



Original Article

Sleep duration in Chinese adolescents: biological, environmental, and behavioral predictors



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ABSTRACT

Objective: To examine sleep duration-related risk factors from multidimensional domains among Chinese adolescents.

Methods: A random sample of 4801 adolescents aged 11–20 years participated in a cross-sectional survey. A self-reported questionnaire was used to collect information about the adolescents' sleep behaviors and possible related factors from eight domains.

Results: In all, 51.0% and 9.8% of adolescents did not achieve optimal sleep duration (defined as <8.0 h per day) on weekdays and on weekends, respectively. According to multivariate logistic regression models, after adjusting for all possible confounders, 17 factors were associated with sleep duration <8 h. Specifically, 13 factors from five domains were linked to physical and psychosocial condition, environment, and behaviors. These factors were overweight/obesity, chronic pain, bedtime anxiety/excitement/depression, bed/room sharing, school starting time earlier than 07:00, cram school learning, more time spent on homework on weekdays, television viewing ≥ 2 h/day, physical activity <1 h/day, irregular bedtime, and shorter sleep duration of father.

Conclusion: Biological and psychosocial conditions, sleep environments, school schedules, daily activity and behaviors, and parents' sleep habits significantly may affect adolescents' sleep duration, indicating that the existing chronic sleep loss in adolescents could be, at least partly, intervened by improving adolescents' physical and psychosocial conditions, controlling visual screen exposure, regulating school schedules, improving sleep hygiene and daytime behaviors, and changing parents' sleep habits.

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1. Introduction

Sleep is recognized as a major contributing factor to physical and mental health in children and adolescents [1,2]. It is generally believed that sleep is beneficial not only for energy conservation, neuronal recuperation, and brain plasticity, which are linked to daytime brain functioning and body homeostasis, but also for growth and cognitive and psychological development [3–7].

It has been demonstrated that despite the need for sleep in children and adolescents, sleep duration decreases with age and, as a result, sleep debt increases with age [8–14]. Therefore, the most marked reductions in sleep duration and the highest prevalence of

sleepiness were thought to occur in adolescents [8–14]. In the context of elevated prevalence and negative consequences of sleep loss, increasing attention has been paid to the potential risk factors associated with short sleep duration in adolescents. These risk factors, or at least some of them, could be intervention targets.

Previous studies have suggested that the influential factors associated with sleep duration among adolescents included demographic factors, family environments, lifestyle patterns, sociocultural conventions, health status, and school schedules [15–21]. However, nearly all of these studies focused on a specific single perspective. Based on a strong tradition of Confucianism and intrinsic sociocultural values in China, Chinese adolescents may be most vulnerable to short sleep duration [8,22,23]. However, to the best of our knowledge, no study has yet specifically explored sleep duration and its related factors in this population. To fill these knowledge gaps, the present epidemiological study was designed to investigate sleep duration and its related factors in eight domains among Chinese adolescents: demographic characteristics, family

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structure and socioeconomic status, biological and psychosocial conditions, family history of sleep disorders, sleep environments, school schedules, routine activities and behaviors, and parents' sleep habits.

2. Methods

2.1. Ethics

The ethical application and consent procedure of this study were approved by the Ministry of Education of the People's Republic of China and Ethics Committee of Shanghai Jiaotong University School of Medicine.

2.2. Subjects and procedures

A cross-sectional study was conducted in Shanghai, which is located along the east coast of China with a total population of ~20.8 million in 2012 (State statistical bureau of the People's Republic of China, 2012). There are 17 districts in Shanghai, nine located in urban areas and eight in suburban/rural areas. From these districts, four located in urban areas and two located in suburban/rural areas were randomly selected. For every district, two junior high schools and two senior high schools were randomly selected. Study sample candidates were selected from the student population of these schools. Among 5159 students eligible for the study, 4966 (96.25%) returned completed questionnaires. One hundred and sixty-five children whose sleep duration was less than -3 standard deviations from the mean (SD) and/or greater than $+3$ SD were deleted. The final sample consisted of 4801 children (49.1% boys vs 50.9% girls). The mean age of the sample was 15.59 years (SD, 2.05; range, 11.0–20.0).

This study was conducted during November 2009. The research aims were explained to school principals and teachers in the target schools. Permission was obtained to carry out the study, which is the usual practice in China. The survey was implemented during a regular health education class. In the class, an anonymous questionnaire was delivered to the students. Researchers explained the study purpose to the students and emphasized that participation was voluntary. Students were requested to fill out the questionnaires. All students who did not attend the class were excluded from the survey.

2.3. Measures

2.3.1. Sleep duration

Sleep behaviors were assessed by a self-reported sleep inventory – the Adolescent Sleep Wake Scale (ASWS). ASWS is a five-subscale instrument which was designed and developed to screen for the most common sleep problems in adolescents [24]. A Chinese version of the ASWS was developed by translation and back-translation, and has excellent sensitivity and reliability (Cronbach's α coefficients for the internal consistency were 0.71 for the overall questionnaire and ranged from 0.61 to 0.73 for subscales; intraclass correlation coefficients for the test–retest reliability were 0.85 for the overall questionnaire and ranged from 0.64 to 0.82 for subscales).

The respondents were also requested to indicate their sleep habit during the previous month. Sleep habit information included bedtime, wake-up time, and sleep duration on weekdays (from Monday to Friday) and on weekends (Saturday and Sunday). For the statistical analysis, the number of minutes was divided by 60, multiplied by 100, and added to the number of hours to obtain a metric variable.

To determine the risk factors related to short sleep duration, the sleep duration was dichotomized into <8.0 h vs ≥ 8.0 h. Sleep duration <8.0 h was defined as less than optimal sleep duration. This cut-off point was chosen based on literature review and clinical evidence,

where it has been shown that 8.0 h reflects the clinical importance of sleep restriction at the age of adolescence [8,15,25,26]. Two recently published papers emphasized that during pubertal development, the physiological needs for sleep do not decrease with increasing age [27,28]. Therefore, we adopted the same cut-off point for all of the sampled adolescents.

2.3.2. Possible risk factors regarding sleep duration

The 38 possible risk factors were grouped into eight domains: (1) demographic characteristic variables, (2) family structure and socio-economic status variables, (3) biological and psychosocial condition variables, (4) family history of sleep disorder variables, (5) sleep environment variables, (6) school schedule variables, (7) daily activity and behavior variables, and (8) parents' sleep habit variables.

Demographic characteristic variables included adolescents' age, gender, and class type (terminal class/general class).

Family structure and socio-economic status variables included household income [<1000 , 1000 – 3000 , and ≥ 3000 Renminbi (RMB; yuan)/person/month], family structure [single parent family, nuclear family, and large family (the family with family members of grandparents, parents, and child)], and parents' educational levels [middle school and below (low), high school (medium), and college and above (high)].

Adolescents' biological and psychosocial condition variables included overweight/obesity status [yes/no, defined by the standardized internationally referenced gender- and age-specific body mass index (weight in kg/height in m^2)] cut-offs [29]. Weight and height came from student physical health screening, which is conducted in September and October every year), chronic respiratory condition (yes/no, with the definition of being ever diagnosed with allergic rhinitis and bronchitis, asthma, or tonsil/adenoidal hypertrophy by pediatricians), chronic pain (yes/no), and history of attention deficit/hyperactivity disorder (ADHD) diagnosis (yes/no, with definition of being ever diagnosed with ADHD by pediatricians), bedtime anxiety (usually/often and occasionally/no, defined as feeling upset or worrying about something during bedtime), and bedtime excitement/depression (usually/often and occasionally/no, defined as feeling excited or feeling very sad during bedtime).

Family history of sleep disorder variables included parents' history of sleep disorders (yes/no) and grandparents' history of sleep disorders (yes/no).

Sleep environment variables included sleep arrangements (routine room/bed sharing vs sleeping alone; routine room/bed sharing was defined as sharing a bed/room with parents/caregivers five to seven nights per week), bedroom intrusive noise (usually/often and occasionally/no), bedroom intrusive light (usually/often and occasionally/no), and temperature too high or low (usually/often and occasionally/no).

School schedule variables included school starting time (before/after 07:00), school ending time (before/after 16:30), cram school learning (yes/no), and homework on weekdays and on weekends (<2 h/day and ≥ 2 h/day; the cut-off was based upon our previous study [30]).

Daily activity and behavior variables included psychotropic medications used during the previous month (yes/no; psychotropic medications include aspirin, Ritalin, caffeine, phenobarbital, etc.), active or passive smoking (yes/no), alcohol drinking (yes/no), television viewing (<2 and ≥ 2 h/day), computer game playing/computer using (usually/often and occasionally/no), physical activity on weekdays and weekends (<1 and ≥ 1 h/day), having drinks with caffeine or alcohol after 18:00 (usually/often and occasionally/no), doing exciting activities (for example, playing outside, playing video/internet games, and watching violent/stimulating television programs) around bedtime (usually/often and occasionally/no), and irregular bedtime (usually/often and occasionally/no).

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