Adolescent Mental Health and the Relationships between Anxiety, Depression and Sleep

Moses Banez

"This report is submitted in partial fulfilment of the Honours degree of Bachelor of Psychological Science (Honours)"

Word Count: 4598

Declaration

"This report 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 report 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."

Adolescent Mental Health and the Relationships between Anxiety, Depression and Sleep

Issues around mental health and sleep continue to be relevant for today's adolescents (Keyes, Gary, O'Malley, Hamilton and Schulenberg, 2019; Singh, Kenney and Pillar, 2013). Previous research has indicated that poor mental health is common amongst young people, with approximately 12.5% of youths in the US showing symptoms of depression, an illness where prolonged feelings of sadness affect cognition and behaviour (Keyes et al., 2019). Anxiety, a condition characterised by persistent fear and negative thoughts, is often diagnosed alongside with depression in patients (Jacobson and Newman, 2017, Kalmbach et al., 2019). When looking at the prevalence of anxiety disorders, recent studies have found that around 3% of US adolescents exhibit symptoms of anxiety, and that some may have developed their first symptoms as early as the age of 11 (Burstein, Beesdo-Baum, He & Merikangas 2014; Jamieson, Shan, Lagopoulos and Hermens, 2021).

Along with this prevalence of mental health issues amongst teenagers is that of sleeping problems, with around 13.6% of US children getting less than five days of adequate sleep every week (Singh et al., 2013). The high frequency of sleeping issues is important to note, as previous research has observed associations between poor sleep and a variety of health conditions, ranging from anxiety and depression, to physical conditions such obesity and diabetes (Magee, Robinson and Keane, 2017; Roberts and Duong, 2017). Considering how pervasive sleeping and mental health problems are amongst youths in the US, it is important to research whether these results are replicated in Australia, and how these problems can interact with each other (Khan and Burton, 2021). This study analyses the relationships between sleep, anxiety and depression amongst adolescents who participated in the Longitudinal Study of Australian Children, or the LSAC (Australian Institute of Family Studies, 2018).

The LSAC is a nationwide survey that began in 2004, where parents and children were asked a wide variety of questions regarding their daily and personal lives (Australian Institute of Family Studies, 2018). While there are numerous studies that have used data from the LSAC, there has not been as much research that has examined the LSAC for associations between anxiety, depression, and sleeping problems in teenagers specifically. The majority of LSAC-related studies that did focus on the relationships between sleep and mental health, tended to analyse primary school students or the parents of the participants, leaving less information on how the mental health of teenage participants associates with their sleep (Lewis, Galbally and Bailey, 2012; Magee, Robinson and Keane, 2017; Williamson, Mendel, Hiscock and Quach, 2020).

When looking back on previous LSAC-related studies, we can see that sleep is a significant factor in maintaining good mental health (Williams, Nicholson, Walker and Berthelsen, 2016). Results have shown that children who have sleeping problems were more likely to have issues with their emotional wellbeing, their energy levels, and their prosocial skills (Williams et al., 2016). According to a study by Williamson et al. (2020), young children who had any kind of sleeping problem, regardless of severity, were more likely to have issues with their cognitive skills and their emotional control, than those who did not have sleeping problems. Children who had persistent sleeping problems in particular were found to have the worst impairments to their mental health in comparison to the rest of their peers (Williamson et al., 2020).

When researching into which specific aspects of sleep are more predictive of mental health issues, one LSAC study by Magee, Robinson and Keane (2016) noted that the quality of sleep might be the most important facet. Magee et al. (2016) observed that poorer sleep quality – which is when the participant does not feel well-rested – was a significant predictor for poorer mental, emotional and physical wellbeing. Furthermore, Magee et al. (2017) observed that the mental wellbeing of participants who had short sleep durations, was not significantly different to those who slept longer, implying that how long a participant sleeps might not matter with regards to their mental health. Another study by Price, Quach, Wake, Bittman and Hiscock (2016) also found that sleep duration was not associated with child and parent health outcomes (Price et al., 2016). In fact, children who did not have psychosocial issues were found to have slightly shorter sleep durations than children with psychosocial issues (Price et al., 2016). These findings into the quality and duration of sleep stand in contrast with some of the results found in non-LSAC related studies.

When reviewing literature outside of the LSAC, there were studies that conflicted with which facet of sleep is more important in predicting depression. Research conducted by Lushington et al. (2015) discovered that shorter sleep durations were not associated with depressive moods, and that poor sleep quality was more predictive of stress and depression (Lushington et al., 2015). The idea that sleep quality and mental health are associated with each other was further supported by Sivertsen, Harvey, Lundervold & Hysing (2014), who noticed that Norwegian teenagers with insomnia were more likely to have depression. However, Sivertsen et al. (2014) also found that participants who were depressed did appear to have shorter sleep durations, which stands in contrast with findings by Lushington et al. (2015). Nonetheless, while findings on the relationship between sleep duration and mental health issues appear to be mixed, the quality of sleep appears to be a consistent factor in predicting sleep problems.

Another important facet of sleep that appears to correlate with mental health is sleep onset latency; the amount of time it takes for a person to fall asleep (Sivertsen et al., 2014). Sivertsen et al. (2014) found that participants who exhibited symptoms of depression tended to have longer sleep onset latencies. Furthermore, another study by Nota, Chu, Beard and Björgvinsson (2020) discovered that participants who had long sleep onset latencies were more likely to have higher levels of both anxiety and depression. This demonstrates that sleep onset latency can be an important variable when analysing the relationship between sleep and mental health.

Previous research has also analysed how anxiety correlates and interacts with sleep. A study by Norell-Clarke, Hagstrom, and Jansson-Frojmark (2021) noted that having an anxiety disorder can exacerbate negative thoughts and constant worrying, therefore worsening a person's sleeping problems. This finding is also similar to those by Jamieson, Shan, Lagopoulos and Hermens (2021), who argued that both sleep duration and sleep quality were important factors in predicting anxiety in adolescents, since both aspects of sleep were found to influence emotional processing, which in turn, affected the severity of anxiety symptoms. However, there are conflicting findings with regards to the direction of the relationship between anxiety and sleep. A study by Roberts and Duong (2017) on sleep duration and anxiety in adolescents, found that while shorter sleep durations did increase the likelihood of developing anxiety, anxiety did not predict shorter sleep durations in participants (Roberts and Duong, 2017).

It should be noted that there are some limitations to these studies. ADHD and Autism have been observed as potential confounding factors that could influence sleep quality along with other chronic physical conditions, but might not have been controlled within a number of these studies (Magee et al., 2017). There were also several other variables that could influence sleep that were kept in mind during this research project, such as exercise, a healthy diet, hyperactivity, use of electronics, and family dysfunction (Chang, Wu, Yen and Chang, 2019; Frolich, Lehmkuhl, Fricke and Wiater 2009; Igelstrom, Asenlof, Emtner and Lindberg 2018, Kline, 2014; Khan and Burton, 2021). Another noted limitation for one study was that it relied too much on third-party opinions - such as those from parents - to help observe participants, thus raising questions about how objective the responses are (Williams et al., 2016).

While the influence of sleep on behaviour and mental health have been analysed using the LSAC data in the past, there are not as many LSAC-related studies that have focused on the relationships that depression and anxiety have with sleeping problems amongst Australian adolescents. As mentioned before, the majority of LSAC studies regarding that subject have focused mainly on younger children and on parents, therefore leaving a lack of data on how the mental health of adolescents interacts with their sleep. By using the LSAC data to research the relationships between anxiety, depression and sleep, hopefully more insight can be provided into the mental health and wellbeing of Australian teenagers, and whether the findings from overseas studies will be replicated with LSAC participants.

The primary aim of this study was to analyse the relationships that anxiety and depression had with various facets of sleep during adolescence. With findings from previous studies in consideration, the following hypotheses were tested: that there will be a significant, negative relationship between sleep duration and anxiety, that there will be a significant, positive relationship between sleep onset latency and anxiety and depression, and that that there will be a significant, positive relationship between sleep quality, and anxiety and depression.

Furthermore, the study will investigate the rates of depression and anxiety in the sample, examine the relationship between sleep duration and depression, and compare anxiety and depression to determine if one of these factors is a stronger predictor for sleeping issues.

Method

Participants

Data for this research project was taken from the Longitudinal Study of Australian Children or LSAC. Starting from 2004, the LSAC gathered information about the life trajectories of participants who had been designated into two cohorts; those observed from birth who are known as the B-cohort, and those age 4-5 who are known as the K-cohort. Surveys were given to the participants and their parents every 2 years; this was labelled as waves. This research project analysed information from participants aged 15-16 year olds from the K-cohort at wave 6. All of the data is drawn from the self-reported answers of the children, with responses from parents being excluded.

Measures

The survey given to the participants included various questionnaires regarding their mental health. Anxiety was measured through answers to the Strengths and Difficulties questionnaire (SDQ), a test that analyses the mental health and behaviours of children, with respondents answering questions on a Likert scale ranging from 1 to 3 (Goodman, 2001). Three questions from the Emotional Problems section of the SDQ were used in this study; these questions related to how often the participants were worried, how often they were nervous, and whether they had many fears (Goodman, 2001). Their answers to these questions were then added together to create an “Anxiety Score” for each participant.

Depression was measured through the Short Mood and Feelings Questionnaire (SMFQ), which calculates symptoms of depression in respondents through a sum of their answers (Thabrew, Stasiak, Bavin, Frampton and Merry, 2018). Those who scored 12 or higher in the SMFQ would be identified as meeting the threshold for having depression (Thabrew et al., 2018).

Sleep duration and sleep onset latency were measured in hours. Sleep onset latency was calculated from when the participant went to bed, to when they fell asleep, while duration was calculated from when the participant fell asleep, to the time when they woke up.

Sleep quality was measured by dividing the participants into four groups depending on how the participants answered the question “during the last month, how well do you feel you have slept in general?”. The participants were given four answers to choose from, ranging from “very well” to “very badly”.

Other variables that could influence sleep were measured through the following: Computer/Phone usage was calculated as a sum of the participants’ answers to how often they used electronics, ranging from 1 (“all the time”) to 45 (“never”). Exercise enjoyment was measured from 1 (“really likes to exercise”) to 5 (“really dislikes exercising”). Family dysfunction was measured by how often the participant’s family would yell at each other, from 1 (“never”) to 5 (“always”). Hyperactivity was calculated through a mean score of the Hyperactivity Scale in the SDQ, and high fat food consumption was measured as a sum of the answers regarding how much junk food – such as french fries and chocolate – were eaten by the participant the day before answering the questions.

Statistical Analyses

Pearson’s correlation tests were used to analyse the relationships between anxiety, depression, sleep duration and sleep onset latency. A Kruskal-Wallis test was implemented to examine for any significant differences between the sleep quality groups and the independent variables, with a pairwise Wilcoxon test being utilised to observe statistical differences between each groups. A nested regression model was then used to see whether anxiety and depression were significant predictors for sleeping problems. The first model had a multiple regression for depression, anxiety and a facet of sleep, while the second model had the same three variables along with other factors that can potentially influence sleep, such as hyperactivity and diet.

Results

Prevalence of Anxiety and Depression

Out of 3160 respondents (male = 1808, female = 1552), 112 or 3.54% received a total of 9 out of 9 in anxiety scores, with a mean score of 5.05.

With regards to depression, 511 respondents or 16.17% scored 12 or higher, with an overall mean score of 5.24.

Correlations between Sleep and Mental Health Issues

When looking at the correlations between anxiety and depression as shown in Table 1, it can be observed that those who scored high in depression were also more likely to have higher scores in anxiety.

When comparing depression and anxiety with sleep duration and onset latency, depression and anxiety were both shown to have approximately the same strength and direction when correlating with the two sleep variables. Sleep duration had a negative correlation with both depression and anxiety, while sleep onset latency had positive correlations with depression and anxiety.

Table 1:

Pearson's Correlations

Variable	n	1	2	3	4
1. Anxiety	3158	-			
2. Depression	3158	0.41**	-		
3. Sleep Duration	3158	-0.17**	-0.14**	-	
4. Sleep Onset Latency	3158	0.13**	0.11**	-0.32**	-

** indicates p = <0.01

The Kruskal-Wallis test for anxiety and sleep quality indicated that there was a statistically significant difference between the anxiety scores of the sleep quality groups ($H(3) = 205.73$, $p = <0.01$). Results from the pairwise Wilcoxon test demonstrated that all of groups had significant differences to each other ($p = <0.01$).

Similar results were also found for depression and sleep quality; the Kruskal-Wallis test found that there was a significant difference between depression and one of the sleep quality groups ($H(3) = 306.87$, $p = <0.01$). Results from the pairwise Wilcoxon test also demonstrated that all groups had significant differences to each other ($p = <0.01$).

The boxplots seen in Figures 1 and 2 indicate that those who slept poorly also tended to have higher Anxiety and Depression scores than those who slept well.

Figure 1:

Anxiety and Sleep Quality

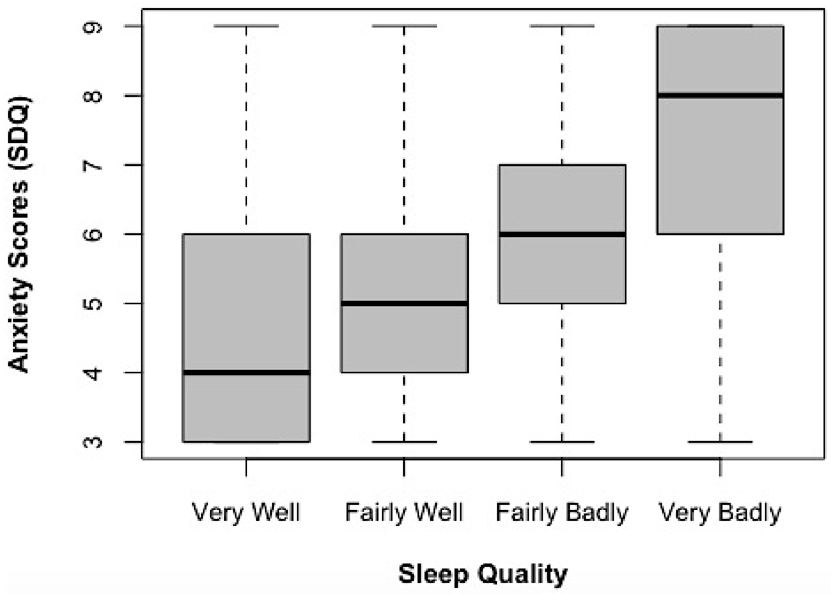
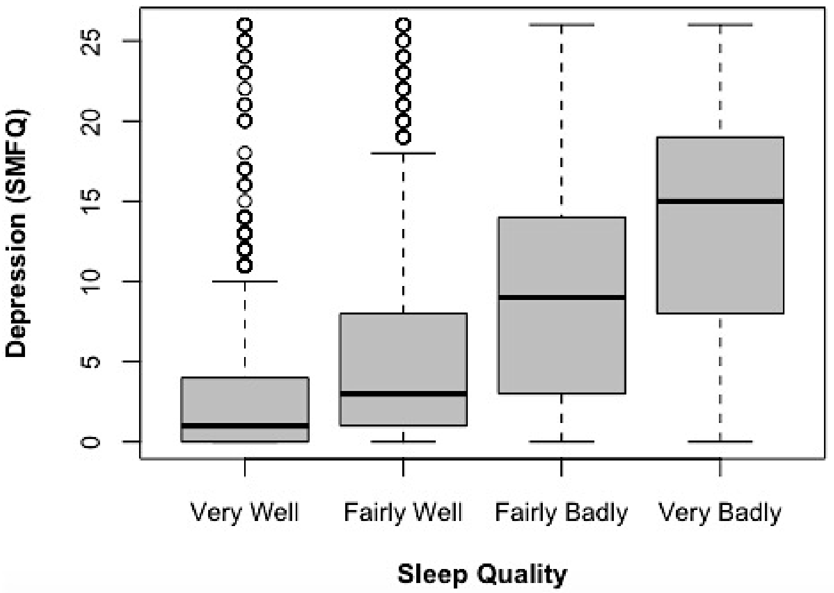


Figure 2:

Depression and Sleep Quality



Predictor Variables for Sleep Problems

When looking at the multiple regressions for sleep duration in Table 2, it can be observed that anxiety was the stronger predictor compared to depression in both models, with anxiety and depression scores decreasing the longer the participant slept. Hence, those with higher scores in anxiety and depression were more likely to be getting less sleep. However, when looking at Model 2, we can see that computer/phone use was the most significant predictor for sleep duration, with more screen time exposure leading to less sleep.

Table 2:

Comparisons of Regression Models for Sleep Duration

Regression Models	**Model 1** F[X] = X, $p < 0.001$, R^2 = X			**Model 2** F[X] = X, $p < 0.001$, R^2 = X		
	Unstand. β	Stand. β	P-Value	Unstand. β	Stand. β	P-Value
Depression	-0.011	-0.085	<0.01	-0.007	-0.050	0.01
Anxiety	-0.072	-0.139	<0.01	-0.052	-0.101	<0.01
Computer/Phone Use				0.021	0.133	<0.01
Exercise				-0.082	-0.073	<0.01
Family Dysfunction				-0.062	-0.062	<0.01
Hyperactivity				-0.011	-0.031	0.10
Junk Food Consumption				0.015	0.032	0.06

In Table 3 for sleep onset latency, both anxiety and depression in Model 1 were statistically significant predictors, with higher scores in both variables potentially leading to longer sleep onset latency, though anxiety was the stronger predictor between the two variables in both models.

When looking at Model 2, it appeared that anxiety had a statistically significant relationship with sleep onset latency but depression did not. Results from Model 2 also indicate that the participant’s hyperactivity might be the strongest predictor for their sleep onset latency, with higher hyperactivity levels leading to a prolonged sleep onset.

Table 3:

Comparisons of Regression Models for Sleep Onset Latency

Regression Models	**Model 1** F[X] = X, $p < 0.001$, R^2 = X			**Model 2** F[X] = X, $p < 0.001$, R^2 = X		
	Unstand. β	Stand. β	P-Values	Unstand. β	Stand. β	P-Values
Depression	0.005	0.076	<0.01	0.002	0.034	0.09
Anxiety	0.027	0.094	<0.01	0.014	0.048	0.01
Computer/Phone Use				-0.002	-0.020	0.26
Exercise				0.061	0.061	<0.01
Family Dysfunction				0.023	0.046	0.01
Hyperactivity				0.019	0.093	<0.01
Junk Food Consumption				0.011	0.041	0.02

Regarding sleep quality in Table 4, the results indicate that in both models, anxiety and depression had significant relationships with duration and were equally strong as predictors. This indicates that participants who had higher scores in anxiety and depression were more likely to have poor sleep quality.

The data in Model 2 showed that while anxiety and depression continue to be important predictors for sleep quality, hyperactivity was the most significant variable in predicting sleep quality, with higher levels of hyperactivity being associated with worse sleep quality.

Table 4:

Comparisons of Regression Models for Sleep Quality

Regression Models	**Model 1** F[X] = X, $p < 0.001$, R^2 = X			**Model 2** F[X] = X, $p < 0.001$, R^2 = X		
	Unstand. β	Stand. β	P-Values	Unstand. β	Stand. β	P-Values
Depression	0.018	0.1837	<0.01	0.012	0.123	<0.01
Anxiety	0.069	0.1840	<0.01	0.045	0.120	<0.01
Computer/Phone Use				-0.003	-0.03	0.07
Exercise				0.082	0.1	<0.01
Family Dysfunction				0.059	0.089	<0.01
Hyperactivity				0.036	0.138	<0.01
Junk Food Consumption				-0.004	-0.013	0.4

Discussion

The majority of the hypotheses for this project were supported by the results. The percentage of LSAC participants who scored 9 out of 9 in Anxiety scores (3.54%) was similar to the 3% of participants observed by Burstein et al. (2014) who exhibited symptoms of anxiety. The findings of Jacobson & Newman (2017) regarding the prevalence of depression and anxiety co-occurring also appear to be supported, since the Pearson's correlation in Table 1 indicate that anxiety and depression scores were moderately and positively correlated. This implies that those who scored high in anxiety were likely to score high in depression as well.

Regarding the relationship between sleep duration and anxiety, both the Pearson's correlation and the nested regression models demonstrated that anxiety symptoms did correlate with and predicted shorter sleep durations in the sample, which has been demonstrated in past research (Nota et al., 2020; Robert and Duong, 2017). For depression and sleep duration, research by Sivertson et al. (2014) indicated that adolescents with depression were more likely to have shorter sleep durations; this was replicated in the results as seen on Tables 1 and 2, with depression being a significant predictor for duration. These findings can be explained by the fact that anxiety and depression tend to cause or exacerbate worrying and stress in patients, thereby making it more difficult for a person to relax and fall sleep (Nota et al., 2020).

For sleep onset latency, anxiety was found to be a good predictor variable that shared a significant, positive relationship with sleep onset latency, indicating that symptoms of anxiety do increase the amount of time it takes for participants to fall asleep, therefore supporting the hypothesis that anxiety and onset latency were positively correlated (Nota et al., 2020; Sivertson et al., 2014). Again, this can be explained by the fact that anxiety symptoms, such as rumination, can make it challenging for participants to fall asleep (Nota et al., 2020).

The results for sleep quality also appeared to support findings by Lushington et al. (2015), since higher scores in depression were found to predict poor sleep quality. As seen in Figure 2, the group that slept the poorest had a median score above 12 in the SDQ, indicating that a high number of depressive symptoms were exhibited by participants in that group (Thabrew et al., 2018). Anxiety scores were also found to predict worse sleep quality, a result that supports findings from previous research (Jamieson et al., 2021). Thus, the hypothesis that anxiety and depression positive correlated with sleep quality was supported. An explanation for these relationships could be due to the neurobiological influence of sleep; the quality of sleep affects the structures of the brain that involve hormone levels and emotional control, which in turn affects the mental wellbeing of the participant (Jamieson et al., 2021; McMakin and Alfano, 2015).

While most of the findings from previous studies were replicated in this project, there were also a few results that did not support the hypotheses of this project and prio research. Concerning the prevalence of mental health issues, the percentage of participants who exhibited depression was found to be 6.56% higher amongst LSAC participants in 2014, compared to US adolescents studied by Kessler and Walters (1998, p. 6) in the 1990s. This higher percentage might not be an isolated observation, as research by Weinberger et al. (2017) found a steady increase in cases of depression amongst US teenagers between 2005 and 2015. Explanations for why this trend occurred can be due to numerous factors, such as the effects of major world events like the 2008 Financial Crisis, or the increase in cyberbullying due to laptops and phones becoming more commonplace amongst youths (Weinberger et al. 2017). If the prevalence of depression is increasing amongst adolescents, then further research needs to be done to definitively identify the major factors behind the increase in cases (Weinberger et al. 2017).

With regards to sleep onset latency, it was hypothesized that depression would have a significant, positive relationship with the variable. However, the regression analysis indicated that depression was not a statistically significant predictor for sleep onset latency despite having a significant correlation, indicating that the findings of Sivertsen et al. (2014) and Nota et al. (2020) might not have been replicated. One reason for this could be due to the associations between anxiety and depression; Jacobson and Newman (2017) found that having depression can be a significant risk factor for developing anxiety and vice versa, though depression appeared to be the stronger predictor between the two variables. The results from the Pearson's correlation tests in Table 1 showed a moderate, positive relationship between depression and anxiety. Consequently, one possible explanation for depression not being a significant predictor for sleep onset latency despite their correlation, could be because it has an indirect effect on sleep onset latency through anxiety. If a participant develops depression, they're more likely to have anxiety and therefore, more likely to have longer sleep onset latencies (Jacobson and Newman, 2017). Similarly, symptoms of depression might be having an indirect effect on sleep onset through one or more of the other variables in Model 2. For example, exercise enjoyment was found to be one of the strongest predictors of sleep onset latency in Model 2. One of the symptoms for depression is tiredness and a lack of energy, which would affect how much a participant enjoys exercising, and therefore indirectly affect how long it takes for the participant to fall asleep (Isaksson, Selinus, Åslund and Nilsson, 2020). However, it should be noted that only correlations were made between depression and other independent variables. Analyses into whether depression is a significant predictor for anxiety and exercise enjoyment were not conducted in this project.

One finding that conflicted with prior research was with regards to sleep duration. An LSAC study by Price et al. (2016) found that participants who did not have mental illnesses slept slightly less than those who were mentally unwell. However, the results of this research project did not support those findings, since symptoms of depression and anxiety did predict a decrease in sleep duration amongst the sample. While these findings conflict with those established by Price et al. (2016), there are a number of other non-LSAC related studies that have found links between shorter sleep durations and depression and anxiety (Kalmbach, Arnedt, Song, Guille and Sen, 2017; Nota et al., 2020). For depression in particular, Anujuo et al. (2021) argued that the link between sleep duration and depression can stem from the fact that patients with depression often have difficulties with self-regulation and maintaining schedules, including for bedtime. This in turn can lead to shorter sleep durations (Anujuo et al., 2021).

Furthermore, contrary to results by Roberts and Duong (2017), anxiety was found to be a statistically significant predictor for sleep duration, and was a stronger predictor than most of the variables in Model 2, other than computer/phone use. One reason for why electronic screen time was such a strong predictor could be because the stimuli from being online during the night disrupted or delayed the sleeping patterns of the participants (Khan and Burton, 2021). A similar explanation can be used to identify why anxiety is also a strong predictor, since symptoms of anxiety make it more difficult for participants to fall asleep, leading to a disruption of their usual sleeping patterns (Nota et al., 2020; Norell-Clarke et al., 2021).

When considering the results of the nested regression models, anxiety appears to be a stronger predictor for sleep problems than depression, though both were statistically significant predictors for various facets of sleep. Thus, for adolescents who suffer from anxiety and depressive disorders, troubles with sleep appear to be a common problem amongst that demographic, especially for those who have an anxiety disorder.

There are a number of limitations that need to be considered when analysing the results. Since the sums for the participants' anxiety scores came from only three questions in the SDQ, the scoring of anxiety only measured three major symptoms and did not include other common symptoms of anxiety disorders, such as irritability and fatigue (American Psychiatric Association, 2013). Furthermore, the time given for how long the participants had been feeling these symptoms ranged anywhere within the 6 month period prior to the survey, and did not specify whether these symptoms have been more long-term, or only occurred recently (American Psychiatric Association, 2013; Goodman, 2001). Therefore, the test for anxiety symptoms in this study were not as rigorous as the questions for depression, which utilised the whole SMFQ rather than a specific section. Additionally, the number of participants who had the worst sleep quality were incredibly low (n = 21), so data collected from that group is likely to be unreliable. Future research can improve on this by focusing specifically on adolescents with sleeping problems, which would yield more reliable results regarding the relationship between sleep quality and mental health issues.

Furthermore, there were a number of variables that could affect sleep that were not included in the study due to a lack of data. Factors such as autism, alcohol consumption and smoking have previously been shown to affect aspects of sleep such as duration and quality (He, Hasler, & Chakravorty 2019; Krishnan, Dixon-Williams and Thornton 2014, Magee et al., 2017). However, since very few of the participants answered questions regarding those variables, they were not included in the regression model.

There are a few future directions for the findings of this study. One way to expand on these results can be to do longitudinal observations, to see whether sleeping problems continue to linger even after treatments for depression and anxiety during adolescence.

Another way to expand on the results of this study is to analyse which facets of sleep are the most predictive of anxiety and depression. Sleep has already been established as an important factor in mental health outcomes due to its effects on brain function and hormone levels (Jamieson et al., 2021; McMakin and Alfano, 2015). Previous research has already demonstrated that sleep problems can predict mental health issues such as depression and anxiety, but a future study can focus on which facets of sleep – such as sleep onset latency or quality – are more predictive of mental health issues (Goldstone et al., 2020; Kalmbach et al, 2019)

Another limitation is how applicable the results are during the present time. The data in this project was taken from a survey that was conducted in 2014 (Australian Institute of Family Studies, 2018). Since the ownership of smartphones and laptops continue to become more common amongst youths, the results I found may not be applicable for the current youth population. Research conducted after 2014 has observed an increase in smartphone ownership and electronic use by adolescents and children (Kenney and Gortmaker, 2017; Sohn, Rees, Wildridge, Kalk, and Carter, 2019). This is especially pertinent as the findings from this project indicate that computer/phone use was the strongest predictor for sleep duration; a result that supports evidence from Chahal, Fung, Kuhle, & Veugelers (2013). Thus, using more contemporary data to analyse the relationships between the use of electronics, mental health and sleep, can be a potential direction for future research.

This project has replicated a majority of findings by LSAC and non-LSAC studies that have analysed the relationships between sleep, anxiety and depression during adolescence. Symptoms of depression and anxiety correlated and predicted various aspects of sleep. However, depression was not a statistically significant predictor for sleep onset latency, and observations regarding the relationships with poor sleep quality may be unreliable. Nonetheless, the mental health of adolescents in the LSAC did appear to correlate with various sleeping issues.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). https://doi.org/10.1176/appi.books.9780890425596

Anujuo, K., Stronks, K., Snijder, M. B., Lok, A., Jean-Louis, G. & Agyemang, C. (2021) Association between Depressed Mood and Sleep Duration among Various Ethnic Groups—The Helius Study. *International Journal of Environmental Research and Public Health, 18*(13), 1-10.

Australian Institute of Family Studies. (2018). *Longitudinal Study of Australian Children Data User Guide – December 2018*. Melbourne: Australian Institute of Family Studies.

Burstein, M., Beesdo-Baum, K., He, J. P. & Merikangas, K. R. (2014). Threshold and subthreshold generalized anxiety disorder among US adolescents: prevalence, sociodemographic, and clinical characteristics. *Psychological Medicine, 44*(11), 2351-2362.

Chahal, H., Fung, C., Kuhle, S. & Veugelers, P. J. (2013). Availability and night-time use of electronic entertainment and communication devices are associated with short sleep duration and obesity among Canadian children. *Pediatric Obesity, 8*(1), 42-51.

Chang, L. Y., Wu, C. C., Yen, L. L. & Chang, H. Y. (2019). The effects of family dysfunction trajectories during childhood and early adolescence on sleep quality during late adolescence: Resilience as a mediator. *Social Science and Medicine, 222*, 162-170.

Frolich, J., Lehmkuhl, G., Fricke, L. & Wiater, A. (2009). Coherency of attention deficit/hyperactivity and sleep-related problems. *Somnologie: Schlafforschung und Schlafmedizin*, 13(3), 176-181.

Goldstone, A., Javitz, H. S., Claudatos, S. A., Buysse, D. J., Hasler, B. P., de Zambotti, M., Clark, D. B., Franzen, P. L., Prouty, D. E., Colrain, I. M. & Baker, F. C. (2020). Sleep Disturbance Predicts Depression Symptoms in Early Adolescence: Initial Findings From the Adolescent Brain Cognitive Development Study. *Journal of Adolescent Health, 66*(5), 567-574.

Goodman, R. (2001). Psychometric Properties of the Strengths and Difficulties Questionnaire. *Journal of the American Academy of Child & Adolescent Psychiatry, 40*(11), 1337-1345

He, S., Hasler, B. P. & Chakravorty, S. (2019). Alcohol and Sleep-Related Problems. *Current Opinion in Psychology*, 30, 117-122.

Igelstrom, H., Asenlof, P., Emtner, M. & Lindberg, E. (2018). Improvement in obstructive sleep apnea after a tailored behavioural sleep medicine intervention targeting healthy eating and physical activity: a randomised controlled trial. *Sleeping and Breathing, 22*(3), 653-661.

Isaksson, J., Selinus, E. N., Åslund, C. & Nilsson, K. W. (2020). Physical activity in early adolescence predicts depressive symptoms 3 years later: A community-based study. *Journal of Affective Disorders, 277*, 825-830.

Jacobson, N. & Newman, M. (2017). Anxiety and Depression as Bidirectional Risk Factors for One Another. *Psychological Bulletin, 143* (11), 1155-1200.

Jamieson, D., Shan, Z., Lagopoulos, J. & Hermens, D. F. (2021). The role of adolescent sleep quality in the development of anxiety disorders: A neurobiologically-informed model. *Sleep Medicine Reviews, 59*, 1-9.

Kalmbach, D. A., Arnedt, J. T., Song, P. X., Guille, C. & Sen, S. (2017). Sleep Disturbance and Short Sleep as Risk Factors for Depression and Perceived Medical Errors in First-Year Residents. *Sleep, 40*(3), 1-8.

Kalmbach, D. A., Abelson, J. L., Arnedt, J. T., Zhao, Z., Schubert, J. R. & Sen, S. (2019). Insomnia symptoms and short sleep predict anxiety and worry in response to stress exposure: a prospective cohort study of medical interns. *Sleep Medicine, 55*, 40-47.

Kenney, E. L. & Gortmaker, S. L. (2017). United States Adolescents' Television, Computer, Videogame, Smartphone, and Tablet Use: Associations with Sugary Drinks, Sleep, Physical Activity, and Obesity. *The Journal of Pediatrics, 182*, 144-149.

Kessler, R. C. & Walters, E. E. (1998). Epidemiology of DSM-III-R major depression and minor depression among adolescents and young adults in the National Comorbidity Survey. *Depression and Anxiety, 7*(1), 3-14.

Keyes, K. M., Gary, D., O'Malley, P. M., Hamilton, A. & Schulenberg, J. (2019). Recent increases in depressive symptoms among US adolescents: trends from 1991 to 2018. *Social Psychiatry and Psychiatric Epidemiology, 54*(8), 987-996.

Khan, A. & Burton, N. W. (2021). Electronic games, television and psychological wellbeing of adolescents: Mediating role of sleep and physical activity. *International Journal of Environmental Research and Public Health, 18*(16), 1-12.

Kline, C. E. (2014). The Bidirectional Relationship Between Exercise and Sleep: Implications for Exercise Adherence and Sleep Improvement. *American Journal of Lifestyle Medicine, 8*(6), 375-379.

Krishnan, V., Dixon-Williams, S. & Thornton, J. D. (2014). Where There Is Smoke…There Is Sleep Apnea: Exploring the Relationship Between Smoking and Sleep Apnea. *Chest, 146*(6), 1673-1680.

Lewis, A. J., Galbally, M. & Bailey, C.M. (2012). Perinatal mental health, antidepressants and neonatal outcomes: Findings from the Longitudinal Study of Australian Children. *Neonatal, Paediatric and Child Health Nursing, 15*(3), 21-27.

Lushington, K., Wilson, A., Biggs, S., Dollman, J., Martin, J. & Kennedy, D. (2015). Culture, Extracurricular Activity, Sleep Habits, and Mental Health: A Comparison of Senior High School Asian-Australian and Caucasian-Australian Adolescents. *International Journal of Mental Health, 44*(1-2), 139-157.

Magee, C. A., Robinson, L. & Keane, C. (2017). Sleep quality subtypes predict health-related quality of life in children. *Sleep Medicine, 35*, 67-73.

McMakin, D. L. & Alfano, C. A. (2015). Sleep and Anxiety in Late Childhood and Early Adolescence. *Current Opinion in Psychiatry, 28*(6), 483-489.

Norell-Clarke, A., Hagstrom, M. & Jansson-Frojmark, M. (2021). Sleep-Related Cognitive

Processes and the Incidence of Insomnia Over Time: Does Anxiety and Depression Impact the Relationship?. *Frontiers in Psychology, 12*, 1-12.

Nota, J. A., Chu, C., Beard, C. & Björgvinsson, T. (2020). Temporal Relations Among Sleep, Depression Symptoms, and Anxiety Symptoms During Intensive Cognitive–Behavioral Treatment. *Journal of Consulting and Clinical Psychology, 88*(11), 971-982.

Price, A. M. H., Quach, J., Wake, M., Bittman, M. & Hiscock, H. (2016). Cross-sectional sleep thresholds for optimal health and well-being in Australian 4–9-year-olds. *Sleep Medicine, 22*, 83-90.

Roberts, R. E. & Duong, H. T. (2017). Is there an association between short sleep duration and adolescent anxiety disorders?. *Sleep Medicine, 30*, 82-87.

Shamsaei, F., Daraei, M. M., Aahmadinia, H. & Seif, M. (2019). The Relationship between Sleep Habits and Mental Health in Iranian Elementary School Children. *Sleep Science, 12*(2), 94-99.

Singh, G. K., Kenney, M. K. & Pillar, G. (2013). Rising Prevalence and Neighborhood, Social, and Behavioral Determinants of Sleep Problems in US Children and Adolescents, 2003–2012. *Sleep Disorders, 2013*, 1-15.

Sivertsen, B., Harvey, A. G., Lundervold, A. J. & Hysing, M. (2014). Sleep problems and depression in adolescence: results from a large population-based study of Norwegian adolescents aged 16-18 years. *European Child & Adolescent Psychiatry, 23*(8), 681-689.

Sohn, S. Y., Rees, P., Wildridge, B., Kalk, N. J. and Carter, B. (2019). Prevalence of problematic smartphone usage and associated mental health outcomes amongst children and young people: a systematic review, meta-analysis and GRADE of the evidence. *BMC Psychiatry, 19*(1), 1-10.

Thabrew, H., Stasiak, K., Bavin, L. M., Frampton, C. & Merry, S. (2018). Validation of the Mood and Feelings Questionnaire (MFQ) and Short Mood and Feelings Questionnaire (SMFQ) in New Zealand help-seeking adolescents. *International Journal of Methods in Psychiatric Research, 27*(3), e610.

Weinberger, A. H., Gbedemah, M., Martinez, A. M., Nash, D., Galea, S. & Goodwin, R. D. (2017). Trends in depression prevalence in the USA from 2005 to 2015: widening disparities in vulnerable groups. *Psychological Medicine, 48*(8), 1308-1315.

Williams, K. E., Nicholson, J. M., Walker, S. & Berthelsen, D. (2016). Early childhood profiles of sleep problems and self-regulation predict later school adjustment. *British Journal of Educational Psychology, 86*(2), 331-350.

Williamson, A. A., Mindell, J. A., Hiscock, H. & Quach, J. (2020). Longitudinal sleep problem trajectories are associated with multiple impairments in child well-being. *The Journal of Child Psychology and Psychiatry, 61*(10), 1092-1103.