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Youth sleep durations and school start times: a cross-sectional analysis of the COMPASS study

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ABSTRACT

Objectives: This study explored school start times (SST) in relation to sleep duration and adherence to guidelines among Canadian youth.
Methods: Using Year 4 (2015/2016) data from the Cannabis, Obesity, Mental health, Physical activity, Alcohol use, Smoking, and Sedentary behaviour (COMPASS) study, the sample included 35,821 grade 9-12 students at 78 secondary schools in Ontario and Alberta, Canada. Random intercepts models tested student-reported sleep duration and whether students met sleep recommendations, as a function of SST, controlling for student- (race/ethnicity, grade, sex, travel mode to school) and school-level (school-area urbanicity and median household income) correlates.
Results: For each hour delay in SST, students reported an average of almost 7 minutes longer sleep and had 1.17 (adjusted odds ratio; 95% confidence interval, 1.04-1.31) higher odds of meeting the recommendations, with other factors held constant.
Conclusions: Potential impacts on student sleep require consideration when deciding on school schedules. Delayed SST warrant further exploration as an intervention to help ameliorate the widespread sleep deprivation found among Canadian youth.

Introduction

Adequate sleep is essential for the health and development of adolescents, yet many youth appear sleep deprived.[1,2] In fact, total sleep time has steadily declined among adolescents over the last 100 years, largely because of later bedtimes.[2–4] Insufficient sleep places youth at increased risk of obesity, injuries, substance use, and emotional dysregulation[5–7] and can impede learning, memory, executive functioning,[8,9] and educational achievement.[5,10] Sleep is also linked to other health behaviors, including physical activity and dietary intake.[5,7]

Only recently has the importance of sleep received greater attention within Canada. For instance, the Canadian Academy of Child and Adolescent Psychiatry, the College of Family Physicians of Canada, and the Canadian Sleep Society released a 2014 consensus position statement on the topic.[9] Additionally, sleep was first included in the movement guidelines for Canadian children and youth in 2016.[11] According to the new 24-hour recommendations, 14- to 17-year-olds require an average of 8 to 10 hours of uninterrupted sleep per night.[11] However, a nationally representative study found that one-third of Canadian youth failed to meet the guidelines, with the majority reporting insufficient sleep (26%).[1] Furthermore, evidence from a large youth cohort study suggests that the steady decline in sleep durations witnessed in past research[3,4] has continued over recent years, contributing to the growing number of sleep-deficient Canadian youth.[2] Among Ontario high school students, more than 40% reported excessive sleepiness,[6] and about 1 in 5 reported that their sleep quality was fairly bad or very bad on weeknights compared with 10% on weekend nights.[12] Despite going to bed earlier, adolescents typically sleep less on school nights and "catch up" by sleeping later on the weekend,[1,6,12] which goes against recommendations for consistent sleep schedules.[11]

Several external factors and developmental changes are proposed to contribute to youth sleep debts. Among Ontario students, caffeine consumption before bed, inconsistent bedtime routines, and nighttime screen use have been linked to poorer sleep outcomes, including shorter, lower-quality, and less efficient sleep.[13,14] On the other hand, parental enforcement of bedtime rules appears protective for children and youth meeting weekday sleep guidelines, yet parents become less involved in sleep routines as their children age.[15]

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Sleep duration is consistently shown to decline with increasing age over adolescence.[1,10,16] In addition to the social changes during this period (eg, less parental monitoring, part-time employment, increased academic demands and extracurricular activities), the onset of puberty triggers a natural circadian shift to delayed bedtimes and greater morning sleep needs. In response, several organizations (eg, Canadian Academy of Child and Adolescent Psychiatry, College of Family Physicians of Canada, American Thoracic Society) have recommended later school start times (SST) to align with adolescent sleep patterns. Existing research generally supports delayed SST as advantageous for weekday sleep durations among adolescents,[17–22] with later wake times largely accountable for the difference.[18,22] In addition to sleeping longer, students attending schools with later SST report less daytime sleepiness, fewer instances of falling asleep in class, and lower depression symptoms.[22]

Limited research has explored how SST relate to youth sleep in the Canadian context. SST in Canada are typically later than the SST reported in US studies, whereas school-day wake times among Canadian youth tend to be earlier in comparison to their European counterparts.[16] To the authors' knowledge, only 1 population-based Canadian study has examined the association between SST and youth sleep.[17] Using data from the Canadian 2013/2014 Health Behavior in School-Aged Children study, Gariépy et al[17] found that students attending schools with later start times reported longer sleep durations, were more likely to meet sleep recommendations, and were less likely to feel tired in the morning. Similarly, in a small Quebec study, students assigned to a morning school schedule had shorter objective sleep durations and more daytime sleepiness in comparison to students following an afternoon school schedule, even among morning chronotypes.[23] Further exploration within the Canadian context is necessary to inform policy, particularly given the mounting sleep debt found among Canadian youth.[2] Moreover, a growing number of school boards are considering adjusting school schedules to save on bussing costs.[24] The current study serves to replicate past research in a more recent cohort of Canadian youth. More specifically, we examined SST in relation to sleep durations and adherence to sleep guidelines among students attending secondary schools in Ontario and Alberta, Canada.

Participants and methods

Design

The Cannabis, Obesity, Mental health, Physical activity, Alcohol use, Smoking, and Sedentary behaviour (COMPASS) study was designed to collect hierarchical longitudinal data from a cohort of secondary school students in grades 9 through 12 and the schools they attend in Ontario and Alberta, Canada.[25] A full description of COMPASS and its methods is available in print[25] or online (www.compass.uwaterloo.ca). All procedures were approved by the University of Waterloo Office of Research Ethics and appropriate school board committees.

Participants

School boards and schools were purposefully selected based on whether they permitted active-information passive-consent parental permission protocols.[25] Eligible schools were approached after board approval. This article used student- and school-level data from Year 4 (Y_4; 2015-2016) of the COMPASS study, as it was the most recent data wave available. In Y_4, data were collected from 40,436 students (79.9% participation rate) attending 72 Ontario and 9 Alberta secondary schools. Students could decline to participate at any time. Missing respondents resulted primarily from scheduled spares or absenteeism during data collection.

After removing 3 schools missing start time data, and students with missing sleep data (n = 317) or with sleep duration responses interpreted as probable misreports (less than 1 hour; n = 2119), the sample included 36,804 students and the 78 schools they attended. Consistent with previous research,[15] students with sleep durations considered outliers (≥3 SDs below the sample mean) were excluded (n = 669). The final sample included 35,821 students with full data.

Data collection tool

The COMPASS questionnaire (Cq) collects student-level data pertaining to multiple health behaviors and demographic characteristics. In each school, the Cq was completed by whole-school samples during class time. Cq items were based on national standards or current national public health guidelines.[13]

Measures

Student-level measures

Sleep duration was assessed by asking students how much time in hours and 15-minute intervals they usually spend sleeping per day. Responses were classified as either "meets recommendations" (≥8 hours) or "insufficient sleep" (<8 hours) according to guidelines for Canadian youth aged 14-17 years.[11]

Method of travel to school was included in the model, as some modes potentially require earlier wake times and certain schools may have a larger proportion of students commuting by particular methods. Response options included "by car (as a passenger)"; "by car (as a driver)"; "by school bus"; "by public bus, subway, or streetcar"; "by walking"; "by bicycling"; and "other." Response options were collapsed into 5 categories: car, school bus, walking/bicycling, public transit, and "other."

Student-level correlates included student-identified sex (male, female), grade (9-12), and race/ethnicity (White, Black, Asian, Latin American/Hispanic, Off-Reserve Aboriginal, other/mixed).

School-level measures

School start times (SST) were defined as the start of the first morning class. SST for each school were obtained by consulting school Web sites and/or handbooks.

School-level correlates included school-area average median household income and urbanicity. Median household income was generated using the census divisions that corresponded with school postal codes according to data from the 2011 National Household Survey. Urbanicity was determined based on school postal codes and Statistics Canada classifications of "rural" area and "small," "medium," and "large urban" population centers.[26] Rural and small-population-center categories were collapsed based on the low frequency of rural schools.

Analyses

All analyses were implemented in SAS (Cary, NC) 9.4. Frequencies of student- and school-level characteristics were calculated. χ^2 tests were performed according to whether students met the sleep duration guidelines. Two random intercept regression models were conducted: a linear regression model of SST as a predictor of student sleep duration and a logistic regression model of SST as a predictor of students meeting sleep recommendations (≥8 hours). Both models included the school- (median household income, urbanicity) and student-level correlates (grade, sex, ethnicity, travel mode to school).

Results

See Table 1 for student- and school-level descriptive statistics. SST ranged from 8:00 to 9:35 AM (mean = 8:32:37 AM ± SD 22:32;

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