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Brief report

Delayed school start time is associated with better sleep, daytime functioning, and life satisfaction in residential high-school students☆

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ABSTRACT

The effects of a delayed school start time by one hour were examined at a boarding school in Hong Kong. Two cohorts of high school students (N = 228; 61.8% female) were recruited respectively before and after a school start time changed from 7:30am to 8:30am. Both cross-cohort and within-cohort longitudinal comparisons yielded significant increase in total sleep time. Cross-cohort comparison yielded improvement in sleep quality, insomnia, life satisfaction, and psychological distress. Longitudinal data suggested that the longer the additional sleep time, the better was sleep quality, day-time functioning, and subjective wellbeing.

It is recommended that adolescents between the ages 13 and 18 should regularly get eight to 10 h of sleep each night (Carskadon et al., 2002; Hirshkowitz et al., 2015). Chronic sleep deprivation can cause harm to the physical and mental health of an adolescent (Kaneita et al., 2009; Paiva, Gaspar, & Matos, 2015; Tom & Berenson, 2013; for a review, see; Shochat, Cohen-Zion, & Tzischinsky, 2014). Furthermore, sleep deprivation is associated with daytime sleepiness, which contributes to cognitive and behavioral problems and impacts academic performance (Brand & Kirov, 2011; Gibson et al., 2006; Joo et al., 2005; Mak, Lee, Ho, Lo, & Lam, 2012; Wong et al., 2013).

During puberty, youth undergo a phase-delay in their circadian rhythm (i.e., late morning wake and later bedtimes) (Hagenauer, Perryman, Lee, & Carskadon, 2009; Minges & Redeker, 2016; Wolfson & Carskadon, 2003). Among other social and environmental influences, Carskadon, Acebo, and Jenni (2004) suggested that early school start time (SST) in particular interferes with the natural sleep-wake cycle and homeostatic sleep regulation process of adolescents. A recent meta-analysis (Bowers & Moyer, 2017) found longitudinal and cross-sectional evidence for the association between delayed SST and longer sleep, as well as cross-sectional evidence for the associations between delayed SST and reduced daytime sleepiness and tardiness. Marx et al. (2017) systematic review and meta-analysis also suggests a positive association between delayed SST and sleep time.

Some studies found that later SST is associated with better behavioral and academic outcomes (Carrell, Maghakian, & West, 2011; Owens, Belon, & Moss, 2010; Perkinson-Gloor, Lemola, & Grob, 2013) and consequently impacts health and classroom behavioral outcomes (for a review, see Minges & Redeker, 2016). However, as noted by Marx et al. (2017), findings on the benefits of longer sleep time is less conclusive, due to the lack of high quality studies.

High quality studies on SST are difficult to conduct, given the logistics difficulty to alter SST in most schools. Boarding schools

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provide a bit more flexibility and thus is a relatively convenient context to examine the impact of delayed SST. The two previously published studies on delayed SST in a boarding school found that delated SST is associated with longer sleep and less depressive mood (Boergers, Gable, & Owens, 2014; Owens et al., 2010). Building on these findings, this study implemented a longer delay in SST and included additional outcome measures on sleep, health, and psychological wellbeing. Specifically, this two-wave prospective study collected data from a boarding school in Hong Kong where the SST was delayed from 7:30am in 2016–17 to 8:30am in 2017–18. Conducting a randomized controlled trial was not feasible; this study followed some of the recommendations by Marx et al. (2017) by 1) using a cross-cohort and longitudinal design to examine the effect of an intervention that 2) could be implemented in other boarding schools.

1. Methods

1.1. Participants

A total of 228 Grade 11 participants across two cohorts of students were recruited from an international boarding school in Hong Kong. Data were collected in April 2017 (T1) and October 2017 (T2). With the cooperation of the school, Cohort 1 (n = 110; 90.2% of entire class) was recruited at T1 whereas Cohort 2 (n = 118; 89.4% of entire class) was recruited at T2; 82 students (74.5%) from Cohort 1 completed the T2 questionnaire. No difference was found between those who completed both T1 and T2 and those who only completed T1 on any of the variables in this study.

The average age of Cohort 1 was 16.87 (SD = 0.83) at T1 and 17.41 (SD = 0.79) at T2. The average age of Cohort 2 was 16.55 (SD = 0.80). Cohort 1 and Cohort 2 had 66 females (60.0%) and 75 females (63.6%), respectively. Over half of the participants reported being Asian (55.70%), 18.4% white, 7.9% black, 3.5% others, 1.8% Hispanic/Latino, 1% Pacific Islander, and 11.8% did not report their race/ethnicity. All participants resided in an on-campus dormitory during the school year and at the time of data collection.

1.2. Procedure

Participants were invited to complete an online questionnaire by their teachers. The delayed SST was implemented five months post T1 (6 weeks before T2). Personal consent and parental assent were sought before data collection. Ethical approval was received from The University of Hong Kong. Data collection was conducted in English.

1.3. Measures

1.3.1. Total sleep time (TST)

Self-reported sleep duration in the past month was measured by a single-item. Participants reported the amount of sleep they had by answering the question “How many hours of sleep do you get at night? (This may be different from the hours you spend in bed)”

1.3.2. Time in Bed (TIB)

Participants reported their bed time and wake-up time in the past month. TIB was calculated from the two items.

1.3.3. Pittsburgh sleep quality index (PSQI)

The PSQI (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) measured self-reported sleep quality in the past month. Lower scores indicate better sleep quality. Sub-components include “Subjective Sleep Quality,” “Sleep Latency,” “Sleep Efficiency,” “Sleep Disturbances,” “Use of Sleep Medication,” and “Daytime Dysfunction.”

1.3.4. Life satisfaction

Life satisfaction was measured by a single item (Cheung & Lucas, 2014). A higher score indicates a higher level of life satisfaction.

1.3.5. Perceived health

Perceived Health was measured by a single-item asking participants to rate their health (Ginneken & Groenewold, 2012). A higher score indicates a higher level of perceived health.

1.3.6. Sleepiness

Sleepiness was measured by nine items in the School Sleep Habits Survey (Wolfson & Carskadon, 1998; SSHS). Higher composite scores indicate higher levels of daytime sleepiness.

1.3.7. Sleep/wake behavioral problems

Sleep/Wake behavioral problems were measured by 10 items in the SSHS (Wolfson & Carskadon, 1998). Higher composite scores indicate more problems.

1.3.8. Insomnia

Insomnia was measured by the Insomnia Severity Index (Morin, 1993). Higher composite scores indicate higher levels of insomnia in the past 2 weeks.