disrupted will be no more than three hours in total across the year. I understand that this is some disruption to school time over the year but I do believe that this study will help raise awareness of the factors that influence children's physical activity. This will enable us and future health promoters to design more effective physical activity programs.

Please note: All information collected as part of this study will be kept confidential and no information which could lead to the identification of individuals will be released. Information will be stored in a locked filing cabinet at the School of Health Sciences, University of South Australia, for a period of five years following the study.

Please contact myself, Rebecca Stanley, on **8302 2550** if you require further information or are interested in taking part in this study. If you have any queries about ethical aspects of this study, please contact Ms Vicki Allen, the Executive Officer of UniSA Human Research Ethics Committee, on 8302 3118.

Alternatively, you may wish to contact my supervisors: Dr Jim Dollman (UniSA) 8302 1413, Dr Kobie Boshoff (UniSA) 8302 1089 and Dr Kate Ridley (Flinders University) 8201 3355.

Thank you for your time and consideration.

Rebecca Stanley

PhD Candidate



University of
South Australia

School of Health Sciences

Measuring factors that influence lunchtime and after school physical activity in children

Dear Parents/Guardians,

Your child has been selected to participate in a PhD project with the University of South Australia. The project is about understanding the factors that influence children's lunchtime play and after school physical activity in South Australia.

Physical activity is an important part of a healthy lifestyle. Extensive research is being conducted all over the world to determine the factors that impact on children's physical activity. I am interested in looking at the reasons why South Australian children are active or not active at lunchtime and after school. This information will be used to develop a questionnaire, which will provide health promoters with the information required to develop physical activity programs to promote children's physical activity behaviour.

What is involved in the study?

Your children will participate in a discussion group with other children of the same gender from Years 5, 6 and 7. The focus groups will be run during school hours and will last for approximately one and half hours. The children will get to have a decent break during the group.

During the discussion group, children will participate in fun activities related to what they do during lunchtime and after school. They will be asked to discuss the factors that influence their physical activity behaviour. These discussions will be friendly and informal. The entire group session will be audio-taped.

What are the benefits of the study?

This study will identify the important factors that influence children's physical activity. This information will be used to develop a questionnaire that will be used by future researchers, health promoters and health professionals to develop effective physical activity programs. Your child's views will help us understand what needs to be included into the questionnaire. Participation in the discussion group is voluntary.

Is there any risk to my child?

There will be no immediate risks to your child and your child is free to withdraw at any stage during the study without penalty. The discussion group is not part of the school curriculum and therefore, your child's decision to participate or not participate in the discussion group will not have an impact on school activities.

There is potential that sensitive issues, such as bullying, may be disclosed during the group. If your child is experiencing bullying and is distressed about this, the researcher will work with an appropriate staff member to ensure that your child receives adequate support. Your child will also be directed to call the Kids HelpLine (1800 551 800) if he/she feels it is necessary. Your child can withdraw from the study at any stage without penalty.

If information about child abuse is disclosed during the discussion groups, I am obligated to report this to the school who will take the necessary actions.

Confidentiality

All information will be kept confidential and no information that can lead to the identification of individuals will be released. The results from this study will be reported in a PhD thesis, professional journals and at conferences. However, your child's personal details will not be presented. The data from the study will be stored in a locked facility within the University of South Australia in accordance with University guidelines. If you wish to see your own child's results these can be made available to you upon request.

This project has been reviewed by the University of South Australia's Human Research Ethics Committee. If you have any enquiries regarding ethical issues, please contact Ms Vicki Allen, the Executive Officer for this committee, on 8302 3118. If you have further questions regarding this study, please contact me on **8302 2550** or via email at rebecca.stanley@postgrads.unisa.edu.au. Alternatively, you may wish to contact my supervisors: Dr Jim Dollman (UniSA) 8302 1413, Dr Kobie Boshoff (UniSA) 8302 1089 and Dr Kate Ridley (Flinders University) 8201 3355.

If your child would like to participate in the discussion group and you as the parent or legal guardian give permission, could you please sign the consent form attached and post it back to the University with the reply-paid envelope enclosed by (insert date).

Thank you very much for your time and consideration.

Rebecca Stanley

PhD Candidate



University of
South Australia
School of Health Sciences

CONSENT FORM

Measuring factors that influence lunchtime and after school physical activity in children

Focus Groups

Researcher: Rebecca Stanley

Supervisors: Dr Jim Dollman

Dr Kobie Boshoff

Dr Kate Ridley

- I have received and read the information about this research project.
- I understand the purpose of the research project and consent to my child taking part.
- I understand that my child may withdraw from the research project at any stage and that this will not affect his/her status now or in the future.
- I understand that while information gained during the study may be published, my child will not be identified and personal results will remain confidential.
- I understand that my child will be audio-taped during the focus group.
- I agree to maintain confidentiality of focus group discussions and preserve the identification of focus group participants.
- I understand that if my child discloses information about child abuse, the researcher is required to report this to the school.
- I understand that the tape will be stored in a locked filing cabinet at the University of South Australia which can only be accessed by the researchers involved in this study.
- I confirm that I am over the age of 18 years, and the legal guardian or parent of the child named below.

Name of Parent/Guardian……

Signed……**Date**……

Name of Child……

Signed……**Date**……

I have provided information about the research to the research participant and believe that he/she understands what is involved.

Researcher's signature and date……

Appendix 4: Focus group procedures

Welcome, overview of topic, ground rules and first question:

Hello everyone. Thank you for coming to talk to us today. My name is Rebecca and this is Leanne and we are from the University of South Australia. Today we are going to talk about the reasons why you are active or not active at lunchtime and after school. By coming to talk to us today, you are helping me develop a questionnaire that will be used by South Australian schools. So to make sure we include the right questions in the survey I want to ask you about what you think helps you or stops you from being active during lunchtime and after school. We think that talking to you is much better than talking to adults about these sorts of things because you have a much better understanding about these things. So you are going to be the teachers today.

Today we are going to do some fun activities and then I am going to ask some questions about the reasons why you and your classmates go out to play at lunchtime. You will then get a break and come back to talk about what influences you to be active after school, which is the time when you get home until just before dinner. There are no right or wrong answers. I am sure you all have different ideas and it will be great to find these out. If you feel uncomfortable at any stage and you don't want to join in anymore, please just let me know and we can find something else for you to do. Everything that is said today is confidential.

The discussion will be taped so that we don't miss anything that you say. Leanne and I will also take some notes along the way just to make sure we get everyone's ideas.

Is that ok? Ok, let's get started.

To start the session off we are going to play a little 'Get to know you' game so that everyone knows each other's names. What I want you to do is say you name and tell me your favourite activity to do during lunchtime? e.g. my name is Rebecca and I love to go for a walk at lunchtime.

Now that everyone knows each other, I think it would be a good idea if we come up with some group rules so that everyone feels comfortable in the group. What are some rules that you want in your group? How about…(give everyone a turn, no laughing or putting down other people, one person speaks at a time). Do you think we should include this? Does anyone have anything else to add or remove from the list? Leanne to write the rules on the butcher's paper.

Questions:

Introductory questions:	Procedures:
What is the first thing that comes to mind when you hear the word physical activity? Yes, these are all good ideas. When we talk about physical activity we don't mean just sports and exercise we also mean any movement that burns up energy such as walking, dancing, gardening etc. Physical activity is any activity that makes you feel slightly out of breath, breathe heavier than usual, feel warm and sweaty. I have put this on a poster so you can refer to it at any time during the discussion. Sometime we can refer to physical activity as play or sport. What do you think? Do you want to use these words today? So let's keep this mind during our discussion.	Get kids to call out Show them the poster and stick the posters on the wall

LUNCHTIME DISCUSSION

Transition questions	
The first part of our discussion today is around the reasons why you participate in lunchtime activities. I have here a map of your school. I am not very familiar with your school so I thought you could take me on a tour using this map. You can point out buildings, where your classroom is, where you play etc. Who wants to start? Ok, next person…let's give everyone a go! (each person identifies at least one area for me) Now that I know your school a little better, I want you to each take a stick figure and show me on the map where you played yesterday at lunchtime? Who did you play with? Let's add them on the map too. Can you also draw a picture of what you were doing yesterday during lunchtime using these paper squares?	*Make sure everyone gets a go*

Key questions	Procedures:
So let's discuss your school map. I can see that many of you (add activity/place of activity). Do you know others who also do this or play in the same area? Let's think a little more about this activity. Is this something you and others do every day? Why did you only do this activity yesterday? Why do you do this activity? Why do you think others/your friends do this activity? What helps you or others do this activity? Or what makes it easy to this activity? How good are you at this activity? How good are the others? Why do you think they are good? When you and the others are doing this activity, is there anything you have to be careful about? Ok, let's go back to the map. I can see that…(some of you play here/some of you are playing [activity]) *repeat question route* Ok we are now going to do a little activity with this ball. I want you to throw it someone. Once that person has caught the ball I want you to tell me what else you do at lunchtimes that hasn't already been discussed.	Clarify child's response by repeating child's words or categorising. Summarise child's response at end by saying: So, am I right in saying… So, you usually play… Give them time to verify or add Maintain a neutral stance – no acknowledgement of answers Look for themes and use opportunity to prompt more/verify themes Prompts: It's fun – what is fun about it/what makes it fun? I like – what is it about….that you like? Can you tell me more about…? Can you give an example? What experience have you had? Who else does this too? Or do you know of other children who do this activity and why they do it? Make sure you cover Social Environmental Psychological

Where do you do this activity? *repeat question route* What else others do at lunchtime? *repeat question route* I have another piece of paper for you all. I want you to think if there is anything you would really like to do at lunchtime that you don't do or can't do? Write it down. Now can you write down what is stopping you from doing this activity? Does anyone want to share what they have written? Now of the right column, I want you to write down what do you think stops children from playing elsewhere in the schoolyard? Who wants to share this? Was there ever a time when you stopped being active at lunchtime? If it was really hot would the map change? What if it was raining? What do you think schools can do to help children be more active at lunchtime?	Prompt here: Does anyone else feel the same?

Ending questions	
Leanne has written all your responses on the whiteboard. Is there anything that she has missed or hasn't written up correctly? Is there anything else you would like to add or change? [Insert name] has mentioned that [insert factor] influences lunchtime play. Do you agree with this? Now, we have a very large list here. Can each of you tell me the 5 most important ones for you? You all have 5 stickers in front of you. I want you to come up to the board and place a sticker next the 5 most important things that influences kids lunchtime play?	

Thank you helping us out and providing these great responses. Before we go, Leanne is going to provide a quick summary of what you have said. This is to make sure that we've understood everything. If you think anything is incorrect and you have changed your mind about something or you think we have missed something please let us know.

AFTERSCHOOL DISCUSSION

Transition questions	
Welcome back. I hope you all had a great break and ready to continue our discussion. So before the break we talked about the reasons why you are active during lunchtime. Now we are going to talk about the reasons why you are active after school, so the period from when the bell rings for home time until dinner time. I have given you all a separate sheet which has a picture of a bell in the first box and a picture of a dinner plate in the last box. What I want you to do is draw pictures, or write words about what you did yesterday after the bell rang until dinner time. Here is an example of what I used to do. Firstly, can you please write your name on top of the page? I want you all to start thinking about what you did yesterday as soon as the home time bell went. Draw or write how you got home from school? Now draw or write any other activity you did until dinner time.	Point them to the poster with definition of PA Show example

Key questions	Procedures:
So let's discuss your pictures. I can see that some/many of you (mode of transport). Do you know others who get home this way? Do you get home this way every day or only on certain days? How else do you get home? Why do you go home [mode of transport]? Why do you think others/your friends use this mode of transport?	Clarify child's response by repeating child's words or categorising. Summarise child's response at end by saying: So, am I right in saying… So, you usually play… Give them time to verify or add Maintain a neutral stance – no acknowledgement of answers

How long do you think it usually takes you? Ok, I can see that…(play a sport) Do you do this with others? Or do you know of others who do sports? Why do you and others play sport? How long do you usually play sport? What helps you or others do sport? Or what makes it easy to sport? How good are you at sport? How good are the others? Why do you think you or others are good? When you and the others are doing this sport, is there anything you have to be careful about? Why do you have to be careful about this? What stops others playing sports? ICE BREAKER – GET UP AND HAVE A WRIGGLE Some of you have put a range of activities that are done outside/or not included outdoor activities. Do you do this with others? Or do you know of others who do this activity? Why do you and others do this activity? How long do you usually play outside? What helps you or others play outside? Or what makes it easy to play outside? Are there others around to play with or look out for you?	Look for themes and use opportunity to prompt more/verify themes Prompts: It's fun – what is fun about it/what makes it fun? I like – what is it about….that you like? Can you tell me more about…? Can you give an example? What experience have you had? Who else does this too? Or do you know of other children who do this activity and why they do it? Make sure you cover Social Environmental Psychological

When you and the others are doing this activity, is there anything you have to be careful about? Why do you have to be careful about this? What stops you or others playing outside? Some of you have put a range of activities that are done inside/or not included inside activities (e.g. homework, TV watching, computer). Do you do this with others? Or do you know of others who do this activity? Why do you and others do this activity? How long do you usually do this activity? What helps you or others do this activity? Or what makes it easy to do this activity? Who do you do this activity with? When you and the others are doing this activity, is there anything you think you have to be careful about? Why do you have to be careful about this? What stops you or others playing inside? Is there anything you would really like to do after school that you don't do or can't do? What is stopping you from doing this activity? Was there ever a time when you stopped being active after school? If it was really hot or raining what would you or others do?	

Ending questions	
I have written all your responses on the whiteboard. Is there anything that I have missed or haven't written up correctly? Is there anything else you would like to add? [Insert name] has mentioned that [insert factor] influences lunchtime play. Do you agree with this? Now, we have a very large list here. Can each of you tell me the 5 most important ones for you? You all have 5 stickers in front of you. I want you to come up to the board and place a sticker next the 5 most important things that influences kids lunchtime play?	

Thank you helping us out and providing these great responses. Before we go, Leanne is going to provide a quick summary of what you have said. This is to make sure that we've understood what you've said. If you think anything is incorrect and you have changed your mind about something or you think we have missed something please let us know.

Appendix 5: Summary of the correlates, number of items and the source of items for Draft One the Y-PASS questionnaire

Table 1 Summary of the correlates, number of items and the source of items for Draft One of the lunchtime Y-PASS questionnaire

Correlate	Number of items	Source of items	Specific theoretical model
Perceived motor skills	1	Modified from the Amhurst Study (Sallis, et al., 2002)	SCT
Perceived competence	3	Purposely developed	SCT
Size of space	1	Purposely developed	
Suitability of space	1	Purposely developed	
Access to space	5	Purposely developed	
Condition of space	1	Purposely developed	
School uniform	2	Purposely developed	
Access to equipment	1	Purposely developed	
Access to facilities	1	Purposely developed	
Time availability	1	Purposely developed	
Policy	2	Purposely developed	
Enjoyment	4	Purposely developed	SCT; TRA and TPB
Activity preference	1	Taken directly from PEACH questionnaire (Ommundsen, et al., 2006; Ommundsen, et al., 2008)	TRA and TPB
Making up own game rules	1	Purposely developed	TRA and TPB
Something to do	1	Purposely developed	SCT; TRA and TPB
Having energy	1	Modified from LEAP Questionnaire (Saunders, et al., 1997)	SCT; TRA and TPB
Improving skills	1	Purposely developed	SCT
Socialisation (hang out with friends)	1	Purposely developed	SCT; TRA and TPB
Nothing to do	1	Purposely developed	TRA and TPB
Lack of motivation	1	Purposely developed	TRA and TPB

Correlate	Number of items	Source of items	Specific theoretical model
Barrier self-efficacy	7	5 items modified from LEAP Questionnaire (Saunders, et al., 1997) and 2 items purposely developed	SCT
Bullying/teasing	1	Purposely developed	
Peer barriers	1	Purposely developed	TRA and TPB
Someone to play with	1	Purposely developed	
Peer support	2	Purposely developed	
Peer acceptance/social norm	2	1 item modified from LEAP Questionnaire (Saunders, et al., 1997) and 1 item purposely developed	SCT; TRA and TPB
Teacher role modelling	1	Purposely developed	
Teacher supervision	1	Purposely developed	
Teacher support	1	Purposely developed	

Notes: SCT = social cognitive theory, TRA and TPB = Theory of Reasoned Action and Theory of Planned Behaviour

Table 2 Summary of the correlates, number of items and the source of the items for Draft One of the after-school Y-PASS questionnaire

Correlate	Number of items	Source of items	Specific theoretical model
Pets	1	Purposely developed	
Access to space	4	1 item taken directly from PEACH questionnaire (Ommundsen, et al., 2006; Ommundsen, et al., 2008) and 3 items purposely developed	
Distance	2	1 item taken directly from PEACH questionnaire (Ommundsen, et al., 2006; Ommundsen, et al., 2008) and 1 item purposely developed	
Cost	3	1 item taken directly from PEACH questionnaire (Ommundsen, et al., 2006; Ommundsen, et al., 2008) and 2 items purposely developed	
Access to facilities	2	1 item modified from LEAP Questionnaire (Saunders, et al., 1997) and 1 item purposely developed	
Access to equipment	3	1 item modified from LEAP Questionnaire (Saunders, et al., 1997) and 2 items purposely developed	
Access to programs	1	Purposely developed	
Safety	11	2 items modified from PEACH questionnaire (Ommundsen, et al., 2006; Ommundsen, et al., 2008), 5 items modified from Timperio et al. (2006), 1 item modified from Rushovich et al. (2006) and 3 items purposely developed	
Weather	6	Purposely developed	
Time availability	4	Modified from the Amhurst Study (Sallis, et al., 2002)	
Things to carry	1	Purposely developed	

Correlate	Number of items	Source of items	Specific theoretical model
Activity preference	5	1 item modified from PEACH questionnaire (Ommundsen, et al., 2006; Ommundsen, et al., 2008) and 4 items purposely developed	TRA and TPB
Enjoyment	8	4 items modified from PEACH questionnaire (Ommundsen, et al., 2006; Ommundsen, et al., 2008) and 4 items purposely developed	SCT; TRA and TPB
Too tired	3	1 item modified from the Amhurst Study (Sallis, et al., 2002), 1 item modified from the Adolescent Physical Activity Perceived Benefits and Barriers Scales (Robbins, et al., 2008) and 1 item purposely developed	SCT; TRA and TPB
Lack of motivation	3	1 item modified from LEAP Questionnaire (Saunders, et al., 1997) and 2 items purposely developed	TRA and TPB
Socialisation (hang out with friends)	3	2 items modified from LEAP Questionnaire (Saunders, et al., 1997) and 1 item purposely developed	SCT; TRA and TPB
Socialisation (meet new people)	2	1 item modified from LEAP Questionnaire (Saunders, et al., 1997) and 1 item purposely developed	SCT; TRA and TPB
Fear of injury	2	Purposely developed	SCT; TRA and TPB
Something to do	2	Purposely developed	SCT; TRA and TPB
Improving skills	1	Purposely developed	SCT
Peer acceptance/social norm	1	Purposely developed	TRA and TPB
Keeps you fit	2	Purposely developed	SCT; TRA and TPB
Keeps you healthy	1	Modified from the Adolescent Physical Activity Perceived Benefits and Barriers Scales (Robbins, et al., 2008)	SCT; TRA and TPB
Barrier self-efficacy	2	Taken directly from LEAP Questionnaire (Saunders, et al., 1997)	SCT

Correlate	Number of items	Source of items	Specific theoretical model
Body image	4	1 item modified from the Amhurst Study (Sallis, et al., 2002) and 3 items purposely developed	TRA and TPB
Bullying/teasing	1	Purposely developed	
No-one to play with	1	Purposely developed	
Peer support	3	2 item modified from LEAP Questionnaire (Saunders, et al., 1997) and 1 item modified Hohepa et al. (2007)	
Someone to play with	2	1 item modified from PEACH questionnaire (Ommundsen, et al., 2006; Ommundsen, et al., 2008) and 1 item purposely developed	
Siblings to play with	1	Purposely developed	
Parental support	5	3 items modified from PEACH questionnaire (Ommundsen, et al., 2006; Ommundsen, et al., 2008) and 2 items purposely developed	
Parental encouragement	3	1 item modified from PEACH questionnaire (Ommundsen, et al., 2006; Ommundsen, et al., 2008), 1 item modified from Hohepa et al. (2007) and 1 item purposely developed	
Parental supervision	1	Modified from Rushovich et al. (2006)	
License	9	3 items modified from PEACH questionnaire (Ommundsen, et al., 2006; Ommundsen, et al., 2008) and 6 items purposely developed	
Perceived competence	5	Purposely developed	SCT
Perceived motor skills	1	Modified from the Amhurst Study (Sallis, et al., 2002)	SCT

Notes: SCT = social cognitive theory, TRA and TPB = Theory of Reasoned Action and Theory of Planned Behaviour

Appendix 6: Invitation letter to the panel of experts

Dear _____,

I am currently doing a PhD at the University of South Australia with Dr Jim Dollman and Dr Kate Ridley entitled "Increasing specificity of correlate research: the development of a questionnaire to measure the predictors of lunchtime and after school physical activity in children". I will essentially be examining the correlates of children's physical activity in two critical time periods, the lunchtime and after school settings. The aim of my project is to develop and trial a computer-delivered questionnaire that will measure psycho-social attributes and perceptions of the physical environment as predictors of setting-specific physical activity among South Australian children in Years 5, 6 and 7. The underlying purpose of this is to see if we can improve the prediction of children's physical activity behaviour by focusing on specific settings.

The questionnaire has evolved from 11 focus groups with children aged 10-13 years, from both high and low socio-economic areas within rural and urban regions in South Australia, and a systematic review of the literature. The draft questionnaire contains a total of 181 questions and is made up of three main parts: 1) demographic questions, 2) questions relating to lunchtime physical activity, and 3) questions relating to after school physical activity. It is anticipated that these sections can be used as a whole or individually. The questionnaire will go through a vigorous piloting process involving an expert panel review, a pilot test with children who both did and did not participate in the focus groups, and a larger pilot test for the purpose of factor analysis.

I am writing this email to invite you to be part of the piloting process of this questionnaire. The purpose of the expert panel will be to review the questionnaire for content, readability and usability. You will only be required to comment on one part of the questionnaire (either the lunchtime questions OR the after school questions). I anticipate this taking no longer than 40 minutes. As an internationally renowned researcher in the physical activity field and/or in questionnaire development, your examination of and comments on the questionnaire would be invaluable to me. The deadline for the review will be three weeks from the date of receiving the questionnaire. If you, or any suggested colleagues are interested in reviewing the questionnaire, I can be contacted via email on rebecca.stanley@postgrads.unisa.edu.au.

I look forward to hearing from you.

Sincerely,

Rebecca Stanley

Appendix 7: Recruitment material for the pilot studies



University of
South Australia

School of Health Sciences

Measuring factors that influence lunchtime and after school physical activity in children

Dear Parent/Guardians,

Thank you for providing consent for your child to participate in the focus group that was run in Term 1. During this focus group your child provided information that contributed to our understanding of what influences children's lunchtime and after school physical activity. The results from the focus groups have been used to develop a questionnaire. I would like to invite your child to be part of the first group of children to trial the questionnaire in South Australia.

What is involved in the study?

Your child will be asked to "test-run" a computer-delivered questionnaire that looks at the factors that influence your child's lunchtime and after school physical activity. The questionnaire will be completed on the school's computers and will take approximately 30 minutes to complete. While your child is filling out the questionnaire, a researcher will be present to answer any questions. Your child will also participate in a short feedback discussion where we will talk about the ease of use, efficiency, content and format of the questionnaire. This information will be used to improve the questionnaire.

What are the benefits of the study?

The study will identify the factors that influence children's physical activity. This information will be used by future researchers, health promoters and health professionals to develop effective physical activity programs. Your child's input will help us ensure that the questionnaire is clear and simple to use. Participation in this study is voluntary.

Is there any risk to my child?

There will be no risk to your child and your child is free to withdraw at any stage during the study without penalty. This study is not part of the school curriculum and therefore, your child's decision to participate or not participate in the study will not have an impact on school activities.

There is potential that sensitive issues, such as bullying, may be disclosed on the questionnaire. If your child is experiencing bullying and is distressed about this, the researcher will work with an appropriate staff member to ensure that your child receives adequate support. Your child will also be directed to call the Kids HelpLine (1800 551 800) if he/she feels it is necessary. Your child can withdraw from the study at any stage without penalty.

If information about child abuse is disclosed at any stage during the study, I am obligated to report this to the school, who will take the necessary actions.

Confidentiality

All information will be kept confidential and no information that can lead to the identification of individuals will be released. The results from this study will be reported in a PhD thesis, professional journals and at conferences. However, your child's personal details will not be presented. The data from the study will be stored in a locked facility within the University of South Australia in accordance with University guidelines. If you wish to see your own child's results these can be made available to you upon request.

This project has been reviewed by the University of South Australia's Human Research Ethics Committee. If you have any enquiries regarding ethical issues, please contact Ms Vicki Allen, the Executive Officer for this committee, on 8302 3118. . If you have further questions regarding this study, please contact me on **8302 2550** or via email at rebecca.stanley@postgrads.unisa.edu.au.

Alternatively, you may wish to contact my supervisors: Dr Jim Dollman (UniSA) 8302 1413, Dr Kobie Boshoff (UniSA) 8302 1089 and Dr Kate Ridley (Flinders University) 8201 3355.

An information session will be run at the school one week prior to starting the study, on (insert date). This session will allow time for you or your child to ask any questions about the study. Details of the session will be provided through the school.

If your child would like to participate in the study and you as the parent or legal guardian give permission, could you please sign the consent form attached and post it back to the University with the reply-paid envelope enclosed by (insert date).

Thank you very much for your time and consideration.

Rebecca Stanley
PhD Candidate



University of
South Australia
School of Health Sciences

CONSENT FORM

Measuring factors that influence lunchtime and after school physical activity in children

Pilot Study

Researcher: Rebecca Stanley

Supervisors: Dr Jim Dollman

Dr Kobie Boshoff

Dr Kate Ridley

- I have received and read the information about this research project.
- I understand the purpose of the research project and consent to my child taking part.
- I understand that my child may withdraw from the research project at any stage and that this will not affect his/her status now or in the future.
- I understand that while information gained during the study may be published, my child will not be identified and personal results will remain confidential.
- I understand that if my child discloses information about child abuse, the researcher is required to report this to the school.
- I confirm that I am over the age of 18 years, and the legal guardian or parent of the child named below.

Name of Parent/Guardian.....

Signed.....**Date**.....

Name of Child.....

Signed.....**Date**.....

I have provided information about the research to the research participant and believe that she/he understands what is involved.

Researcher's signature and date.....

Appendix 8: Feedback form for the pilot study

Computer Questionnaire Evaluation Form

Circle one of the numbers to answer each question.

	Agree	Kind of Agree	Not Sure	Kind of Disagree	Disagree
A. The computer questionnaire instructions were easy to understand.	1	2	3	4	5
B. The computer questionnaire was easy to complete.	1	2	3	4	5
C. The computer questionnaire included everything I wanted to report.	1	2	3	4	5
D. The computer questionnaire doesn't take up too much time to fill in.	1	2	3	4	5

Write down anything else you want to say about the questionnaire.

Appendix 9: Recruitment material for the factor analysis study



University of
South Australia

School of Health Sciences

Measuring factors that influence lunchtime and after school physical activity in children

Dear (principal – will be named personally),

Thank you for your involvement in the study thus far. The focus group findings have been used to develop two questionnaires that investigate the factors that influence children's lunchtime play and after school physical activity. To ensure that the questionnaires are appropriate, the second study will involve testing them with a larger group of children. This will occur in Terms 3 and 4 of this year.

What are the benefits to the school?
Group data for participating children in your school will be provided. The information obtained from the questionnaire can be used by the school to identify the factors that are preventing the children from being active and develop physical activity programs that address these barriers.

Each student who returns a completed consent form will receive a squeeze-ball toy as a thank-you gift, regardless of whether their parents give consent for their child to participate or not.

Who will be involved?
All children from each year level in Years 5, 6 and 7 will be invited to complete the computer-delivered questionnaires for the pilot study.

What is involved?
Participants will be asked to complete the computer-delivered questionnaires, which will measure the factors that influence lunchtime and after school physical activity. It is anticipated that the questionnaires will only take between 30-40 minutes to complete in total. We are aiming to get about 300 participants across South Australia.

What will be asked of the school?

- To manage the distribution of information sheets and consent forms to parents and to collect the returned consents.
- The school will be asked to allow students to access computers to complete the questionnaire during an arranged time.
- Approximately an hour of class time will be needed to complete the questionnaires.

I expect that total class time disrupted will be no more than an hour in total. I understand that this is some disruption to school time over the day but I do believe that this study will help raise awareness of the factors that influence children's physical activity. This will enable us and future health promoters to design more effective physical activity programs.

Please note: All information collected as part of this study will be kept confidential and no information which could lead to the identification of individuals will be released. Information will be stored in a locked filing cabinet at the School of Health Sciences, University of South Australia, for a period of five years following the study.

Please contact myself, Rebecca Stanley, on **8302 2550** if you require further information or are interested in taking part in this study. If you have any queries about ethical aspects of this study, please contact Ms Vicki Allen, the Executive Officer of UniSA Human Research Ethics Committee, on 8302 3118.

Alternatively, you may wish to contact my supervisors: Dr Jim Dollman (UniSA) 8302 1413, Dr Kobie Boshoff (UniSA) 8302 1089 and Dr Kate Ridley (Flinders University) 8201 3355.

Thank you for your time and consideration.

Rebecca Stanley
PhD Candidate



University of
South Australia

School of Health Sciences

Measuring factors that influence lunchtime and after school physical activity in children

Dear Parent/Guardians,

Your child has been selected to participate in a PhD project with the University of South Australia. The project is about understanding the factors that influence children's lunchtime play and after school physical activity in South Australia.

Physical activity is an important part of a healthy lifestyle. Extensive research is being conducted all over the world to determine the factors that impact on children's physical activity. I am interested in looking at the reasons why South Australian children are active or not active at lunchtime and after school. This information will be collected via a computer-delivered questionnaire, which will provide health promoters with the information required to develop physical activity programs to promote children's physical activity behaviour.

We are planning to administer the questionnaire to 300 children in South Australia to find out what the major factors are that influence their physical activity during lunchtime and after school.

What is involved in the study?

Your children will be asked to complete two computer-delivered questionnaires that look at the factors that influence your child's lunchtime and after school physical activity. The questionnaires will be completed on the school's computers and will take approximately an hour to complete. While your child is filling out the questionnaire, the researcher will be present to answer any questions. This information will be used to improve the questionnaire.

What are the benefits of the study?

The study will identify the factors that influence children's physical activity. This information will be used by future researchers, health promoters and health professionals to develop effective physical activity programs. Your child's input will help us ensure that the questionnaire is clear and simple to use. Participation in this study is voluntary.

Is there any risk to my child?

There will be no risk to your child and your child is free to withdraw at any stage during the study without penalty. This study is not part of the school curriculum and therefore, your child's decision to participate or not participate in the study will not have an impact on school activities.

There is potential that sensitive issues, such as bullying, may be disclosed on the questionnaire. If your child is experiencing bullying and is distressed about this, the researcher will work with an appropriate staff member to ensure that your child receives adequate support. Your child will also be directed to call the Kids HelpLine (1800 551 800) if he/she feels it is necessary. Your child can withdraw from the study at any stage without penalty.

If information about child abuse is disclosed at any stage during the study, I am obligated to report this to the school, who will take the necessary actions.

Confidentiality

All information will be kept confidential and no information that can lead to the identification of individuals will be released. The results from this study will be reported in a PhD thesis, professional journals and at conferences. However, your child's personal details will not be presented. The data from the study will be stored in a locked facility within the University of South Australia in accordance with University guidelines. If you wish to see your own child's results these can be made available to you upon request.

This project has been reviewed by the University of South Australia's Human Research Ethics Committee. If you have any enquiries regarding ethical issues, please contact Ms Vicki Allen, the Executive Officer for this committee, on 8302 3118. . If you have further questions regarding this study, please contact me on **8302 2550** or via email at rebecca.stanley@postgrads.unisa.edu.au.

Alternatively, you may wish to contact my supervisors: Dr Jim Dollman (UniSA) 8302 1413, Dr Kobie Boshoff (UniSA) 8302 1089 and Dr Kate Ridley (Flinders University) 8201 3355.

To indicate whether or not you give consent for your child to participate in the study, please complete and return the attached consent form to your child's class teacher before **(insert date)**. **Please note that it is important you return the consent form even if you do not wish to take part in the study.** There is a space to indicate this on the form. We realise that as parents you are very busy and to thank you for taking the time to read the information and complete the consent form, **each child who returns a completed consent form will receive a squeeze-ball toy as a thank-you gift.**

Thank you very much for your time and consideration.

Rebecca Stanley
PhD Candidate

University of South Australia

School of Health Sciences

CONSENT FORM

Measuring factors that influence lunchtime and after school physical activity in children

Researcher: Rebecca Stanley

Supervisors: Dr Jim Dollman

Dr Kobie Boshoff

Dr Kate Ridley

Please tick the appropriate box:

☐ I have received and read the information about this research project and **DO NOT CONSENT** to my child taking part.

Name of Parent/Guardian.....

Signed.....**Date**.....

Name of Child.....

Signed.....**Date**.....

☐ I have received and read the information about this research project and **CONSENT** to my child taking part.

- I understand that my child may withdraw from the research project at any stage and that this will not affect his/her status now or in the future.
- I understand that while information gained during the study may be published, my child will not be identified and personal results will remain confidential.
- I understand that if my child discloses information about child abuse, the researcher is required to report this to the school
- I confirm that I am over the age of 18 years, and the legal guardian or parent of the child named below.

Name of Parent/Guardian.....

Signed.....**Date**.....

Name of Child.....

Signed.....**Date**.....

I have provided information about the research to the research participant and believe that she understands what is involved.

Researcher's signature and date.....

Appendix 10: Recruitment material for the reliability study



University of
South Australia
School of Health Sciences

Measuring factors that influence lunchtime and after school physical activity in children

Dear (principal – will be named personally),

I am doing my PhD at the University of South Australia in which I am developing a questionnaire that will provide information on the factors that influence children's lunchtime play and after school physical activity in South Australia. The development of this questionnaire will provide health promoters with the information required to develop physical activity programs that will promote children's physical activity behaviour. This will be achieved in three separate studies.

Your school is invited to participate in the reliability study. To ensure that the questionnaire is appropriate, the reliability study will involve administering the questionnaire to a group of children, which will occur during [insert time of year].

What are the benefits to the school?
Group data for participating children in your school will be provided. The information obtained from the questionnaire can be used by the school to identify the factors that are preventing the children from being active and develop physical activity programs that address these barriers.

Each student who returns a completed consent form will receive a squeeze-ball toy as a thank-you gift, regardless of whether their parents give consent for their child to participate or not.

Who will be involved?
Twelve children from each year level in Years 5, 6 and 7 will be invited to complete the computer-delivered questionnaire for the reliability study.

What is involved?
Participants will be asked to complete the computer-delivered questionnaire and then again a week later so that we can test for reliability of the questionnaire.

What will be asked of the school?

- Classroom teachers will be asked to identify twelve children from each year level from Years 5, 6 and 7 who would be interested in completing the computer-delivered questionnaire.
- To manage the distribution of information sheets and consent forms to parents and to collect the returned consents.
- The school will be asked to allow students to access computers to complete the questionnaire during an arranged time.
- Approximately one hour of class time on two occasions will be needed to complete the questionnaires. This will occur during [insert time of year].

I expect that total class time disrupted will be no more than an hour in total. I understand that this may be a disruption to the school day but I do believe that this study will help raise awareness of the factors that influence children's physical activity. This will enable us and future health promoters to design more effective physical activity programs.

Please note: All information collected as part of this study will be kept confidential and no information which could lead to the identification of individuals will be released. Information will be stored in a locked filing cabinet at the School of Health Sciences, University of South Australia, for a period of five years following the study.

Please contact myself, Rebecca Stanley, on **8302 2550** if you require further information or are interested in taking part in this study. If you have any queries about ethical aspects of this study, please contact Ms Vicki Allen, the Executive Officer of UniSA Human Research Ethics Committee, on 8302 3118.

Alternatively, you may wish to contact my supervisors: Dr Jim Dollman (UniSA) 8302 1413, Dr Kobie Boshoff (UniSA) 8302 1089 and Dr Kate Ridley (Flinders University) 8201 3355.

Thank you for your time and consideration.

Rebecca Stanley
PhD Candidate

University of South Australia

School of Health Sciences

Measuring factors that influence lunchtime and after school physical activity in children

Dear Parent/Guardians,

Your child has been selected to participate in a PhD project with the University of South Australia. The project is about understanding the factors that influence children's lunchtime play and after school physical activity in South Australia.

Physical activity is an important part of a healthy lifestyle. Extensive research is being conducted all over the world to determine the factors that impact on children's physical activity. I am interested in looking at the reasons why South Australian children are active or not active at lunchtime and after school. This information will be collected via a computer-delivered questionnaire, which will provide health promoters with the information required to develop physical activity programs to promote children's physical activity behaviour.

We are planning to administer the questionnaire to 36 children in South Australia to determine reliability of the computer-delivered questionnaire.

What is involved in the study?

Your children will be asked to complete a computer-delivered questionnaire that looks at the factors that influence your child's lunchtime and after school physical activity. Your child will also be asked to complete the questionnaire again a week later so that we can test for consistency in results. The questionnaire will be completed on the school's computers and will take approximately 30 minutes to complete. While your child is filling out the questionnaire, the researcher will be present to answer any questions. This information will be used to improve the questionnaire.

What are the benefits of the study?

The study will identify the factors that influence children's physical activity. This information will be used by future researchers, health promoters and health professionals to develop effective physical activity programs. Your child's input will help us ensure that the questionnaire is clear and simple to use. Participation in this study is voluntary.

Is there any risk to my child?

There will be no risk to your child and your child is free to withdraw at any stage during the study without penalty. This study is not part of the school curriculum and therefore, your child's decision to participate or not participate in the study will not have an impact on school activities.

There is potential that sensitive issues, such as bullying, may be disclosed on the questionnaire. If your child is experiencing bullying and is distressed about this, the researcher will work with an appropriate staff member to ensure that your child receives adequate support. Your child will also be directed to call the Kids HelpLine (1800 551 800) if he/she feels it is necessary. Your child can withdraw from the study at any stage without penalty.

If information about child abuse is disclosed at any stage during the study, I am obligated to report this to the school, who will take the necessary actions.

Confidentiality

All information will be kept confidential and no information that can lead to the identification of individuals will be released. The results from this study will be reported in a PhD thesis, professional journals and at conferences. However, your child's personal details will not be presented. The data from the study will be stored in a locked facility within the University of South Australia in accordance with University guidelines. If you wish to see your own child's results these can be made available to you upon request.

This project has been reviewed by the University of South Australia's Human Research Ethics Committee. If you have any enquiries regarding ethical issues, please contact Ms Vicki Allen, the Executive Officer for this committee, on 8302 3118. . If you have further questions regarding this study, please contact me on **8302 2550** or via email at rebecca.stanley@postgrads.unisa.edu.au.

Alternatively, you may wish to contact my supervisors: Dr Jim Dollman (UniSA) 8302 1413, Dr Kobie Boshoff (UniSA) 8302 1089 and Dr Kate Ridley (Flinders University) 8201 3355.

To indicate whether or not you give consent for your child to participate in the study, please complete and return the attached consent form to your child's class teacher before **(insert date)**. **Please note that it is important you return the consent form even if you do not wish to take part in the study.** There is a space to indicate this on the form. We realise that as parents you are very busy and to thank you for taking the time to read the information and complete the consent form, **each child who returns a completed consent form will receive a squeeze-ball toy as a thank-you gift.**

Thank you very much for your time and consideration.

Rebecca Stanley
PhD Candidate

University of
South Australia

School of Health Sciences

CONSENT FORM

Measuring factors that influence lunchtime and after school physical activity in children

Researcher: Rebecca Stanley

Supervisors: Dr Jim Dollman

Dr Kobie Boshoff

Dr Kate Ridley

Please tick the appropriate box:

☐ I have received and read the information about this research project and **DO NOT CONSENT** to my child taking part.

Name of Parent/Guardian.....

Signed.....**Date**.....

Name of Child.....

Signed.....**Date**.....

☐ I have received and read the information about this research project and **CONSENT** to my child taking part.

- I understand that my child may withdraw from the research project at any stage and that this will not affect his/her status now or in the future.
- I understand that while information gained during the study may be published, my child will not be identified and personal results will remain confidential.
- I understand that if my child discloses information about child abuse, the researcher is required to report this to the school
- I confirm that I am over the age of 18 years, and the legal guardian or parent of the child named below.

Name of Parent/Guardian.....

Signed.....**Date**.....

Name of Child.....

Signed.....**Date**.....

I have provided information about the research to the research participant and believe that she understands what is involved.

Researcher's signature and date.....

Appendix 11: Lunchtime and after-school Y-PASS questionnaires

Y-PASS: The Youth Physical Activity Survey for Specific Settings

Y-PASS: The Youth Physical Activity Survey for Specific Settings

The Lunchtime Questionnaire



What is your ID number? (this is the number on the piece of paper titled "Y-PASS Questionnaire")*

_____

INTRODUCTION

Thank you for agreeing to fill out this important questionnaire.

The information you share will help us to understand what things help children be active or make it difficult for children to be active during different times of the day.

- **Please answer every question carefully.**
- **Do not spend too much time on one question.**
- **If something is not clear, please ask for help.**
- **This is NOT a test.**
- **There are no right or wrong answers.**
- **We are interested in what you think, so please be as honest as you can in your responses.**

Thank you for your help with this project.

LET'S BEGIN THE QUESTIONNAIRE WITH SOME INFORMATION ABOUT YOU

Please fill out the following information

1) What is your first name?*

_____

2) What is your last name?*

_____

3) What is the name of your school?*
_____

4) What year are you in?*
( ) Year 5
( ) Year 6
( ) Year 7

5) Are you a boy or girl? Please tick:*
( ) Boy
( ) Girl

6) What is your Date of Birth? (dd/mm/yyyy, e.g. 02/10/1990)*
_____

7) In what country were you born?*
( ) Australia
( ) Another Country (please specify): _____

8) Are you an Aboriginal or Torres Strait Islander? Please tick:*
( ) Yes
( ) No

9) What suburb/town do you live in?*
_____

10) What is the postcode where you live?
_____

DEFINITION OF TERMS

Before you move on, it is important to understand some of the words used in this questionnaire.

BEING ACTIVE involves any movement which can make you breathe quicker and heavier than usual. You may start to sweat and feel out of breath.

There are different ways of BEING ACTIVE at lunchtime, including:
Playing four-square
Playing on the playground
Playing on the oval
Skipping
Playing chasey





LET'S START THINKING ABOUT LUNCHTIME AT SCHOOL

In a USUAL WEEK, what do you do at lunchtime?
You may want to think about the following things:
What games do you play at lunchtime?



Who do you hang out with at lunchtime?

Where do you normally hang out at lunchtime?

Tick the MAIN ACTIVITIES that you usually do at lunchtime and how often you do these activities at lunchtime. You can pick more than one activity.

Example:

	Do you usually do this activity? (if yes, tick the box)	How often do you do this activity?		
		1 day a week	2-3 days a week	4-5 days a week
Arts and crafts	☐	○	○	○
Basketball	☑	◉	○	○
Chasey/tag/tips/tiggy	☑	○	○	◉

	Do you usually do this activity? (if yes, tick the box)	**How often do you do this activity?**		
	Yes	**1 day a week**	**2-3 days a week**	**4-5 days a week**
Arts and crafts	[ ]	( )	( )	( )
Basketball	[ ]	( )	( )	( )
Chasey/tag/tips/tiggy	[ ]	( )	( )	( )
Computer work (e.g. typing/internet)	[ ]	( )	( )	( )
Cricket	[ ]	( )	( )	( )
Dodge ball/poison ball/brandy/speed ball	[ ]	( )	( )	( )
Football (Australian/Gaelic/American)	[ ]	( )	( )	( )
Hand tennis (four-square)	[ ]	( )	( )	( )
Kickball	[ ]	( )	( )	( )
Mucking around outdoors in the school yard	[ ]	( )	( )	( )
Netball	[ ]	( )	( )	( )
Playing catch	[ ]	( )	( )	( )
Playing on playground equipment (e.g. monkey bars)	[ ]	( )	( )	( )
Rugby league	[ ]	( )	( )	( )
Running/jogging	[ ]	( )	( )	( )
Skipping/jump rope	[ ]	( )	( )	( )
Sitting (e.g. eating, talking to friends, lunchtime meetings, writing, reading)	[ ]	( )	( )	( )
Soccer (field/indoor)	[ ]	( )	( )	( )
Touch football	[ ]	( )	( )	( )
Walking around the school yard	[ ]	( )	( )	( )

Do you USUALLY do activities at lunchtime that are NOT on the list?

If **NO**, please click "next" to continue with the questionnaire.
If **YES**, please complete the table below.

	Name the activity	**How often do you do these activities at lunchtime?**		
		1 day a week	**2-3 days a week**	**4-5 days a week**
1. Other	___	( )	( )	( )
2. Other	___	( )	( )	( )
3. Other	___	( )	( )	( )
4. Other	___	( )	( )	( )
5. Other	___	( )	( )	( )

Think about where you play at school at lunchtime

Please click on the circle which most closely describes how much you agree or disagree with each statement.

11) There is enough space in the school yard for me to be active at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



12) We have school rules about where we are allowed to be active at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

13) Our school has areas that suit the games I want to play at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

14) There are too many kids in the playground for me to be active at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

15) There are lots of shaded areas where I can be active even if it is really hot.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

16) There are indoor spaces where I can be active if it is raining.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

17) The oval is too dry and hard to play on.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

18) There is enough grass in the school yard to be active at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

19) Our school play area has painted lines on the ground (e.g. hopscotch and 4-square) to help me be active at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



20) There are facilities at school, such as playgrounds or ovals, where I can be active at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

Still thinking about when you are active in the school yard at lunchtime, please click on the circle which most closely describes how much you agree or disagree with each statement.

21) It is hard to be active in our school uniform at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

22) There is enough equipment available for me to play with at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



23) Some school rules keep me from doing the activities I like at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

24) I have other commitments at lunchtime that keep me from being active, such as meetings and music lessons.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

25) I can still be active at lunchtime even if I am wearing my school uniform.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

The next section is about your enjoyment of being active

Please click on the circle which most closely describes how much you agree or disagree with each statement.

26) It is fun to be active at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



27) I prefer to watch other kids rather than play active games at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



28) I like to walk around at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

29) I prefer to sit rather than be active at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

30) I really like doing PE at school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

Still thinking about lunchtime at school, please click on the circle which most closely describes how much you agree or disagree with each statement.

31) Making up your own game rules makes playing games at lunchtime more fun.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

32) I am active at lunchtime because it makes me popular with the other children.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



33) I always have the energy to be active at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

34) I play certain games at lunchtime because I want to get extra practice.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

35) I am active at lunchtime so I can hang out with my friends.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

36) There is nothing to do at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

37) It is 'cool' to be active at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little

( ) Agree a lot

38) I don't play in certain areas of the school yard because I am scared of the other kids.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

The following statements are about your confidence to be active at lunchtime

Please click on the circle which most closely describes **how much you agree or disagree with each statement**.

39) I am confident that I can ask my friends to be active with me during lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



40) I am confident that I can find other kids to be active with at lunchtime even if my friends don't want to.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

41) I am confident that I can ask a teacher to get me equipment to play with at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

42) I am confident that I can be active at lunchtime even if the space in the playground/oval is limited.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

43) I am confident that I can still be active in the school yard even if it is very hot or raining.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

44) I am confident that I can still be active at lunchtime even if there are bullies in the school yard.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



45) I am confident that I can still be active at lunchtime even if my friends don't want to.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

Now think about your friends and the people around you at lunchtime

Please click on the circle which most closely describes how much you agree or disagree with each statement.

46) Bullying stops me from being active in the school yard at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

47) My friends would rather sit and talk at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

48) I have friends who I am active with at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

49) My friends teach me how to play active games at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

50) I do what my friends do at lunchtime so I don't feel left out.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

51) I teach other children how to play active games at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

52) I only play active games if other children/friends organise it.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

Thinking about the teachers at your school, please click on the circle which most closely describes how much you agree or disagree with each statement.

53) Teachers play with us at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

54) There is always a teacher who is on yard duty during lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

55) Teachers help us with the active games we play at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

56) Teachers encourage us to be active at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

The next statements are about how good you think you are at playing active games at lunchtime

Please click on the circle which most closely describes **how much you agree or disagree with each statement.**

57) I play certain games at lunchtime because I think I am good at them.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

58) I have the skills I need to be active at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

59) I am NOT good at being active at lunchtime.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



60) I am just as coordinated as kids of my age and gender.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

Thank You!

Thank you for completing this survey.

Y-PASS: The Youth Physical Activity Survey for Specific Settings

Y-PASS: The Youth Physical Activity Survey for Specific Settings

The After School Questionnaire



What is your ID number? (this is the number on the piece of paper titled "Y-PASS Questionnaire")*

_____

INTRODUCTION

Thank you for agreeing to fill out this important questionnaire.

The information you share will help us to understand what things help children be active or make it difficult for children to be active during different times of the day.

- **Please answer every question carefully.**
- **Do not spend too much time on one question.**
- **If something is not clear, please ask for help.**
- **This is NOT a test.**
- **There are no right or wrong answers.**
- **We are interested in what you think, so please be as honest as you can in your responses.**

Thank you for your help with this project.

LET'S BEGIN THE QUESTIONNAIRE WITH SOME INFORMATION ABOUT YOU

Please fill out the following information

1) What is your first name?*

_____

2) What is your last name?*

_____

3) What is the name of your school?*

_____

4) What year are you in?*
( ) Year 5
( ) Year 6
( ) Year 7

5) Are you a boy or girl? Please tick:*
( ) Boy
( ) Girl

6) What is your Date of Birth? (dd/mm/yyyy, e.g. 05/09/1991)*
_____

7) In what country were you born?*
( ) Australia
( ) Another Country (please specify): _____

8) Are you an Aboriginal or Torres Strait Islander? Please tick:*
( ) Yes
( ) No

9) What suburb/town do you live in?*
_____

10) What is the postcode where you live?
_____

DEFINITION OF TERMS

Before you move on, it is important to understand some of the words used in this questionnaire.

BEING ACTIVE involves any movement which can make you breathe quicker and heavier than usual. You may start to sweat and feel out of breath.

There are different ways of BEING ACTIVE, including: Active transportation; Non-organised play, games and activities; and Organised sports and activities. You can be active at school, home or in your neighbourhood.

ACTIVE TRANSPORTATION is how you get to and from places actively (i.e. not using motorised transport like a car or bus). Some examples of active transportation include:
Walking or riding your bike, skateboard or scooter home from school

Walking or riding your bike, skateboard or scooter to and from places in your neighbourhood

Walking or riding your bike, skateboard or scooter to sport or activity practices



NON-ORGANISED PLAY, GAMES AND ACTIVITIES are NOT led by an adult. Some examples of being active in non-organised play, games and activities include:
Playing four-square with your friends

Playing in the playground

Taking the dog for a walk

Mucking around with your friends or siblings

Riding your bike, skateboard or scooter (not for transport)

Jumping on the trampoline



ORGANISED SPORTS AND ACTIVITIES are directed by a leader, such as a coach or a teacher. Some examples of organised sports and activities include:
Scouts

Girl Guides

Dancing

Any sport or sport practices, such as soccer, football, netball, swimming and basketball



LET'S START THINKING ABOUT AFTER SCHOOL

This is the period from when the home time school bell goes to just before dinner.

In a **USUAL WEEK**, what do you do after school?

You may want to think about the following things:
What organised sports or activities do you do after school?

What non-organised play, games or activities do you do after school?



Who do you hang out with after school?

Where do you normally go after school?

Tick the MAIN ACTIVITIES that you usually do after school and how often you do these activities after school. You can pick more than one activity.

Example:

	Do you usually do this activity? (if yes, tick the box)	How often do you do this activity?		
		1 day a week	2-3 days a week	4-5 days a week
Arts and crafts	☐	○	○	○
Basketball	☑	◉	○	○
Computer/console games (eg playstation/xbox/handheld)	☑	○	○	◉

	Do you usually do this activity? (if yes, tick the box)	**How often do you do this activity?**		
	Yes	**1 day a week**	**2-3 days a week**	**4-5 days a week**
Arts and crafts	[ ]	( )	( )	( )
Basketball	[ ]	( )	( )	( )
Computer/console games (e.g. playstation/xbox/handheld)	[ ]	( )	( )	( )
Computer work (e.g. typing/internet)	[ ]	( )	( )	( )
Dancing (general)	[ ]	( )	( )	( )
Dressing and undressing	[ ]	( )	( )	( )
Feeding or caring for pets/farm animals	[ ]	( )	( )	( )
Football (Australian/Gaelic/American)	[ ]	( )	( )	( )
Kickball	[ ]	( )	( )	( )
Mucking around indoors walk/run	[ ]	( )	( )	( )
Mucking around outdoors	[ ]	( )	( )	( )
Netball	[ ]	( )	( )	( )
Packing/unpacking bag	[ ]	( )	( )	( )
Playing with animals (e.g. throwing a ball to your dog)	[ ]	( )	( )	( )
Playing cards/puzzles/board games	[ ]	( )	( )	( )
Playing the piano or organ	[ ]	( )	( )	( )
Riding a bicycle/bike	[ ]	( )	( )	( )
Riding in a bus/train/tram	[ ]	( )	( )	( )
Riding in a car/truck	[ ]	( )	( )	( )
Running/jogging	[ ]	( )	( )	( )
Shopping	[ ]	( )	( )	( )
Sitting (e.g. talking, eating, reading)	[ ]	( )	( )	( )
Soccer (field/indoor)	[ ]	( )	( )	( )
Studying/homework or writing	[ ]	( )	( )	( )
Swimming laps	[ ]	( )	( )	( )
Tidying/cleaning room	[ ]	( )	( )	( )
Trampoline	[ ]	( )	( )	( )
Walking	[ ]	( )	( )	( )
Walking the dog	[ ]	( )	( )	( )
Watching TV	[ ]	( )	( )	( )

Do you USUALLY do activities after school that are NOT on the list?
If **NO**, please click "next" to continue with the questionnaire.

If **YES**, please complete the table below.

	Name the activity	**How often do you do these activities after school?**		
		1 day a week	**2-3 days a week**	**4-5 days a week**
1. Other	___	( )	( )	( )
2. Other	___	( )	( )	( )
3. Other	___	( )	( )	( )
4. Other	___	( )	( )	( )
5. Other	___	( )	( )	( )

Think about the places where you are active after school

Please click on the circle which most closely describes <u>how much you agree or disagree with each statement.</u>

11) There is somewhere at home where I can play actively after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



12) My yard is too small for me to be active after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

13) Dog poo on the lawn at home keeps me from being active on the grass after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



14) I play actively in my yard after school because I have a lot of lawn.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

The next section is about the distance to and from places after school

Please click on the circle which most closely describes **how much you agree or disagree with each statement.**

15) I don't have to travel far to play with my friends after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

16) I live too far away to walk, ride, skate or scooter to and from places after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

17) I do an organised sport or activity because it is close to where I live.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

The following statements are about cost

Please click on the circle which most closely describes **how much you agree or disagree with each statement.**

18) Petrol costs too much to drive to and from places where I can be active after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

19) We do not have enough cars to drive to and from places where I can be active after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

20) It costs too much money to do an organised sport or activity after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

Think about the activities you do after school

Please click on the circle which most closely describes **how much you agree or disagree with each statement.**

21) There are playgrounds or parks near my house where I can be active after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



22) I have the right equipment (e.g. a bike lock, helmet or bike) to ride a bike after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

23) I have the right equipment to do my chosen organised sport or activity after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

24) It is easy to get to an organised sport or activity after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



25) There are sport or recreation centres that I can go to after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

26) There is enough equipment to play actively at home after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

Still thinking about after school, please click on the circle which most closely describes how much you agree or disagree with each statement.

27) It is safe to play actively near where I live after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

28) It is safe to play actively in my yard after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

Think about your neighbourhood after school

Please click on the circle which most closely describes <u>how much you agree or disagree with each statement.</u>

29) I am scared of strangers in my neighbourhood after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



30) There is heavy traffic in the streets where I live.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

31) The roads are safe in my neighbourhood after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

32) There are not enough traffic lights and crossings in my neighbourhood after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

33) My parents think it is safe for me to be active in the neighbourhood after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

Think about when you are at home after school

Please click on the circle which most closely describes **<u>how much you agree or disagree with each statement.</u>**

34) I am scared of dangerous animals in my yard, such as snakes, lizards, dogs or magpies.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

35) There are dangerous objects in my yard, such as rusty scrap metal.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

36) My parents think it is safe for me to play in my yard when I am home alone after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

The following statements are about the weather after school

Please click on the circle which most closely describes <u>how much you agree or disagree with each statement.</u>

37) When it is raining, it stops me from walking, riding, skating or riding a scooter to and from places after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



38) When it is too hot, it stops me from walking, riding, skating or riding a scooter to and from places after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

39) When it is raining, it stops me from playing actively after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

40) When it is too hot, it stops me from playing actively after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

41) When it is raining, it stops me from doing an organised sport or activity after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



42) When it is too hot, it stops me from doing an organised sport or activity after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

Think about the time you have available after school

Please click on the circle which most closely describes **how much you agree or disagree with each statement.**

43) I have enough time to play actively at home or in my neighbourhood after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

44) Homework stops me from playing actively at home or in the neighbourhood after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



45) I have enough time to do an organised sport or activity after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

46) Homework stops me from doing an organised sport or activity after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

The next statements are about the things you have to carry after school

Please click on the circle which most closely describes how much you agree or disagree with each statement.

47) My school bag(s) is too heavy for me to walk, ride, skate or scooter home after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



48) I don't walk, ride, skate or scooter home from school when I have too many bags to carry.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

Think about what you prefer to do after school

Please click on the circle which most closely describes **how much you agree or disagree with each statement.**

49) I prefer to be active after school instead of watching television or playing electronic games.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



50) I prefer to watch other kids rather than do organised sports and activities after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

51) I prefer to do homework rather than be active after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

The next section is about your enjoyment of being active after school

Please click on the circle which most closely describes <u>how much you agree or disagree with each statement.</u>

52) It is fun being active after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



53) Being active after school is the thing I like to do best.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

54) I wish I could do more organised sports or activities after school than I get a chance to.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

55) I don't enjoy doing an organised sport or activity after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

56) I don’t feel like playing actively at home or in the neighbourhood after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

57) I enjoy being part of an organised sport or activity team.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

58) I don't feel like doing an organised sport or activity after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

59) Being active after school is boring.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

60) Being active after school makes me feel good.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

Please click on the circle which most closely describes how much you agree or disagree with each statement.

61) I am too tired to be active after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

62) I catch a bus or get driven to and from places after school because I can't be bothered walking or riding.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

63) I walk or ride to and from places after school because I get to hang out with my friends.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

64) I do an organised sport or activity after school because I want to improve my skills.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

65) I do an organised sport or activity after school because I get to hang out with friends.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

66) I do an organised sport or activity after school because I want to meet new people.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

67) I am not active after school because I am scared that I will get injured.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

68) I play in the neighbourhood after school because I get to hang out with my friends.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

69) I play in the neighbourhood after school because I get to meet new people.*



( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

Still thinking about after school, please click on the circle which most closely describes how much you agree or disagree with each statement.

70) I ride, walk, skate or scooter to and from places after school because it gets me fit.*



( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

71) Playing outside after school keeps me healthy.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

72) I do an organised sport or activity after school because I have nothing else to do.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

73) I don't participate in some activities after school because it is only a boys/girls activity.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

74) I play actively at home or in the neighbourhood after school because it gives me something to do.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

75) I do an organised sport or activity after school because it gets me fit.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

76) I am active after school because I don't want to put on weight.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

The following statements are about your confidence to be active after school

Please click on the circle which most closely describes <u>how much you agree or disagree with each statement.</u>

77) I am confident that I can ask my parent or another adult to take me to an organised sport or activity after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

78) I am confident that I can ask my parent or another adult to take me somewhere I can play actively after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



79) I am confident that I can be active after school on most days.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

80) I am confident that I can be active after school on most days even if I could watch TV or play video games instead.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

81) I am confident that I can be active after school on most days even if it is hot or cold outside.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

82) I am confident that I can ask friends to be active with me after school on most days.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

83) I am confident that I can be active after school on most days even if I have to stay at home.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

84) I am confident that I can be active after school on most days even if I am being bullied.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

85) I am confident that I can be active after school on most days no matter how busy I am.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

The next statements are about how good you think you are at doing activities after school
Please click on the circle which most closely describes **how much you agree or disagree with each statement.**

86) I ride my bike, skateboard or scooter to and from places after school because I think I am good at it.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



87) I play active games after school because I think I am good at them.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

88) I do an organised sport or activity after school because I think I am good at it.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

89) It is not worth doing an organised sport or activity after school because I am not good at it.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

90) I don't do an organised sport or activity after school because other kids are better than me.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

Now think about your friends and the people around you after school

Please click on the circle which most closely describes **how much you agree or disagree with each statement.**

91) Bullying stops me from being active after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

92) I am not active after school because I have no one to play with.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

93) My friends encourage me to be active after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

94)
I walk, ride, skate or scooter to and from places with friends after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



95) My friends tell me I am doing well at sport.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

96) I play with friends in the neighbourhood after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

97) I do an organised sport or activity with friends after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

Now think about your parents and your family

Please click on the circle which most closely describes **how much you agree or disagree with each statement.**



98) I have brothers/sisters who play actively with me after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

99) My parents play actively with me after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

100) My parents encourage me to play outside after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

101) My parents are not home after school to supervise my play.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

102) My parents make me go outside and play after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

103) My parents are too busy to play with me after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

104) I always have to tell my parents where I am when I go out after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

105) My parents make me help around the house, which stops me from being active after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

106) If I am going out after school, I always have to be back by a certain time.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

107) My parents won't let me ride, walk, skate or scooter to and from places after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

108) My family always watch me do an organised sport or activity after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

109) My parents help me practise sport after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

110) I don't do an organised sport or activity after school because my parents work late.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

111) My parents won't let me do an organised sport or activity because I am already doing too many other activities.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



112) My parents encourage me to do an organised sport or activity after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

113) My family tell me I am doing well at my after school organised sport or activity.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

114) We have a rule at home that we have to do an organised sport or activity after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

115) I am not allowed to do an organised sport or activity after school because my parents are scared that I might get hurt.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot



116) My parents have rules about watching TV and playing electronic games after school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

What organised sports and activities have you done in the last year?

117) What ORGANISED SPORTS AND ACTIVITIES have you done in the LAST YEAR?

Example:

	Activity	Time of year		Who do you do this sport or activity for?		
		Summer	Winter	School	Club	Other
1	Basketball	☑	☐	☑	☐	☐
2	Ballet	☑	☑	☐	☐	☑
3	Soccer	☐	☑	☐	☑	☐

	Activity	**Time of year**		**Who do you do this sport or activity for?**		
		Summer	**Winter**	**School**	**Club**	**Other**
1	___	[ ]	[ ]	[ ]	[ ]	[ ]
2	___	[ ]	[ ]	[ ]	[ ]	[ ]
3	___	[ ]	[ ]	[ ]	[ ]	[ ]
4	___	[ ]	[ ]	[ ]	[ ]	[ ]
5	___	[ ]	[ ]	[ ]	[ ]	[ ]
6	___	[ ]	[ ]	[ ]	[ ]	[ ]

This statement is about your coordination

Please click on the circle which most closely describes **how much you agree or disagree with each statement.**

118) I am just as coordinated as kids of my age and gender.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

This statement is about how you view your body

Please click on the circle which most closely describes **how much you agree or disagree with each statement.**

119) I am shy about how my body looks.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

The next statement is about how much you enjoy PE lessons

Please click on the circle which most closely describes **how much you agree or disagree with each statement.**

120) I really like doing PE at school.*
( ) Disagree a lot
( ) Disagree a little
( ) Neither disagree nor agree
( ) Agree a little
( ) Agree a lot

Thank You!

Thank you for completing this survey.

Appendix 12: Administration scripts for the Y-PASS questionnaires and LEAP II questionnaire

General Information for the Questionnaire Facilitator

- Children are to complete the questionnaire on a school computer. This may be in a computer lab.
- The lunchtime questionnaire should take approximately 20 to 30 minutes to complete. The after school questionnaire should take approximately 30 to 40 minutes to complete. The LEAP-II questionnaire should take approximately 30 to 40 minutes to complete.
- Children have the right not to complete the questionnaire if they do not wish to. If a child does not want to participate, please allow him/her to be dismissed, rather than getting them to fill in the questionnaire with random answers.
- For children with poor reading skills, you may need to read through each question, or work through each question with them individually. The questionnaire has been worded at a Year 5 level, which has been confirmed by the Flesch-Kincaid Grade Level and Flesch Reading Ease Score.

Y-PASS questionnaire instructions

Lunchtime Questionnaire

- Ask the children to log onto their computer and open the internet.
- Then ask the children to type in the following URL: bec.id.au

  There will be three web links relating to each questionnaire. Ask the children to click on the lunchtime questionnaire link (http://edu.surveygizmo.com/s3/286277/lunch). If this does not work, ask the children to type the link directly.

- Before beginning the questionnaire, please give each child a business card containing an ID number. Instruct them to write their names in the space provided.
- Instruct the children to enter the number on their business card into the ID box provided and then click on the “NEXT” button. A page containing instructions will appear.
- Read the instruction page aloud.

  Emphasise:

  - The questions need to be answered about “YOU”.
  - Do not worry about what the person next to you is doing.

- Tell the children to click on the "NEXT" button. A page containing demographic questions will appear.
- Instruct the children to fill out each question on the page.
- Instruct the children to click on the "NEXT" button. A page containing the title "**DEFINITION OF TERMS**" will appear.
- Read out the definitions. Emphasise that "**BEING ACTIVE** involves any movement which can make you breathe quicker and heavier than usual and feel warm and sweaty."
  Direct them to the pictures for further examples.
  The definitions will be placed on posters and handouts so that the children can refer to them during the administration of the questionnaire.
- Instruct the children to click on the "NEXT" button. A page containing the title "**LET'S START THINKING ABOUT LUNCHTIME AT SCHOOL**" will appear.
- Read through the instructions on the page.
- Go through the example with the children.

  The children will need to pick the main activities they usually do at lunchtime. If they select an activity, a scale will appear and the children will need to identify how often they do the activity in a week. For example, if they click on "Eating", a scale from "1 day a week" to "4-5 days a week" will appear. They will need to click on the circle which best describes how many times a week they eat at lunchtime.

- "Other" options are provided where the children can enter the activity on the line provided and then complete the same process. Emphasise that they MUST write down the activity on the line.
- Instruct the children to click on the "NEXT" button. A page containing the title "**Think about where you play at school at lunchtime**" will appear.
- Instruct the children to "Please click on the circle which most closely describes **how much you agree or disagree with each statement**."
- Let the children know that they can click on the "NEXT" button when they have completed the page and to continue with the rest of the questionnaire.
- Walk around the room to answer any queries the children may have.
- Every so often remind them of:
  - The definitions of being active.
  - There are no right or wrong answers.
  - Choose the option that best fits for YOU.

After school Questionnaire

- Ask the children to log onto their computer and open the internet.
- Then ask the children to type in the following URL: bec.id.au

  There will be three web links relating to each questionnaire. Ask the children to click on the after school questionnaire link (http://edu.surveygizmo.com/s3/288806/afterschool). If this does not work, ask the children to type the link directly.

- Instruct the children to enter the number on their business card into the ID box provided.
- Remind the children about the definitions of "**BEING ACTIVE**" and direct them to the posters and handouts for further explanation of the terms.
- Instruct the children to click on the "NEXT" button. A page containing the title, "**LET'S NOW START THINKING ABOUT AFTER SCHOOL**" will appear.
- Read through the instructions on the page.
- Go through the activity checklist with the children.

  The children will need to pick the main activities they usually do after school. If they select an activity, a scale will appear and the children will need to identify how often they do the activity in a week. For example, if they click on "Watching TV", a scale from "1 day a week" to "4-5 days a week" will appear. They will need to click on the circle which best describes how many times a week they watch TV after school.

- "Other" options are provided where the children can enter the activity on the line provided and then complete the same process. Emphasise that they MUST write down the activity on the line.
- Instruct the children to click on the "NEXT" button. A page containing the title, "**Think about where you are active after school**" will appear.
- Instruct the children to "Please click on the circle which most closely describes **how much you agree or disagree with each statement**."
- Let them know that they can click on the "NEXT" button when they have completed the page and to continue with the rest of the questionnaire.
- Walk around the room to answer any queries the children may have.
- Every so often remind them of:
  - The definitions of being active.
  - There are no right or wrong answers.
  - Choose the option that best fits for YOU.
- "**What organised sports and activities have you done in the last year**" is one section in the questionnaire. Direct the children to write down the sport or activity they have done in the last year and whether they participate in winter or summer. They can click on both options if necessary. They will also need to identify if they do the sport

or activity for a school team, a club or other. “Other” may be a dance company, a Scout group or a Girl Guide group. Again, they can click on more than one option.

LEAP II questionnaire

- Ask the children to log onto their computer and open the internet.
- Then ask the children to type in the following URL: bec.id.au

  There will be three web links relating to each questionnaire. Ask the children to click on the LEAP questionnaire link (http://edu.surveygizmo.com/s3/308513/LEAP). If this does not work, ask the children to type the link directly.

- Before beginning the questionnaire, please give each child a business card containing an ID number. Instruct them to write their names in the space provided.
- Instruct the children to enter the number on their business card into the ID box provided and then click on the “NEXT” button. A page containing instructions will appear.
- Read the instruction page aloud.

  Emphasise:

  - The questions need to be answered about “YOU”.
  - Do not worry about what the person next to you is doing.
- Tell the children to click on the “NEXT” button. A page containing demographic questions will appear.
- Instruct the children to fill out each question on the page.
- Instruct the children to click on the “NEXT” button. A page containing the title “**DEFINITION OF TERMS**” will appear.
- Read out the definitions. Emphasise that “**BEING ACTIVE** involves any movement which can make you breathe quicker and heavier than usual and feel warm and sweaty.”
  Direct them to the pictures for further examples.
  The definitions will be placed on posters and handouts so that the children can refer to them during the administration of the questionnaire.
- Instruct the children to click on the “NEXT” button and to continue with the rest of the questionnaire.
- Walk around the room to answer any queries the children may have.
- Every so often remind them of:
  - The definitions of being active.
  - There are no right or wrong answers.
  - Choose the option that best fits for YOU.

Frequently Asked Questions

- Every child needs to complete every question in the questionnaire. If a child does not want to answer a question or they do not know, instruct them to click on the circle "Neither agree nor disagree".
- If a child asks about Wii or active computer games, you will need to specify that they need to be standing and doing movement that makes them breathe quicker and heavier than usual and feel warm and sweaty (i.e. the definition of being active).
- Active transport after school is about the trip from school to home or any other place.
- A child may not understand why his/her date of birth is not working. Make sure they are entering their date of birth in the correct format (i.e. dd/mm/yyyy, 08/05/2000).

Appendix 13: The LEAP II questionnaire

First Name: _____
(Please print)

Last Name: _____
(Please print)

S.S. # (last 4 digits): _____

Your date of birth: _____/_____/_____
(month) (day) (year)

School: _____

Today's date: _____/_____/_____
(month) (day) (year)

LEAP II Survey



Perceived Self-Efficacy

Please circle the number which most closely describes how much you agree or disagree with each statement. Remember that physical activity can be any play, game, sport, or exercise that gets you moving and breathing harder. There are no wrong answers. (**CIRCLE ONE NUMBER FOR EACH ITEM**)

		Disagree a lot	Disagree a little	Neither disagree nor agree	Agree a little	Agree a lot
1.	I can be physically active during my free time on most days.	1	2	3	4	5
2.	I can ask my parent or other adult to do physically active things with me.	1	2	3	4	5
3.	I can be physically active during my free time on most days even if I could watch TV or play video games instead.	1	2	3	4	5
4.	I can be physically active during my free time on most days even if my friends want me to do something else.	1	2	3	4	5
5.	I can ask my parent or other adult to sign me up for a sport, dance, or other physical activity program.	1	2	3	4	5
6.	I can be physically active during my free time on most days even if it is very hot or cold outside.	1	2	3	4	5
7.	I can ask my best friend to be physically active with me during my free time on most days.	1	2	3	4	5
8.	I can ask my parent or other adult to get me the equipment and clothes I need to be physically active.	1	2	3	4	5
9.	I can ask my parent or other adult to take me to a physical activity or sport practice.	1	2	3	4	5
10.	I can be physically active during my free time on most days even if I have a lot of homework.	1	2	3	4	5
11.	I can be physically active during my free time on most days even if I have to stay at home.	1	2	3	4	5
12.	I have the coordination I need to be physically active during my free time on most days.	1	2	3	4	5
13.	I can be physically active during my free time on most days no matter how busy my day is.	1	2	3	4	5
14.	I can be physically active during my free time on most days no matter how tired I may feel.	1	2	3	4	5
15.	I can be physically active during my free time on most days even when I'd rather be doing something else.	1	2	3	4	5

Intention

Think about your free time in the next 7 days. Please circle the number which most closely describes how much you agree or disagree with each statement. Remember that physical activity can be any play, game, sport, or exercise that gets you moving and breathing harder. **(CIRCLE ONE NUMBER FOR EACH ITEM)**					
	Disagree a lot	Disagree a little	Neither disagree nor agree	Agree a little	Agree a lot
I intend to be physically active during my free time on most days.	1	2	3	4	5
I will be physically active during my free time on most days.	1	2	3	4	5
I plan to be physically active during my free time on most days.	1	2	3	4	5
I am going to be physically active during my free time on most days.	1	2	3	4	5

Perceived outcomes and evaluation of those possible outcomes

On the scales below circle the number that shows (1) how much you disagree or agree with each statement, and (2) how "bad" or "good" each statement is to you. Remember that physical activity can be any play, game, or sport, or exercise that gets you moving and breathing harder.

If I were to be physically active during my free time on most days….	Disagree a lot	Disagree a little	Neither disagree nor agree	Agree a little	Agree a lot			Very bad	Somewhat bad	Neither bad nor good	Somewhat good	Very good
1. It would help me spend more time with my friends.	1	2	3	4	5	→	Spending more time with my friends is ...	1	2	3	4	5
2. It would lead to my getting an injury.	1	2	3	4	5	→	Getting an injury is …	1	2	3	4	5
3. It would help me control my weight.	1	2	3	4	5	→	Controlling my weight is ...	1	2	3	4	5
4. It would cause me pain and muscle soreness.	1	2	3	4	5	→	Having pain and muscle soreness is …	1	2	3	4	5
5. It would help me cope with stress	1	2	3	4	5	→	Coping with stress is …	1	2	3	4	5

If I were to be physically active during my free time on most days….	Disagree a lot	Disagree a little	Neither disagree nor agree	Agree a little	Agree a lot			Very bad	Somewhat bad	Neither bad nor good	Somewhat good	Very good
6. It would interfere with my hanging out with friends.	1	2	3	4	5	→	Not hanging out with my friends is …	1	2	3	4	5
7. It would make me tired.	1	2	3	4	5	→	Being tired is …	1	2	3	4	5
8. It would be fun.	1	2	3	4	5	→	Having fun is ...	1	2	3	4	5
9. It would make me too muscular	1	2	3	4	5	→	Being too muscular is ….	1	2	3	4	5
10. It would make me less popular	1	2	3	4	5	→	Being unpopular is …	1	2	3	4	5

If I were to be physically active during my free time on most days….	Disagree a lot	Disagree a little	Neither disagree nor agree	Agree a little	Agree a lot			Very bad	Somewhat bad	Neither bad nor good	Somewhat good	Very good
11. It would help me make new friends.	1	2	3	4	5	→	Making new friends is ...	1	2	3	4	5
12. It would make me embarrassed in front of others.	1	2	3	4	5	→	Being embarrassed in front of others is …	1	2	3	4	5
13. It would get or keep me in shape.	1	2	3	4	5	→	Getting or staying in shape is …	1	2	3	4	5
14. It would prevent me from doing my homework	1	2	3	4	5	→	Not doing my homework is	1	2	3	4	5
15. It would interfere with my television watching/playing video games	1	2	3	4	5	→	Not watching television or playing video games is …	1	2	3	4	5

If I were to be physically active during my free time on most days….	Disagree a lot	Disagree a little	Neither disagree nor agree	Agree a little	Agree a lot			Very bad	Somewhat bad	Neither bad nor good	Somewhat good	Very good
16. It would interfere with my talking on the telephone.	1	2	3	4	5	→	Not talking on the telephone is ….	1	2	3	4	5
17. It would make me more attractive	1	2	3	4	5	→	Being more attractive is …	1	2	3	4	5
18. It would be boring.	1	2	3	4	5	→	Being bored is …	1	2	3	4	5
19. It would give me energy.	1	2	3	4	5	→	Having energy is ...	1	2	3	4	5
20. It would mess up my hair or make-up	1	2	3	4	5	→	Messing up my hair or make-up is…	1	2	3	4	5
21. It would make me hot and sweaty	1	2	3	4	5	→	Being hot and sweaty is…	1	2	3	4	5
22. It would make me better in sports, dance, or other activities	1	2	3	4	5	→	Being better in sports, dance, or other activities is ...	1	2	3	4	5

Perceived expectations and motivations to comply

On the scales below circle the number that shows how much you disagree or agree with each statement. Remember that physical activity can be any play, game, or sport, or exercise that gets you moving and breathing harder.

If the person listed does not apply to you, leave the item blank.

	Disagree a lot	Disagree a little	Neither disagree nor agree	Agree a little	Agree a lot		Disagree a lot	Disagree a little	Neither agree nor disagree	Agree a little	Agree a lot
1. My fellow students think I should be physically active during my free time on most days.	1	2	3	4	5	→ I want to do what my fellow students want me to do	1	2	3	4	5
2. My best friend thinks I should be physically active during my free time on most days.	1	2	3	4	5	→ I want to do what my best friend wants me to do	1	2	3	4	5
3. My physical education teacher thinks I should be physically active during my free time on most days.	1	2	3	4	5	→ I want to do what my physical education teacher wants me to do.	1	2	3	4	5
4. My other teachers thinks I should be physically active during my free time on most days.	1	2	3	4	5	→ I want to do what my other teachers want me to do	1	2	3	4	5
5. My mother or female guardian thinks I should be physically active during my free time on most days.	1	2	3	4	5	→ I want to do what my mother or female guardian wants me to do	1	2	3	4	5
6. My father or male guardian thinks I should be physically during my free time on most days.	1	2	3	4	5	→ I want to do what my father or male guardian wants me to do	1	2	3	4	5
7. My sister/sisters think I should be physically active during my free time on most days.	1	2	3	4	5	→ I want to do what my sister/sisters want me to do	1	2	3	4	5
8. My brother/brothers think I should be physically active during my free time on most	1	2	3	4	5	→ I want to do what my brother/brothers wants me to do.	1	2	3	4	5

Perceived behavioral control

The following statements are about how easy or difficult it would be for you to be physically active during your free time on most days. Circle the numbers below each statement that best describes how you feel. Remember that physical activity can be any play, game, sport, or exercise that gets you moving and breathing harder.				
1. For me to be physically active during my free time on most days would be:…				
1	2	3	5	6
very easy	somewhat easy	Neither easy nor difficult	somewhat difficult	very difficult
2. I have control over my being physically active during my free time on most days.				
1	2	3	5	6
Very easy	somewhat easy	Neither easy nor difficult	somewhat difficult	very difficult
3. I believe I have all the things I need to be physically active during my free time on most days				
1	2	3	5	6
very easy	somewhat easy	Neither easy nor difficult	somewhat difficult	very difficult
4. If I want to be I can be physically active during my free time on most days				
1	2	3	5	6
very easy	somewhat easy	Neither easy nor difficult	somewhat difficult	very difficult

Social support

The following questions are about the people you live with. If the person listed below each question does not apply to you leave it blank. **(CIRCLE ONE NUMBER FOR EACH TYPE OF PERSON)**

	None	Once	Sometimes	Almost daily	Daily	Don't know
1. During a typical week, how often has a member of your family encouraged you to do physical activity or sports?						
A. Male adult(s)	0	1	2	3	4	?
B. Female adult(s)	0	1	2	3	4	?
C. Other children	0	1	2	3	4	?
2. During a typical week, how often has a member of your family done a physical activity or played sports with you?						
A. Male adult(s)	0	1	2	3	4	?
B. Female adult(s)	0	1	2	3	4	?
C. Other children	0	1	2	3	4	?
3. During a typical week, how often has a member of your family provided transportation to a place where you can do physical activities or play sports?						
A. Male adult(s)	0	1	2	3	4	?
B. Female adult(s)	0	1	2	3	4	?
C. Other children	0	1	2	3	4	?
4. During a typical week, how often has a member of your family watched you participate in physical activities or sports?						
A. Male adult(s)	0	1	2	3	4	?
B. Female adult(s)	0	1	2	3	4	?
C. Other children	0	1	2	3	4	?
5. During a typical week, how often has a member of your family told you that physical activity is good for your health?						
A. Male adult(s)	0	1	2	3	4	?
B. Female adult(s)	0	1	2	3	4	?
C. Other children	0	1	2	3	4	?

Environment

How much do you agree with the following statements? **(CIRCLE ONE NUMBER FOR EACH ITEM)**

	Disagree a lot	Disagree a little	Neither disagree nor agree	Agree a little	Agree a lot
1. At home there are enough **supplies and pieces of sports equipment** (like balls, bicycles, skates) to use for physical activity	1	2	3	4	5
2. There are **playgrounds, parks, or gyms** close to my home or that I can get to easily	1	2	3	4	5
3. It is **safe to walk or jog alone** in my neighborhood during the day	1	2	3	4	5
4. It is **difficult to walk or jog in my neighborhood** because of things like traffic, no sidewalks, dogs, or gangs.	1	2	3	4	5

At your school, are there supervised physical activity programs for all interested students? **(CIRCLE ONE NUMBER FOR EACH ITEM)**

	No	Yes	Don't know
A. After School	0	1	2
B. On weekends	0	1	2
C. During the summer	0	1	2

PE enjoyment

5. How much do you enjoy physical education classes at school? **(CIRCLE ONE NUMBER ONLY)**

1. PE is very un-enjoyable
2. PE is somewhat un-enjoyable
3. PE is neither un-enjoyable or enjoyable
4. PE is somewhat enjoyable
5. PE is very enjoyable

PE and sport participation

7. During the past 12 months, how many sports teams run by your school did you play on? **(DO NOT INCLUDE PE CLASSES).**

O None O 1 team O 2 teams O 3 teams

8. During the past 12 months, how many sports teams run by organizations outside of your school, did you play on?

O None O 1 team O 2 teams O 3 teams

9. Are you taking physical education now?

O Yes O No

10. Did you take physical education the first half of the school year?

O Yes O No

Social provisions

Please circle the number which most closely describes how much you agree or disagree with each statement. Remember that physical activity can be any play, game, sport, or exercise that gets you moving and breathing harder. **(CIRCLE ONE NUMBER FOR EACH ITEM)**

	Disagree a lot	Disagree a little	Neither disagree nor agree	Agree a little	Agree a lot
1. There are people I can count on to be physically active with me.	1	2	3	4	5
2. I do not have any friends and relatives who are physically active.	1	2	3	4	5
3. There is no one I can turn to for advice about physical activity.	1	2	3	4	5
4. There are people who depend on me to help them be physically active.	1	2	3	4	5
5. I know people who enjoy the same physical activities that I do.	1	2	3	4	5
6. Other people think of me as being physically active.	1	2	3	4	5
7. I feel personally responsible for helping another person be physically active.	1	2	3	4	5
8. I am part of a group of people who have the same attitudes about physical activity.	1	2	3	4	5
9. Other people do not respect my physical skills and abilities.	1	2	3	4	5
10. There is no one to take over chores for me so I have time to be physically active.	1	2	3	4	5
11. I am good friends with at least one person who values physical activity.	1	2	3	4	5
12. There is someone I can talk to about physical activity.	1	2	3	4	5
13. There are people who recognize my skills and abilities at physical activity.	1	2	3	4	5
14. There is no one who shares my interests about physical activity.	1	2	3	4	5
15. No one relies on me for help with their physical activity.	1	2	3	4	5
16. There is a person I can turn to for advice if I have problems with physical activity.	1	2	3	4	5
17. I have close relationships with people who make me feel good about myself.	1	2	3	4	5
18. There is no one who rewards me for being physically active.	1	2	3	4	5
19. There is no one I feel comfortable talking to about physical activity.	1	2	3	4	5
20. There are people who admire my talents and abilities regarding physical activity.	1	2	3	4	5
21. I am not close to anyone who values physical activity	1	2	3	4	5
22. There is no one who likes the same physical activities I do.	1	2	3	4	5
23. There are people who will change their schedule to be physically active with me.	1	2	3	4	5
24. No one counts on me to be physically active with them.	1	2	3	4	5

Specific goalsPlease circle the number which most closely describes how much you agree or disagree with each statement. Remember that physical activity can be any play, game, sport, or exercise that gets you moving and breathing harder. **(CIRCLE ONE NUMBER FOR EACH ITEM)**

A goal of mine now is to be physically active so I can…	**Disagree a lot**	**Disagree a little**	**Neither disagree nor agree**	**Agree a little**	**Agree a lot**
1. Spend more time with my friends.	1	2	3	4	5
2. Control my weight.	1	2	3	4	5
3. Deal with stress.	1	2	3	4	5
4. Hang out with friends.	1	2	3	4	5
5. Have fun.	1	2	3	4	5
A goal of mine now is to be physically active so I can…	**Disagree a lot**	**Disagree a little**	**Neither disagree nor agree**	**Agree a little**	**Agree a lot**
6. Be more muscular.	1	2	3	4	5
7. Be more popular.	1	2	3	4	5
8. Make new friends.	1	2	3	4	5
9. Keep in shape.	1	2	3	4	5
10. Be better looking.	1	2	3	4	5
A goal of mine now is to be physically active so I can…	**Disagree a lot**	**Disagree a little**	**Neither disagree nor agree**	**Agree a little**	**Agree a lot**
11. Increase my energy.	1	2	3	4	5
12. Be better in sports.	1	2	3	4	5
13. Be better in dance.	1	2	3	4	5
14. Be better in other physical activities.	1	2	3	4	5

	Disagree a lot	**Disagree a little**	**Neither disagree nor agree**	**Agree a little**	**Agree a lot**
15. A goal of mine now is to be physically active.	1	2	3	4	5
16. I am happy with the amount of physical activity I get now.	1	2	3	4	5

Physical activity enjoyment

On the scales below circle the number which most closely describes how much you agree or disagree with each statement. Remember that being active can be any play, game, sport, or exercise that gets you moving and breathing harder. **(CIRCLE ONE NUMBER FOR EACH ITEM)**

When I am active, …	Disagree a lot	Disagree a little	Neither disagree nor agree	Agree a little	Agree a lot
1. I enjoy it.	1	2	3	4	5
2. I feel bored.	1	2	3	4	5
3. I dislike it.	1	2	3	4	5
4. I find it fun.	1	2	3	4	5
5. It's no fun at all.	1	2	3	4	5
6. It gives me energy.	1	2	3	4	5
7. It makes me depressed.	1	2	3	4	5
8. It's very pleasant.	1	2	3	4	5
9. My body feels good.	1	2	3	4	5
10. I get something out of it.	1	2	3	4	5
11. It's very exciting.	1	2	3	4	5
12. It frustrates me.	1	2	3	4	5
13. It's not at all interesting.	1	2	3	4	5
14. It gives me a strong feeling of success.	1	2	3	4	5
15. It feels good.	1	2	3	4	5
16. I feel as though I would rather be doing something else.	1	2	3	4	5

Specific intentions

Think about your free time in the next 7 days. Please circle the number which most closely describes how much you agree or disagree with each statement. Remember that physical activity can be any play, game, sport, or exercise that gets you moving and breathing harder. **(CIRCLE ONE NUMBER FOR EACH ITEM)**

I intend to be physically active…	Disagree a lot	Disagree a little	Neither disagree nor agree	Agree a little	Agree a lot
1. During my free time on most days even if I could watch TV or play video games instead	1	2	3	4	5
2. During my free time on most days even if my friends want me to do something else	1	2	3	4	5
3. During my free time on most days even if it is very hot or cold outside	1	2	3	4	5
4. During my free time on most days even if I have a lot of homework	1	2	3	4	5
5. During my free time on most days even if I have to stay at home	1	2	3	4	5
I intend to be physically active…	Disagree a lot	Disagree a little	Neither disagree nor agree	Agree a little	Agree a lot
6. During my free time on most days no matter how tired I may feel	1	2	3	4	5
7. During my free time on most days even when I'd rather be doing something else	1	2	3	4	5
8. During my free time on most days even if I could talk on the phone instead.	1	2	3	4	5
9. During my free time on most days even if I have chores to do.	1	2	3	4	5

Self motivation

Read each of the following statements and circle the number which best describes you. Please be sure to answer every item and try to be as honest as possible in your responses. There are no right or wrong answers. Your answers will be kept private. **(Circle one number for each item.)**

	Very unlike me	Somewhat unlike me	Somewhat like me	Very much like me
1. I'm not very good at getting myself to do things.	1	2	3	4
2. When I get bored I switch to something else.	1	2	3	4
3. I can keep going at things even when they are tiring or painful.	1	2	3	4
4. If something gets to be too much of an effort to do I am likely to stop doing it.	1	2	3	4
5. I'm good at keeping promises that I make to myself.	1	2	3	4
6. When I take on something difficult, I try to stick to it until it's finished.	1	2	3	4
7. I'm good at making decisions and keeping to them.	1	2	3	4
8. I usually try to find the easiest way to do things.	1	2	3	4
9. I don't like to work too hard.	1	2	3	4
10. I am a lazy person most of the time.	1	2	3	4
11. I work harder than most of my friends.	1	2	3	4
12. I don't often let myself down.	1	2	3	4
13. I like to do things that challenge me.	1	2	3	4
14. I change my mind quite easily.	1	2	3	4
15. Things don't matter much to me.	1	2	3	4
16. I often work until I get tired out.	1	2	3	4
17. I never force myself to do things that I don't feel like doing.	1	2	3	4
18. It takes a lot to get me going.	1	2	3	4
19. I really want to achieve things.	1	2	3	4
20. I don't have much self-discipline.	1	2	3	4

Appendix 14: Recruitment material for the predictive utility study



University of
South Australia

School of Health Sciences

Measuring factors that influence lunchtime and after school physical activity in children

Dear (principal – will be named personally),

I am doing my PhD at the University of South Australia in which I am developing a questionnaire that will provide information on the factors that influence children's lunchtime play and after school physical activity in South Australia. The development of this questionnaire will provide health promoters with the information required to develop physical activity programs that will promote children's physical activity behaviour. This will be achieved in three separate studies.

The first two studies have already occurred and involved running focus groups with children to find out the reasons why children are active or not active during lunchtime and after school. This information was used to inform the development of a computer-delivered questionnaire. The second study involved pilot testing the questionnaire with a group of children.

The third study aims to establish the validity of the computer-delivered questionnaire to measure the factors that influence children's lunchtime and after school physical activity in South Australia. Your school is invited to participate in this part of the study.

What are the benefits to the school?
Group data for participating children in your school will be provided. The information obtained from the questionnaire can be used by the school to identify the factors that are preventing the children from being active and develop physical activity programs that address these barriers.

Each student who returns a completed consent form will receive a squeeze-ball toy as a thank-you gift, regardless of whether their parents give consent for their child to participate or not.

Who will be involved?
Children in Years 5, 6 and 7.

What is involved?

- Children will be asked to complete two computer-delivered questionnaires – one on a Monday and one on a Friday.
- Children will also wear an accelerometer (in a pouch attached at the waist by a belt) for 5 consecutive school days (Monday to Friday), only removing it for sleeping, and any activity involving water, such as swimming or showering. Children will be given a log sheet to provide details of when the accelerometer is removed and for what reason. In previous studies we have found that this is an acceptable protocol for schools, children and parents. The information collected by the accelerometers will be compared to the results of the questionnaires, so that validity of the questionnaire can be determined.

- Height and weight will be measured according to strict DECS guidelines for preserving privacy of participants and their results. This information in needed to convert accelerometer data into estimates of physical activity. A researcher of the same sex will be present to take the required height and weight measurements. All researchers involved in the project will have a current police clearance.

What will be asked of the school?

- To manage the distribution of information sheets and consent forms to parents and to collect the returned consents.
- The school will be asked to allow students to access computers to complete the questionnaires during an arranged time. This study will run during [insert time of year].
- Approximately 30-40 minutes of class time will be needed to complete each questionnaire and 20-30 minutes of class time will be required to measure height and weight and distribute accelerometers.

I expect that total class time disrupted will be no more than three hours across the week. I understand that this is some disruption to the day but I do believe that this study will help raise awareness of the factors that influence children's physical activity. This will enable us and future health promoters to design more effective physical activity programs.

Please note: All information collected as part of this study will be kept confidential and no information which could lead to the identification of individuals will be released. Information will be stored in a locked filing cabinet at the School of Health Sciences, University of South Australia, for a period of five years following the study.

Please contact myself, Rebecca Stanley, on **8302 2550** if you require further information or are interested in taking part in this study. If you have any queries about ethical aspects of this survey, please contact Ms Vicki Allen, the Executive Officer of UniSA Human Research Ethics Committee, on 8302 3118.

Alternatively, you may wish to contact my supervisors: Dr Jim Dollman (UniSA) 8302 1413, Dr Kobie Boshoff (UniSA) 8302 1089 and Dr Kate Ridley (Flinders University) 8201 3355.

Thank you for your time and consideration.

Rebecca Stanley
PhD Candidate



University of
South Australia

School of Health Sciences

Measuring factors that influence lunchtime and after school physical activity in children

Dear Parent/Guardians,

Your child has been selected to participate in a PhD project with the University of South Australia. The project is about understanding the factors that influence children's lunchtime play and after school physical activity in South Australia.

Physical activity is an important part of a healthy lifestyle. Extensive research is being conducted all over the world to determine the factors that impact on children's physical activity. I am interested in looking at the reasons why South Australian children are active or not active at lunchtime and after school. This information will be collected via computer-delivered questionnaires, which will provide health promoters with the information required to develop physical activity programs to promote children's physical activity behaviour. To make sure that the questionnaires are effective, we will be comparing the results to an existing questionnaire.

We are planning to administer the questionnaires to about 400 children in South Australia to find out what the major factors are that influence their physical activity during lunchtime and after school.

What is involved in the study?

Your child will be asked to complete two computer-delivered questionnaires that look at the factors that influence your child's lunchtime and after school physical activity. The questionnaires will be completed on the school's computers and will take approximately 30 minutes each to complete. One questionnaire will be completed on the Monday and the other will be completed on the Friday during school hours.

Your child will wear a motion sensor (in a pouch attached at the waist by a belt), which monitors activity levels directly, in a similar way to a pedometer. Your child will wear the motion sensor for 5 days starting on Monday and finishing on Friday, only removing it for sleeping, and any activity involving water, such as showering and swimming. Your child will be given a log sheet to document

the times when the motion sensor is removed. The pictures below show the motion sensor and how it is worn. The motion sensor may be worn under clothing.





The motion sensor is small and light so that your child can carry out normal tasks without hindrance. After the 5 days, a research assistant of the same gender as your child will remove the unit and height and weight of your child will be measured to change motion sensor readings to estimates of physical activity. These measurements will be taken at the school in private circumstances so that children will be unable to see each other's results.

What are the benefits of the study?

The study will identify the factors that influence children's physical activity. This information will be used by future researchers, health promoters and health professionals to develop effective physical activity programs. Your child's input will help us ensure that the questionnaire is appropriate and assist us in designing effective physical activity programs in the future. Participation in this study is voluntary.

Is there any risk to my child?

There will be no risk to your child and your child is free to withdraw at any stage during the study without penalty. This study is not part of the school curriculum and therefore, your child's decision to participate or not participate in the study will not have an impact on school activities.

There is potential that sensitive issues, such as bullying, may be disclosed on the questionnaires. If your child is experiencing bullying and is distressed about this, the researcher will work with an appropriate staff member to ensure that your child receives adequate support. Your child will also be directed to call the Kids HelpLine (1800 551 800) if he/she feels it is necessary. Your child can withdraw from the study at any stage without penalty.

If information about child abuse is disclosed at any stage, I am obligated to report this to the school, who will take the necessary actions.

Confidentiality

All information will be kept confidential and no information that can lead to the identification of individuals will be released. The results from this study will be reported in a PhD thesis, professional journals and at conferences. However, your child's personal details will not be presented. The data from the study will be stored in a locked facility within the University of South Australia in accordance with University guidelines. If you wish to see your own child's results these can be made available to you upon request.

This project has been reviewed by the University of South Australia's Human Research Ethics Committee. If you have any enquiries regarding ethical issues, please contact Ms Vicki Allen, the Executive Officer for this committee, on 8302 3118. . If you have further questions regarding this study, please contact me on **8302 2550** or via email at rebecca.stanley@postgrads.unisa.edu.au.

Alternatively, you may wish to contact my supervisors: Dr Jim Dollman (UniSA) 8302 1413, Dr Kobie Boshoff (UniSA) 8302 1089 and Dr Kate Ridley (Flinders University) 8201 3355.

To indicate whether or not you give permission for your child to participate in the study, please complete and return the attached consent form to your child's class teacher before **(insert date)**. **Please note that it is important you return the consent form even if you do not wish to take part in the study.** There is a space to indicate this on the form. We realise that as parents you are very busy and to thank you for taking the time to read the information and complete the consent form, **each child who returns a completed consent form will receive a squeeze-ball toy as a thank-you gift.**

Thank you very much for your time and consideration.

Rebecca Stanley
PhD Candidate

School of Health Sciences

CONSENT FORM

Measuring factors that influence lunchtime and after school physical activity in children

Researcher: Rebecca Stanley

Supervisors: Dr Jim Dollman

Dr Kobie Boshoff

Dr Kate Ridley

Please tick the appropriate box:

☐ I have received and read the information about this research project and **DO NOT CONSENT** to my child taking part.

Name of Parent/Guardian……..

Signed……**Date**…….

Name of Child……..

Signed……**Date**…….

☐ I have received and read the information about this research project and **CONSENT** to my child taking part.

- I understand that my child may withdraw from the research project at any stage and that this will not affect his/her status now or in the future.
- I understand that while information gained during the study may be published, my child will not be identified and personal results will remain confidential.
- I understand that if my child discloses information about child abuse, the researcher is required to report this to the school
- I confirm that I am over the age of 18 years, and the legal guardian or parent of the child named below.

Name of Parent/Guardian……..

Signed……**Date**…….

Name of Child……..

Signed……**Date**…….

I have provided information about the research to the research participant and believe that she understands what is involved

Researcher's signature and date……..

Appendix 15: Accelerometer instruction sheet and log sheet

Dear Student and Parent/Guardian,

Thank you for taking part in this important project. Here are a few points to remember over the next 5 days.

- Please wear your motion sensor every day, except when sleeping, showering or swimming.
  REMEMBER TO PUT IT BACK ON AS SOON AS POSSIBLE

- Please record on the log sheet why you took the motion sensor off and for how much time.

- Please wear the motion sensor on your right hip, in a straight line down from the front of your armpit (see diagram).



- **PLEASE**, just do you usual activities.

- HAVE FUN!

Thank you for your time and your cooperation!

Further information please contact Rebecca Stanley on (08) 8302 2550, or email rebecca.stanley@postgrads.unisa.edu.au

Motion Sensor Log Sheet

Child's Name:
Child's School:
Year Level:

DAY	TIME MONITOR TAKEN OFF (am/pm)	TIME MONITOR PUT BACK ON (am/pm)	BRIEF REASON
Example *Sunday*	*7.30am*	*8.30am*	*Swimming lesson*
Monday			
Tuesday			
Wednesday			
Thursday			
Friday			

Appendix 16: Variance Inflation Factor scores

Table 1 Test of multicollinearity in the lunchtime Y-PASS questionnaire using the Variance Inflation Factor (VIF) score

Predictor variable	Variance Inflation Factor
Sex	1.28
Actual age from day of data collection	1.14
SEIFA	1.27
BMI z-score	1.15
Barrier self-efficacy	1.70
Perceived self-efficacy	2.36
Behavioural attitude/belief	1.54
I can still be active at lunchtime even if I am wearing my school uniform.	1.57
I like to walk around at lunchtime.	1.31
I really like doing PE at school.	1.44
I always have the energy to be active at lunchtime.	1.49
I am just as coordinated as kids of my age and gender.	1.16
Making up your own game rules makes playing games at lunchtime more fun.	1.15
Peer influence	1.52
Teacher influence	1.20
Social barriers	1.45
Physical environmental/policy barriers	1.74
Access to space	1.55
We have school rules about where we are allowed to be active at lunchtime.	1.10
There are facilities at school, such as playgrounds or ovals, where I can be active at lunchtime.	1.17
Access to facilities and equipment	1.61
Our school play area has painted lines on the ground (e.g. hopscotch and 4-square) to help me be active at lunchtime.	1.24

Table 2 Test of multicollinearity in the after-school Y-PASS questionnaire using the Variance Inflation Factor (VIF) score

Predictor variable	Variance Inflation Factor
Sex	1.49
Actual age from day of data collection	1.26
SEIFA	1.15
BMI z-score	1.27
Behavioural attitude/belief (organised sport/activities)	3.74
Behavioural attitude/belief (non-organised activities)	3.50
Barrier self-efficacy	4.06
Support seeking	2.38
Perceived competence	1.71
Perceived barriers	2.30
I wish I could do more organised sports or activities after school than I get a chance to.	1.45
Being active after school is boring.	2.83
I do an organised sport or activity after school because I want to improve my skills.	2.42
I do an organised sport or activity after school because I want to meet new people.	1.75
I ride, walk, skate or scooter to and from places after school because it gets you fit.	1.87
Playing outside after school keeps you healthy.	1.94
I don't participate in some activities after school because it is only a boys/girls activity.	1.43
I play actively at home or in the neighbourhood after school because it gives me something to do.	1.47
I do an organised sport or activity after school because it gets you fit.	2.40
I am active after school because I don't want to put on weight.	1.41
I am confident that I can be active after school on most days even if I could watch TV or play video games instead.	2.02
I am confident that I can be active after school on most days even if it is hot or cold outside.	2.03
I am confidents that I can be active after school on most days even if I am being bullied.	1.82
I am just as coordinated as kids of my age and gender.	1.52
I am shy about how my body looks.	1.60
I really like doing PE at school.	1.54

Predictor variable	Variance Inflation Factor
Social Support	2.54
Parental barriers	1.93
Perceptions of safety	3.11
Parental rules	1.35
Bullying stops me from being active after school.	1.83
I am not active after school because I have no one to play with.	2.04
I have brothers/sisters who play actively with me after school.	1.52
My friends encourage me to be active after school.	1.71
My friends tell me I am doing well at sport.	1.79
My parents are too busy to play with me after school.	1.46
My parents make me help around the house, which stops me from being active after school.	1.39
We have a rule at home that we have to do an organised sport or activity after school.	1.33
Weather	1.84
Access to facilities and equipment	2.05
Safety	1.76
Access to space	1.61
Time commitments	1.60
Financial barriers	1.78
School bag	1.78
Dog poo on the lawn at home keeps me from being active on the grass after school.	1.31
I have enough time to do an organised sport or activity after school.	1.89
It is safe to play actively near where I live after school.	1.72
There are not enough traffic lights and crossings in my neighbourhood after school.	1.26
There is enough equipment to play actively at home after school.	1.92

Appendix 17: Univariate analyses between the potential predictor factors and predictor items and lunchtime and after-school physical activity

Univariate correlations between the lunchtime Y-PASS and LEAP II questionnaire independent variables and the percentage of lunchtime MVPA lunchtime, and the after-school Y-PASS and LEAP II questionnaire independent variables and the percentage of after-school MVPA, for boys and girls, are presented in Tables 1, 2, 3 and 4, respectively.

Table 1 Univariate correlation coefficients for the lunchtime Y-PASS independent variables and lunchtime physical activity

Predictor variable	% lunchtime MVPA	
	BOYS (n = 191)	GIRLS (n = 219)
Age	-0.20**	-0.24**
SES (SEIFA)	0.20**	-0.05
BMI z-scores	-0.19*	-0.10
Barrier self-efficacy	0.14	0.18**
Perceived self-efficacy	0.26**	0.26**
Behavioural attitude/belief	0.203**	0.03
I can still be active at lunchtime even if I am wearing my school uniform.	-0.01	0.18**
I like to walk around at lunchtime.	-0.29**	-0.28**
I really like doing PE at school.	0.17*	0.20**
I always have the energy to be active at lunchtime.	0.15*	0.14*
I am just as coordinated as kids of my age and gender.	0.12	0.01
Making up your own game rules makes playing games at lunchtime more fun.	-0.06	0.01
Peer influence	0.24**	0.25**
Teacher influence	0.01	0.05
Social barriers	0.12	0.06
Access to facilities/equipment	-0.02	0.18**
Physical environmental/policy barriers	0.02	0.14*
Access to space	0.03	0.004
We have school rules about where we are allowed to be active at lunchtime.	-0.03	0.03
There are facilities at school, such as playgrounds or ovals, where I can be active at lunchtime.	-0.03	0.13
Our school play area has painted lines on the ground (e.g. hopscotch and 4-square) to help me be active at lunchtime.	-0.03	0.08

* p<0.05, **p<0.001

Table 2 Univariate correlation coefficients for the LEAP II questionnaire independent variables and lunchtime physical activity

Predictor variable	% lunchtime MVPA	
	BOYS (n = 196)	**GIRLS (n = 208)**
Age	-0.27**	-0.08
SES (SEIFA)	0.08	0.10
BMI z-scores	-0.17*	-0.08
Perceived self-efficacy	0.16*	0.15*
Intention	0.09	0.10
Specific intention	0.06	0.08
Attitude	0.08	-0.004
Subjective norm	0.07	-0.02
Perceived behavioural control	0.13	0.08
Social support	0.12	0.15*
Perceived physical environment	0.08	0.11
Access to physical activity programs	0.07	0.09
PE enjoyment (one item)	0.14	0.24*
Sport participation	0.15*	0.17*
PE participation	0.10	-0.05
Social provisions	-0.02	0.05
Goal setting	0.07	0.01
Physical activity enjoyment	0.02	-0.12
Self-motivation	0.08	0.16*

* $p<0.05$, ** $p<0.001$

Table 3 Univariate correlation coefficients for the after-school Y-PASS independent variables and after-school physical activity

Predictor variable	% after-school MVPA	
	BOYS (n = 179)	**GIRLS (n = 208)**
Age	-0.10	-0.28**
SES (SEIFA)	0.16*	-0.05
BMI z-scores	-0.16*	-0.06
Behavioural attitudes/beliefs (organised sports/activities)	0.34**	0.20**
Behavioural attitudes/beliefs (non-organised activities)	0.38**	0.23**
Barriers self-efficacy	0.30**	0.10
Support seeking/social norm	0.28**	0.12
Perceived competence	0.25**	0.04
Perceived barriers	0.27**	0.08
I wish I could do more organised sports or activities after school than I get a chance to.	0.09	0.01
Being active after school is boring.	0.20**	0.16*
I do an organised sport or activity after school because I want to improve my skills.	0.27**	0.16*
I do an organised sport or activity after school because I want to meet new people.	0.26**	0.05
I ride, walk, skate or scooter to and from places after school because it gets you fit.	0.18*	0.03
Playing outside after school keeps you healthy.	0.13	0.12
I don't participate in some activities after school because it is only a boys/girls activity.	0.18*	-0.02
I play actively at home or in the neighbourhood after school because it gives me something to do.	0.09	-0.00
I do an organised sport or activity after school because it gets you fit.	0.28*	0.26**
I am active after school because I don't want to put on weight.	-0.04	0.003
I am confident that I can be active after school on most days even if I could watch TV or play video games instead.	0.14	0.13
I am confident that I can be active after school on most days even if it is hot or cold outside.	0.22**	0.16*
I am confident that I can be active after school on most days even if I am being bullied.	0.07	0.04
I am just as coordinated as kids of my age and gender.	0.17*	0.07
I am shy about how my body looks.	0.18*	-0.03
I really like doing PE at school.	0.09	0.21**

Predictor variable	% after-school MVPA	
	BOYS (n = 179)	GIRLS (n = 208)
Social support	0.35**	0.20**
Parental barriers	0.14	0.10
License to be active	0.21**	0.14*
Parental rules	-0.02	0.02
Bullying stops me from being active after school.	0.12	0.11
I am not active after school because I have no one to play with.	0.34**	0.07
I have brothers/sisters who play actively with me after school.	0.11	0.03
My friends encourage me to be active after school.	0.17*	-0.002
My friends tell me I am doing well at sport.	0.10	0.08
My parents are too busy to play with me after school.	0.19**	0.15*
My parents make me help around the house, which stops me from being active after school.	0.19**	0.06
We have a rule at home that we have to do an organised sport or activity after school.	0.11	0.14*
Weather	0.32**	0.05
Access to facilities/equipment	0.26**	0.10
Safety	0.10	0.01
Access to space	0.19*	0.03
Time commitments	0.21**	0.07
Financial barriers	0.17*	-0.01
School bag	0.21**	0.03
Dog poo on the lawn at home keeps me from being active on the grass after school.	0.03	0.03
I have enough time to do an organised sport or activity after school.	0.26**	0.12
It is safe to play actively near where I live after school.	0.18*	0.02
There are not enough traffic lights and crossings in my neighbourhood after school.	0.017*	-0.003
There is enough equipment to play actively at home after school.	0.14	0.05

* p<0.05, **p<0.001

Table 4 Univariate correlation coefficients for the LEAP II questionnaire independent variables and after-school physical activity

Predictor variable	% after-school MVPA	
	BOYS (n = 185)	**GIRLS (n = 200)**
Age	-0.14	-0.22**
SES (SEIFA)	0.15*	-0.04
BMI z-scores	-0.14	-0.05
Perceived self-efficacy	0.13	0.26**
Intention	0.16*	0.29**
Specific intentions	0.15*	0.05
Attitude	-0.18*	-0.06
Subjective norm	0.05	0.06
Perceived behavioural control	0.20**	0.24**
Social support	0.16*	0.19**
Perceived physical environment	0.20*	0.12
Access to physical activity programs	0.11	0.11
PE enjoyment (one item)	0.02	0.07
Sport participation	0.26**	0.37**
PE participation	0.08	0.13
Social provisions	0.08	0.17*
Goal setting	0.01	0.06
Physical activity enjoyment	-0.15*	-0.09
Self-motivation	-0.001	0.02

* $p<0.05$, ** $p<0.001$

Appendix 18: Complete list of activities identified from the activity checklist (for boys and girls)

Table 1 Most reported lunchtime activities

GIRLS (n = 219)				BOYS (n = 191)			
Activity	**n**	**%**	**Total frequency**	**Activity**	**n**	**%**	**Total frequency**
Sitting (e.g. eating, talking to friends, lunchtime meetings, writing, reading)	172	78.5	87376	Running/jogging	125	65.4	45500
Walking around the schoolyard	176	80.4	86592	Mucking around outdoors in the schoolyard	121	63.4	39809
Mucking around outdoors in the schoolyard	157	71.7	74261	Walking around the school yard	126	66.0	38934
Running/jogging	138	63.0	49818	Football (Australian/Gaelic/American)	100	52.4	27400
Chasey/tag/tips/tiggy	138	63.0	41814	Chasey/tag/tips/tiggy	108	56.5	25272
Playing on playground equipment (e.g. monkey bars)	93	42.5	16740	Sitting (e.g. eating, talking to friends, lunchtime meetings, writing, reading)	93	48.7	23157
Computer work (e.g. typing, internet)	88	40.2	16456	Computer work (e.g. typing, internet)	90	47.1	17460
Netball	86	39.3	15136	Soccer (field/indoor)	83	43.5	16434
Dodgeball/poisonball/brandy/speedball	92	42.0	13892	Dodgeball/poisonball/brandy/speedball	98	51.3	15778
Skipping/jump rope	70	32.0	9240	Hand tennis/foursquare	66	34.6	9570
Playing catch	64	29.2	7296	Basketball	55	28.8	6050
Arts and crafts	66	30.1	7128	Playing on playground equipment (e.g. monkey bars)	57	29.8	6042

GIRLS (n = 219)				BOYS (n = 191)			
Activity	**n**	**%**	**Total frequency**	**Activity**	**n**	**%**	**Total frequency**
Soccer (field/indoor)	43	19.6	3655	Cricket	46	24.1	2990
Hand tennis/foursquare	40	18.3	3080	Playing catch	42	22.0	2856
Basketball	37	16.9	2553	Arts and crafts	41	21.5	2337
Football (Australian/Gaelic/American)	33	15.1	2310	Kickball	29	15.2	1827
Kickball	35	16.0	2065	Touch football	31	16.2	1674
Cricket	14	6.4	322	Skipping/jump rope	34	17.8	1598
Rugby league/union	10	4.6	190	Rugby league/union	26	13.6	1326
Dance	6	2.7	102	Netball	12	6.3	240
Touch football	4	1.8	52	Riding bike/scooter	7	3.7	168
Hula hoops	5	2.3	45	Computer games	4	2.1	56
Musical instrument	4	1.8	24	Tennis	6	3.1	54
Tennis	3	1.4	18	Hockey	2	1.0	12
Sand pit	3	1.4	18	Climbing trees	2	1.0	12
School clubs	3	1.4	15	Table tennis	2	1.0	6
Baseball	2	0.9	10	School clubs	2	1.0	4
Shooting hoops	2	0.9	6	Hide and seek	1	0.5	4
Gymnastics	2	0.9	6	Musical instrument	1	0.5	2
Hockey	1	0.5	2	Shooting hoops	1	0.5	2
Riding bike/scooter	1	0.5	2	Gardening	1	0.5	1
Gardening	1	0.5	2	Karate	1	0.5	1

GIRLS (n = 219)				BOYS (n = 191)			
Activity	**n**	**%**	**Total frequency**	**Activity**	**n**	**%**	**Total frequency**
Cheerleading	1	0.5	2	Dance	0	0.0	0
Table tennis	1	0.5	2	Baseball	0	0.0	0
Hide and seek	1	0.5	1	Sand pit	0	0.0	0
Athletics	1	0.5	1	Gymnastics	0	0.0	0
Karate	1	0.5	1	Athletics	0	0.0	0
Volleyball	1	0.5	1	Hula hoops	0	0.0	0
Computer games	0	0.0	0	Volleyball	0	0.0	0
Climbing trees	0	0.0	0	Cheerleading	0	0.0	0

Notes: Total frequency was calculated as the number of children reporting the activity, multiplied by the number of bouts of activity they engaged in.
% = the number of girls/boys reporting the activity divided by the total number of girls/boys, multiplied by 100.

Table 2 Most reported after-school activities

GIRLS (n = 208)				BOYS (n = 179)			
Activity	**n**	**%**	**Total frequency**	**Activity**	**n**	**%**	**Total frequency**
Studying, homework or writing	169	81.3	81796	Watching TV	132	73.7	52140
Watching TV	169	81.3	81796	Mucking around outdoors	113	63.1	37177
Dressing and undressing	142	68.3	74692	Running/jogging	116	64.8	36308
Sitting (e.g. talking/eating/reading)	152	73.1	71288	Computer console games (e.g. playstation/xbox/handheld)	126	70.4	35658
Mucking around indoors (walk/run)	153	73.6	64719	Studying, homework or writing	107	59.8	33812
Packing/unpacking bag	135	64.9	60615	Mucking around indoors (walk/run)	105	58.7	31920
Mucking around outdoors	146	70.2	58838	Packing/unpacking bag	95	53.1	31065
Feeding or caring for pets/farm animals	133	63.9	57855	Walking	101	56.4	30704
Walking	135	64.9	53730	Riding in a car/truck	98	54.7	29498
Riding in a car/truck	125	60.1	51125	Sitting (e.g. talking/eating/reading)	98	54.7	29400
Running/jogging	128	61.5	43776	Dressing and undressing	87	48.6	28623
Playing with animals (e.g. throwing a ball to your dog)	118	56.7	36580	Computer work (e.g. typing/internet)	107	59.8	23005
Computer work (e.g. typing/internet)	132	63.5	36036	Feeding or caring for pets/farm animals	85	47.5	22525
Tidying/cleaning room	135	64.9	33615	Playing with animals (e.g. throwing a ball to your dog)	88	49.2	22088
Shopping	135	64.9	33480	Riding a bicycle/bike/scooter	87	48.6	19227
Netball	109	52.4	25833	Tidying/cleaning room	82	45.8	12956
Computer console games (e.g. playstation/xbox/handheld)	112	53.8	24640	Football (Australian/Gaelic/American)	70	39.1	12810
Riding a bicycle/bike/scooter	106	51.0	20246	Soccer (field/indoor)	68	38.0	11900

GIRLS (n = 208)				BOYS (n = 179)			
Activity	**n**	**%**	**Total frequency**	**Activity**	**n**	**%**	**Total frequency**
Trampoline	91	43.8	19019	Basketball	63	35.2	8001
Dancing (general)	85	40.9	17510	Trampoline	59	33.0	7611
Arts and crafts	100	48.1	17500	Shopping	73	40.8	7592
Walking the dog	80	38.5	13120	Walking the dog	57	31.8	6726
Playing cards/puzzles/board games	69	33.2	7245	Playing cards/puzzles/board games	61	34.1	5673
Playing the piano or organ	45	21.6	4725	Arts and crafts	46	25.7	3726
Soccer (field/indoor)	41	19.7	3362	Kickball	31	17.3	2139
Swimming laps	42	20.2	3024	Playing the piano or organ	20	11.2	860
Basketball	37	17.8	2257	Swimming laps	22	12.3	792
Kickball	27	13.0	1404	Riding in a bus/train/tram	23	12.8	782
Riding in a bus/train/tram	21	10.1	945	Netball	23	12.8	736
Football (Australian/Gaelic/American)	18	8.7	468	Dancing (general)	20	11.2	660
Horse riding	12	5.8	396	Hockey	7	3.9	105
Singing	9	4.3	252	Karate	5	2.8	55
Gymnastics	10	4.8	240	Motor bikes	4	2.2	40
Skipping	6	2.9	84	Playing with sibling(s)	2	1.1	16
Hockey	6	2.9	66	Cooking	3	1.7	15
Volleyball	5	2.4	45	Climbing trees	2	1.1	12
Chasey	3	1.4	36	Musical instrument	2	1.1	10
Playing with sibling(s)	3	1.4	30	Singing	2	1.1	6
Tennis	4	1.9	24	Tennis	2	1.1	4

GIRLS (n = 208)				BOYS (n = 179)			
Activity	**n**	**%**	**Total frequency**	**Activity**	**n**	**%**	**Total frequency**
Motor bikes	4	1.9	24	Scouts	2	1.1	4
Chores	3	1.4	24	Horse riding	2	1.1	4
Musical instrument	3	1.4	18	Chores	1	0.6	4
Work out	2	1.0	16	Medical care	1	0.6	4
Cricket	2	1.0	10	Sailing	1	0.6	2
Baseball	2	1.0	10	Volleyball	1	0.6	2
Girl Guides	3	1.4	9	OSHC	1	0.6	2
Wrestling	2	1.0	8	Squash	1	0.6	2
Karate	2	1.0	4	Chasey	1	0.6	2
Calisthenics	1	0.5	4	Cricket	1	0.6	1
Hacky sack	1	0.5	4	Fishing	1	0.6	1
Volunteer work	1	0.5	4	Girl Guides	0	0.0	0
Scouts	1	0.5	2	Work out	0	0.0	0
Cooking	1	0.5	2	Athletics	0	0.0	0
Visiting family	1	0.5	2	Theatre	0	0.0	0
Climbing trees	1	0.5	2	Gymnastics	0	0.0	0
Cheerleading	1	0.5	2	Skipping	0	0.0	0
Hula Hoop	1	0.5	2	Visiting family	0	0.0	0
Playing catch	1	0.5	2	Cheerleading	0	0.0	0
Athletics	1	0.5	1	Boxing	0	0.0	0
Theatre	1	0.5	1	Rugby	0	0.0	0

GIRLS (n = 208)				BOYS (n = 179)			
Activity	**n**	**%**	**Total frequency**	**Activity**	**n**	**%**	**Total frequency**
Sailing	1	0.5	1	Calisthenics	0	0.0	0
Boxing	1	0.5	1	Hula Hoop	0	0.0	0
Shooting hoops	1	0.5	1	Shooting hoops	0	0.0	0
Gardening	1	0.5	1	Playing catch	0	0.0	0
OSHC	0	0.0	0	Wrestling	0	0.0	0
Squash	0	0.0	0	Gardening	0	0.0	0
Rugby	0	0.0	0	Baseball	0	0.0	0
Medical care	0	0.0	0	Hacky sack	0	0.0	0
Fishing	0	0.0	0	Volunteer work	0	0.0	0

Notes: Total frequency was calculated as the number of children reporting the activity, multiplied by the number of bouts of activity they engaged in.
% = the number of girls/boys reporting the activity divided by the total number of girls/boys, multiplied by 100.