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## Commentary

### Are adolescents sleeping less and worse than before? ☆

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Sleep in adolescents has been receiving increased attention, because of its vital role on mood, daytime functioning, academic performance, overall health and development. The intrinsic changes in sleep architecture and circadian factors, together with other developmental changes in psychosocial aspects as well as the external factors (e.g., increased school workload, excessive media usage) may increase the vulnerability for sleep problems, especially sleep deprivation and insomnia, in adolescents [1,2]. A large body of evidence across different countries consistently demonstrates the pervasiveness of sleep problems in adolescents [3,4]. Indeed, sleep problems in adolescents are not only found to be prevalent but also showing an increasing trend in the past decades, albeit that the existing data is limited and conflicting, particularly among Asian countries [2].

Yoshitaka Kaneita and colleagues investigated the secular trend of sleep patterns and problems including insomnia, late bedtime, and short sleep duration (<7) in Japanese adolescents from 2004 to 2017 [5]. By analyzing a total of 545 285 Japanese adolescents across 6 waves of survey, they noted a decrease in the prevalence of insomnia (Adjusted odds ratio [AOR] 0.85, 95% CI 0.82-0.87), but a reverse trend of increasing prevalence for late bedtime (AOR 1.17, 95% CI 1.12-1.23), shorter sleep duration (AOR 1.13, 95% CI 1.10-1.17) and poor mental health problems during this 13-year study period.

Their study provides encouraging, interesting but also some conflicting findings. For example, there was a decreasing trend of insomnia problems in Japanese adolescents over the study period. However, this observation was inconsistent with the data found in European adolescents as the majority of the countries (28/33) reported a secular trend of increasing prevalence of sleeping difficulties over a similar period of time from 2002 to 2014 [6]. Yoshitaka Kaneita and colleagues speculated that the improvement of insomnia might be possibly due to the introduction of sleep health policy in the schools and the territory-wide promotion of sleep health in the community in Japan. If this was the case, such changes are encouraging because the majority of the previous studies on school-based sleep education programs only suggested a significant improvement in sleep knowledge but little effect on sleep behaviors [7]. It is possible that the translation from knowledge to behavior takes time and a larger scale promotion with continued education in school are necessary to facilitate the sleep-related behavioral changes. Besides school-based promotion, small group intervention with selective focus on vulnerable adolescents might be another approach to promote sleep health in high risk population. Recently, our group have shown that insomnia could be proactively prevented by a 4-week cognitive-behavioral prevention program in high-risk adolescents (those adolescents with a positive family history and subsyndromal insomnia symptoms) [8], indicating the necessity of timely intervention for those who are vulnerable to sleep problems. In this regard, both general sleep education and specific cognitive prevention program are necessary to both general and high-risk population in order to reduce the health care burden of insomnia in the future.

Nevertheless, the study also reported discrepant findings showing an increasing prevalence of later bedtime and shorter sleep duration. If the nationwide sleep education and promotion in Japan could lead to a reduction of sleep problems, we would expect a

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parallel improvement of bedtime and sleep duration in this population. In this regard, we may take a reference from previous studies and suggest some potential but unexplored factors to explain such a discrepancy in Yoshitaka Kaneita and colleagues' study. For example, early school start time and increased screen time are two widely studied factors that could lead to delayed bedtime and sleep deprivation in adolescents [6,9,10]. In addition, some other cultural and environmental factors might also warrant further investigation. For example, a recent population-based study showed that the satellite measured outdoor artificial light at night increases the risk for short sleep, delayed bedtime and poor mental health problems in adolescents [11]. The downwards trends in sleep behaviors, especially later bedtime, in Yoshitaka Kaneita and colleagues' study could possibly be related to negative effects of environmental light pollution as well as the sharp rise of the usage of electronic devices in the past decades. Moreover, different cultural and sociodemographic characteristics might also contribute to the wide variations in sleep patterns. The inconsistent data from various regions suggest that country-level factors could either promote or adversely affect adolescent sleep [4,12]. For example, bed and bedroom sharing in the families are common in the Eastern culture such as Chinese and Korean society, which might have negative effects on children's sleep [13]. It is of note that people in two cities of China, even with similar cultural and ethnicity groups, could show different sleep patterns. Our previous study demonstrated that children in Hong Kong went to bed later and slept approximately 45 minutes less than their counterparts in Shanghai. We also found that Hong Kong children sleep less than 10 years ago, whilst there is a slight increase of sleep duration in Shanghai children from early 2000 to 2010s [3]. The exact causes for the subcultural differences in sleep pattern between these two cities was not clear, different systemic policy change might be a contributing factor because Hong Kong has abolished half-day (afternoon) school and all the children had to attend school in the morning, whereas Shanghai has implemented the policy of delaying school start time in all primary schools.

In order to answer the question "Are adolescents sleeping less and worse than before?", further interdisciplinary work across various regions is necessary to enable researchers to harmonize and gather multi-dimensional data covering cultural, governmental policy especially over schooling and health, environmental and sociodemographic characteristics. The rich and diverse cultural, social, and economic differences among Asian countries would be an ideal starting point for the much-needed study in order to understand the factors and develop potential intervention to improve sleep health in adolescents.

## Declaration of Competing Interest

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