The foundations for health include proper nutrition, regular exercise and good sleep quality. Sleep quality is often overlooked as a contributory factor to poor health. Disrupted and inadequate sleep is considered by some to be a modern societal problem which has arisen from urbanisation, increased access to technology, creation of social media and an engaging 24/7 lifestyle. From a public health perspective, the cost of inadequate sleep is widespread from greater risk of motor vehicle accidents to mental illness. In Australia, inadequate sleep is highly prevalent with an estimated economic cost of $66.3 billion (AUD) per year. Accordingly, the Australian Sleep Health Foundation are advocating the importance of good sleep hygiene practices and implementing preventative measures to promote sleep health.

There is a perception that school-aged children are at the greatest risk of disrupted sleep. Poor sleep hygiene practices including irregular sleep schedules, variable bedtime routines, the use of electronic devices and social media engagement pre-bedtime, are associated with sleep problems in children. This could also be a reflection of discrepancies between parental enforcement of bedtimes on weeknights compared to the weekend. In children, inadequate sleep has been associated with poor immune functioning, greater risk of obesity, disrupted memory consolidation, impairment of academic performance and risk of mood disorders. Both the Sleep Health Foundation and the National Sleep Foundation’s multidisciplinary expert panel recommended a sleep duration of 9–11 hours for school-aged children between the

**ABSTRACT**

**AIM:** Obtain an overview of the current sleep habits and sleep hygiene practices in a group of intermediate-aged students, and establish whether these students achieve adequate sleep according to the New Zealand education and health guidelines.

**METHODS:** A standardised sleep health questionnaire and seven-day sleep diary were completed by 163 participants (aged 11–13; 62% female) from a cross-section of five Christchurch schools.

**RESULTS:** In this group, 71% of students reported 9–11 hours of sleep per night (averaged over seven days). Total sleep time was independent of gender and the day of the week. Bedtimes and wake-times were earlier from Monday–Thursday compared to the weekend (p<0.0001). Fifty-nine percent of students used a device in the hour before bed. Pre-bedtime device users were more likely to achieve less sleep than non-device users (p<0.001). The majority of students (66%) did not choose their bedtime.

**CONCLUSIONS:** In this group of students, the majority achieved a sleep duration within the advised Ministry of Education and Sleep Health Foundation guidelines, despite non-recommended sleep hygiene practices in the pre-bed routine. Parental guidance, with respect to bed times and reduction in device usage before sleep are two factors that could be employed to improve sleep in this group.
Subsequently, the New Zealand Ministry of Education released guidelines advocating for “quality uninterrupted sleep of 9–11 hours per night for those aged 5–13 years, with consistent bed and wake-up times” and “no more than two hours per day of recreational screen time”.14

To the authors’ knowledge, there is no structured education pertaining to sleep health mandated in the New Zealand curriculum. Thus, there is a possible health education gap, and a loss of education opportunity in this group of students. There is evidence of increasing use of social media between the ages of 11–13 years, which may have a downstream effect of increased susceptibility to poor sleep.13 Previous research has examined the sleep duration of seven year-old New Zealand children and the sleep hygiene practices in 15–17 year-old New Zealand adolescents.16,17 However, there is limited data on the bedtime routines and sleep practices of New Zealand intermediate-aged students. The purpose of this study is to obtain an overview of the current sleep habits and sleep hygiene practices in a group of intermediate-aged students. The authors wished to ascertain whether or not inadequate sleep was common in this cohort.

Method

Study design
Cross-sectional, observational study of the sleep practices and knowledge of sleep health in a sample of intermediate-aged students.

Setting
Participants were recruited from intermediate classes in Christchurch, New Zealand in November 2018. Intermediate classes consisted of students in year 7 and 8 (aged 11–13 years). The Christchurch schools were inclusive of two state schools, two Catholic schools and a kura kaupapa, with decile ratings ranging from 3–10.

Data collection
More than 20 Christchurch schools were invited to participate. Given the busy time of the school year, only five schools agreed to participate and were included in the study. From the collective sample of 328 recruited students, consent forms were returned by 163 participants, an overall 50% response rate.

Education seminars were given at each school just prior to the data collection. These seminars consisted of a demonstration of the correct way to complete the seven-day sleep diary and standardised sleep health questionnaire, and a brief presentation outlining the importance of good-quality sleep and sleep hygiene practices. A time frame of seven consecutive days was arranged with each teacher for the sleep diaries to be completed with oversight in their classroom and consistency across students within and between schools. The teachers were also given an educators survey to complete; however, the low response rate produced an insufficient sample size to present these findings. After the week allocated for the study, the student questionnaires and sleep diaries, teacher surveys and consent forms were collected from the school.

Research measures

Demographic information
Age, educational year, gender and ethnicity were taken from the student questionnaires. Ethnicity data was recorded according to the New Zealand Ministry of Health Level I Ethnic Group code descriptions.

The sleep health questionnaire
Table 1 summarises the study questions.
A Friedman test was used to assess differences between the days of the week, for sleep onset time, sleep offset time and total sleep time. The Wilcoxon test was used to compare the sleep onset time and sleep offset time between two paired days of the week. As there was a non-significant difference between Monday to Thursday and Friday to Sunday, the authors used these groups to define weekdays and the weekend. This test was also used to compare the sleep onset time, sleep offset time and total sleep time on weekdays (defined as Monday–Thursday) versus weekend days (defined as Friday–Sunday). The Mann-Whitney test was used to compare boys and girls for sleep onset time, sleep offset time and total sleep time, and sleep length differences between device users versus non-device users. This test was also used to compare the sleep onset time, sleep offset time and total sleep time between children that chose their bedtime versus children whose parents chose their bedtime.

Fisher's exact test was used to determine the effect of pre-bedtime device use on short sleepers (<9 hours) versus normal sleepers (>9 hours). Fisher's exact test was also used to look at the effect of short and normal sleep versus feeling sleepy in the morning.

From a total of 328 recruited students, 163 (50%) completed and returned the consent form, sleep health questionnaire and seven-day sleep diary. Participants were aged 11–13 years (mean=12, SD= 0.1) with 37% male and 62% female. Age information was missing for one child (1%) and gender was missing for one other (1%). The sample was 81% European, 10% Māori, 7% Asian, 1% Pacific peoples and 1% Middle Eastern/Latin American/African.

When averaged over the week, in the hour before bedtime (Figure 1) the majority of students (59±2%) used a device, and to a lesser degree watched TV (48±2%), ate food (47±5%) and/or read a book (41±6%). Despite this finding, only a relatively small number reported trouble falling asleep (25±7%) and waking during the night (20±7%). However, the majority reported feeling sleepy in the morning (53±9%). When asked as a one-off question, only 3% of the students reported falling asleep at school.

There was a statistically significant difference (p<0.0001) between sleep onset time and sleep offset time on weekdays (Monday–Thursday) compared to the weekend (Friday–Sunday) (see Figure 2).
Figure 1: Activities one hour before bedtime; daily average over the week (mean ± SD).

Figure 2: Sleep diary (sleep onset and sleep offset in 24-hour time on the y axis).
Between boys and girls, there was a statistically significant difference (p<0.05) for sleep offset time and a non-significant difference (p=0.0871) for sleep onset time. The average sleep onset time was earlier on weekdays (21:48±62 minutes) than the weekend (22:12±78 minutes). The average sleep offset time was earlier on weekdays (06:54±37 minutes) than the weekend (07:18±53 minutes). For children with parent-implemented bedtimes, the average sleep onset time was earlier compared to children that chose their bedtime (21:48±59 minutes versus 22:15±50 minutes: p<0.001). Children with parent-implemented bedtimes were also more likely to have a longer sleep (9.6±1 hour versus 9.2±0.87 hours: p<0.05). Total sleep time was independent of gender (p=0.503) and the day of the week (p=0.56), with an average daily sleep time of 9.4±1.3 hours and 71.6% meeting the recommended guidelines (see Figure 3). On each weekend night, one student reported achieving zero hours of sleep and this student was different each time.

Participants that used a device before bed were more likely to have a shorter sleep (9.2±1.3 hours versus 9.8±1.3 hours: p<0.001). Pre-bed device users were also more likely to report that they felt sleepy the following morning (p<0.01). However, this effect was isolated to device use, as watching television before bed had no significant effect on sleep length (p=0.834).

Almost all of the students (96%) reported that they do not fall asleep at school. The majority of students (85%) have a bedroom of their own. Most students (66%) do not determine their own bedtime and approximately 50% would prefer to go to bed at another hour.

Discussion

The aim of this study was to obtain an overview of the current sleep habits and sleep hygiene practices in a group of intermediate-aged students, and establish whether these students achieve adequate sleep according to the New Zealand education and health guidelines. In this group of students, adequate sleep was achieved by most, despite a large proportion of the cohort using a device or watching television in the hour before bedtime. Importantly, students that used a device before bed were more likely to achieve less sleep and feel sleepier compared to those that did not. Of interest is that sleep onset time and sleep offset time was earlier during weekdays than the weekend; however, total sleep time was independent of the day of the week. Most students reported that they did not choose their own bedtime.

Figure 3: Total sleep time (TST). Shaded area is the Ministry of Education guidelines.
It is noteworthy that a significant number of intermediate-aged students achieved sleep within the Ministry of Education, the Sleep Health Foundation and the National Sleep Foundation guidelines of 9–11 hours per night. Specifically, between 70–77% of the students achieved these recommended guidelines each night, over the seven-day period. Consistent with previous research in seven year-old New Zealand children, the average total sleep time was within the guidelines of 9–11 hours, for those aged 5–13 years. However, approximately one in four students did not achieve sleep within these recommended guidelines. In addition, reduced sleep was most prominent in the weekend with around 6% of the students reporting less than seven hours of sleep, including a small number of students reporting not sleeping at all. Therefore, while the average across the week of 72% of students reporting adequate sleep is reassuring, it is far from the goal of every child achieving sleep within the recommended guidelines.

Previous researchers have established that the use of electronic devices pre-bedtime has a negative impact on sleep in adolescence. Accordingly, sleep hygiene practices recommended by the Sleep Health Foundation include avoiding electronic devices before bedtime. Moreover, device use before bed has been associated with obesity, reduced levels of physical activity and a poor diet. Recently, a relationship has been found between device use within one hour of bedtime and inadequate sleep duration and a lower health-related quality of life. Consistent with previous research in 15–17 year-old New Zealand adolescents, the results in the present study support a reduced sleep duration on the nights where devices were used in the hour before bed. Hence, bedtime device use has implications for physical and mental health, in addition to the consequences associated with poor sleep. This suggests the need for parental guidance and moderation of the use and availability of electronic devices before bed.

The present findings confirm that there is a need for sleep health education in New Zealand schools. Educating children on the importance of sleep health will promote the notion of prioritising time for good-quality sleep and prevent sleep problems linked to poor sleep hygiene. Accordingly, we propose a set of recommendations for students, parents and educators. Firstly, all school-aged children should receive sleep health education within the New Zealand curriculum. At present, the Ministry of Education guidelines advocate for a consistent sleep schedule and good quality sleep. However, there are no further guidelines for sleep health or sleep hygiene practices. Intermediate-aged students’ lack of instruction of good sleep-hygiene practices is a missed educational opportunity in the New Zealand curriculum. Therefore, the educational guidelines should be updated to incorporate instruction of good sleep hygiene, knowledge of sleep health and completion of a sleep diary to encourage self-awareness of their sleeping habits.

Of note, most students did not choose their own bedtime, with half preferring to go to bed at a different hour. The students that chose their own bedtime went to bed almost half an hour later and had a shorter sleep duration than students whose parents chose their bedtime. Therefore, adequate sleep was achieved in this group due to parental enforcement of bedtimes. As such, the aforementioned gap in sleep health education may not affect many students until there is a decline in parental involvement and an increase in independence during late adolescence. Based on this premise, parents were a mediating factor as they provided guidance for bedtimes which ensured that most students achieved adequate sleep. Therefore, we recommend that parents initially implement bedtimes for this age group and then teach and monitor their children as they take increasingly more responsibility during adolescence. Previous research reported that parent knowledge about good sleep habits was poor, therefore, children’s sleep may also benefit by providing parents with sleep health education. Due to the impact of pre-bedtime device use, we also recommend that parents monitor the use of electronic devices before bed, where possible.

Teachers may be in a better position to assume the responsibility of teaching children about sleep, through mandated sleep health education. Of the four teachers that returned surveys, most were unaware of the current Ministry of Education guidelines pertaining to sleep health and did not...
teach their students sleep hygiene practices. Therefore, we recommend providing teachers with their own education regarding sleep health and sleep hygiene practices. This is crucial to inform and guide their teaching of the Ministry of Education guidelines to their students.

While the present study was the first to our knowledge examining sleep duration and sleep hygiene in a local group of intermediate-aged students, it was not without limitations. The main limitation of our study is the reliance on self-report by the students, which may lead to an overestimation of total sleep onset time and an underestimation of night wakings. However, this method of reporting provided the students with awareness of their own sleeping patterns and the ability to self-monitor their own sleep health. Future research could examine whether similar findings are replicated using an objective measure accessible outside of a clinical setting, for example, an activity tracker. Also, while the intention of the education session was training focused on how to complete the sleep diaries and questionnaires, there was a small component of sleep health education to improve the data accuracy. In addition, the study population was local to Christchurch, New Zealand, there was an uneven distribution of boys and girls, and 135 of the 163 students (83%) were from a decile 9 or 10 school. Therefore, these findings may not generalise to the New Zealand population. Further limitations were a relatively small number of students (n=163), a 50% response rate from the 328 recruited participants and a short sampling time frame of seven days.

In conclusion, sleep health education should be prioritised in the New Zealand curriculum in order for adequate sleep to be achieved by every student. Providing this education prior to the teenage years may help students to achieve good-quality sleep as they become more independent. Alongside education, there is a need for consistent information pertaining to sleep health that can be resourced by children, parents and teachers. While parents provided guidance with regard to bedtimes, it is recommended that they moderate the use and availability of devices before bed. Education of sleep health and sleep hygiene practices from childhood is the key to preventing lifelong consequences associated with poor-quality sleep.

Competing interests: Nil.

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