Original article

Correlates for poor sleepers in a Los Angeles high school

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Abstract

Background and purpose: We explored sleep patterns including morning–evening preference and their associations with other lifestyle determinants among high school students.

Participants and methods: We conducted a cross-sectional survey of students grades 9–12 from a private high school in the United States. One hundred and thirty-one students completed an online survey comprising 23 original, investigator-created questions, a mood scale, the Pittsburgh Sleep Quality Index (PSQI), and the Horne–Ostberg Morningness–Eveningness Questionnaire (MEQ).

Results: We found that 80% of students reported a sleep deficit. As defined by the PSQI, 69% of girls and 58% of boys in this sample were poor sleepers. Eveningness was a strong predictor of poor sleep, particularly among students aged $\leqslant 15$ years (odds ratio [OR] 9.92; 95% confidence interval [CI], 1.52–64.8), among whom poor sleep quality was also associated with a higher body mass index (BMI) (OR, 6.97; 95% CI, 1.01–48.2).

Conclusions: Our pilot study suggests that morningness–eveningness is a strong predictor of sleep quality among high school students.

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Keywords: Sleep; Adolescents; BMI; Morningness–eveningness

1. Introduction

Sleep is one of the most important human biological processes. Studies have shown that numerous health consequences, including an increase in obesity, cancer risk, and mortality risk, can result from lack of sufficient sleep or unusual sleep habits in adults [1,2]. There is strong evidence that adolescents all across the world fail to get enough sleep [3–5], whether due to early school start times [6], school schedules [7], or other factors, including academic and social responsibilities [8]. Few studies have evaluated the implications of unusual sleep patterns on the health of adolescents. We sought to explore whether the sleep quality of teenagers is associated with age, gender, ethnicity, smoking status, mood, body mass index (BMI), and hours per week spent exercising, as well as hours of sleep per night, specifically considering the role of morningness–eveningness in these associations.

2. Methods

2.1. Study subjects and procedures

Subjects included a population of high school students ($n = 585$) from a private high school in Los Angeles, California, grades 9 through 12. On September 12,

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2005, all students were sent a message to their high school e-mail address, containing a link to an online version of a questionnaire, and 145 students responded (response rate, 24.8%). Participation was voluntary; respondents were similar to non-respondents in age, gender, and grade. Fourteen participants did not provide complete responses to the main survey instrument, the Pittsburgh Sleep Quality Index (PSQI), so their data were not included in these analyses. Thus, of the 585 initial questionnaires distributed, 131 responses held data valid for evaluation. The study was approved by a school-level Institutional Review Board as well as by the Committee on the Use of Human Subjects in Research at the Brigham and Women's Hospital.

2.2. Instrumentation

Data were collected from students using a single questionnaire composed of 23 original, investigator-created questions, a mood scale, and two instruments, the PSQI [9] and the Horne–Ostberg Morningness–Eveningness Questionnaire (MEQ) [10]. The primary outcome measure was global sleep quality, as evaluated by the PSQI. This scale, a 19-item questionnaire that assesses general sleep quality over the past month, has seven components, each of which deals with a major aspect of sleep. A total score of six or more is indicative of a "poor" sleeper. The PSQI is a well-validated instrument that has frequently been used in adolescent and young adult populations [11–13]. Morningness–eveningness preference was assessed with the MEQ, a 19-item validated questionnaire [10] with a total score ranging from 16 to 86, which has previously been used among adolescents [14,15]. A high score is indicative of morning types, and a lower score of evening types. The investigator-created questions sought demographic information: age, gender, age at menarche, ethnicity, height, weight, current smoking status, and hours per week spent exercising. It also asked questions about subjects' sleep habits during the past month. In addition, subjects were asked to describe how, on average, they felt over the past four weeks, on a scale from 1 to 10 (1 = very sad, 10 = very happy). Such quick single-item rating scales of mood can be time-efficient and reasonable; though rough guides to mood [16], they appear sufficiently specific in ruling out depression when a person is not depressed [17–19].

2.3. Statistical analyses

Among children and adolescents, being at risk for being overweight was defined as at or above the 85th percentile of the sex-specific BMI for age-growth charts. Various definitions of obesity in adolescents exist [20], and the prevalence of childhood obesity is estimated at 25–30% [21] with increasing trends. We, therefore, in some analyses, dichotomized BMI along the median. According to Horne and Ostberg's definition of morningness and eveningness [10], four categories were derived from the MEQ score: $\geqslant 70$ (definite morning type), 51–69 (probable morning type), 31–50 (probable evening type), and 16–30 (definite evening type). We categorized sleepers as either "poor" or "fair" according to the PSQI, with a score >5 implying poor sleeper.

We tested differences in proportions for statistical significance using the Chi-square test or Fisher's exact test. To assess whether a single question from the MEQ (question 19) could replace the overall score of the full 19-item questionnaire (which would be useful in future surveys for saving both time and cost), we created matching scores defining four distinct categories as described above and derived from the overall MEQ score and analyzed these against the response to question 19. To quantify the extent of agreement between the two scores, we used Cohen's kappa statistic, a measure of chance-corrected agreement [22]. To examine associations of these variables with sleep quality, we used multivariate logistic regression models to calculate odds ratios (OR).

3. Results

Of 131 respondents to the initial questionnaire with valid data on the sleep assessments, 72 were female and 59 were male. Their ages ranged from 13 to 18 years with a mean age of 15.6. Respondents were similar to non-respondents in age, gender, and grade. Among study participants who provided complete responses ($n = 131$), 45.0% were male and 55.0% were female. Among those who did not respond or did not provide complete responses ($n = 454$), 51.1% were male and 48.9% were female. Similarly, among respondents, the average age was 15.6 years, whereas it was 15.4 among the non-respondents.

Overall, the proportion of students using sleeping pills was 13.1%. Sixty-nine percent of girls and 58% of boys qualified as poor sleepers. The majority of students (89%) classified themselves as neither definite morning nor definite evening types but rather as intermediate types, according to their scores from the MEQ; overall, only 4% were definite morning types, and 7% were definite evening types; 66% were classified as "probable morning types." Of the overall sample, 23.6% classified themselves as rather sad on the mood scale ($\leqslant 5$ on a scale from 1 to 10, with 1 being very sad).

In multivariate logistic regression analyses, poor sleep was significantly associated with sad mood (OR, 8.99; 95% CI, 1.93–41.8) and being an evening type, as defined by the MEQ (OR, 3.56; 95% CI, 1.43–8.90; results stratified by gender are presented in Table 1). Further adjustment for the amount of sleep an adolescent received at night strengthened these associations (OR for sad mood,