
The Biological and Behavioural Effects
of Maternal Trauma and Posttraumatic
Stress Disorder on Child Development

Thesis submitted for the degree of
Doctor of Philosophy

by
Jacqueline Anne Beall

December 2006

The University of Adelaide, Australia

Discipline of Psychiatry
School of Medicine
Faculty of Health Sciences

Table of Contents

List of Tables	xi
List of Figures	xvi
Abstract	xvii
Declaration	xix
Acknowledgements	xx
1. Introduction	1
<i>1.1. Significance of the Study</i>	<i>1</i>
<i>1.2. Aims of the Study</i>	<i>3</i>
<i>1.3. Overview of Thesis</i>	<i>4</i>
2. Literature Review	6
2.1. <i>Trauma</i>	8
2.1.1. Psychopathology Following Trauma	9
2.1.1.1. Trauma prevalence rates.....	9
2.1.1.2. Psychological impact of traumatic events	11
2.1.1.3. Prevalence of PTSD	12
2.1.1.4. Diagnosis and characteristics of PTSD.....	15
2.1.1.5. Longitudinal course of PTSD.....	17
2.1.1.6. Models of PTSD development	18
2.1.2. Biological Impact of Trauma	20
2.1.2.1. The HPA system.....	20
2.1.2.1.1. Normal production of cortisol.....	21
2.1.2.1.2. Normal stress response.....	22
2.1.2.1.3. Measurement of the stress response	23
2.1.2.1.4. Effects of PTSD on the HPA axis	24

2.1.2.1.5.	Intergenerational transmission of PTSD	29
2.2.	<i>Impact of Trauma on Parenting Behaviours</i>	36
2.2.1.	Animal Studies.....	36
2.2.2.	Attachment: The Importance of the Carer-Infant Relationship.....	38
2.2.2.1.	Attachment behavioural system.....	38
2.2.2.1.1.	Secure base behaviour.....	39
2.2.2.1.2.	Internal working model.....	40
2.2.2.2.	Patterns of infant attachment	42
2.2.2.3.	Patterns of adult attachment	45
2.2.2.4.	Development of self regulation	46
2.2.2.4.1.	Attachment and cortisol	47
2.2.2.5.	Attachment and the development of psychopathology.....	50
2.2.2.5.1.	Internalising and externalising problems	51
2.2.2.5.2.	Developmental abilities.....	53
2.2.2.6.	Carer behaviours.....	56
2.2.3.	Impact of Maternal Mental Health on the Mother-Infant Relationship.....	60
2.2.3.1.	Depression.....	60
2.2.3.2.	Anxiety	63
2.2.4.	PTSD and Parenting.....	64
2.2.4.1.	Impact of PTSD on effective parenting.....	66
2.2.4.2.	Impact of PTSD on attachment	67
2.2.4.3.	Impact of parental PTSD on child outcomes.....	69
2.2.4.4.	Intergenerational effects of PTSD	70
2.3.	<i>Summary and Study Aims</i>	72
3.	Study Design and Methods	77
3.1.	<i>Study Design</i>	77
3.1.1.	Recruitment.....	78
3.1.2.	Ethics Approval and Grant Support	79
3.1.3.	Procedure	80
3.2.	<i>Methods</i>	83

3.2.1.	Mother Specific Measures	86
3.2.1.1.	Personal information	86
3.2.1.1.1.	Mothers' report of children's health.....	86
3.2.1.1.2.	Child care arrangements.....	87
3.2.1.1.3.	Ongoing stress.....	87
3.2.1.1.4.	Social connectedness.....	87
3.2.1.2.	Lifetime mental health problems and trauma exposure.....	88
3.2.1.2.1.	Composite International Diagnostic Interview-2.1 (CIDI 2.1).....	88
3.2.1.2.1.1.	Posttraumatic stress disorder (PTSD).....	89
3.2.1.2.1.2.	Depression and anxiety	92
3.2.1.2.2.	Traumatic Antecedence Questionnaire (TAQ).....	92
3.2.1.3.	Mothers current mental health.....	93
3.2.1.3.1.	General Health Questionnaire 28 items (GHQ-28).....	94
3.2.1.3.2.	Posttraumatic Stress Disorder Checklist-Civilian Version (PCL-C).....	96
3.2.1.3.3.	Dissociative Experience Scale (DES)	97
3.2.1.3.4.	Impact of Event Scale (IES).....	98
3.2.1.3.5.	Edinburgh Postnatal Depression Scale (EPDS)	99
3.2.1.4.	Mothers perceptions of parenting	100
3.2.1.4.1.	Mother and Baby Scale (MABS)	100
3.2.1.4.2.	Personal Appraisal Inventory (PAI).....	101
3.2.1.4.3.	Parental Stress Index (PSI).....	103
3.2.1.4.4.	Parent-Child Relationship Inventory (PCRI)	104
3.2.2.	Infant Specific Measures.....	106
3.2.2.1.	Behavioural measures.....	106
3.2.2.1.1.	Neurological and Adaptive Capacity Assessment (NACS)	106
3.2.2.1.2.	Neonatal Behavioural Assessment Scale (NBAS)	106
3.2.2.1.3.	Child Behaviour Checklist (CBCL)	107
3.2.2.2.	Cognitive measures	108
3.2.2.2.1.	The Griffiths Mental Development Scales (GMDS).....	108
3.2.2.2.2.	Reynell Developmental Language Scales (RDLS)	109
3.2.2.2.3.	Language Development Survey (LDS)	110
3.2.2.3.	Temperament measure.....	112

3.2.2.3.1.	Distress to novelty.....	112
3.2.2.3.2.	Emotionality Activity and Sociability (EAS) questionnaire	112
3.2.3.	Mother-Infant Dyad Relational Measures.....	114
3.2.3.1.	Alarm Distress Baby Scale (ADBB)	114
3.2.3.2.	Emotional Availability (EA) scales.....	115
3.2.3.3.	Strange Situation Procedure (SSP).....	117
3.2.4.	Physiology Measure.....	119
3.2.4.1.	Salivary cortisol testing	120
3.2.4.1.1.	Saliva collection.....	120
3.2.4.1.2.	Saliva assays	121
3.2.5.	Statistical Analyses	122
4.	Sample Description and Trauma Groups	123
4.1.	<i>Sample Numbers</i>	<i>123</i>
4.2.	<i>Sample Description and Demographics</i>	<i>124</i>
4.2.1.	Mothers	126
4.2.1.1.	Comparisons between study mothers and withdrawals	126
4.2.2.	Infants	128
4.3.	<i>Maternal Trauma History and PTSD Diagnosis</i>	<i>129</i>
4.3.1.	Maternal Life-Time Trauma Experience and Diagnosis of PTSD	130
4.3.1.1.	Trauma experience	130
4.3.1.2.	Trauma symptoms and lifetime PTSD diagnosis	133
4.3.1.3.	Trauma and PTSD status of women who withdrew	135
4.3.2.	Trauma Groups	135
4.4.	<i>Group Comparisons for Mother Specific Measures</i>	<i>136</i>
4.4.1.	Demographics	137
4.4.2.	Mothers Family Trauma History.....	138
4.4.3.	Birth Trauma.....	141
4.4.4.	Maternal Lifetime Mental Health History.....	141
4.4.4.1.	Depression.....	143
4.4.4.2.	Anxiety	143

4.4.4.3.	Comorbidity and posttraumatic stress disorder.....	143
4.4.5.	Maternal Current Mental Health.....	144
4.4.5.1.	Postnatal depression.....	144
4.4.5.2.	General psychological distress.....	145
4.4.5.2.1.	Multiparous compared to primiparous mothers.....	149
4.4.5.3.	Current trauma symptoms.....	150
4.4.5.3.1.	Posttraumatic Stress Checklist (PCL-C).....	150
4.4.5.3.2.	Dissociative Experiences Scale (DES).....	151
4.4.6.	Life Stressors.....	153
4.4.6.1.	Relationship stress.....	155
4.4.6.2.	Parenting stress.....	155
4.4.6.2.1.	Relationship between PSI and maternal mental health.....	156
4.4.6.2.2.	Relationship between PSI and maternal trauma.....	158
4.4.7.	Confidence in Parenting.....	161
4.4.7.1.	Mother and Baby Scale (MABS).....	161
4.4.7.1.1.	Relationship between MABS and maternal mental health.....	162
4.4.7.1.2.	Relationship between MABS and maternal trauma.....	162
4.4.7.2.	Personal Appraisal Inventory (PAI).....	163
4.4.7.2.1.	Relationship between PAI and maternal mental health.....	164
4.4.7.2.2.	Relationship between PAI and maternal trauma.....	166
4.4.8.	Social Connectedness.....	167
4.4.9.	Group Comparison for Infant Measures.....	167
4.4.9.1.	Birth measures.....	168
4.4.9.2.	Neonatal development measures.....	168
4.4.9.3.	Child Development Quotient (CDQ).....	168
4.4.9.3.1.	Relationship to maternal trauma.....	169
4.4.9.3.2.	Relationship to ongoing maternal mental health.....	170
4.4.9.4.	Infant health.....	170
4.4.9.5.	Infant temperament.....	170
4.4.9.5.1.	Relationship to maternal trauma.....	171
4.4.9.5.2.	Relationship to ongoing maternal mental health.....	172

4.5.	<i>Mental Health Comparisons between Study Mothers and Withdrawals</i>	172
4.6.	<i>Summary and Discussion</i>	174
5.	Relationship between Mother and Child Cortisol Levels	185
5.1.	<i>Results</i>	188
5.1.1.	Preliminary Analyses	189
5.1.1.1.	Associations with obstetric, antenatal and sociodemographic variables	189
5.1.2.	Relationship between Mothers and Infants Cortisol Measures	191
5.1.3.	Mother and Infant Cortisol Levels and Maternal Trauma Experience	191
5.1.3.1.	Relationship between mother and infant cortisol levels and trauma experience	193
5.1.3.2.	Trauma group differences for mother and child cortisol levels	198
5.1.4.	Mother and Infant Cortisol Levels and Maternal Ongoing Mental Health	202
5.1.5.	Predictors of Mother and Infant Cortisol Levels.....	208
5.1.6.	Relationship of Infant Temperament to Maternal and Infant Cortisol	221
5.2.	<i>Summary and Discussion</i>	222
6.	The Impact of Trauma on Infant-Carer Interactions	238
6.1.	<i>The impact of Trauma on Mother-Infant Interactions</i>	241
6.1.1.	Infant Withdrawal at 3 Months of Age	242
6.1.1.1.	Relationship between withdrawal and maternal trauma	242
6.1.1.2.	Relationship between withdrawal and maternal mental health.....	242
6.1.1.3.	Relationship between infant withdrawal and biological measures	243
6.1.1.4.	Relationship between infant withdrawal and maternal perceptions of parenting	244
6.1.2.	Emotional Availability at 13 Months of Age	244
6.1.2.1.	Relationship between trauma and EA.....	244
6.1.2.2.	Relationship between EA and maternal ongoing mental health	248
6.1.2.3.	Relationship between EA and biological measures	248
6.1.2.4.	Relationships between EA and maternal perceptions of parenting.....	249
6.1.3.	Infant Attachment at 19 Months of Age.....	249
6.1.3.1.	Relationship between attachment and trauma groups.....	251
6.1.3.1.1.	Description of mothers with disorganised infants	251
6.1.3.2.	Relationship between attachment and maternal mental health	255

6.1.3.3.	Relationship between attachment and cortisol.....	255
6.1.3.4.	Relationships between maternal perceptions and attachment.....	256
6.1.4.	Relationship between Infant Withdrawal, Maternal Emotional Availability and Attachment Status	256
6.1.5.	Relationship of Infant Temperament to Measures of Mother-Infant Interaction	258
6.2.	<i>The Impact of Trauma on Hypervigilance and Over-protectiveness</i>	260
6.2.1.	Maternal Hypervigilance.....	260
6.2.2.	Maternal Over-protectiveness	263
6.3.	<i>Summary and Discussion</i>	264
7.	Impact of Maternal Trauma on Child Developmental Outcomes	277
7.1.	<i>Infants</i>	279
7.2.	<i>Language Development</i>	279
7.2.1.	Examiner Assessed Language Development at 19 Months of Age	280
7.2.1.1.	Relationship to maternal trauma.....	281
7.2.1.2.	Relationship to ongoing maternal mental health	283
7.2.1.3.	Relationship to measures of mother-infant interaction.....	283
7.2.1.4.	Relationship to maternal and infant cortisol.....	285
7.2.1.5.	Predictors of language development at 19 months of age	285
7.2.2.	Maternal Report of Language Development at 24 Months of Age	290
7.2.2.1.	Relationship to maternal trauma.....	290
7.2.2.2.	Relationship to ongoing maternal mental health	291
7.2.2.3.	Relationship to measures of mother-infant interaction.....	293
7.2.2.4.	Relationship to maternal and infant cortisol.....	295
7.2.2.5.	Predictors of language development at 24 months of age	297
7.2.3.	Maternal-infant Interactions as Mediators between Maternal Trauma and Language Outcomes.....	299
7.3.	<i>Emotional and Behavioural Development at 24 Months of Age</i>	299
7.3.1.	Relationship to Maternal Trauma.....	300
7.3.2.	Relationship to Ongoing Maternal Mental Health	301
7.3.2.1.	Mental health as mediator or moderator of child self regulation.....	305

7.3.3.	Relationship to Measures of Mother-Infant Interaction	306
7.3.4.	Relationship to Maternal and Infant Cortisol.....	308
7.3.5.	Predictors of Child Behavioural Outcomes.....	308
7.4.	<i>Summary and Discussion</i>	311
8.	Discussion and Conclusion	326
8.1.	<i>Limitations and Methodological Issues</i>	326
8.1.1.	Sample	327
8.1.1.1.	Recruitment and Sample Composition	327
8.1.1.2.	Size	329
8.1.2.	Measures	330
8.1.2.1.	Cortisol	331
8.1.2.2.	Maternal-infant interactions	332
8.1.2.3.	Cognitive functioning	334
8.1.2.4.	Child self regulation	334
8.2.	<i>Summary of Study Findings</i>	335
8.3.	<i>Discussion and Clinical Implications</i>	339
8.3.1.	PTSD Diagnosis.....	339
8.3.2.	Intergenerational Transmission of Resilience and Vulnerability	342
8.3.2.1.	Resilience	343
8.3.2.1.1.	Clinical implications	347
8.3.2.2.	Vulnerability.....	349
8.3.2.2.1.	Clinical implications	351
8.4.	<i>Concluding Comments</i>	353
	References.....	355
	Appendices.....	383
	<i>A Appendices: Participation and Consent Forms</i>	383
A.1.	Participation Information Sheet.....	383
A.2.	Mother Consent Form.....	385

A.3. Child Consent Form	387
A.4. Video Recording Consent Form 1	389
A.5. Video Recording Consent Form 2	391
A.6. The University of Adelaide Human Research Ethics Committee: Document for people who are subjects in a research project	393
<i>B Appendices: Questionnaires</i>	<i>395</i>
B.1. Personal Information Questionnaire	395
B.2. Traumatic Antecedants Questionnaire (TAQ)	398
B.3. Posttraumatic Checklist-Civilian (PCL-C)	403
B.4. Dissociation Experiences Scale (DES)	405
B.5. Impact of Events Scale-Revised (IES-R).....	408
B.6. Edinburgh Postnatal Depression Scale (EPDS)	410
B.7. Mother and Baby Scale (MABS).....	412
B.8. Personal Appraisal Inventory (PAI)	415
B.9. The Emotionality, Activity and Sociability (EAS) temperament survey	419
B.10. Alarm Distress Baby Scale (ADBB)	421
B.11. Saliva Collection Instructions.....	423
<i>C Appendices: Certificates of accreditation</i>	<i>425</i>
C.1. Accreditation for Griffith Mental Development Scales (GMDS)	425
C.2. Accreditation for Strange Situation Procedure (SSP)	427

List of Tables

Table 3.1. Overview of the methods used in phase one by Linke (2002) and Lowe (2003)	84
Table 3.2. Overview of methods used in phase two.....	85
Table 3.3. Differences in the DSM-IV and ICD-10 diagnostic criteria requirement for the diagnosis of PTSD	91
Table 4.1. Family marital status, number of children, and annual gross income after the birth of the study child.....	127
Table 4.2. Birth country, education level, and employment status before the birth of the study child, for both the mother and father.	128
Table 4.3. Comparison of demographic variables between participants who withdrew from the study and those who completed study	129
Table 4.4. Lifetime occurrence of traumatic experiences of women in the current study compared with a survey of Australian women (ANSMHW).....	131
Table 4.5. Types of traumatic experiences of women in the current study compared with a survey of Australian women (ANSMHW)	132
Table 4.6. Number of women who met each diagnostic criteria for both the DSM-IV and ICD-10 PTSD criteria	134
Table 4.7. Summary of maternal family trauma experiences across their life span as measured by the TAQ.....	139
Table 4.8. Trauma group comparisons for TAQ summary scores	140
Table 4.9. Frequency of lifetime occurrence of anxiety and depression by trauma groups	142
Table 4.10. Mean and standard deviations for General Health Questionnaire total and subscale scores for each trauma group.....	146

Table 4.11. Case levels of psychological distress as measured by the GHQ-28 (cut-off 5/6) for each trauma group and as a whole group across the six assessment periods.	148
Table 4.12. Means and standard deviations for PCL-C scores over the course of the study.....	152
Table 4.13. Descriptive statistics for DES scores at each assessment period.....	153
Table 4.14. Means and standard deviations of maternal life stressors for each trauma group.	154
Table 4.15. PSI descriptive statistics for the current study compared with the expected range.	156
Table 4.16. Correlations between concurrent GHQ summary scores, ongoing Life Stress measure and PSI summary scores.....	157
Table 4.17. <i>T</i> -test results for PSI and control and trauma groups.	159
Table 4.18. Analysis of variance results for PSI and control, trauma control and PTSD groups.....	160
Table 4.19. Correlations between GHQ summary scores and MABS when infants were 2 weeks old	163
Table 4.20. Means and standard deviations of MABS scores for the total sample and the trauma groups.....	164
Table 4.21. Correlations between GHQ summary scores and the PAI	165
Table 4.22. Means and standard deviations of PAI scale scores for the three trauma groups.....	166
Table 4.23. Group statistics for the Griffiths General Developmental Quotient measured at 13 months	169
Table 4.24. Results of analysis of variance for the EAS and trauma groups.....	171
Table 4.25. Correlations between EAS temperament ratings at 24 months and maternal mental health in the perinatal period and over the second year of the infants' life.....	173
Table 4.26. Comparison of maternal prenatal mental health between mothers who withdrew from the Study and mothers who remained.....	174
Table 5.1. Descriptive statistics for mother and child morning and evening saliva cortisol levels	190
Table 5.2. Pearson partial correlations between mother and infant morning, evening, total cortisol and difference scores, controlling for maternal age	192

Table 5.3. Pearson partial correlations between mother and infant morning, evening, total cortisol and difference scores for the control and trauma Groups	194
Table 5.4. Descriptive statistics for absolute differences between mother and infant morning cortisol for each trauma group	196
Table 5.5. Pearson partial correlations between mother and infant cortisol measures, controlling for maternal age, and number of traumas and PTSD symptoms experienced post trauma.....	199
Table 5.6. Log-transformed means and standard deviations of mother and infant cortisol levels for different groups based on trauma experience and diagnosis of PTSD.....	201
Table 5.7. Pearson partial correlations between mother and infant cortisol measures and ongoing maternal mental health, controlling for maternal age	204
Table 5.8. Hierarchical regression analyses for the dependent variable maternal morning cortisol for the total sample and trauma group alone	211
Table 5.9. Block 4 beta weights, <i>t</i> tests and significance levels for independent variables predicting maternal morning cortisol for the whole sample and the trauma group alone	212
Table 5.10. Hierarchical regression analyses for the dependent variable maternal evening cortisol for the total sample and trauma group alone	213
Table 5.11. Block 4 beta weights, <i>t</i> tests and significance levels for independent variables predicting maternal evening cortisol for the whole sample and the trauma group alone	214
Table 5.12. Hierarchical regression analyses for the dependent variable child morning cortisol for the total sample and trauma group alone	217
Table 5.13. Block 4 beta weights, <i>t</i> tests and significance levels for independent variables predicting child morning cortisol for the whole sample and the trauma group only.....	218
Table 5.14. Hierarchical regression analyses for the dependent variable child evening cortisol for the total sample and trauma group alone	219

Table 5.15. Block 4 beta weights, <i>t</i> tests and significance levels for independent variables predicting child evening cortisol for the whole sample and the trauma group alone	220
Table 6.1. ANOVA and chi-square analyses of infant withdrawal and trauma groups.....	243
Table 6.2. Descriptive statistics for the Emotional Availability scale scores for the total sample	245
Table 6.3. Multivariate analysis of variance comparing the Emotional Availability scale scores between control and trauma groups, controlling for concurrent mental health.....	246
Table 6.4. Descriptive statistics of the Emotional Availability scale scores for the control, trauma control, PTSD (ICD-10), and PTSD (DSM-IV) groups	247
Table 6.5. Percentage of A-B-C-D attachment categories found in the different trauma groups.....	250
Table 6.6. Correlations between maternal perceptions of infant behaviour and examiner ratings.....	261
Table 6.7. Group comparisons for PCRI subscale of autonomy	264
Table 7.1. Descriptive statistics of Reynell Developmental Language Scales by gender	280
Table 7.2. Estimated marginal means of the Reynell comprehension and expressive language variables, covaried for gender and IQ, for the control and trauma group as a whole, and in relation to PTSD diagnosis	282
Table 7.3. Estimated marginal means of the Reynell comprehension and expressive language variables, covaried for gender and IQ, for the high, medium and low emotional availability groups.....	284
Table 7.4. Estimated marginal means of the Reynell comprehension and expressive language variables, covaried for gender and IQ, for the attachment groups of secure-insecure, secure-avoidant-ambivalent, and organised-disorganised	286
Table 7.5. Estimated marginal means of the Reynell comprehension and expressive language variables, covaried for gender and IQ, for infant and mother high-low groups	287
Table 7.6. Regression analysis of RDLS comprehension and expressive language variables	288
Table 7.7. Descriptive statistics of Achenbach Language Development Survey raw scores by gender.....	290

Table 7.8. Estimated marginal means of the LDS average phrase length and total vocabulary raw scores, covaried for gender and IQ, for the control and trauma group as a whole, and in relation to PTSD diagnosis.....	292
Table 7.9. Estimated marginal means of the Reynell comprehension and expressive language variables, covaried for gender and IQ, for the high and low emotional availability groups	294
Table 7.10. Estimated marginal means of the Language Development Survey scales, covaried for gender and IQ, for the attachment groups of secure-insecure, secure-avoidant-ambivalent, and organised-disorganised...	295
Table 7.11. Estimated marginal means of the Language Developmental Survey, covaried for gender and IQ, for infant and mother high-low groups	296
Table 7.12. Regression analysis of LDS language variables.....	298
Table 7.13. One-way ANOVA analyses of CBCL summary scores and trauma groups	301
Table 7.14. Correlations of perinatal and second year summary scores for maternal mental health and CBCL total and subscale scores	302
Table 7.15. Group comparisons for normal and problem CBCL scores and ongoing maternal mental health variables.....	304
Table 7.16. CBCL marginal means, standard errors and multivariate statistics for high and low antenatal PCL groups controlled for general psychological distress in the antenatal and postnatal periods as well as post traumatic stress symptoms in the postnatal period.....	306
Table 7.17. Means and standard deviations of the CBCL summary scores for the attachment groups of secure-insecure, secure-avoidant-ambivalent, and organised-disorganised.....	307
Table 7.18. CBCL means and standard deviations for High, Median and Low cortisol groups	309
Table 7.19. Regression analyses for CBCL Total score for the whole sample and the trauma group only	310

List of Figures

- Figure 4-1.** Flow diagram of subject recruitment and withdrawals. Yellow boxes represent assessment periods conducted by Linke (2002) and Lowe (2003). Blue boxes represent the current study. 125
- Figure 4-2.** Flow diagram of subject participation and trauma group assignment. 136
- Figure 5-1.** Scatterplot of log transformed child morning cortisol levels correlated with their mother's log-transformed morning, evening, and difference cortisol levels with mean fit line for both control and trauma groups 195
- Figure 5-2.** Drop line graphs of morning, evening, and difference saliva cortisol measures for each mother-child dyad in the control, trauma control, PTSD ICD-10, and PTSD DSM-IV groups. 197
- Figure 5-3.** Line graphs of mother and child mean morning and evening cortisol levels for the three trauma groups used in the repeated measures ANOVA. 203
- Figure 5-4.** Correlations between log transformed maternal perinatal PTSD systems and log transformed child morning cortisol ($r = -.437$). 208

Abstract

Environmental factors such as stress and hormones acting during embryogenesis, as well as early life experiences such as parental care have been clearly demonstrated in animal models to shape the individual's phenotypic gene expression, brain development, and behavioural repertoires (Meaney, 2005). However, human studies have not assessed both prenatal mental health and the quality of postnatal parental care with the same sample of mothers. The current study sought to fill this gap by investigating the impact of women's experiences of trauma and posttraumatic stress disorder (PTSD) before pregnancy on the mother's ante- and postnatal mental health problems, parenting, and children developmental outcomes. The study reported here is the second phase of a longitudinal study that commenced in 2002. In phase one community based middle class women in their third trimester of pregnancy were recruited and followed during the early postnatal period (Linke, 2002; Lowe 2003). The current study assessed forty four mother-infant dyads at three time points during the second postnatal year. The dyads were divided into one of three groups (control, trauma control and PTSD) depending on the mother's trauma experience and whether she met the lifetime diagnosis for PTSD. The assessments included the measure of the mother and infant's basal cortisol, the mother's lifetime and ongoing mental health problems, the quality of the mother-infant relationship, and the development of the infant's general cognitive abilities, emerging language skills and emotional and behavioural self regulation.

The current study found infant morning cortisol levels measured at 13 months of age were significantly predicted by maternal trauma experience and the subsequent PTSD symptoms of hyperarousal supporting the research of Yehuda and colleagues (2005) and implicating

an epigenetic transmission of environmental experience from the mother to her offspring possibly via *in utero* programming of the HPA axis. Overall, maternal trauma was found to impact on both child language and self regulation development. Unexpectedly, the trauma control or resilient mothers were found to be least engaged with their infants, and their infants had the lowest language development. However, poorer language development was not mediated through dyadic emotional availability or maternal sensitivity. Maternal PTSD was found to be related to poorer child emotional and behavioural outcomes which were mediated through maternal mental health problems. Overall, the findings of the current study suggest that maternal trauma experience is associated with a biologically based mechanism occurring in both the mother and the infant which is protective for both the mother and the child's emotional health, but comes at a cost of slower infant language development. Furthermore, this mechanism appears to have broken down in the presence of maternal PTSD for both the mother and the infant with subsequent associations with greater maternal mental health problems, more problematic infant emotional and behavioural problems, and disorganised attachment. These findings have clinical implications, particularly for early intervention programs. The results need to be interpreted with caution due to the small sample size. However, the findings have broad implications in relation to resilience to trauma and the development of psychopathology and warrant repetition.

Declaration

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person except where due reference has been made in the text.

I give consent to this copy of my thesis, when deposited in the University Library, being available for photocopying and loan.

Jacqueline Anne Beall

I believe that this thesis is properly presented, conforms to the specification for the degree of sufficient standard to be, prima facie, worthy of examination.

Professor Alexander Cowell McFarlane

Principal Supervisor

Acknowledgements

I would firstly like to acknowledge Dr Clara Bookless whose work on maternal trauma and mother-infant interactions fuelled my interest for research in this area. She gave me the opportunity and encouraged me to set up the current study following on from the earlier work of Felicity Linke and Jacinta Lowe. She also helped code many hours of videotaped footage of mother-infant interactions. Your input was invaluable. I would also like to thank Professor Alexander McFarlane for his encouragement and insightful suggestions throughout the course of this study. Furthermore, I would like to thank the Channel 7 Children's Research Foundation and The Variety Club of South Australia for funding this research. Several key aspects of this study would not have been possible without their financial support. Finally, I would like to thank the women who participated in this study. They were prepared to answer questions about their mental health and their ability to cope on an ongoing basis, to be videotaped interacting with their infants, and they allowed their infants to be assessed both at home and at The Queen Elizabeth Hospital. To do all this knowing they and their children would be rated on performance takes a great deal of courage.

I would also like to acknowledge the assistance of the staff of The Queen Elizabeth Hospital. Firstly, I would like to thank the support staff of the Psychiatry Department, particularly Valda Doig who made me feel welcome, Deanna Alberton for assistance with purchasing and travel arrangements, Tracy Air for her statistical advise, and Kaye Brown who was always helpful. My thanks also go to Gwenda Graves, Research Secretariat for her assistance with grant applications, and arranging a dedicated room for conducting the Strange Situation Procedure. I would also like to thank Dr Prue Cowled, Department of Surgery, at the Basil

Hetzel Institute of Medical Research, for allowing me to use her laboratory facilities to carry out the cortisol assays.

Several people were very helpful in assisting me in gaining the additional specialised training required to carry out assessments or code videotaped material. In relation to obtaining accreditation for using the Griffiths Mental Development Scales I would like to thank Dr Francis Gibson, North Shore Hospital, N.S.W. for being prepared to train me long distance with the assistance of Rachel Coxon at the Women's and Children's Hospital Adelaide. I would also like to thank Patrica O'Rourke whom I met in Minnesota while training to code the Strange Situation Procedure. Without her encouragement, clinical insights, and company back in Adelaide I suspect I would have found the task of becoming accredited too arduous.

I would also like to thank my family, particularly my two boys Nick and Tim and my mother Dawn, for their support, encouragement and tolerance. At times my studies have allowed me flexibility that paid employment would not have. However, at other times I'm sure I've been distant and preoccupied. Certainly fun and extra-curricula activities have been lacking in the last 12 months. I had promised Nick I would be finished by the time he started University. I'm pleased to say this is one promise I have kept.

I would also like to thank several friends for their support over the years. To Jan Soltys and Linda Vivian, a special thank you for your encouragement and unwavering belief in me. A special thank you also needs to go to the 'uni girls' Caroline Bates, Naomi Guiver and Penny Mount, who have been my friends and colleagues during and since completing our clinical training. Thank you for the many discussions about the meaning of life. May there be many more long dinners! A special thankyou needs to go to Naomi Guiver for reading my thesis. A brave effort, I appreciated you comments enormously.