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Gender differences in sleep hygiene practices and sleep quality in New Zealand adolescents aged 15 to 17 years☆

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ABSTRACT

Aim: To examine, in a nationwide sample of New Zealand adolescents, self-reported sleep hygiene, and specifically evening technology and caffeine use, and body mass index, in relation to sleep quality.
Design: Cross-sectional survey.
Participants: A total of 692 adolescents (59% girls), predominantly European (78%), with an average age of 16 years 9 months were recruited through schools, community advertising, and social media.
Measures: All participants completed the Pittsburgh Sleep Quality Index and Adolescent Sleep Hygiene Scale online, and questions about their height, weight, evening technology use, and caffeine consumption.
Results: Fifty-six percent of adolescents had poor sleep quality with a higher prevalence in girls (63.1%) than in boys (44.5%), and sleep hygiene (Adolescent Sleep Hygiene Scale) was significantly worse in girls. Caffeine after dinner was associated with increased adjusted odds of a poorer score for Pittsburgh Sleep Quality Index–evaluated daytime dysfunction ($P = .002$). A higher proportion of girls drank hot caffeinated drinks (51.8%) after dinner than did boys (38.1%), and although more boys (12.1% vs 9.2%) drank energy drinks, the difference was not significant. A 1-hour increase in evening technology time increased the odds of poor sleep efficiency by 20% ($P = .04$). A 1-zscore increase in body mass index resulted in a 38% higher adjusted odds of poor sleep efficiency ($P = .015$) and 21% higher adjusted odds of long sleep latency ($P = .032$).
Discussion: The findings highlight gender differences in sleep quality and some presleep behaviors of New Zealand youth, and support the role for good sleep hygiene practices to promote healthy sleep in adolescents.

Introduction

Although poor sleep promotes poor physical and mental well-being at any age, the unique developmental period of adolescence, marked by increased physical changes and cognitive abilities, presents distinct challenges. Adolescents prefer to go to bed later and to wake much later than their adult or child counterparts, reflecting two principal differences in their biological patterns of sleep-wake regulation. One factor is the shift in the circadian rhythm driving sleep and wakefulness to peak later in the evening causing them to feel naturally more alert for longer.[1] The other factor is an altered sleep drive in which the pressure to fall asleep accumulates more slowly in older than younger adolescents.[2] Although these biological factors mean that social demands, technology, extracurricular activities, and after-school employment can be accommodated in the evenings,[3–5] their preference to wake later is thwarted by early school start times during the week. In turn, this leads to an accumulation of sleep debt over the weekdays, which can be offset at the weekends and holidays by "catch-up" sleep, if given the opportunity to sleep in. However, these abrupt changes from weekday to weekend worsen circadian disruption in adolescents.[6]

Many countries report that adolescents rarely obtain the hours of sleep needed for normal functioning and that improvements in sleep hygiene (behaviors that promote quantity and quality of sleep) are needed.[7] Adolescents with good sleep hygiene tend to go to bed earlier, fall asleep more quickly (shorter sleep latency), and have longer sleep duration.[8] Risk factors for reduced sleep time include caffeine

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consumption, computer use, and exposure to artificial light before bed, whereas protective factors include physical activity, good sleep hygiene, and parent-set bedtimes.[8] Factors becoming increasingly important in the modern world include an explosive rise in technology usage in this age group[9] and the emergence of newer high-caffeine energy drinks.[4] Excessive TV viewing, and time spent using smartphones, tablets, and/or video gaming not only influence sleep but also have been independently linked with a higher likelihood of obesity-promoting behaviors in youth.[10] Furthermore, adolescents using multiple forms of technology late into the night and using caffeine to boost alertness are compromised in their ability to function during the day as a result of excessive daytime sleepiness.[3]

In older adolescents, gender differences in sleep timing, duration, disturbance, and quality are apparent. However, although it is well-established that sleep hygiene is associated with several of these sleep variables in this particular age group, few studies have specifically examined how gender may influence these relationships.[11,12] The objective of this study was to examine, in a large nationwide sample of New Zealand (NZ) adolescents, the sleep hygiene practices and specifically evening technology (including multitasking) and caffeine use (including the beverage source of caffeine), in relation to sleep quality and as a function of gender. Because body mass index (BMI) is also implicated in poor sleep quality in youth,[13] BMI was included not only as a variable of interest per se but also as a controlling variable to account for a potential relationship between obesity and poor sleep quality.

Methods

Recruitment

An Internet survey reached a large national sample via advertisements displayed on Facebook newsfeeds of the target audience (only visible to those resident in NZ), and letters of invitation sent to 76 high schools in the 4 main centers of NZ. Inclusion criteria were adolescents aged 15 to 17 years (inclusive) having resided in NZ over the past 12 months. The survey was open between December 2012 and November 2013. Ethical approval was granted by the University of Otago Human Ethics Committee (Reference No. 12/281).

Survey

Participants completed an online survey (SurveyMonkey) covering demographic information, height and weight, sleep behaviors, caffeine consumption, and technology use. Respondents were requested to measure their height and weight before entering the survey. Within the survey itself, they were asked if the values provided were measured or estimated. Participants provided their birth date and address at the start of the survey in mixed numerical code, and later in full detail, to ensure they met the inclusion criteria. Participants with discrepancies in these details were excluded (n = 15). Address was used to determine their household's NZ Deprivation index[14] as an indicator of socioeconomic status, where a score of 10 (scale 1–10) indicates high deprivation. Ethnicity was coded as Māori, Pacific, Asian, other ethnicities (except NZ European), and NZ European. BMI was calculated as weight (in kilograms) divided by height (in meters) squared, and age- and sex-specific BMI *z* scores were calculated according to the World Health Organization growth standards.[15] Participants were classified as underweight (BMI <5th percentile), normal weight (≥5th and <85th percentiles), overweight (≥85th and <95th percentiles), or obese (BMI ≥95th percentile).

For all questionnaire items, the respondents were asked about their usual sleep habits and sleep hygiene during a typical school month with answers to indicate the most accurate reply for most days and nights in a typical month. Information was collected using the Pittsburgh Sleep Quality Index (PSQI)[16] and the Adolescent Sleep Hygiene Scale (ASHS).[17] The PSQI yields subjective information about sleep quality and sleep quantity, whereas the ASHS informs pre-bedtime behavioral practices with the potential to influence both sleep quality and sleep quantity and some aspects of daytime functioning. The PSQI is a 19-item self-report questionnaire that measures sleep quality during the previous month to discriminate between good and poor sleepers. Originally devised as a 21-item score, 2 items related to sleeping with a bed partner are not included for adolescents. The PSQI generates 7 domains for subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, sleep medication, and daytime dysfunction, with each component score ranging from 0 to 3, and summed to produce a global score. A global score>5 suggests a "poor sleeper" with significant sleep complaints. In the context of the PSQI, "daytime dysfunction" is the composite of 2 component scores, from one question evaluating sleepiness and the other evaluating lack of enthusiasm. The algorithm for "sleep duration" was adjusted to reflect sleep recommendations for adolescents as 1 hour longer than adults[18] and permission was granted by the developer for altering this. Reponses were coded as ≥8 hours =0, <8 and ≥7 hours =1, <7 and ≥6 hours =2, and <6 hours =3. The PSQI has been shown to have good reliability with high internal consistency ($\alpha = .83$).[16] In this study, an acceptable internal consistency coefficient was obtained ($\alpha = .77$), with item-rest correlations ranging from 0.43 to 0.61. Sleep timing variables were collected from the PSQI.

The ASHS is a 33-item self-report questionnaire that assesses sleep-facilitating and sleep-inhibiting practices in adolescents with total scoring among 8 of 9 domains.[17] The 8 domains are as follows: "physiological" covering evening status (eg, evening caffeine consumption, activity before bed, going to bed hungry), "behavioral arousal" (activating behaviors before bedtime, ie, using the telephone, playing video games, and watching TV), "cognitive/emotional" (rumination behaviors and negative emotional states at bedtime), "sleep environment" (eg, falling asleep while watching TV or with lights on, sleeping in a room that is too hot or cold), "sleep stability" (more regular bedtimes and wake times on weekdays and weekends), "daytime sleep" (eg, napping), "substances" (eg, evening alcohol, tobacco use), and "bedtime routine" (having a routine, eg, bathing, brushing teeth, reading). Participants report how often each sleep item occurred over the last month along a 6-point ordinal rating scale, with responses ranging from never (6 points) to always (1 point). All but one item is reverse-coded. Each subscale score is calculated by taking the average of the individual items, and the mean of the subscale scores creates the total sleep hygiene score, with higher scores indicating better sleep hygiene. The ASHS has good internal consistency (Cronbach $\alpha = 0.80$).[17]

Extra information about nighttime technology use during a typical school month was gathered via use of the multitasking index,[3] a score derived from the total number of hours spent across all the technology divided by 9 (the number of hours between 9 PM and 6 AM). The questionnaire listed 12 common technology devices and an "other" option, and asked which ones were used between 9 PM and 6 AM, and how much time was spent on each after 9 PM.

To gather further information about caffeine use, we listed 17 common caffeinated drinks plus "other" and asked which products participants would normally consume after their evening meal. The exact caffeine content of all reported products was obtained from the manufacturers' declarations and caffeine consumption estimated based on the average portion sizes of drinks consumed as asked within a subsample of participants (n = 298). For coffee and tea, caffeine content per cup of instant coffee and regular tea bag provided the basis for estimations.