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Adolescent Sleep Quality: An Exploratory Study of Sleep Complaints and Impacts for Boarding Students from Regional and Remote Communities in Years 7 to 12

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Abstract

This exploratory study investigates aspects of sleep quality and some of the potential impacts of sleep complaints for 168 male boarding students from regional and remote communities in Years 7 to 12. An online self-report questionnaire was used to examine the relationship between sleep quality and participants' sense of academic self-perception, motivation and regulation, resilience, as well as indicators of non-specific psychological distress, life satisfaction, behavioural and emotional wellbeing. Results found general parity between participants' overall scores for sleep quality and norms on the sleep/wake problems scale. However, it emerged that over the previous seven days only a small proportion of participants were satisfied with their sleep every night, with the majority reporting feeling tired or sleepy during the day. This and other findings are discussed in relation to current national sleep recommendations for adolescents, as well as with consideration to the promotion of healthy adolescent development and optimal academic performance, behavioural and cognitive functioning, and emotional regulation. Implications for boarding school routines are discussed with an emphasis on time allocated to sleep, and actual time spent asleep, by adolescent boarders. Strengths and limitations of this study are presented.

Key words: *regional and remote education, adolescence, sleep quality and complaints, boarding school, mental health*

Introduction

It is well-established that sleep plays a crucial and complex role in supporting healthy psychological functioning in adolescence (Tarokh, Saletin, & Carskadon, 2016). Yet, in the past decade sleep complaints and exposure to insufficient sleep during adolescence are increasingly being regarded as a burgeoning global health issue (Gradisar, Gardner, & Dohnt, 2011; Shochat, Cohen-Zion, & Tzischinsky, 2014). Of particular concern is the close bi-directional interaction adolescent sleep complaints have with increased risk for psychopathology and behavioural problems well into adulthood (Vermeulen et al., 2021). Adolescence has long been associated with maturation in bioregulatory mechanisms and re-orientation of attention and motivational salience towards peers and social evaluation and/or status, causing some to describe it as a

perfect storm of short, ill-timed, and inadequate sleep (Carskadon, 2011; Crowley, Wolfson, Tarokh, & Carskadon, 2018). For example, population studies estimate that on school nights young people aged 12 to 18 years achieve on average 7 to 8 hours of sleep (Galland, et al., 2018; Hayes & Bainton, 2020). This is in stark contrast to experimental studies that conclude 9 to 9 ½ hours of sleep per night is required by adolescents to promote the healthy development and optimal academic performance, behavioural and cognitive functioning, and emotional regulation (Fuligni, Bai, Krull, & Gonzales, 2019).

National sleep guidelines in Australia recommend consistent bed and wake times, with children aged 5 to 13 years of age receiving 9 to 11 hours of sleep per night and adolescents aged 14 to 17 years of age receiving 8 to 10 hours sleep per night (Commonwealth of Australia, 2019). According to The Longitudinal Study of Australian Children (LSAC), one in four children aged 12 to 13 years and around half of those aged 16 to 17 years attain healthy amounts of sleep on school nights (Evens-Whipp & Gasser, 2019). Further, those young people not meeting minimum sleep guidelines were more likely to report symptoms associated with poor mental health (e.g., anxiety, depression, unhappiness), be late for or absent from school, require more time for homework, have access to the internet in their bedroom, and to have spent greater time on the internet (Evens-Whipp & Gasser, 2019). Of concern, emerging research suggests the interplay of adolescents as rapid adopters of new technology and social media can adversely intensify risk and vulnerability to sleep problems, low self-esteem, and clinical symptoms associated with mental ill-health (Kelly, Zilanawala, Booker, & Sacker, 2018).

Multiple systematic reviews, meta-analyses, and large-scale studies have been published investigating the impact of sleep complaints on mental health and wellbeing in adolescence (Becker, Langberg, & Byars, 2015; Blake, Sheeber, Yousseff, Raniti, & Allen, 2017; Blake, Trinder, & Allen, 2018; Hayes & Bainton, 2020; Hysing, Haugland, Stormark, Boe, & Sivertsen, 2015; Kearns et al., 2020; Kortesoja et al., 2020). Studies have also considered sleep complaints in association with schooling, including school start times, school-night sleep schedules and bedtimes, sleep duration and quality (Beebe, 2011; Crowley et al., 2018; Kelley, Lockley, Foster, & Kelley, 2015; Wheaton, Chapman, & Croft, 2015). Sleep studies involving young people from regional and remote communities at boarding schools are sparse but nevertheless several have investigated: cognitive performance and mood (Lo, Ong, Leong, Gooley, & Chee, 2016); delayed start time and quality of life (Chan, Poon, Leung, Lau, & Lau, 2018); daytime napping (Lau, McAteer, Leung, Tucker, & Li, 2018; Lo et al., 2017); and verbal memory (Huang et al., 2016). Only a few have specifically explored the intersection between sleep complaints, boarding school, and mental health (Boerger, Gable, & Owens, 2014; Kala et al., 2019) but none feature Australian boarding schools.

Why Investigate Adolescent Sleep Quality and Complaints and their Implications for Boarding Students from Regional and Remote Communities?

On average over 21,000 boarding students attend just over 200 boarding schools across Australia, the majority of these from regional and remote communities. It is further estimated that of these students, over 1600 attend a boarding school outside of their home state or territory (Barrett, 2020). At a time of pronounced neurobiological and maturational change, a search of the sleep literature shows that there is a paucity in Australian research investigating the perceptions of sleep quality and their experiences with sleep complaints for young people from regional and remote communities that school away from home at boarding school. This is surprising given the importance of sleep to adolescence as a developmental stage (Commonwealth of Australia, 2019; Evens-Whipp & Gasser, 2019) and the significant effort that the boarding school community puts into promoting healthy growth and development of students, see the Australian Boarding Schools Association for example (<https://www.boarding.org.au>).

Sleep in Adolescence

Australian research shows that for young people aged 12 to 13 years, the average bedtime on school nights was 9pm, with those aged 16 to 17 years going to bed around 10:15pm (Evens-Whipp & Gasser, 2019). As Australian adolescents get older, early bedtimes become less common and sleep-onset latency increases (i.e., the time it takes to fall asleep), with school nights tending to be longer than non-school nights (e.g., 32 minutes vs 26 minutes for males aged 12 to 13 years, 35 minutes vs 31 minutes for males aged 16 to 17 years) (Evens-Whipp & Gasser, 2019). On school mornings, the average wake time across all adolescent age groups (i.e., 6 to 17 years of age) is around 7am, however on non-school mornings those aged 12-to-13-years woke up on average 90 minutes later, while those 16 to 17 years slept in an extra 120 to 150 minutes. Lastly, it is estimated on average Australian adolescents lose about 90 minutes of sleep on school nights between the ages of 12 to 17 years, with those aged 12 to 13 years getting nearly 9 ½ hours of sleep and those 16 to 17 years reporting 8.1 hours (Evens-Whipp & Gasser, 2019). Gender differences in sleep complaints are not well established across the sleep literature, however in Australia males aged 11 to 17 years tend to sleep less than females on non-school nights, but no difference was found for school nights (Evens-Whipp et al., 2019). A study by Cooper, Kohler, and Blunden (2012) investigated disruptions to sleep and academic performance for 21 Indigenous children aged 6 to 13 years of age living in a remote community located in the Northern Territory. It found that participants reported relatively less sleep at night and that on average they went to bed later on school nights compared with predominantly non-Indigenous urban Australian counterparts. Further, that participants demonstrated relatively poor sleep efficiency and fragmentation, with one-quarter reporting frequent daytime tiredness and reduced academic performance.

Even with dwindling time spent asleep, sleep has been described as a core behaviour of adolescents and adolescence asserted as a phase in life that is vital to the development of well-timed and restorative sleep/wake behaviours (Tarokh et al., 2016). Indeed, the need for sleep does not diminish in adolescence (Crowley et al., 2018), rather it is postulated that delays in the circadian timing system (Carskadon, 2011) and a shift in the sleep/wake homeostatic regulatory system mean that a greater tolerance to sleep pressure (i.e., the homeostatic drive for sleep) grows as adolescents mature (Crowley et al., 2018). Although further research is required (Bei, Wiley, Trinder, & Manber, 2016; Hayes & Bainton, 2020), considerable intraindividual variability in sleep patterns takes place in adolescence (Magee & Blunden, 2020). Variability in adolescent sleep patterns, particularly between school and non-school nights, but also in connection with sleep complaints like sleep onset, sleep quality and quantity, have been associated with impaired executive functioning, memory and attention (Kelley et al., 2015; Kosticova, Husarova, & Dankulinova, 2020; Kuula et al., 2015), reduced impulse control and behavioural flexibility (Beebe, 2011; Blake et al., 2018), as well as diminished somatic, psychosocial, and mental health (Fuligni, Arruda, Krull, & Gonzales, 2018; Shochat et al., 2014).

Although sparse, several international studies contribute to our understanding of the impact sleep loss can have on adolescents from regional and remote communities while at boarding school. Lo and colleagues (2016) investigated over seven days the effect of restricted sleep on 25 adolescent males aged 15 to 19 years at a boarding school in Singapore. When compared with a control group (i.e., nine hours sleep every night), the restricted sleep group (i.e., five hours sleep per night) demonstrated incremental deterioration in cognitive performance (i.e., executive functioning and memory) and poorer positive mood. Interestingly, after two consecutive recovery sleep sessions (i.e., nine hours each night), subjective sleepiness and attention were still found to not have returned to baseline levels of cognitive performance for the restricted sleep group (Lo et al., 2016). A later study exploring the effectiveness of napping to mediate the impact of restricted sleep on cognitive performance (i.e., 5 hours sleep per night), Lo and colleagues (2017) found that afternoon naps even when combined with weekend catch-up sleeps, were inferior to receiving the opportunity to have nine hours sleep every night. Recently, research

involving 1571 adolescents at 11 boarding schools in Switzerland (Kala et al, 2019), found that boarding students reported more sleep complaints than their day student counterparts and that both sleep complaints and reduced sleep duration were associated with poorer psychological functioning in boarding students.

Sleep Complaints and Mental Health in Adolescence

A growing body of research has asserted a bidirectional relationship (Becker et al., 2015; Orchard, Gregory, Gradisar, & Reynolds, 2020) between sleep disturbances and increased vulnerability in adolescence to psychopathology, however it is important to note these links are highly complex and not all studies report a robust association (Gregory & Sadeh, 2012). Sleep loss in adolescence has been associated with increases in elevated emotional reactivity and negative mood (Tarokh et al., 2016) and has been examined in relation to attention deficit hyperactivity disorder, major depressive disorder, and anxiety disorders including obsessive compulsive disorder (Agostini & Centofanti, 2021; Kuhlman et al., 2020). A study by Hudson, Gradisar, Gamble, Shnirer and Rebelo (2009) for example, found children aged 7 to 12 years of age with clinically diagnosed anxiety disorders, reported going to bed later and getting significantly less sleep than their non-anxious counterparts on school nights. Yet, on weekends they fell asleep more quickly and reported less awake time during the night than on weekdays. It is similarly intriguing that laboratory research exploring sleep problems in children and adolescents diagnosed with early onset clinical anxiety and major depressive disorders (i.e., aged 7 to 17 years), has shown those experiencing anxiety report poorer sleep (i.e., more time awake at night) than those with depression and matched controls (Forbes et al., 2008).

Given that a lack of consensus exists regarding how best to define and measure sleep problems in adolescence (Gregory & Sadeh, 2012), it is likely that the link between mental health with both general sleep complaints and specific clinical sleep disorders (i.e., insomnia) has not been examined thoroughly (Blake et al., 2015; Bei et al., 2016). Despite this, sleep complaints have been posited to predict a wide range of behavioural and emotional consequences (Shochat et al., 2014), feelings such as hopelessness, sadness and worthlessness (Kortesoja et al., 2020), and more recently with less healthy coping strategies and thinking cognitions such as self-harm (Hysing et al., 2015) and suicidal ideation (Kearns et al., 2020). Until recently, sleep related problems have habitually been considered a secondary issue or symptom to other problems rather than important to consider within its own right (Gregory & Sadeh, 2012). This is steadily changing, and sleep has increasingly been viewed as a primary avenue for clinical intervention and treatment (Blake et al., 2017). Moreover, emerging evidence posits sleep complaints should signal important implications for treatment formulation and management of complex psychiatric disorders, particularly the need for early additional assessment and acute intervention in suicidal thoughts and behaviours (Kearns et al., 2020; Orchard et al., 2020). That said, further research is required into the efficacy of adolescent cognitive-behavioural sleep interventions, and other treatments, despite promising preliminary evidence (Blake et al., 2017; Harvey, Hein, Dolsen, Dong, & Blum, 2018; Magee & Blunden, 2020).

In sum, while progress in the adolescent sleep field has moved forward at a rapid rate (Crowley et al., 2018), there remains a dearth in research investigating perceptions of sleep quality and experience with sleep complaints for students from regional and remote communities while attending boarding school. Hence, the aim of this exploratory study is to investigate aspects of sleep quality and some of the potential impacts that sleep complaints might have for boarding students from regional and remote communities, including the relationship between sleep quality and students' sense of academic self-perception, motivation and regulation, resilience, as well as indicators of non-specific psychological distress, life satisfaction, behavioural and emotional wellbeing.

Methodology

This investigation used a quantitative case-study approach to explore sleep quality at a large sized independent Catholic boys' only day and boarding school (e.g., Kindergarten to Grade 12) located in, Perth Western Australia (WA) – herein referred to as S1. It is important to recognise that this exploratory study is reporting on one aspect of a much larger research project that received approval from the Human Ethics Office at The University of Western Australia (Reference Number: RA/4/20/4055) and the Principal of S1.

S1

An overall total of 1300 students are enrolled at S1. The Boarding Handbook at S1 indicates the majority of students are day students (~1100) with a smaller boarding student population (~200), the vast majority of these boarding students are from regional and remote communities in WA. S1 has four boarding houses in total with approximately 50 students residing in each. Three of these boarding houses have students in Grades 8 to 12 and one boarding house dedicated to new boarding students that arrive in Grade 7. After completing their first year at S1, students transition into a Grade 8 to 12 boarding house. On weekdays, all boarding students at S1 are to be awake at 7am and ready for the school day beginning at 8:25am until 3:15am. From 3:30pm, all boarding students participate in sports training twice a week (Monday and Wednesday for Grades 7 to 9, Tuesday, and Thursday Grades 10 to 12) until 4:30pm. It is common for some boarding students to attend early morning sports training (6am) such as rowing and cross country.

Dinner time for all boarding students commences at 5:30pm and this meal process is staggered between the four boarding houses due to COVID-19 requirements. From 6pm, Grade 7 students watch the nightly news and participate in a house meeting, while also completing set house jobs until the start of evening prep (i.e., homework and study). This begins at 6:45pm for one hour until supper at 7:45pm, with bedtime at 8pm. For Grades 8 to 12, prep takes place from 7pm until supper at 8:45pm, with Grades 8 and 9 going to bed at 9pm. Grades 10 to 12 complete a second quiet independent prep until 10:30pm, with Grade 10 going to bed at 10:30pm. Grades 11 and 12 are allowed to do further quiet independent prep until 11pm, but academically focussed students regularly study beyond this time. Friday evening is allocated as study free time for all boarding students across Grades 7 to 12, with optional study club on Saturday mornings, and independent prep occurring throughout Sunday daytime, and a compulsory boarder's chapel service taking place Sunday evening.

S1 employs over 115 teaching staff and more than 80 non-teaching staff, including two full-time nurse managers and four part-time school nurses, and three part-time psychologists. One evening per week during term time a General Practitioner and Physiotherapist visits the health centre at S1 to review medical treatment plans and progress for boarding students. There are over 30 staff employed in boarding including a Head of Boarding (i.e., teacher) with each boarding house having a House Director (i.e., teacher) and House Mother. Up to eight Duty Supervisors (i.e., teachers and/or university students) are employed in each house to cover weeknights and weekend supervision, of these two live on-site in each boarding house. The 2021 fees and charges schedule at S1 indicates annual tuition costs for Grades 7 to 10 is \$16,992 and Grades 11 to 12 \$17,991, with annual boarding costs at \$24,282 Grades 7 to 12. Other varying additional costs exist for book hire, uniforms (i.e., summer, winter, and sport), excursions, and camps. Each year S1 offers a range of full and partial, internally, and externally, funded academic and boarding scholarships and bursaries. These are awarded based on need and vary in value according to the circumstance of each family.

Participants

168 male participants in Years 7 to 12 from an overall total of 192 eligible boarding students at S1 participated in this study giving a response rate of 88%. Participants were aged 12 to 18 years old (average age 14.7 years). The vast majority of participants at S1 (165) identified a primary home location in regional and remote communities across WA, including communities in the Gascoyne, Goldfields-Esperance, Kimberley, Mid-West, Peel, Pilbara, Southwest and Wheatbelt regions of WA. Twenty-three participants (14%) indicated they were Indigenous and three (2%) indicating they were international boarding students.

Procedure

An online survey was used to collect information on academic, emotional, and mental wellbeing, and sleep for participants. Informed active written parental/legal guardian and student consent was sought. An information package explaining this research was distributed to all parents/legal guardians of potential participants via S1 (information letter, consent form and reply-paid envelop). An information evening was also held with potential participants a week prior to survey distribution. In consultation with the Principal, Head of Boarding, and House Directors at S1, the survey was conducted towards the end of Term 3, 2020 (September). Participants completed the online survey independently via Qualtrics during boarders' evening prep time (7pm to 8:45pm) and this process was overseen by both researchers and respective S1 boarding staff in each of the four boarding houses.

Measures

Measures used were selected in consultation with the Principal, Head of Boarding, and House Directors at S1 and aimed to also compliment a prior and larger research project at S1.

Sleep quality and complaints. The Sleep/wake problems scale consisted of 15 questions measured on a 5-point likert scale (1=never to 5=every day/night) ($\alpha=0.78$) (Carskadon, Seifer, & Acebo, 1991). Questions included frequencies of erratic sleep/wake behaviours over the last two weeks (e.g., had an extremely hard time falling asleep, needed more than one reminder to get up in the morning). A total sleep/wake problems scale score was calculated for each student with a higher score reflecting greater sleep/wake problems.

Academic self-perception, motivation and self-regulation. The academic self-perception scale consisted of 5 questions measured on a 7-point likert scale (1=strongly disagree to 7=strongly agree) ($\alpha=0.89$) (McCoach & Siegle, 2003). Questions included 'I am confident in my academic ability' and 'I do well in school'. The motivation and self-regulation scale consisted of 4 questions measured on a 7-point likert scale (1=strongly disagree to 7=strongly agree) ($\alpha=0.83$). Average academic self-perception and self-regulation scores were calculated, with a higher score reflecting greater academic self-perception and self-regulation.

Resilience. Resilience was measured using a modified form of The Resilience and Youth Development Module (RYDM) – California Health Kids Survey (Furlong, Ritchey, & O'Brennan, 2009). The RYDM uses a four-point likert scale (1=not at all to 4=very much true) to explore aspects of resilience. The RYDM was modified to reflect the boarding school context. Peer protective factors were modified to reflect friends in boarding (e.g., 6 questions offering 2 subscales: Caring relationships of friends in boarding ($\alpha=0.87$) and pro-social friends in boarding ($\alpha=0.476$)). Home protective factors referred both to the boarding school and at home with the participants family (e.g., 9 questions offering 2 subscales: Boarding school support ($\alpha=0.90$), and meaningful participation at home with the family ($\alpha=0.82$)). School protective factors were modified to reflect protective factor within the boarding school (e.g., 14 questions offering 3 subscales: Boarding school connectedness ($\alpha=0.81$), boarding staff connectedness ($\alpha=0.90$), and boarding school interest ($\alpha=0.74$)). Average scale scores were calculated, with higher scores reflecting greater resilience.

Day school staff connectedness. Day school staff connectedness scale was drawn from the 6-item Teacher Connectedness Scale (Resnick et al., 1997) assessing whether day-teacher staff cares about them and notices when they are not there, measured on a 4-point scale (1 not at all true to 4 very much true). For each student an average score was calculated, with a higher score reflecting greater feelings of connectedness to their teacher ($\alpha=0.92$).

Non-specific psychological distress. The Kessler Psychological Distress Scale (K-6) (Kessler et al., 2002) is a self-rating six-item screener that uses a six-point likert scale (1=none of the time to 5=all of the time) to measure symptoms associated with non-specific psychological distress ($\alpha=0.84$). A higher score represents greater distress.

Life satisfaction. The Students' Life Satisfaction Scale is designed to measure global life satisfaction in children (Huebner, 1991). The seven-item measure uses a six-point likert scale (1=strongly disagree to 6=strongly agree) ($\alpha=0.81$). An average life satisfaction score was created, with a higher score reflecting greater life satisfaction.

Behavioural and emotional wellbeing. The Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997) was used to measure self-reported strengths and difficulties for participants. This is a self-rating 25-item screening tool appropriate for use with 4 to 17-year old's and uses a three-point scale (0 = not true, 1 = somewhat true, 2 = certainly true). The SDQ measures strengths (10 items) and difficulties (15 items) over the last month and comprises five subscales (e.g., emotional symptoms ($\alpha=0.77$), conduct problems ($\alpha=0.61$), hyperactivity ($\alpha=0.72$), peer problems ($\alpha=0.66$), pro-social behaviour ($\alpha=0.61$)). Scale scores as well as an overall total difficulties score is calculated as per the authors instructions.

Analysis

Analyses were conducted using SPSS v26. Cronbach's alpha was used to measure the reliability of the sleep/wake problem behaviours scale, and the academic, resilience, psychological, behavioural and emotional wellbeing scales. Separate linear regressions were used to determine the relationship between sleep/wake problems and academic, resilience, psychological, behavioural and emotional wellbeing factors as dependent variables. Logistic regression models were used to determine the relationship between sleep/wake problems and non-specific psychological distress and abnormal behavioural and emotional wellbeing factors as dependent variables. All regression models took into consideration grade and used $p=0.05$ significant levels.

Results

Descriptive Level Analysis

Sleep quality and complaints. Participant scores indicated low levels of sleep/wake problems (mean=23.1, sd=6.6) with no overall significant differences found in sleep/wake problems over grade or between the four boarding houses at S1. To explore the link between participants perceived overall sleep quality and reported sleep complaints, frequency of responses to individual items within the sleep/wake problems scale were further examined. During the seven days prior to survey completion 25 per cent (or one in four) of participants reported being satisfied with their sleep every night and 31 per cent reported having an extremely hard time falling sleep twice or more nights (i.e., sleep onset-latency). Results showed that 25 per cent of participants reported waking early in the morning and not get back to sleep several times or every day. Survey items indicated that 35 per cent of participants reported staying up until 1am, with 14 per cent reporting they stayed up all night once, twice or several times over the previous seven days. While very few participants reported arriving late to day school or sleeping past noon in the seven days prior, with 39 per cent indicating they need more than one reminder to get up in the morning. Lastly, 52 per cent of participants reported that they felt tired or sleepy during

the day either several times or every day over the previous seven days. Figure 1 indicates the proportion of students responding 'never' to sleep items.

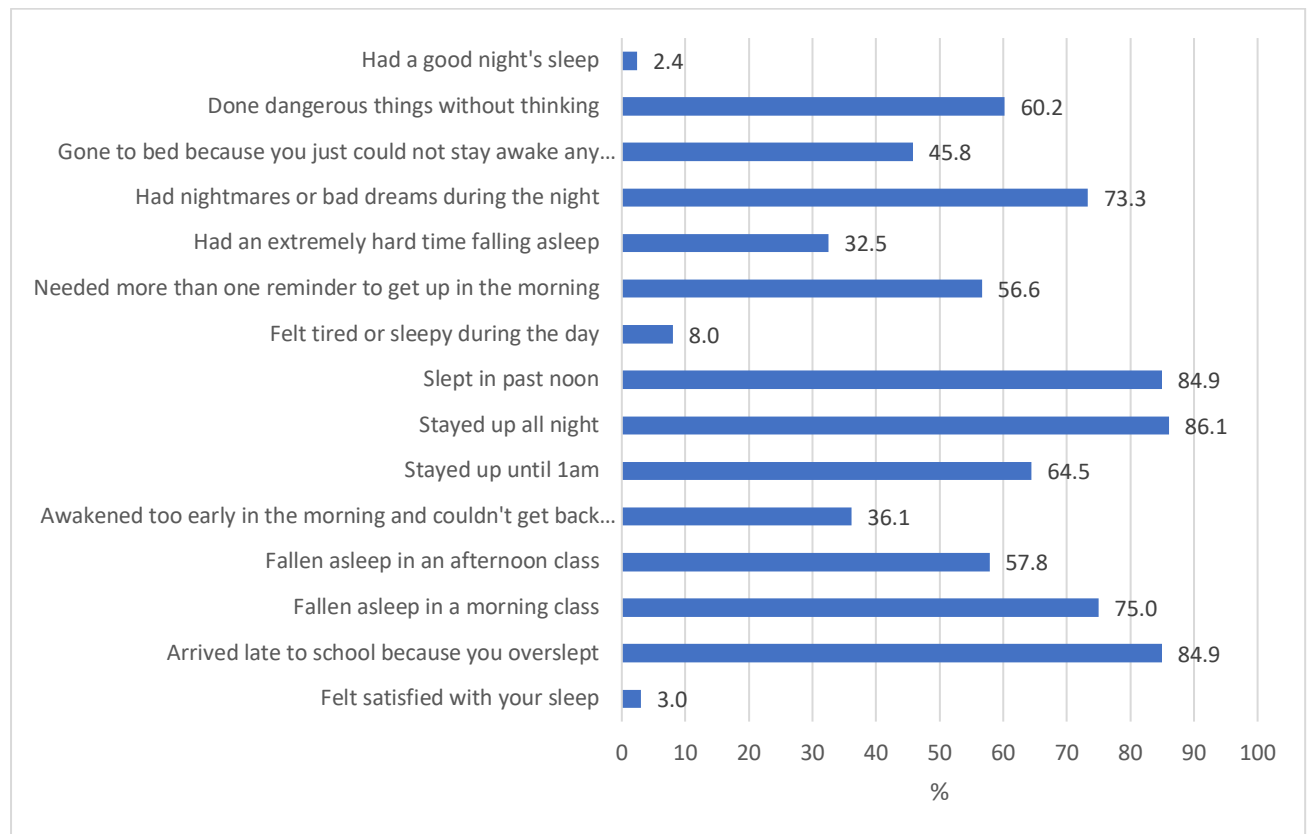


Figure 1: Proportion of Students Responding 'Never' to Sleep Items

Academic self-perception, motivation and self-regulation. Participants scored above average self-perception (mean =4.8, sd=1.3) and academic motivation and self-regulation (mean= 5.5, sd=1.0). Overall, there were no significant differences between academic factors and grade (Table 1).

Resilience. Participants reported high peer protective factor caring relationships scores (mean=3.2, sd=0.8) and above average pro-social friends scores (mean=2.9, sd=0.5). Participants reported high connectedness to boarding school scores (mean=4.2, sd=0.7), above average connectedness to boarding staff scores (mean=3.2, sd=0.7) and average boarding school interest scores (mean=2.5, sd=0.7). Boarding school interest was significantly lower in Grade 9 and Grade 10. Overall, participants reported boarding school support (mean=3.2, sd=0.7) and participation at home (mean=3.3, sd=0.7) higher than average, however boarding school support was significantly lower in Grade 7. Connectedness with day teachers was higher than average (mean=3.1, sd=0.8).

Non-specific psychological distress. Participants reported high life satisfaction (mean=4.6, sd=0.9) and low levels of symptoms associated with non-specific psychological distress (mean=12.8, sd=4.6)

Emotional and behavioural wellbeing. Participants reported scores within the normal range for emotional problems (mean=3.0, sd=2.4), conduct problems (mean=1.9, sd=1.7), hyperactivity (mean=4.6, sd=2.2), peer problems (mean=1.9, sd=1.9), pro-social behaviour (mean=7.4, sd=1.7), and total difficulties (mean=11.4, sd=5.8).

Sleep Complaints and Student Level Predictor Variables

Linear regression models were used to determine if wake/sleep problems were significant predictors of academic self-perception, motivation and self-regulation, resilience, non-specific psychological distress, emotional and behavioural wellbeing factors.

Academic self-perception, motivation, and self-regulation. Students reporting greater sleep/wake problems reported significantly lower academic self-perception ($\beta=-0.06$, $p<0.001$), motivation/self-regulation ($\beta=-0.03$, $p=0.007$).

Resilience. Students reporting greater sleep/wake problems reported significantly lower connectedness to the boarding school ($\beta=-0.03$, $p<0.001$), connectedness to boarding school staff ($\beta=-0.03$, $p<0.001$), interest in the boarding school ($\beta=-0.03$, $p=0.002$), and day teacher connectedness ($\beta=-0.03$, $p=0.003$). However, wake/sleep problems were not a significant predictor of caring relationships ($p=0.327$) or having pro-social boarding school friends ($p=0.270$). With respect to home protective factors, wake/sleep problems were a significant predictor of boarding staff support ($\beta=-0.03$, $p=0.001$) but were not a significant predictor of participation at home ($p=0.871$).

Non-specific psychological distress. Students reporting greater sleep/wake problems also reported significantly greater symptoms for non-specific psychological distress ($\beta=0.17$, $p=0.002$), emotional problems ($\beta=0.09$, $p=0.001$), conduct problems ($\beta=0.10$, $p<0.001$), hyperactivity ($\beta=0.11$, $p<0.001$), peer problems ($\beta=0.06$, $p=0.008$), total difficulties ($\beta=0.35$, $p<0.001$), and significantly less life satisfaction ($\beta=-0.03$, $p=0.004$).

Behavioural and emotional wellbeing. Logistic regression models showed students who reported greater sleep/wake problems had increased odds of emotional distress (OR=1.1, $p=0.027$), conduct problems (OR=1.1, $p=0.002$), hyperactivity (OR=1.1, $p=0.019$), and total emotional difficulties (OR=1.1, $p=0.019$).

Table 1: Sleep, Academic, Psychological, Behavioural, and Emotional Wellbeing by Grade Level

Mean (sd)	Grade 7 (n=29)	Grade 8 (n=29)	Grade 9 (n=27)	Grade 10 (n=30)	Grade 11 (n=32)	Grade 12 (n=21)	Total (n=168)
Sleep problems (13-65)	24.3(7.5)	22.1(6.6)	22.2(6.0)	24.4(6.9)	24.0(6.6)	21.0(5.4)	23.1(6.6)
Academic							
Self-perception (1-7)	4.9(1.1)	4.9(1.2)	5.0(1.3)	4.6(1.4)	4.6(1.2)	5.1(1.4)	4.8(1.3)
Motivation and self-regulation (1-7)	5.5(1.1)	5.8(0.7)	5.7(0.6)	5.3(1.1)	5.3(1.1)	5.3(1.3)	5.5(1.0)
Resilience							
Peer protective factors							
Caring boarding school relationships (1-4)	3.1(0.9)	3.1(0.8)	3.2(0.7)	3.0(0.8)	3.1(1.0)	3.6(0.6)	3.2(0.8)
Pro-social boarding school friends (1-4)	2.8(0.5)	3.0(0.7)	2.9(0.5)	2.8(0.5)	3.0(0.5)	3.0(0.6)	2.9(0.5)
School protective factors							
Connectedness to boarding school (1-5)	4.0(0.8)	4.1(0.7)	4.2(0.6)	4.2(0.6)	4.1(0.7)	4.4(0.6)	4.2(0.7)
Connectedness to boarding staff (1-5)	3.0(0.6)	3.2(0.7)	3.3(0.6)	3.0(0.6)	3.3(0.6)	3.5(0.8)	3.2(0.7)
Boarding school interest (1-4)*	2.7(0.6)	2.5(0.6)	2.3(0.7)	2.2(0.6)	2.6(0.8)	2.7(0.9)	2.5(0.7)
Home protective factors							
Boarding school support (1-4)*	2.8(0.8)	3.3(0.7)	3.1(0.6)	3.0(0.7)	3.3(0.7)	3.5(0.7)	3.2(0.7)
Participation at home (1-4)	3.1(0.9)	3.3(0.8)	3.3(0.6)	3.3(0.7)	3.3(0.7)	3.5(0.7)	3.3(0.7)
Day teacher connectedness (1-4)	3.1(0.7)	3.2(0.8)	3.1(0.9)	2.8(0.8)	3.0(0.6)	3.2(0.8)	3.1(0.8)
Life satisfaction scale (1-6)	4.5(1.1)	4.7(0.9)	4.7(0.8)	4.6(0.8)	4.3(0.8)	5.0(0.6)	4.6(0.9)
K6 (6-30)	14.0(5.0)	11.8(4.1)	12.3(4.5)	13.6(5.4)	13.7(4.4)	10.5(3.3)	12.8(4.6)
% K6 distressed	14.3	7.1	7.4	20.7	18.0	0.0	
SDQ mean scores							
Emotion (0-10)*	3.5(2.4)	2.5(2.5)	2.7(2.4)	3.6(2.5)	3.6(2.5)	1.7(1.6)	3.0(2.4)
Conduct (0-10)	2.3(1.9)	1.8(1.7)	2.1(1.4)	2.1(1.8)	1.5(1.6)	1.5(1.3)	1.9(1.7)
Hyper (0-10)	4.4(2.1)	4.2(2.3)	5.1(2.9)	4.6(1.7)	5.1(2.3)	4.1(1.6)	4.6(2.2)
Peer (0-10)	1.8(2.5)	1.8(2.0)	2.4(1.9)	2.4(1.7)	1.8(1.6)	1.1(1.4)	1.9(1.9)
Pro social (0-10)	7.4(1.6)	8.0(1.8)	7.2(1.7)	7.0(1.7)	7.6(1.7)	7.3(1.6)	7.4(1.7)
Total difficulties (0-40)	11.9(5.7)	10.3(6.5)	12.3(7.0)	12.8(4.9)	12.1(5.1)	8.4(4.4)	11.4(5.8)
SDQ (% abnormal)							
Emotion	14.3	10.7	7.4	13.8	15.6	0.0	10.9
Conduct	17.9	10.7	7.4	10.3	6.3	4.8	9.7
Hyper	14.3	14.3	25.9	10.3	28.1	4.8	17.0
Peer	7.1	7.1	11.1	0.0	6.3	0.0	5.5
Pro social	3.6	3.6	3.7	6.9	3.1	0.0	3.6
Total difficulties	7.1	3.6	14.8	10.3	9.4	4.8	8.5

*p<0.05

Discussion

This exploratory study sought to investigate sleep and some of the potential impacts that sleep complaints might have for boarding students from regional and remote communities. Across grade level and the four boarding houses at S1, results showed general parity between participants' overall scores for sleep quality and norms on the sleep/wake problems scale. Yet, it emerged that over the previous seven days only a small proportion were satisfied with their sleep every night, with the majority reporting feeling tired or sleepy during the day. Of particular concern is the number of students reporting staying up until 1am or all night on at least one occasion over the past week. The disparity between responses to individual survey items and overall sleep quality scores raises several questions regarding boarding students from regional and remote communities, including the influence of intraindividual variances in sleep homeostasis and circadian timing (Crowley et al., 2018). It arguably suggests that participants merely perceiving their overall sleep quality as adequate, might not accurately reflect and be sufficient to account for their experiences of sleep complaints such as daytime sleepiness, extreme difficulties getting to sleep in the evening and awaking too early in the morning. Interestingly, recent Australian longitudinal research into adolescent sleep similarly concluded that *“the majority of those children and adolescents not getting enough sleep, particularly at younger ages, appear to be unaware that they were lacking in sleep”* (Evens-Whipp & Gasser, 2019, p.44). Indeed, this research reported that daytime sleepiness, extreme difficulties getting to sleep in the evening (i.e., increased sleep latency) and awaking too early in the morning, was perceived by participants as part of growing up and normative experience (Evens-Whipp & Gasser, 2019).

Nine to 9 ½ hours of sleep every night is increasingly being identified as the ideal minimum time spent asleep to promote healthy adolescent development and optimal academic performance, behavioural and cognitive functioning, and emotional regulation (Fuligni et al., 2019; Short et al., 2018). Erratic, insufficient, and restricted sleep, or missing a full night of sleep, has been linked with sleep deprivation and creating a sleep debt (Blake et al., 2018). Research by Baum and colleagues (2015) found that after five nights of shortened sleep (6.5 hours per night), healthy adolescents (14–17 years) showed worsened mood and decreased ability to regulate emotions. Notably, for boarding schools, Lo and colleagues (2016; 2017) assert the importance for adolescent male boarding students (i.e., aged 15-19 years) not sacrificing sleep quality for academic outcomes and for staff to understand the cumulative negative impact of insufficient sleep on mood, attention, working memory, speed of processing. Further, this impact did not return to baseline after two nights of recovery sleep (Lo et al., 2017) and was not completely reversed through weekend catch-up sleeps (Lo et al., 2016).

Yet, as a pattern of findings, it emerged in this study that participants' overall scores for academic self-perception, motivation and self-regulation, and life satisfaction were comparable to norms. Results here also indicated that participants generally reported low level symptoms associated with non-specific psychological distress, and scores within the normal range for behavioural and emotional difficulties. Overall, participants reported higher than average scores for connectedness with teachers in the day school, while mixed results were found for protective factors associated with resilience. To further explain, most scores on the multifaceted RYDM showed many indicators of resilience were in the high and average ranges, although results showed significantly lower scores for boarding school support in Grade 7 and in interest in boarding school in Grades 9 and 10. These seemingly positive findings contrast with Australian research that asserts young people not meeting minimum sleep guidelines were more likely to report symptoms associated with poor mental health (Evens-Whipp & Gasser, 2019). This also contrasts with a recent international critical evaluation and systematic review of 17 studies that found restricted and reduce sleep during the ages of 11 to 19 years is negatively associated with school performance and cognitive outcomes (Hayes & Bainton, 2020).

Sleep Complaints and Student Level Predictor Variables

Like previous exploratory research (Cooper et al., 2012), the descriptive findings of this study raised several questions and warranted further consideration of the impact sleep complaints for those participants reporting greater sleep/wake problems. After controlling for grade, it was found that experiencing greater sleep/wake problems was significantly more likely to predict participants reporting reduced academic self-perception, motivation, and self-regulation, reduced school, and home protective factors (i.e., resilience), increased symptoms associated with non-specific psychological distress, behaviour, and emotional wellbeing difficulties (i.e., emotional, conduct, hyper, peer problems and total difficulties). These findings arguably draw attention to international research that has called for sleep complaints to be given substantially higher priority in boarding schools (Boerger et al., 2014; Kalak et al., 2019; Huang et al., 2016; Lo et al., 2016, 2017; Lau et al., 2018). Australian research suggests this is particularly important when formulating mental health and wellbeing support (Cooper et al., 2012; Evens-Whipp & Gasser, 2019). Rather, sleep complaints commonly remain a peripheral consideration and not central to reported difficulties at school with learning (Crowley et al., 2018), or even to the way that it might impair the quality of social interactions and relationships a young person has with friends and peers (Tarokh et al., 2016) such as through compromised decision-making, poor impulse control and behaviour regulation (Cooper et al., 2012), or diminished emotion expressivity and recognition (Blake et al., 2018).

The complex relationship between adolescent sleep and mental health has been further reinforced by a recent large-scale (i.e., N = 5,003) longitudinal study investigating the nature of sleep problems amongst adolescents with anxiety and depression (Orchard et al., 2020). It found participants that report sleeping poorly at the age of 15 years, yet who did not report symptoms of anxiety or depression at that time, were more likely to report symptoms and met diagnosis criteria for anxiety or depression when they reached 17, 21, and 24 years of age. Notably, the study concluded that those adolescents that did have depression, reported later sleep onset times and less total time asleep on school nights, as well as greater daytime sleepiness and difficulties with falling asleep on school nights (Orchard et al., 2020). This research complements assertions (Cooper et al., 2012; Tarokh et al., 2016) emphasising the importance of looking beyond overall sleep scores and the usefulness of self-reports when assessing perceived sleep difficulties and daytime functioning and the important link they can play in guiding the diagnostic assessment and treatment intervention for both adolescent sleep problems and mental ill-health (Blake et al., 2018; Kearns et al., 2020).

Implications

Sleep is a core behaviour during adolescence and a behaviour that promotes healthy wellbeing both in the immediate and on into later life (Blake et al., 2018; Evens-Whipp & Gasser, 2019; Kearns et al., 2020; Orchard et al., 2020). The data from this study suggests there are compelling benefits associated with closely monitoring and carefully modifying aspects of sleep-wake scheduling and patterns. Aspects of this may include pre-bedtime activities, screen time and access to technology, bedtime settings, greater tolerance to sleep pressure, sleep onset latency, amount of sleep, sleep quality, sleep complaints including daytime sleepiness (i.e., all day, morning, afternoon), variability in sleep between school and non-school nights, and later morning wake times and school start times. For example, see Crowley and colleagues (2018) for an excellent summary regarding school start times, cognitive functioning, and academic performance. Given the rapid growth in adolescent sleep research, it is argued here that matching these against circadian timing preferences, bioregulatory mechanisms, and neurodevelopmental changes during early and mid-adolescence would seem particularly valuable. This may promote optimal brain development and learning, healthy pubertal growth including physiological, psychological, and social maturation. To ameliorate periods where

multiple nights of sleep restriction occur (i.e., studying for examinations or early morning sports training) the allocation of well-timed and restorative sleep-wake opportunities for older adolescent students also seem beneficial (Tarokh et al., 2016).

An inexpensive approach to this could include investment in sleep education and technologies with students, families from regional and remote communities, and boarding staff, starting pre-transition to boarding school. For example, it may include working with prospective families from regional and remote communities utilising sleep technologies (i.e., Fitbit, sleep diaries and other sleep apps) that track and monitor sleep-wake behaviours (i.e., over 30 days) prior to new students arriving at boarding school. Collecting and reviewing this information, may help students, families, and boarding staff to better understand the influence of both grade cohort and intraindividual variances in sleep-wake behaviours. This could then continue throughout each preceding year as young people progress from late childhood to early and mid-adolescence. For older adolescents, it may also include synchronizing course and subject scheduling (i.e., timetabling) with times of peak alertness and daytime functioning. Lastly, a novel but not new aspect may include systematically exploring the role and suitability of lighting systems used to promoting healthy sleep-wake behaviours in other industries such as aviation (i.e., explore use and timing of colours, ambience, warmth). For example, it is well recognised that in aviation various colour palettes are utilised to encourage calmness during the boarding process, with other colour palettes, ambience and warmth changes throughout flights designed to elicit deeper and restful sleep, then to gradually wake passengers up and energise them for the next stage in their travels.

Strengths and Limitations

Congruent with other similar exploratory Australian sleep studies (Cooper et al., 2012), there are several important caveats with the current research, not least amongst these being that this is an exploratory study that offers prospective associations. It is based on one boarding school with small participant numbers (N = 168) that were all male where sleep quality was measured subjectively, which affects the generalisability of the findings. Further, not all aspects of adolescent sleep/wake behaviour were accounted for, including the potential influence of memory biases. Hence, this research arguably raises more questions than it answers, and a clear need exists for future longitudinal investigation to explore adolescent sleep/wake behaviour across the full Grade 7 to 12 journey for boarding students, including, if possible, the pre-transition period to boarding school of Grade 6.

Conclusions

In sum, this exploratory study sought to investigate sleep and some of the potential impacts that sleep complaints might have for boarding students from regional and remote communities. Findings suggest participants perceiving their overall perception of sleep quality as adequate, might not accurately reflect and be sufficient to account for their actual experiences of sleep complaints over the previous seven-day period—a finding congruent with recent Australian longitudinal research into adolescence sleep (Evens-Whipp & Gasser, 2019). It also found participants thought that reduced time allocated to sleep, and reduced time spent asleep (i.e., sleep loss), are inevitable and normative aspects of growing up. This finding was also found by Australian population level studies (Evens-Whipp & Gasser, 2019), which reported early bedtimes seemed to become less common and tended to become later with each passing year, meaning dwindling time spent asleep while morning rise times remain relatively unchanged, or even earlier, as these are often school determined (i.e., early morning sports training). This paper challenges boarding schools to consider sleep quality and compelling benefits associated with closely monitoring and carefully modifying aspects of sleep-wake scheduling and patterns, including pre-bedtime activities.

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