

**Exploring Relationships Between Sleep Health, Mental Health, and School Engagement  
in Australian Adolescents**



The University of Adelaide

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### **Abstract**

Indicators of poor sleep, including sleep quantity, sleep quality, and daytime tiredness, are associated with adolescent school engagement. Emerging evidence suggests mental health may play a role in the relationship between sleep and school engagement. The research to date has largely focussed on academic achievement as the measure of school engagement, failing to consider the broader factors associated with school experience. This is the first study to investigate the relationship between sleep, mental health, and school engagement in Australian adolescent high school students, with the aim to assess whether mental health mediates a relationship between sleep and school engagement. A sample of 44,037 high school students from grades 7 to 12, aged from 12 to 18 years ( $M = 14.17$ ,  $SD = 1.63$  years; 45.8% male, 49.8% female), completed an online cross-sectional survey consisting of demographic items, items relating to sleep quantity, sleep quality, and daytime tiredness, as well as measures of anxiety, depression, and life satisfaction. Consistent with prior research, indicators of good sleep, decreased symptoms of anxiety and depression, and increased life satisfaction, were each associated with greater school engagement. The mediation analysis further indicated that anxiety symptoms, depression symptoms, and life satisfaction all partially mediated the relationship between sleep and school engagement. These cross-sectional results suggest that adolescents who experience sleep disturbances, may also suffer poorer mental health, which may result in decreased school engagement. It is important that parents, teachers, and health professionals seek to explore possible experiences of sleep disturbance among adolescent high school students experiencing challenges related to school engagement and poor mental health.

### **Declaration**

This thesis contains no material which has been accepted for the award of any other degree of diploma in any University, and, to the best of my knowledge, this thesis contains no material previously published except where due reference is made. I give permission for the digital version of this thesis to be made available on the web, via the University of Adelaide's digital thesis repository, the Library Search, and through web search engines, unless permission has been granted by the School to restrict access for a period of time.

September 2023

**Contributor Roles**

<b>Role</b>	<b>Role Description</b>	<b>Student</b>	<b>Supervisor 1</b>
<b>Conceptualisation</b>	Ideas; formulation or evolution of overarching research goals and aims.	X	X
<b>Methodology</b>	Development or design of methodology; creation of models.	X	X
<b>Project Administration</b>	Management and coordination responsibility for the research activity planning and execution.	X	X
<b>Supervision</b>	Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team.		X
<b>Resources</b>	Provision of study materials, laboratory samples, instrumentation, computing resources, or other analysis tools.	N/A	N/A
<b>Software</b>	Programming, software development; designing computer programs; implementation of the computer code and supporting algorithms; testing of existing code.	X	X
<b>Investigation</b>	Conducting research - specifically performing experiments, or data/evidence collection.		X
<b>Validation</b>	Verification of the overall replication/reproducibility of results/experiments.	X	X
<b>Data Curation</b>	Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later re-use.	X	X
<b>Formal Analysis</b>	Application of statistical, mathematical, computational, or other formal techniques to analyse or synthesize study data.	X	X
<b>Visualization</b>	Visualization/data presentation of the results.	X	
<b>Writing – Original Draft</b>	Specifically writing the initial draft.	X	
<b>Writing – Review &amp; Editing</b>	Critical review, commentary or revision of original draft	X	X

## **Understanding Sleep Health in Australian Adolescence: Exploring Relationships Between Sleep Health, Mental Health, and School Engagement**

Sleep is a crucial aspect of adolescent development, particularly as it pertains to school engagement and achievement. A systematic review (Wolfson & Carskadon, 2003) concluded that shorter sleep duration, erratic sleep/wake schedules, late sleep and rise times, and poor sleep quality are all negatively associated with academic engagement in adolescents. Similarly, Becker et al. (2019) acknowledged that sleep disturbance in adolescence is linked to poor school engagement. Sleep is also broadly associated with mental health (O'Callaghan et al., 2021), and the mental health problems frequently occurring during adolescent years can be exacerbated by sleep disturbances (Morales-Munoz & Gregory, 2023). However, the interactions between sleep, mental health, and school engagement when considered together in the adolescent context remain unclear. Exploration of these relationships is important to maximise adolescent well-being and to develop a more holistic understanding of the role of sleep during adolescence.

### **Importance of sleep and daytime behaviour in adolescence**

It is well established that sleep is an integral part of child and adolescent development. The amount of sleep children require depends upon age, with adolescents aged 13 to 18 years recommended to sleep approximately 8 to 10 hours per night (Paruthi et al., 2016). The Sleep Foundation (2022) have outlined a wealth of factors that may cause sleep disturbance, including but not limited to: stress and anxiety, changes in circadian rhythms, alcohol, caffeine, prescription and recreational drug use, food consumption, and physical health. The types of factors placing an individual most at risk of poor sleep varies across the lifespan, and adolescence presents unique challenges.

The Sleep Foundation (2023) outline that sleep deprivation during adolescence can commonly be attributed to: (a) delayed sleep schedules and early school start times

(Winnebeck et al., 2020), (b) time demands (Pereira et al., 2010), (c) stress and other mental health conditions such as anxiety and depression (creating a bidirectional relationship, worsening both sleep and emotional wellness; Tarokh et al., 2016), (d) sleep disorders (Colten et al., 2006), (e) neurodevelopmental disorders (Robinson-Shelton & Malow, 2015), and (f) technology use (Zhang et al., 2015). An empirical review (Owens & Weiss, 2017) similarly concluded that the typical causes of inadequate sleep during adolescence include both internal biological processes (i.e., puberty-related shifts in circadian rhythms), and external factors (i.e., extracurricular activities and early school start times; Crowley & Carskadon, 2010).

The consequences of inadequate sleep during adolescence range from reduced executive functioning, inattentiveness, and poor academic performance, to increased risk of obesity and cardio-metabolic dysfunction (Leproult & Van Cauter, 2010), mood disturbances including increased suicidal ideation (Coulombe et al., 2010), and a greater likelihood of engaging in health-risk behaviours including alcohol and substance use (Mednick et al., 2010; Roberts et al., 2009). The literature has explored the impact of inadequate sleep using various sleep measures, broadly operationalised as sleep duration (Chaput et al., 2016; Fuligni et al., 2017), sleep quality (Roeser et al., 2012), and self-reported tiredness (Coulombe et al., 2011). A review by Dewald et al. (2010) assessed the impact of sleep quality, sleep duration, and sleepiness on school performance in children and adolescents. They found that daytime sleepiness was the most predictive of school performance, however noted the importance of continuing to consider all three aspects of sleep to better understand the utility of the different sleep measures in predicting outcomes.

### **School Engagement in adolescence**

School engagement is a multi-faceted concept referring to students' level of participation and intrinsic interest in school (Akey, 2006). While academic performance is a

key component of school engagement, participation is also important and is characterised by factors such as attendance, homework completion, and involvement in extra-curricular activities (Delfino, 2019; Willms, 2003). School engagement also includes engagement in the domain of emotions, behaviour, and cognition (Fredricks et al., 2005).

Emotional engagement typically refers to students' sense of belonging and value at school, and their positive emotional responses to academic tasks, teachers and classmates. Cognitive engagement is demonstrated through investment in learning and the school community, and exerting effort to do well. Finally, behavioural engagement refers to students' participation in academic or non-academic activities during school days, and positive attitudes towards school-related activities (Fredricks et al., 2005).

Research highlights that declining school engagement during adolescence frequently results in poorer academic achievement (Delfino, 2019; Eccles, 2004; Niehaus et al., 2012) and is a strong predictor of student attrition (Archambault et al., 2009; Fall & Roberts, 2012). High school retention rates have fallen by almost 5% in Australia between 2017 and 2023, now sitting at around 80% nationally (Australian Bureau of Statistics, 2023). Early school dropout is associated with reduced likelihood of employment, increased likelihood of engaging in high-risk behaviours, incarceration, and risk of suicide (Constitutional Rights Foundation, 2012). Thus, investigating the modifying factors and impacts of school engagement, as well as potential strategies to combat adolescent student retention, has become a priority for researchers, educators, and government.

### **Sleep and School Engagement**

The literature examining the relationship between sleep and school engagement almost exclusively focuses on academic performance, failing to consider other components of school engagement such as behaviours (including persistence, effort, attention), attitudes (including motivation, positive learning values, enthusiasm, interest, pride in success), and

social support (including parental support, teacher support and peer support; Akey, 2006). In a review of literature examining the role of sleep on academic performance, Hershner (2020) concluded (a) morning classes (when students are most alert) are associated with higher grades, (b) the frequency of sleep disturbances likely impacts student retention, and (c) sleep duration alone is a weaker predictor of GPA than consistency of sleep patterns. As such, Hershner (2020) proposed that students facing academic failure should be screened for a comorbid sleep disorder.

More recently, a systematic review (Bacaro et al., 2023) highlighted the contribution of poor sleep quality and sleep disturbances on longitudinal school experience-related outcomes (i.e., decreased school engagement and performance, and increased school-related burnout). A bidirectional relationship was found, with factors such as school burnout, a stressful school environment, and early school entrance time, each associated with decreasing sleep quality and quantity over time (Bacaro et al., 2023). Furthermore, disturbed sleep mediates the effect of burnout on academic performance, and poor academic achievement further contributes to experiences of burnout (Evers et al., 2020). These findings provide novel insights into the bidirectional relationship between school experience and sleep health, however these factors do not exist in isolation. Consideration of the additional factors most prevalent during adolescence is necessary for developing a holistic and ecologically meaningful understanding of the mechanisms linking sleep to school engagement. This understanding will ultimately inform more effective approaches towards promoting educational outcomes.

### **Mental Health: A third factor in sleep and school engagement**

Another prominent issue emerging during adolescence is mental health. Approximately 20% of young people (11 to 17 years) experience high or very high levels of psychological distress during any 12-month period, with anxiety and depression being the

most prevalent mental disorders (Australian Institute of Health and Welfare [AIHW], 2021).

The association between sleep and mental health in adolescence is evident in the literature (Franzen & Buysse, 2022; O’Callaghan et al., 2021; Peterman et al., 2015), as is the association between mental health and school engagement (Augustinavicius et al., 2014; Chow et al., 2015; Gregory et al., 2022; Jules et al., 2021; Kendall et al., 2001; Raniti et al., 2022). Therefore, it is important to understand how all three factors interact to gain a better understanding of the role of sleep upon overall well-being and school engagement.

### **Anxiety**

Anxiety is typically characterised by excessive and uncontrollable worry occurring more days than not, restlessness, fatigue, irritability, muscle tension, feelings of distress and sleep disturbances (American Psychiatric Association, 2013). Studies suggest that approximately 278,000 Australian children and adolescents experience anxiety disorders each year (Lawrence et al., 2016). However, this statistic fails to recognise those who suffer the adverse effects of sub-clinical anxiety symptoms such as excessive worry, impaired sleep, restlessness, and fatigue.

### ***Sleep and Anxiety***

A cross-sectional analysis by Johnson et al. (2006) reported that among adolescence with anxiety, approximately 25.6% also met the diagnostic criteria for insomnia. These findings were reinforced through literature reviews produced by both Peterman et al. (2015) and Chellappa and Aeschbach (2022) who found bidirectional relationships between sleep and anxiety. Overall, across adolescence: (a) those who report poor sleep tend to also report high anxiety symptoms, (b) sleep and anxiety symptoms are associated with each other at the individual level, (c) anxiety symptoms are likely to follow sleep problems in early and mid-adolescence, and (d) sleep-oriented interventions in early adolescence improve sleep and prevent the development of anxiety symptoms (Narmandakh et al., 2020).

### ***Anxiety and School Engagement***

The literature also highlights a relationship between anxiety and school engagement. Anxiety symptoms can negatively interfere with general well-being and academic performance (Kendall et al., 2001), impair memory and cognitive functions (Daleiden, 1998; Lukasik et al., 2019), and contribute to poor school performance and academic failure (Jules et al., 2021). Poor school performance is not only a consequence of excessive anxiety, but can also cause anxiety itself, creating a self-reinforcing cycle (Gregory et al., 2022). Gregory et al. (2022) established that adolescents with current anxiety symptoms were less likely to engage at school compared to adolescents who did not display anxiety symptoms. A recent systematic review (Raniti et al., 2022) demonstrated that higher levels of school connectedness predicted lower levels of future anxiety symptoms, noting the inverse relationship was significant for school disconnectedness.

### **Depression**

Depression is a common mental health disorder amongst adolescents (AIHW, 2021), characterised by low mood, loss of motivation and/or pleasure, decreased concentration, weight loss or gain, feelings of worthlessness, suicidal ideation and sleep disturbances such as insomnia (i.e., clinically reduced sleep duration) and hypersomnia (i.e., clinically excessive sleep duration; American Psychiatric Association, 2013). Importantly, depressive symptoms can be present without a clinical diagnosis of depression. Depression poses challenges throughout all aspects of adolescent life, particularly at school (World Health Organisation, 2023).

### ***Sleep and Depression***

Liu et al. (2007) highlights the bidirectional relationship of sleep disturbances and depressive symptoms; 75% of adolescents suffering from depression also experience sleep disturbances. A recent meta-analysis found adequate sleep duration was associated with a

reduction in depressive symptoms (Franzen & Buysse, 2022). Another adolescent meta-analysis supported these conclusions, demonstrating that aspects of sleep, including sleep latency and duration, are significantly correlated with depressive symptoms (O'Callaghan et al., 2021). Interestingly, O'Callaghan et al. (2021) voice the importance of assessing participants' perception of sleep, in conjunction with their sleep-wake behaviours, as adolescent attitudes correlated most strongly with depressive symptoms.

### ***Depression and School Engagement***

School engagement has been shown to be bidirectionally associated with depressive symptoms. A systematic review found higher levels of school connectedness protect against symptoms of depression (Augustinavicius et al., 2014). Conversely, others suggest depressive symptoms are a risk factor for decreased school engagement and poor academic achievement (Chow et al., 2015; Humensky et al., 2010; Verboom et al., 2014). Elliott and Dweck's (1988) prominent study indicates that decreased school engagement results from negative beliefs typically coinciding with depressive symptoms, leading to reduced competency and feelings of helplessness. Depression symptoms have also been associated with intentions to quit school and student attrition (Garvik et al., 2013; Korpershoek et al., 2019). Evidently, depressive symptoms are influential in adolescent school engagement.

### **Life Satisfaction**

While understanding factors that place adolescents at risk of reduced mental health, it is important to address factors contributing to increased well-being and overall life satisfaction, to promote positive development. Subjective well-being refers to the way in which individuals perceive and experience positive and negative emotional responses (Karatas et al., 2021). The American Psychological Association (2020) define life satisfaction as '*the extent to which a person finds life rich, meaningful, full, or of high quality*'. Life

satisfaction appears as contentment with life, whilst acknowledging adversity, typically resulting in positive mental health (Ospina & Roser, 2013).

### ***Sleep and Life Satisfaction***

Shin & Kim (2018) reinforce that sleep has received little attention regarding its association with positive life satisfaction. Their longitudinal research indicates that young adults who suffer from poor sleep report lower life satisfaction over time. A cross-sectional study in young adults also highlighted that better sleep quality and less variability in sleep duration were significant predictors of greater life satisfaction (Ness & Saksvik-Lehouillier, 2018). Furthermore, Cao et al. (2022) investigated the relationship between sleep, life satisfaction, and physical exercise in a population of high school students and found that subjective sleep quality and quantity were predictive of life satisfaction.

### ***Life Satisfaction and School Engagement***

The manner in which life satisfaction and school engagement are associated is vastly under-researched. Yuen (2016) examined the association between life satisfaction and school engagement among adolescents and concluded that life satisfaction significantly predicts school engagement. Similarly, school climate, attachment or connection to school, reduced problem behaviours, and peer relations are all associated with life satisfaction in students (Oberle et al., 2011; Suldo et al., 2008). Li & Lerner (2011) support this notion by concluding that students who demonstrate greater behavioural and emotional engagement with school typically score higher on measures of well-being. Interestingly, Lewis et al. (2011) determined a significant bidirectional relationship between life satisfaction and cognitive engagement at school but failed to determine a significant association between emotional and behavioural engagement with life satisfaction. Overall, it appears life satisfaction is associated with school engagement, however the precise manner of this relationship, and the factors relevant to it, remain unclear.

## **Aims and Hypotheses**

The existing literature demonstrates a clear relationship between sleep and mental health in adolescents, in addition to a relationship between mental health and school engagement. There is a lack of existing research on school engagement holistically, particularly as it relates to sleep, and regarding the role mental health symptoms have on this relationship. Hence, the aim of this study is to investigate the association between sleep and school engagement in high-school children, and whether this relationship is mediated by mental health factors.

Researchers, parents, and educators stand to gain valuable insights from the present study. Findings could enhance the quality of information and services provided to adolescents facing sleep disturbances. The results could also have clinical implications for health professionals dealing with adolescents and/or their parents who express concerns about school engagement. In such cases, medical practitioners should evaluate their sleeping habits and aspects of their mental health. Results may also have implications for government programs aimed at optimising student involvement in classrooms, which must account for the critical role of sleep.

It is hypothesised that better sleep, conceptualised as sleep quantity, sleep quality, and self-reported tiredness, will be associated with greater school engagement, and that this will be mediated by levels of anxiety symptoms, levels of depression symptoms, and overall life satisfaction.

## **Method**

### **Participants**

Participants of the current study were derived from an Australian convenience sample generated by Resilient Youth Australia (RYA) as part of their national Resilience Survey

(<https://resilientyouth.org/survey>). The survey was administered within schools as part of a well-being and resilience reporting program and included public and private schools across regional and suburban areas of Australia.

The total sample size of the Resilience Survey in 2022 consisted of 100,597 participants. The present study included participants between the ages of 12-18 years ( $M = 14.17$ ,  $SD = 1.62$ ), attending high school in grades 7-12, and after removing additional cases based on missing or invalid data left a final sample of 44,037. In total, 45.8% ( $n = 20,189$ ) were male, 49.8% ( $n = 21,937$ ) female, and 4.4% ( $n = 1,911$ ) reported gender as 'other' or 'prefer not to say' (refer to Table 1 for full demographic details). Socioeconomic status was measured using the most recent Socio-Economic Indexes for Areas (SEIFA; Australia Bureau of Statistics, 2021), and based on Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD) scores corresponding to participant postcode. This score summarises the economic and social conditions of individuals and households within a given area, where higher scores indicate greater socioeconomic advantage. The Australian national average IRSAD score is 1000 ( $SD = 100$ ) and the average of the present study was 991.55 ( $SD = 72.55$ ).

**Table 1***Participant demographic details.*

Variable	Sample Characteristics	<i>n</i>	%
Gender	Male	20,189	45.8
	Female	21,937	49.8
	Other	963	2.2
	Prefer not to say	948	2.2
Nationality	Australian	29,369	66.7
	Aboriginal and/or Torres Strait Islander	1,338	3.0
	European	3,078	7.0
	Asian	5,236	11.9
	African	824	1.9
	New Zealander	596	1.4
	Māori or Pasifika	781	1.7
	Other	2,815	6.4
	Grade	7	8,943
8		9,542	21.7
9		8,998	20.4
10		6,840	15.5
11		5,607	12.7
12		4,107	9.3

*Note.* *N* = total number of participants.

Based on previously reported effect sizes between sleep problems and mental health in adolescence (Alfano et al., 2008) and depression and school engagement (Fiorilli et al., 2017), with an alpha of .05, power of .80, and including the number of predictors proposed for analyses ( $n = 7$ ), a minimum sample size of between 19 and 63 participants was required. The data set used in the present study was more than adequate to reliably test the hypothesised effects. Ethics approval to use data from the Resilience Survey for research

purposes was granted by University of Adelaide's Human Research Ethics Committee (approval number 20/87).

### **Measures**

The data obtained each year by the Resilience Survey is used to report back to individual schools with a snapshot of their student well-being, compared with national averages. Australia-wide, more than 1,500 schools have administered this survey to students, and the present study will rely on Resilience Survey data collected in 2022, being the most current year of data available.

The Resilience Survey is an online survey consisting of 77 items that students complete during school hours (see Appendix A). The first eight items relate to demographic questions, specifically the participant's age, grade, gender, nationality, birthplace, language spoken at home, and residing suburb. The remaining 69 items measure various other aspects of a child's life, including life satisfaction, peer and familial relationships (including bullying), peer and adult supports, physical and mental well-being, physical and mental health, self-perception, personal beliefs and values, and participation in risky behaviours. The survey's core items contain six previously validated measures, of which the Patient Health Questionnaire (PHQ-4; Kroenke et al., 2009) and the Cantril Self Anchoring Scale (CSAS; Cantril, 1965) were used in the current study.

#### ***Patient Health Questionnaire-4 (PHQ-4)***

The PHQ-4 (Kroenke et al., 2009) is a general mental health screener that assesses the occurrence of anxiety and depression symptoms. The PHQ-4 consists of four items; two corresponding to anxiety symptoms and two corresponding to depressive symptoms. The items related to anxiety assessed how often over the past fortnight participants were bothered by "feeling nervous, anxious, or on edge" and "not being able to stop or control worrying." The two depression related items assessed how often over the past fortnight participants were

“feeling down, depressed, or hopeless” and having “little interest or pleasure in doing things”. Participants respond to each item on a Likert scale from 1 (nearly every day) to 4 (not at all). Participants’ scores on the PHQ-4 were calculated by summing the scores for the two anxiety-related items, and then summing the scores of the two depression-related items, to give a total score for ‘anxiety’ and ‘depression’ respectively. Possible scores within each of the two domains range from 2 to 8, with higher scores indicating a greater experience of symptoms associated with poorer mental health.

### ***Cantril Self Anchoring Scale (CSAS)***

The CSAS (Cantril, 1965), commonly referred to as the ‘Cantril Ladder’, is also integrated into the Resilience Survey. The Cantril Ladder, originally established in 1965, is a measure of life satisfaction based on people's attitudes towards their life and its components in various respects (Glatzer & Gulyas, 2014). The CSAS consisted of one item corresponding to life satisfaction, whereby participants were asked “Imagine a ladder with steps numbered 1 at the bottom to 8 at the top. The top represents the best possible life for you and the bottom represents the worst possible life for you. On which step of the ladder do you feel you stand at this time?”. Higher scores were indicative of greater life satisfaction.

### ***Sleep***

Sleep was measured using three items to assess quantity, quality, and daytime tiredness – a symptom of poor sleep. The first item, assessing the regularity of adequate sleep quantity, stated, “I get at least 8 hours sleep most nights”, and participants indicated their agreement with this statement via scores from one to four (1 = never or rarely, 4 = always or almost always). Higher scores indicated that participants were regularly obtaining an adequate amount of sleep. For the two sleep items assessing sleep quality and tiredness participants were asked how often over the last 2 weeks they have been bothered by “...trouble falling asleep, staying asleep, or sleeping too much”, and “...feeling tired, or

having little energy”. Possible scores for these two items ranged from one to four (1 = nearly every day, 4 = not at all), where higher scores indicated that participants were experiencing better sleep quality and minimal to no daytime tiredness, respectively.

### ***School Engagement***

Based upon a factor analysis conducted by Dhingra (2022), school engagement was measured by 9 items from the Resilience Survey that have previously demonstrated to form a reliable factor of school engagement in high school students (see Appendix B). A reliability analysis using these items for the current data produced a reliable Cronbach’s alpha of .864. All items were measured on a Likert scale ranging from 1 (never or rarely) through to 4 (always or almost always). The average value of all nine items was used to create the School Engagement domain, with higher scores indicating greater engagement.

### **Procedure**

Schools across Australia have the opportunity to complete the Resilience Survey in each calendar year on a “fee for service” basis via RYA. To maintain confidentiality, schools that opted to participate were given a unique code. Students then took part in the study by individually completing the anonymous survey electronically using the allocated school code. Completion of the survey was voluntary, and a self-report survey style was elected as it allows participants to describe their own experiences rather than inferring this from observations.

### **Statistical Analysis**

Boot-strapped statistical mediation analysis as proposed by Hayes (2009) was conducted using SPSS statistical software (IBM, Version 28). Descriptive group analyses and mixed effects modelling, including ANOVA, were also conducted to investigate group differences of interest, as well as correlations to evaluate the bivariate relationship between proposed variables in the mediation model. There are four basic assumptions underlying

mediation analyses. These are that: (1) the dependent, independent, and mediator variables must be continuous, (2) the variables of interest should have a linear relationship, (3) the data must not show multicollinearity, and (4) there should be no spurious outliers, and (5) the distribution of the variables should be approximately normal (Hayes, 2009). Due to the size of the present dataset, QQ plots along with Boxplots were used to assess the normality of the data. Linearity was assessed using visual inspection of scatterplots. Multicollinearity was assessed using variance inflation factor (VIF). All variables met the assumptions tested.

## Results

### Descriptive Statistics

Table 2 reports descriptive data, including the means, standard deviations, and the ranges for participant's scores for each measure.

**Table 2**

*Descriptive Statistics for Age, SES score, Sleep Quantity, Sleep Quality, Tiredness, Anxiety, Depression, Life Satisfaction and School Engagement.*

	<i>M</i>	<i>SD</i>	Range
Age	14.17	1.62	12-18
SES score	991.55	72.55	658.67-1184.66
Sleep Quantity	2.64	1.04	1-4
Sleep Quality	2.63	1.19	1-4
Tiredness	2.54	1.12	1-4
Anxiety	4.50	2.08	2-8
Depression	4.01	1.86	2-8
Life Satisfaction	5.56	1.46	1-8
School Engagement	2.79	0.64	1-4

Differences in measures according to gender were explored. There was an approximately equal distribution of males (45.8%) and females (49.8%) with 4.4% of the study population identifying as ‘other’ or ‘prefer not to say’. For the purpose of gender comparisons, 948 participants who responded ‘prefer not to say’ were excluded.

Table 3 reports the descriptive data by gender along with results from Welch ANOVA tests. Differences for all variables obtained a  $p$ -value of  $<.001$ . However, given the large sample size, inspection of the eta-squared values demonstrated that the only difference of moderate effect or greater was for ratings of anxiety.

**Table 3**

*Robust Tests of Equality of Means including F-statistics, Degrees of Freedom, Significance and Eta-squared effect size by gender.*

	<i>Group</i>			<i>F-statistic</i>	<i>Degrees of Freedom</i>	<i>p-value</i>	<i>Eta-squared</i>
	<i>Male</i>	<i>Female</i>	<i>Other</i>				
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>				
Age	14.13 (1.62)	14.22 (1.63)	14.16 (1.53)	14.64	2470.72	<.001	.001
SES score	985.43 (67.08)	997.87 (76.78)	981.93 (72.54)	111.71	2460.55	<.001	.008
Sleep Quantity	2.76 (1.02)	2.57 (1.03)	1.93 (1.01)	345.91	2459.33	<.001	.020
Sleep Quality	2.87 (1.15)	2.47 (1.18)	1.92 (1.14)	614.44	2461.06	<.001	.037
Tiredness	2.82 (1.08)	2.32 (1.09)	1.90 (1.08)	915.28	2454.56	<.001	.058

Anxiety	3.81 (1.89)	5.03 (2.05)	5.82 (2.12)	1557.37	2443.77	<.001	.094
Depression	3.62 (1.70)	4.26 (1.89)	5.45 (2.00)	695.11	2439.03	<.001	.043
Life Satisfaction	5.77 (1.42)	5.45 (1.43)	4.50 (1.59)	372.07	2435.03	<.001	.024
School Engagement	2.80 (0.64)	2.80 (0.62)	2.42 (0.63)	173.27	2457.37	<.001	.008

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### Correlations

Table 4 presents the correlations between age, SES score, sleep quantity, sleep quality, tiredness, anxiety, depression, life satisfaction, and school engagement. As predicted, higher levels of anxiety and depression were associated with reduced school engagement. Additionally, greater levels of sleep quantity and sleep quality, and lower levels of tiredness, were all associated with increased school engagement. Reduced sleep quantity and quality, and increased tiredness, were all associated with greater levels of anxiety and depression symptoms. Finally, greater reported life satisfaction was associated with greater school engagement.

**Table 4**

*Correlations (r) Between Age, SES score, Sleep quantity, Sleep quality, Tiredness, Anxiety, Depression, Life Satisfaction, and School Engagement.*

	1	2	3	4	5	6	7	8	9
1. Age	-								
2. SES score	.04**	-							
3. Sleep quantity	-.17**	.06**	-						
4. Sleep quality	-.06**	.05**	.48**	-					
5. Tiredness	-.16**	-.00	.42**	.57**	-				
6. Anxiety	.13**	.01*	-.34**	-.50**	-.54**	-			
7. Depression	.11**	-.05**	-.39**	-.54**	-.57**	.67**	-		
8. Life Satisfaction	-.09**	.06**	.38**	.36**	.37**	-.41**	-.48**	-	
9. School Engagement	-.14**	.11**	.44**	.32**	.33**	-.28**	-.38**	.41**	-

*Note.* \*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).

### Testing Mediation Models

To examine the relationships between the predictor variables: sleep quantity, sleep quality and tiredness, and the outcome variable: adolescent school engagement, via the mediator variables: anxiety symptoms, depression symptoms and life satisfaction, mediational analysis was conducted. Direct, indirect, and total effects were observed. The direct effect refers to the relationship between the predictors and outcome variable (i.e., the direct effect of sleep quantity, sleep quality and tiredness, on adolescent school engagement). The indirect effect refers to the relationship between a predictor and the outcome variable via the mediating variables (i.e., the indirect effect of sleep quantity, sleep quality and tiredness, on adolescent school engagement, via anxiety, depression, and life satisfaction). The total

effect refers to the sum of the mediation pathways. In all three mediation models presented below, covariates of age and SES score were included to ensure greater confidence in the relationships established.

### *Sleep quantity*

Table 5 displays the effect of sleep quantity on school engagement via anxiety, depression, and life satisfaction. The direct effect of sleep quantity on school engagement was significant ( $c = .258$ ). The indirect effect of sleep quantity on school engagement in the presence anxiety, depression and life satisfaction decreased in strength but was still significant ( $c' = .173$ ). This suggests that the relationship between sleep quantity and school engagement was partially mediated by anxiety, depression, and life satisfaction. The overall model accounted for 29% of the variance in school engagement,  $F(6, 44030) = 2978.78$ ,  $p < .001$ ,  $R^2 = .29$ . Figure 1 presents a visual representation of the mediational relationship between sleep quantity and school engagement via anxiety, depression, and life satisfaction.

**Table 5**

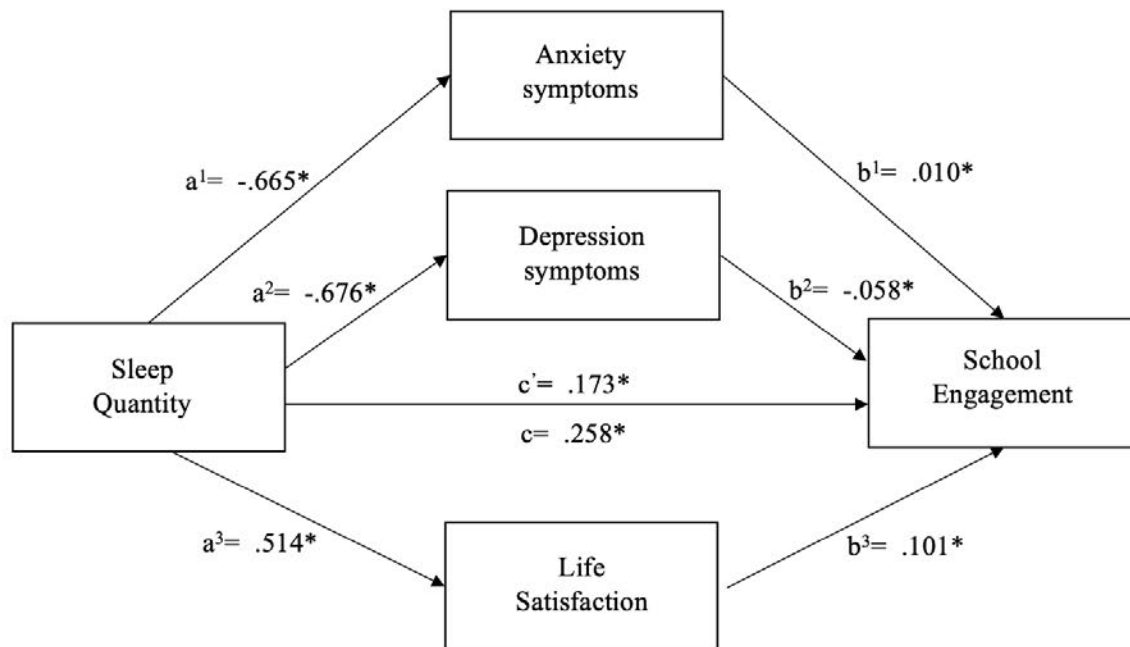
*Mediational Effect of Sleep quantity on School Engagement via Anxiety, Depression and Life Satisfaction (n = 44,037).*

	Unstandardised coefficient (B)	Standardised coefficient (b)	SE	95% CI	
				LL	UL
Total mediation effect	.084	.138	.003	.133	.143
Anxiety	-.007	-.011	.002	-.015	-.007
Depression	.039	.064	.002	.060	.069
Life Satisfaction	.052	.084	.002	.080	.089

*Note.* CI = confidence interval; LL = lower limit; UL = upper limit.

**Figure 1**

*The Relationship Between Sleep quantity and School Engagement Mediated by Anxiety, Depression and Life Satisfaction.*



*Note.* Values in Figure 1 are standardised coefficients, \*  $p < .05$ .

$c$  = the effect of sleep quality on school engagement in the absence of the mediators.

$c'$  = the effect of sleep quality on school engagement in the presence of the mediators.

### ***Sleep quality***

Table 6 displays the effect of sleep quality on school engagement via anxiety, depression, and life satisfaction. The direct effect of sleep quality on school engagement was significant ( $c = .162$ ). The indirect effect of sleep quality on school engagement in the presence of anxiety, depression, and life satisfaction decreased in strength but was still significant ( $c' = .066$ ). This suggests that the relationship between sleep quality and school engagement was partially mediated by anxiety, depression, and life satisfaction. The overall model accounted for 24% of the variance in school engagement,  $F(6, 44030) = 2268.44$ ,  $p < .001$ ,  $R^2 = .24$ . Figure 2 presents a visual representation of the mediational relationship between sleep quality and school engagement via anxiety, depression, and life satisfaction.

**Table 6**

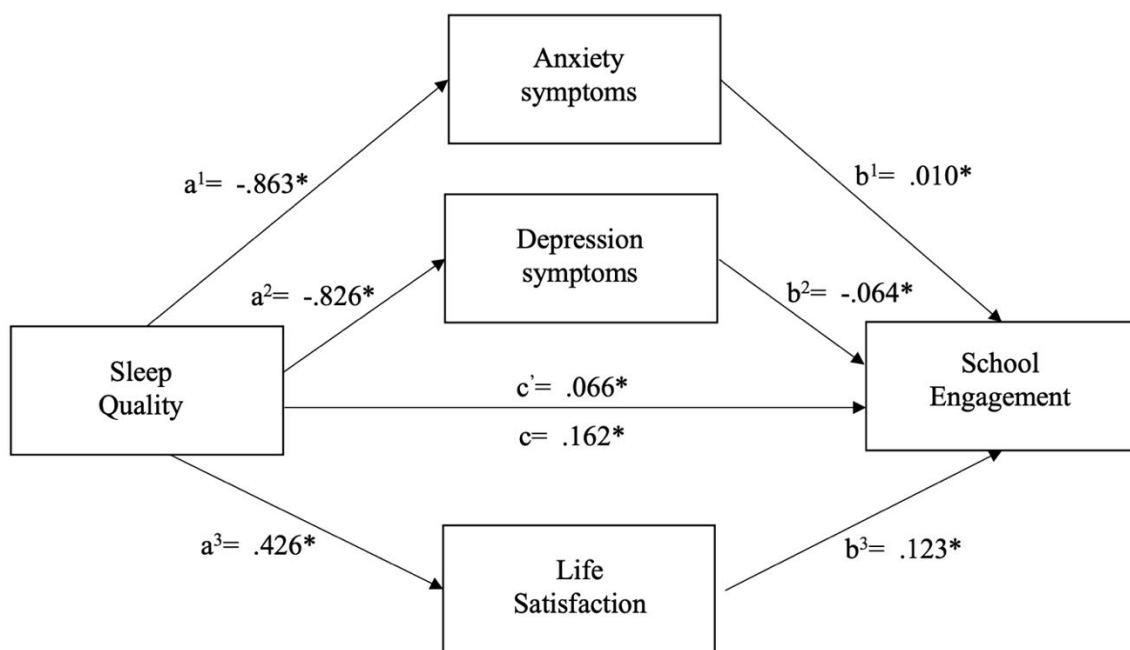
*Mediational Effect of Sleep quality on School Engagement via Anxiety, Depression and Life Satisfaction (n = 44,037).*

	Unstandardised coefficient (B)	Standardised coefficient (b)	SE	95% CI	
				LL	UL
Total mediation effect	.096	.180	.003	.173	.187
Anxiety	-.009	-.017	.003	-.023	-.010
Depression	.053	.098	.004	.092	.106
Life Satisfaction	.052	.098	.002	.093	.103

*Note.* CI = confidence interval; LL = lower limit; UL = upper limit.

**Figure 2**

*The Relationship Between Sleep quality and School Engagement Mediated by Anxiety, Depression and Life Satisfaction.*



*Note.* Values in Figure 2 are standardised coefficients, \*  $p < .05$ .

c = the effect of sleep quality on school engagement in the absence of the mediators.

c' = the effect of sleep quality on school engagement in the presence of the mediators.

***Tiredness***

Table 7 displays the effects of tiredness on school engagement via anxiety, depression, and life satisfaction. The direct effect of tiredness on school engagement was significant ( $c = .180$ ). The indirect effect of tiredness on school engagement in the presence of anxiety, depression, and life satisfaction decreased in strength, but was also significant ( $c' = .074$ ). This suggests that the relationship between tiredness and school engagement was partially mediated by anxiety, depression, and life satisfaction. The overall model accounted for 24% of the variance in school engagement,  $F(6, 44030) = 2272.48, p < .001, R^2 = .24$ .

Figure 3 presents a visual representation of the mediational relationship between sleep quality and school engagement via anxiety, depression, and life satisfaction.

**Table 7**

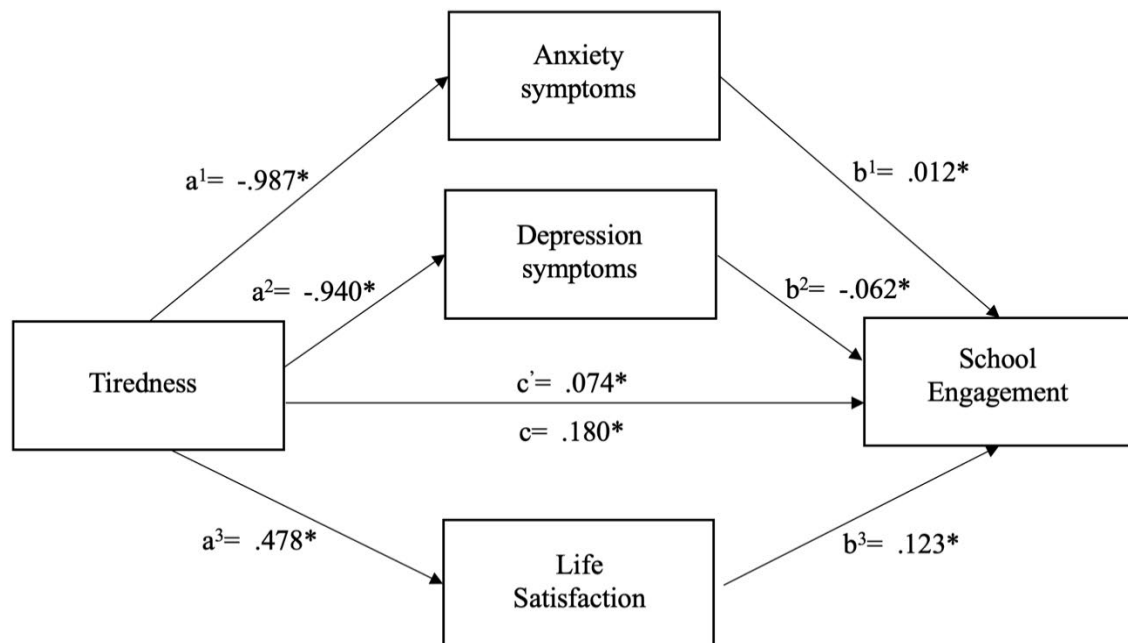
*Mediational Effect of Tiredness on School Engagement via Anxiety, Depression and Life Satisfaction (n = 44,037).*

	Unstandardised coefficient (B)	Standardised coefficient (b)	SE	95% CI	
				LL	UL
Total mediation effect	.106	.186	.004	.179	.194
Anxiety	-.012	-.020	.003	-.026	-.014
Depression	.058	.103	.004	.096	.110
Life Satisfaction	.059	.104	.002	.099	.108

*Note.* CI = confidence interval; LL = lower limit; UL = upper limit.

**Figure 3**

*The Relationship Between Tiredness and School Engagement Mediated by Anxiety, Depression and Life Satisfaction.*



*Note.* Values in Figure 3 are standardised coefficients, \*  $p < .05$ .

$c$  = the effect of sleep quality on school engagement in the absence of the mediators.

$c'$  = the effect of sleep quality on school engagement in the presence of the mediators.

### Post Hoc Analyses

Post hoc analyses were conducted to explore patterns of interest in the data that were not part of the primary hypotheses. Due to differences in outcomes found across genders (see table 3), mediation models for each predictor variable were run separately for females, males and those who identified as 'other', to establish any significant gender differences. Effects for each gender typically followed the same pattern as the overall findings. The main difference found between genders was that anxiety was not a significant mediator for males or females in the context of sleep quantity (males:  $B < .000$ , females:  $B = -.002$ ), sleep quality (males:  $B = -.001$ , females:  $B = -.003$ ), or tiredness (males:  $B = -.002$ , females:  $B = -.005$ ). However,

anxiety was significant in the group identifying as ‘other’, for all sleep predictors (quantity:  $B = -.023$ , quality:  $B = -.028$ , tiredness:  $B = -.039$ ; see Appendix C for further details).

## Discussion

### Overview

The present study explored relationships between aspects of sleep, mental health, and school engagement in a sample of Australian adolescents. There is a breadth of literature demonstrating a relationship between sleep and aspects of school engagement. However, the literature almost exclusively focuses on academic performance, failing to consider other components of school engagement (Akey, 2006). Furthermore, previous research has consistently demonstrated relationships between sleep and mental health (O’Callaghan et al., 2021; Owens, 2014; Peterman et al., 2015) and mental health and school performance (Jules et al., 2021; Kendall et al., 2001; Raniti et al., 2022) but has failed to consider the possible interplay between all three variables.

It was hypothesised that indicators of better sleep would be associated with greater school engagement, and that this would be mediated by levels of anxiety symptoms, levels of depression symptoms, and overall life satisfaction. This hypothesis was tested in a total of three separate mediational analyses, with all hypotheses supported.

### Present Findings

#### *The Effect of Sleep on School Engagement*

The hypothesis that indicators of better sleep would be associated with greater school engagement was supported. This relationship has been well-documented in the literature (Bacaro et al., 2023; Evers et al., 2020; Hershner, 2020). Further research has also demonstrated the significance of sleep on short- and long-term school outcomes in the context of mental health, whereby sleep is also related to psychological well-being

(Coulombe et al., 2010; Owens, 2014; Tarokh et al., 2016). Therefore, it is reasonable to assume that poor sleep, and consequently poor psychological well-being, may result in reduced school engagement.

This finding builds upon prior research indicating that poor sleep quantity and quality, as well as sleep disturbances, have long-term effects on school experience-related outcomes, school engagement, poor academic achievement and burnout (Bacaro et al., 2023; Evers et al., 2020). In the present study, ‘sleep quantity’ had the strongest predictive effect on school engagement, explaining 20.3% of the variance in school engagement scores alone. ‘Tiredness’ and ‘Sleep quality’ were less predictive of levels of school engagement, explaining 12.9% and 12.3% of the variance in school engagement respectively. Combined, these findings highlight the critical role sleep plays in adolescent well-being.

### ***The Effect of Mental Health on School Engagement***

Consistent with previous literature, depression symptoms were negatively associated with adolescent school engagement (Augustinavicius et al., 2014; Humensky et al., 2010; Verboom et al., 2014), and life satisfaction was positively associated with adolescent school engagement (Li & Lerner, 2011; Oberle et al., 2011; 2008; Yuen, 2016). Contrary to existing literature which has demonstrated that increased experiences of anxiety symptoms result in decreased school engagement (Gregory et al., 2022; Jules et al., 2021; Raniti et al., 2022), the results of the current study indicated that while anxiety did mediate the relationship between sleep and school engagement, the pathway between anxiety and school engagement was of a positive nature, rather than negative as expected. The Australian Research Alliance for Children and Youth (ARACY, 2019) noted a similar finding, reporting that participants experienced high levels of pressure, stress, and anxiety in relation to their achievements at school and future success. This performance- and future-related anxiety resulted in increased school engagement, which was most common in years 10-12 (ARACY, 2019).

An alternate explanation for the observed relationship is the presence of suppression effects. As seen in Table 3, anxiety and school engagement were negatively correlated as predicted, however when placed into a model with other factors (i.e., depression) the effect of anxiety on school engagement is potentially suppressed. The resulting positive relationship observed in our model may therefore be explained by effects of anxiety that are not fully captured by our measure. A possible explanation for this relationship may be *eustress* – or stress leading to a positive response, thus referring to any type of beneficial stress (Lu et al., 2021). Eustress is linked to academic achievement and investment in coursework (Levi et al., 2013), setting ambitious goals, having high expectations and a desire to achieve (Dockterman & Weber, 2017). While this relationship may seem intuitive, there is a dearth of research to support the findings of the present study in adolescence and hence, may be an appropriate area for future research.

### ***Mental Health Explaining the Relationship between Sleep and School Engagement***

Anxiety partially-mediated the relationship between sleep and school engagement. Chellappa & Aeschbach (2022) suggest that this relationship may result from an array of dysfunctional cognitions, maladaptive behaviours such as excessive time in bed, and physiological hyperarousal including increased night-time sympathetic brain activity. Molen et al. (2014) also proposes that anxiety-induced worry about the consequences of insufficient sleep lead to maintained sleep disturbances. As discussed, this resulting increased anxiety also elevates students concerns about their academic performance, often leading to greater school engagement (ARACY, 2019).

Depression symptoms partially mediated the relationship between sleep and school engagement. Individuals with depression typically suffer disruptions to sleep because of impacts to their homeostatic and circadian rhythms, resulting in increased sleep disturbances which consequently reduces total sleep duration (Nutt et al., 2008). It has also been

postulated that the negative relationship between depression and school engagement may be due to negative self-belief, leading to reduced competency and feelings of helplessness, as well as avoidance of challenge, lack of persistence, lack of belonging and feelings of inadequacy (Elliott and Dweck, 1988; Korpershoek et al., 2019).

Finally, levels of life satisfaction also partially-mediated the relationship between sleep and school engagement. Life satisfaction in the context of sleep and school engagement is under-researched. However, a likely explanation for the observed relationship is that poor sleep negatively impacts cognitive and physical function, family and social relationships, and self-perception, which in turn can reduce individuals' life satisfaction by increasing mental health problems (Chen et al., 2011). Moreover, poor sleep has been associated with risky coping mechanisms, such as smoking, drinking alcohol and misusing medications, which also decrease life satisfaction (Banerjee & Boro, 2022). Numerous studies have also posited that adolescent life satisfaction is associated with improved school engagement through improved self-efficacy, self-esteem, academic achievement, social acceptance and reduced school absenteeism (Fergusson et al., 2015; Proctor et al., 2009).

### **Implications**

The existing literature primarily focuses on the impacts of sleep in the context of academic achievement and fails to address the broader impacts surrounding school engagement holistically. The present study has implications for how school engagement is conceptualised theoretically and researched, suggesting that research in this area should encapsulate multiple aspects of school engagement and academic achievement to ensure the most valid findings are produced.

Additionally, the exploratory analysis within the present study suggests that there are no clear differences in sleep health, mental health, or school engagement between the gender populations. This indicates that these challenges are a problem for all adolescents, regardless

of their gender. However, it is important to acknowledge the high incidence of anxiety symptoms reported by the ‘female’ and ‘other’ gender groups, as this finding has been demonstrated in the broader literature (Afifi, 2007; Johansson et al., 2022; Mental Health Foundation, 2022). The results of the present study suggest that addressing adolescents’ sleep patterns may provide an effective target for addressing mental health in many adolescence, which may be particularly advantageous in populations where mental health symptoms are elevated.

These finding may also have implications for clinical practice. For example, when working with an adolescent and/or their parents who raise concerns surrounding school engagement, health professionals should assess adolescent sleep patterns, as well as aspects of mental health. Where sleep disturbances are present, Cognitive Behaviour Therapy for Insomnia (CBT-I) may be appropriate. CBT-I has been associated with reduced stress, anxiety, and depression; improved sleep; and overall emotional well-being among adolescents (Blake et al., 2017; Lunsford-Avery et al., 2021).

In view of the present findings and recent government investment aimed at implementing effective routines and approaches to maximise student engagement in classrooms (Clarke, 2022), it will be important for such initiatives to recognise sleep as a critical component. Broad school-based education around promoting healthy sleep habits is lacking and needs to be considered moving forward. Such considerations are of further importance given that maximising adolescents’ engagement in school is predictive of future career progression, as school engagement can shape and direct adolescent habits and abilities that are important for later educational and occupational success (Symonds et al., 2023).

### **Methodological Considerations**

To the researcher’s knowledge, this is the first study to assess relationships between indicators of sleep, mental health, and school engagement in Australian adolescence. This

study provides novel insight into these relationships as the sample included in the present study includes Australia-wide high school attending students of different genders, socio-economic status', ages, and education levels. Moreover, to the best of the researcher's knowledge, no study to date has achieved such a large or representative sample for their research. Much of the existing research in the field of adolescence, sleep, mental health, and school engagement has been based upon samples between 175 (Alfano et al., 2008) to 2,440 (Ramírez et al., 2021) participants. Our sample of 44,037 high school-attending adolescence can be seen as a significant strength of the present study and increases the generalisability of our findings to the wider adolescent population.

Importantly, the inclusion of self-reported data provides authentic insights into an individual's circumstance. Robins et al. (2009) highlight that people are the most qualified witnesses to their own experiences. The researchers also outline that another advantage of self-reported psychological data is that it provides insight into intrapsychic information such as feelings and attitudes that are unavailable to others (Robins et al., 2009). In the context of the present study, internal feelings such anxiety symptoms, depression symptoms, and feelings of connectedness at school are most appropriately collected via self-report.

Although there are many advantages of using self-report methods, it can be subject to social desirability bias, whereby participants modify the information they provide in a way they perceive to be favourable. This is especially important when studying sensitive topics, such as mental health (Fadnes et al., 2009). In the present study, the anonymity of the survey likely mitigated this effect, although it cannot be completely ruled out.

Another limitation in the context of self-reported survey research is susceptibility to recall bias (Fadnes et al., 2009). Gmel & Daeppen (2007) identified that one-third of information often cannot be recalled after one week. Numerous items in the present study

were asked in the context of the preceding two-weeks, hence it is likely that recall bias was introduced.

Possibly the most important limitation to consider in the current study is the use of single item responses to measure many of the target behaviours. Hays et al. (2012) illustrate that multiple-item scales yield scores that are generally more reliable, and likely more valid, than those produced by single items. In particular, sleep quantity, sleep quality, and tiredness were not only determined by a single item each but were also measured subjectively. Mallinson et al. (2019) suggest that the gold-standard of self-reported sleep is a sleep diary, as it obtains detailed “real time” (rather than recalled) information on daily sleep patterns at various points in time. Scott et al. (2020) suggests objective measures of sleep are the most reliable, such as Actigraphy devices, including wearable smart watches. Aili et al. (2017) utilised a combination of wearable actigraphy devices and a sleep diary, and found a low correlation between the two, suggesting that the two methods of measurement capture different dimensions of sleep. Thus, a recommendation for future research is to use multiple methods in the assessment of sleep, including both subjective and objective measures to increase validity.

### **Future Directions**

The current study assessed outcomes cross-sectionally and as such, could not determine causal relationships. Longitudinal research should be conducted in the future to assess medium- to long-term outcomes, to verify the strength and directions of the relationships established in the current study (Caruana et al., 2015). A recent study by Bacaro et al. (2023) highlighted that poor sleep quality and sleep disturbances are significant predictors of longitudinal school experiences-related outcomes (i.e., decreased school engagement and performance), and highlighted the importance of more longitudinal research

to investigate all aspects of healthy sleep, including the size and direction of the association between sleep and school experience.

A pilot study by Davis et al. (2022) on 'Healthy Sleep for Healthy Schools' demonstrated that embedding sleep-health education programs into the school curriculum improved students' healthy sleep practices. The researchers did not directly target nor assess school engagement, but postulated that there could be an association between the resulting improved sleep practices, and long-term improvements in school engagement. The program is still in the evaluation stage; future researchers could consider trialling a similar education program within high schools to address adolescent sleep and mental health in the context of school engagement, informed by the findings of the current study about interfering factors for adolescent school engagement.

Finally, in view of the positive relationship found between anxiety and school engagement, in the context of the other mediating variables, future research should also seek to assess measures of negative stress (i.e., distress) as well as positive stress (i.e., eustress). The results of the present study indicate that the relationship between anxiety and school engagement was not in the predicted direction, as increased anxiety symptoms resulted in greater school engagement. While this relationship seems intuitive upon consideration, there is a lack of empirical research to explain the nature of this relationship. This provides a gap for future studies to investigate further.

## **Conclusion**

The present study was the first to provide insight into the relationships between indicators of poor sleep, positive and negative aspects of mental health, and school engagement in a diverse sample of Australian high school students. The findings of the present study suggest that indicators of greater sleep and better mental health positively influence school engagement. The relationships established are complex and likely bi-

directional, hence it is recommended that future longitudinal research be conducted to verify the strengths and directions of the relationships. Nonetheless, the present study's findings suggest that Australian adolescents experiencing challenges associated with school engagement should seek to explore their sleep patterns and mental health as possible explanations for said challenges. Improving adolescent sleep and mental health is likely to be an effective way of bettering their associated school engagement.

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## Appendix A

### Survey Questions

ITEMS	RESPONSE OPTIONS
How old are you?	7,8,9,10,11,12,13,14,15,16,17,18,19
What is your year level?	3,4,5,6,7,8,9,10,11,12
What is your gender?	[F]Female,[M]Male,[O]Other,[P]Prefer Not To Say
Which term best describes your background?	[1]Australian,[8]New Zealander,[2]Aboriginal or Torres Strait Islander,[9]Māori,[3]African,[4]Asian,[5]European,[6]Pacific Islander,[7]Other
What country were you born in?	> too many options to fit here <
Do you (or people you live with) speak a language other than English at home?	[0.00]No,[1]Yes
Which language?	> too many options to fit here <
What suburb do you live in?	> too many options to fit here <
Imagine a ladder with steps numbered 1 at the bottom to 8 at the top. The top represents the best possible life for you and the bottom represents the worst possible life for you. On which step of the ladder do you feel you stand at this time?	[8]8 (best possible life),[7]7,[6]6,[5]5,[4]4,[3]3,[2]2,[1]1 (worst possible life)
I get love and support from my family.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I have a teacher at my school who cares about me.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I have a least one teacher who encourages me.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always

I have parents/carers who encourage me to do well.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I spend time with friends.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I have at least one good friend at school.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I have adults who set good examples for me.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I have a parent/carer who listens to me.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I am good at keeping friends.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I get along with people who are different from me.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I can talk about things if they upset me.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I find it easy to keep out of trouble.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I feel safe at home.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I feel safe at school.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I feel safe in the area where I live.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I eat well to stay well.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always

I get at least 8 hours of sleep most nights.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I keep myself fit.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I read for fun.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I try hard at school.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I care about my school.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I do my homework.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I enjoy learning new things at school.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I feel good about myself.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I am given useful jobs at school.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I am able to trust people.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I am trustworthy.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I forgive others who are mean to me.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I forgive myself when I mess up.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always

I take responsibility for my actions.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I think it is important to help other people.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I am involved with at least one activity outside of school such as a club, music, art, dance, sport, hobby or youth group.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I give my time to help others.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I have an adult in my life who I can talk to about my worries.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
I have fun at school.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
My friends and I can disagree about things and still be friends.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
My school gives students clear rules.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
My school enforces rules fairly.	[1]Never or Rarely,[2]Sometimes,[3]Often,[4]Always or Almost Always
In the last school term I have been bullied at school.	[4]Never,[3]Once a term,[2]Weekly,[1]Daily
In the last school term I have been bullied online.	[4]Never,[3]Once a term,[2]Weekly,[1]Daily
For example, by message or social media.	
During the last week, how many times have you sent or received messages between the hours of midnight and 6am in the morning?	[4]None,[3]Once or twice,[2]3 or 4 times,[1]5 or more times

Feeling nervous, anxious, or on edge.

Over the last 2 weeks, how often have you been bothered by this problem?

[1]Nearly every day,[2]More than half the days,[3]Several days,[4]Not at all

Not being able to stop or control worrying.

Over the last 2 weeks, how often have you been bothered by this problem?

[1]Nearly every day,[2]More than half the days,[3]Several days,[4]Not at all

Feeling down, depressed or hopeless.

Over the last 2 weeks, how often have you been bothered by this problem?

[1]Nearly every day,[2]More than half the days,[3]Several days,[4]Not at all

Little interest or pleasure in doing things.

Over the last 2 weeks, how often have you been bothered by this problem?

[1]Nearly every day,[2]More than half the days,[3]Several days,[4]Not at all

Trouble falling asleep, staying asleep, or sleeping too much.

Over the last 2 weeks, how often have you been bothered by this problem?

[1]Nearly every day,[2]More than half the days,[3]Several days,[4]Not at all

Poor appetite, weight loss, or overeating.

Over the last 2 weeks, how often have you been bothered by this problem?

[1]Nearly every day,[2]More than half the days,[3]Several days,[4]Not at all

Feeling tired, or having little energy.

Over the last 2 weeks, how often have you been bothered by this problem?

[1]Nearly every day,[2]More than half the days,[3]Several days,[4]Not at all

Trouble concentrating on things like school work, reading, or watching TV.

Over the last 2 weeks, how often have you been bothered by this problem?

[1]Nearly every day,[2]More than half the days,[3]Several days,[4]Not at all

I avoid thinking or doing anything about the problem.

How often do you do this when you have a problem?

[4]Never or Rarely,[3]Sometimes,[2]Often,[1]Always or Almost Always

I wish the problem would go away or somehow be over with.

How often do you do this when you have a problem?

[4]Never or Rarely,[3]Sometimes,[2]Often,[1]Always or Almost Always

I criticise myself for what is happening.

How often do you do this when you have a problem?

[4]Never or Rarely,[3]Sometimes,[2]Often,[1]Always or Almost Always

I spend more time alone.

How often do you do this when you have a problem?

[4]Never or Rarely,[3]Sometimes,[2]Often,[1]Always or Almost Always

In most situations I think I am doing pretty well.

[1]None of the time,[2]A little of the time,[3]Some of the time,[4]A lot of the time,[5]Most of the time,[6]All of the time

In most situations I can think of many ways to get things in life that are most important to me.

[1]None of the time,[2]A little of the time,[3]Some of the time,[4]A lot of the time,[5]Most of the time,[6]All of the time

In most situations I am doing just as well as other kids my age.

[1]None of the time,[2]A little of the time,[3]Some of the time,[4]A lot of the time,[5]Most of the time,[6]All of the time

In most situations when I have a problem, I can come up with lots of ways to solve it.

[1]None of the time,[2]A little of the time,[3]Some of the time,[4]A lot of the time,[5]Most of the time,[6]All of the time

In most situations I think the things I have done in the past will help me in the future.

[1]None of the time,[2]A little of the time,[3]Some of the time,[4]A lot of the time,[5]Most of the time,[6]All of the time

In most situations even when others want to quit, I know that I can find ways to solve the problem.

[1]None of the time,[2]A little of the time,[3]Some of the time,[4]A lot of the time,[5]Most of the time,[6]All of the time

I vape or use e-cigarettes.

[4]Never or Rarely,[3]Sometimes,[2]Often,[1]Always or Almost Always

I smoke cigarettes.

[4]Never or Rarely,[3]Sometimes,[2]Often,[1]Always or Almost Always

I drink alcohol.	[4]Never or Rarely,[3]Sometimes,[2]Often,[1]Always or Almost Always
I use illegal drugs.	[4]Never or Rarely,[3]Sometimes,[2]Often,[1]Always or Almost Always
I gamble online.	[4]Never or Rarely,[3]Sometimes,[2]Often,[1]Always or Almost Always
I play online games.	[4]Never,[3]Up to 2 hours each day,[2]2-4 hours each day,[1]More than 4 hours each day
In the last school term I carried a weapon to protect myself.	[4]Never,[3]Once a term,[2]Weekly,[1]Daily
In the last school term I threatened to physically hurt someone.	[4]Never,[3]Once a term,[2]Weekly,[1]Daily
If you could magically do anything, what is one thing that you would do to support the wellbeing of young people?	>blank text box<

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## Appendix B

### School Engagement Items

School engagement scores were calculated based on the average value of all nine items, and ranged from one to four as each item was measured on a Likert scale from one to four.

#### 4-point Likert scale from:

*1 = Never or Rarely*

*2 = Sometimes*

*3 = Often*

*4 = Always or Almost Always*

#### Items included:

1. I have a teacher at my school who cares about me.
2. I care about my school.
3. I enjoy learning new things at school.
4. I am given useful jobs at school.
5. I have fun at school.
6. My school gives students clear rules.
7. I try hard at school.
8. I do my homework.
9. My school enforces rules fairly.

**Appendix C**  
**Post-hoc Analyses**

**Table 1**

*Mediational Effect of Sleep quantity, Sleep quality and daytime Tiredness on School Engagement via Anxiety, Depression and Life Satisfaction in Males (n = 20,189)*

<i><b>Sleep Quantity</b></i>				
	Unstandardised coefficient (B)	SE	95% CI	
			LL	UL
TOTAL (c)	.256	.004	.248	.263
Direct effect (c')	.182	.004	.174	.190
Indirect effects				
Anxiety	.000	.001	-.003	.003
Depression	.030	.002	.026	.033
Life Satisfaction	.044	.002	.040	.048
<i><b>Sleep Quality</b></i>				
	Unstandardised coefficient (B)	SE	95% CI	
			LL	UL
TOTAL (c)	.157	.004	.149	.164
Direct effect (c')	.072	.004	.064	.080
Indirect effects				
Anxiety	-.001	.002	-.006	.003

Depression	.042	.003	.037	.047
Life Satisfaction	.044	.002	.041	.047
<b><i>Tiredness</i></b>				
	Unstandardised	SE	95% CI	
	coefficient (B)		LL	UL
TOTAL (c)	.175	.004	.167	.182
Direct effect (c')	.082	.004	.073	.090
Indirect effects				
Anxiety	-.002	.002	-.006	.003
Depression	.045	.003	.040	.051
Life Satisfaction	.050	.002	.046	.053

**Table 2**

*Mediational Effect of Sleep quantity, Sleep quality and daytime Tiredness on School Engagement via Anxiety, Depression and Life Satisfaction in Females (n = 21,937)*

<b><i>Sleep Quantity</i></b>				
	Unstandardised	SE	95% CI	
	coefficient (B)		LL	UL
TOTAL (c)	.255	.004	.247	.262
Direct effect (c')	.163	.004	.155	.170
Indirect effects				

Anxiety	-.002	.002	-.005	.001
Depression	.041	.002	.037	.045
Life Satisfaction	.053	.002	.049	.057

***Sleep Quality***

	Unstandardised coefficient (B)	SE	95% CI	
			LL	UL
TOTAL (c)	.168	.003	.162	.175
Direct effect (c')	.064	.004	.057	.071
Indirect effects				
Anxiety	-.003	.002	-.007	.001
Depression	.054	.003	.049	.059
Life Satisfaction	.054	.002	.050	.057

***Tiredness***

	Unstandardised coefficient (B)	SE	95% CI	
			LL	UL
TOTAL (c)	.196	.004	.189	.203
Direct effect (c')	.080	.004	.071	.088
Indirect effects				
Anxiety	-.005	.002	-.009	.000
Depression	.060	.003	.054	.065
Life Satisfaction	.061	.002	.057	.065

**Table 3***Mediational Effect of Sleep quantity, Sleep quality and daytime Tiredness on School**Engagement via Anxiety, Depression and Life Satisfaction in Others (n =963)*

<i>Sleep Quantity</i>				
	Unstandardised coefficient (B)	SE	95% CI	
			LL	UL
TOTAL (c)	.266	.018	.231	.301
Direct effect (c')	.189	.019	.151	.227
Indirect effects				
Anxiety	-.023	.009	-.040	-.007
Depression	.027	.010	.009	.049
Life Satisfaction	.072	.012	.052	.097
<i>Sleep Quality</i>				
	Unstandardised coefficient (B)	SE	95% CI	
			LL	UL
TOTAL (c)	.143	.017	.110	.177
Direct effect (c')	.069	.019	.031	.107
Indirect effects				
Anxiety	-.028	.012	-.053	-.004
Depression	.037	.014	.010	.064
Life Satisfaction	.065	.010	.046	.087

*Tiredness*

	Unstandardised coefficient (B)	SE	95% CI	
			LL	UL
TOTAL (c)	.152	.018	.117	.187
Direct effect (c')	.069	.023	.024	.114
Indirect effects				
Anxiety	-.039	.017	-.072	-.007
Depression	.045	.017	.012	.078
Life Satisfaction	.077	.011	.058	.101

## Appendix D

### Research Plan

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Note. some minor changes were made from the original research plan to the final research thesis. Firstly, the ‘physical health’ was removed as a mediating variable. Additionally, ‘life satisfaction’ was added as a mediating variable, to enable the researcher to assess mental health from both a positive and negative perspective. The change to these key variables was made to refine the scope of the study and was made prior to looking at any data. It was also decided that adolescence aged between 12 and 18 years would be included in the study as this would capture a larger number of students in grades 7 to 12. Thus, the final sample consisted of 44,037 participants, rather than the initially calculated 38,730. Finally, only three measures of sleep were used, as the researchers decided that item, “During the last week, how many times have you sent or received messages between the hours of midnight and 6am in the morning?”, was not particularly relevant to the research question.  
.....

### Psychology Honours Project 2023 – Research Plan

Student Name: [REDACTED]

Student ID: [REDACTED]

Design Plan

Sampling Plan

Analysis Plan

Study Information

**1. Title:**

The relationship between sleep and school engagement in adolescent school children as mediated by mental and physical health factors.

**2. Target Journal:**

Broadly, the publication of the current research will be directed towards any academic journals on Developmental and Educational Psychology. More specifically, I will be targeting the *Journal of Child Psychology and Psychiatry and Allied Disciplines* (JCPP), which is internationally recognised to be the leading journal covering both child and adolescent psychology and psychiatry. Types of articles that are typically published in this journal include experimental and developmental studies, especially those relating to developmental psychopathology and the developmental disorders.

This journal specifically aims to incorporate empirical research, clinical studies and reviews of high-quality emerging from differing research perspectives. This journal was preferred above journals such as *The Educational Psychologist* as conceptual, theoretical and review articles (including meta-analyses) tend to be preferred by this journal, rather than empirical studies such as the present study.

**3. Research Aim/s:**

To investigate the relationship between sleep and school engagement in high-school children, and whether this is mediated by mental and physical health factors.

**4. Research Question/s:**

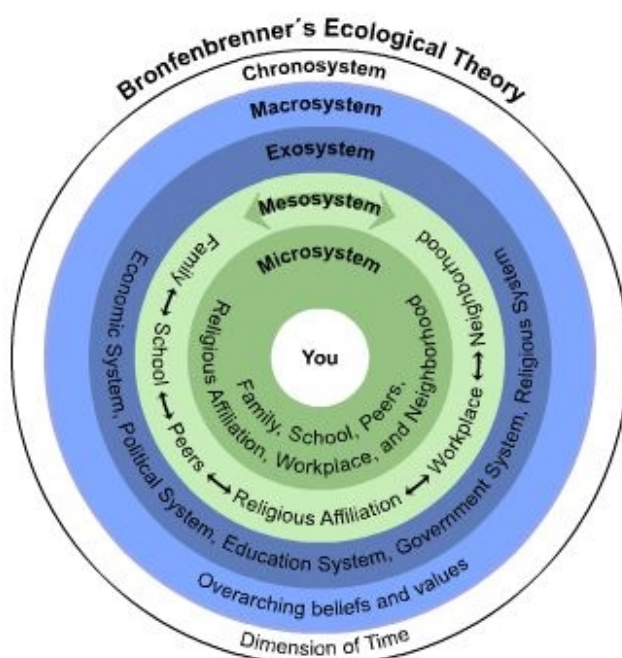
Does sleep quality in adolescent high-school children predict school engagement?

Is the relationship between sleep and school engagement in adolescent high-school children mediated by mental and physical health?

**5. Use of Theory:**

This project is contextualized within a systems-level approach to wellbeing. The theoretical model underpinning this research is Bronfenbrenner's Ecological Theory (figure 1). The present study will address factors at the Individual level, Micro-systems level, and the Macro systems level. The study will incorporate factors at each of the levels that are empirically demonstrated in the literature, to better understand the possible mechanisms linking sleep and school engagement in adolescent aged school children.

Figure 1: Bronfenbrenner's Ecological Theory



It is worthwhile noting that while the present study does have some theoretical underpinning, it will largely be empirically driven. Empirical findings will be used to explain the links between the independent variable, dependent variable, and the mediating variables, and to justify the present study. Based on the literature, we are predicting that better sleep will be associated with better school engagement, and that this will be mediated by levels of anxiety symptoms, levels of depression symptoms, healthy eating, and physical exercise. More specifically, better school engagement in association with better sleep will be mediated by lower levels of anxiety and depression symptoms, and higher levels of physical exercise and healthy eating.

## Design Plan

### 6. Tradition (optional):

Frequentist approach. The present study will use quantitative methods based on the frequentist approach – an approach to drawing conclusions from statistical samples that is based on the number of times an event is expected to occur in the long run if conditions for observing the event are held constant. It considers any research study to be one of a very large possible number of replications.

### 7. Study Design:

The study design uses observational data in the form of survey responses. The data obtained for use in the present study was acquired from Resilient Youth Australia (RYA) and had been collected as part of the Resilience Survey in Australian students aged 7-19 in school grades 3 -12 (Resilient Youth Australia, 2022). School students took part in an online questionnaire containing items on demography, resilience and wellbeing, responses on which formed the dataset collected. A mix of both public and private schools were included in the study, and schools and students who partook in this survey were largely diverse in their socio-economic backgrounds, suburban and regional areas.

### 8. Study Measures (optional):

A measure of **School Engagement** will be generated by combining the following seven items of the Resilience Survey: “I have a teacher at my school who cares about me”, “I care about my school”, “I enjoy learning new things at school”, “I am given useful jobs at school”, “I have fun at school”, “My school gives students clear rules”, and “My school enforces rules fairly”. These seven factors had been determined following a factor analysis based on a previous cohort of the same survey data conducted by the research supervisor.

**Sleep** will be measured by two items. The first item states, “I get at least 8 hours sleep most nights” and participants indicate their agreement with this statement via scores from 1-4 and hence, higher scores will be indicative of better sleep. The second item asks, “Over the last 2 weeks, how often have you been bothered by ... Trouble

falling asleep, staying asleep, or sleeping too much.” Scores also range from 1-4, where higher scores are again indicative of better sleep. If necessary, a further two items from the questionnaire may be included, and these items ask, “Over the last 2 weeks, how often have you been bothered by feeling tired or having little energy?”, and “During the last week, how many times have you sent or received messages between the hours of midnight and 6am in the morning?”. The internal consistency and factorability of these items will be assessed by conducting a factor analysis where required.

The first two mediating variables indicative of **mental health** being measured in this study are anxiety symptoms and depression symptoms. Integrated into the Resilience Survey is the Patient Health Questionnaire (PHQ-4). The PHQ-4 is a general mental health screener that assesses the occurrence of anxiety and depression symptoms, determined on the basis that anxiety and depression are two of the most prevalent mental health disorders today. The PHQ-4 consists of four items; two items corresponded to **anxiety symptoms** and the other two items corresponded to **depressive symptoms**.

The second two mediating variables indicative of **physical health** being measured in this study are healthy eating and physical exercise. **Healthy eating** will be measured using a single item from the Resilience Survey: “I eat well to stay well”. Scores range from 1-4, where higher scores indicate healthier eating. **Physical exercise** will also be measured using a single item: “I keep myself fit”. Scores range from 1-4, where higher scores indicate more activity.

## 9. Study Materials (optional):

The data obtained by the Resilience Survey is amalgamated into a national report, which is subsequently used to provide schools with a snapshot of the wellbeing and performance averages of students nationally, compared with students at individual schools.

Australia-wide, more than 1,500 schools have administered this survey to school children ages 7 to 19. The present study will rely on Resilience Survey data collected in 2022, being the most up-to-date data available at this time.

The Resilience Survey is an online survey consisting of 77 items that students complete during school time. The first eight items relate to demographic questions, specifically surrounding the participant’s age, grade, gender, nationality, birthplace, language spoken at home and residing suburb at that time. The other 69 items encompassed various other possible aspects of a child’s life, including life satisfaction, peer and familial relationships (including bullying), peer and adult supports, physical and mental wellbeing, physical and mental health, self-perception, personal beliefs and values, and participation in risky behaviours.

**10. Study Procedure:**

At the commencement of the study, every school across Australia was given the opportunity to partake in research with Resilient Youth Australia (RYA) and in turn, receive an individualised school report outlining the well-being of students at their school, in comparison with national norms.

To maintain confidentiality, schools that opted to participate were given a “school code”. Students then took part in the study by individually completing the anonymous RYA survey at the school-level by using the allocated school code. A self-reported survey style was elected as it allows participants to describe their own experiences rather than inferring this from observing participants and facilitates assessing large samples of people in an efficient and timely manner. The survey items were largely measured on likert scales, whereby students were asked to rank their agreement with the statement (e.g., from 1-4).

Items relate to demographic information such as age, grade, gender, and nationality, followed by questions about school, sociability, safety and physical health, finishing with questions around mental health, coping strategies and alcohol/drug use and other risky behaviours. The presentation of these items was fixed and did not differ between schools or students.

The variables of interest in the present study form part of a larger data set collected by Resilient Youth Australia. For further details, please refer to the Resilient Youth Australia website.

**Sampling Plan****11. Existing Data/Partial Existing Data/Original Data (choose one)**

The current study will rely on existing data collected by my supervisor, [REDACTED], and Resilient Youth Australia, for the purpose of creating a Resilient Youth Australia (RYA) snapshot report.

The purpose of the data from RYA’s point of view is to provide a snapshot of wellbeing in Australian students and to provide educators with individual reports on their school students wellbeing status.

As part of report, schools can elect to be provided with prompts for aspects of wellbeing that may require further development. The suggestions made would be based on the major areas of need identified and would propose areas where schools could focus on/intervene in the school population, given what they now know about their students’ wellbeing.

**12. Data Collection Procedures**

Initially, schools that opted to participate in this research and receive a RYA report, were given a “school code”. Students then completed an anonymous online survey at a school-level, all using the same afore mentioned code during school time.

Convenience sampling was most appropriate for the present study. All schools were given equal opportunity to partake in the research, but only the schools that elected to participate (to receive a school report on student wellbeing) were chosen to complete the survey. This method was chosen as participants had already agreed to complete the survey as part of a broader school wellbeing program.

**13. Type of Data Collected:**

The data was collected in the form of self-report survey responses which were completed by school children and largely consisted of quantitative data, with one textbox for qualitative data at the close of the questionnaire. Most questions were scored on a Likert scale, while the range of the scale differed between questions based on the standardisation for those questions.

**14. Sample Size:**

The total sample size of the Resilient Youth Survey in 2022 consisted of 100,597 participants; however, our study will only include participants between the ages of 13-18 years who are attending high school between grade 7-12 (n= 38,730).

**15. Stopping Rule:**

Due to the nature of the research, there was no stopping rule when collecting data other than responses had to be made during the year 2022. In the case of the present research, the greater the rates of participation, the greater the validity and generalizability of the data. The Resilience Survey is administered by schools voluntarily, following payment of a per student and per administration fee, and anyone who chose to engage was given the opportunity to.

## **Analysis Plan**

**16. Data Analyses:**

Boot-strapped Statistical Mediation Analysis as proposed by Hayes (2009) will be conducted on the data of the present study and will be run using SPSS statistical software. Descriptive group analyses may also be used where necessary (e.g., Mixed effects modelling, incl. ANOVA). The data analysis will be conducted by myself under guidance from my primary supervisor, [REDACTED].

Data will be screened for inclusion/exclusion of particular ages. Students between the ages of 13-18 years will be included in the data, and any participants who fall outside of this age range will be excluded, as well as excluding any missing cases for any individual item.

There are four basic assumptions underlying Mediation analyses. These are that (1) the dependent, independent, and mediator variables (the variables of interest) need to be using a continuous scale, (2) the variables of interest (the dependent variable and the independent and mediator variables) should have a linear relationship, (3) the data must not show multicollinearity, and (4) there should be no spurious outliers, and the distribution of the variables should be approximately normal (Hayes, 2009).

Due to the enormity of the present dataset, QQ plots along with Boxplots will be used to assess the normality of the data. Beyond removal of outliers, if our data violates any of the assumptions, the distributions will be transformed as necessary (ie, logarithms) to conform with test assumptions. Linearity will be assessed using visual inspection of scatterplots. Multicollinearity will be assessed using variance inflation factor (VIF). VIF values above 5 may indicate multicollinearity and will be initially addressed by removing one of highly correlated predictors from the model.

## References

Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. *Communication Monographs*, 76, 408-420

## Research Plan Checklist

**Students:** This checklist must be completed and signed by your primary supervisor as a requirement of the research plan component of the thesis. Please append a signed copy of the completed checklist to your research plan document and submit them together (as a single PDF document) via the MyUni assignments tab no later than **9am 15th of May**. To ensure your supervisor has sufficient time to review your research plan and complete the checklist, we encourage you to provide them with a copy of the checklist and a draft of your research plan as early as possible — at least one week before the due date. We also encourage you to work with supervisors to develop your research plans from early on in the semester.

**Supervisors:** Research plans for honours projects should be well reasoned and well thought-out (sound), and also manageable within the scope of the timeline, available resources and the student’s capabilities (feasibility). Please review the student’s research plan (template provided on MyUni) and indicate if each step of their plan is sound and feasible by ticking the appropriate box. If the component is not applicable given the nature of the project please tick “Not Applicable”. If any step of the plan is not yet sound or feasible please leave the box/s unticked.

Study Information	Not Applicable	Feasible	Sound
Title	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Target Audience	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Research Aim/s	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Research Question/s	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Use of Theory	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Design Plan	Not Applicable	Feasible	Sound
Tradition	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Study Design	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Study Measures	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Study Materials	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Study Procedure	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Sampling Plan	Not Applicable	Feasible	Sound
Data Collection Procedures	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Type of Data Collected	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Sample Size	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Stopping Rule	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Analysis Plan	Not Applicable	Feasible	Sound
Data Analyses	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Other	Not Applicable	Feasible	Sound
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Student Name	Signature	Date
[Redacted]	[Redacted]	28/04/2023

Primary Supervisor Name	Signature	Date
[Redacted]	[Redacted]	26/04/2023