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Brief Communication

Effect of delayed sleep phase during university life on the daytime functioning in work life after graduation

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ABSTRACT

Objective: To examine the effects of changes in sleep phase on the daytime functioning of new university graduates.
Methods: Questionnaire data of university students ($n = 745$) and university graduates working full time ($n = 360$) were analyzed to explore sleep phase changes during this life stage. The newly graduated full-time workers ($n = 117$) were divided into 2 (bedtime at investigation: earlier/later) × 2 groups (bedtime at one year prior to investigation: earlier/later), and depressive symptoms and health-related quality of life were compared among groups.
Results: New university graduates experienced ~1 h of sleep phase advancement and shortened time in bed compared to one year before investigation. In addition, those who experienced such sleep changes showed larger daytime dysfunction.
Conclusion: Prevention of extreme sleep phase delay during university days might be helpful for students' adaptation to work environment after graduation.

1. Introduction

Several studies have reported that university students are likely to have a delayed sleep phase [1–3]. For example, Brown et al. [3] found that the prevalence of delayed sleep phase syndrome in university students was 11.5% – about twice the rate found in the general population. Additionally, this delay was reported to be associated with their mental malfunction [4,5], and lower academic performance [4,6,7]. Previous studies have found that the sleep phase of university students is delayed with advancing age or school year [2,5,8], which may imply that the delay would reach a peak in the last year of university life. Since the sleep phase of working adults in their 20s is much earlier than that of university students [2], when they start to work regularly, shortly after graduation, university students are thought to modify their sleep phase to meet job-related demands.

A study exploring the effects of the change of adolescents' sleep phase during the early days of transition from junior to high school suggested that advancement of their sleep phase is likely to cause a lack of nocturnal sleep, leading to the development of daytime sleepiness [9]. Other studies showed that the presence of delayed sleep phase during a certain life stage may have a negative impact on the daytime functioning of the following life stage [10,11]. Considering these findings, there is a possibility that there may be daytime malfunction in new graduate full-time workers due to the sleep phase advancement after university graduation. However, there has been no study exploring this issue. Therefore, in this study, we explored the condition of sleep phase change and its effects on sleep quality, depressive symptoms, and health-related quality of life (HRQOL) in new university graduates.

2. Methods

This study was part of a comprehensive research project on the sleep health of the young generation in Japan. In this cross-sectional study, a web-based questionnaire survey was conducted. It included 3904 participants with different occupations, including students, workers, and unemployed youth, aged 19–25 years. The participants accessed a website to respond to this

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survey; 3613 (93%) completed the questionnaire. In this study, we utilized only data on university students [413 male and 332 female; mean age, 21.52 years; standard deviation (SD), 1.51], and university graduate full-time workers without night shifts (153 male and 207 female; mean age, 23.92 years; SD, 1.02). The study protocol was approved by the ethics committee of the Neuropsychiatric Research Institute, Tokyo, Japan.

Questionnaires consisted of items concerning demographic variables, current and former employment status (e.g. worker, university students), sleep habits and subjective sleep quality, depressive symptoms, and HRQOL. Their sleep habits and sleep quality were assessed with the Japanese version of the Pittsburgh Sleep Quality Index (PSQI) [12,13]. They were also asked about their usual (weekday) bedtime and wake-up time at the time of the investigation. In addition, they were requested to recall their sleep habits from one year prior to the present investigation and report their usual bedtime and wake-up time in that period. Depressive symptoms and HRQOL were assessed using a 12-item version of the Center for Epidemiologic Studies Depression scale (CESD) [14] and Short Form-8 (SF-8) [15], respectively. In this study, the Cronbach's α was 0.92 for the CESD and 0.85 for the SF-8.

Based on the bedtime and wake-up time of the participants, usual time in bed (TIB) was calculated. Total scores of the CESD and PSQI were also calculated. For SF-8, the mental component summary (MCS) and physical component summary (PCS) were calculated. Based on the university grade or duration of full-time work, participants were divided into eight groups: 1st, 2nd, 3rd, or ≥4th year university students and 1st, 2nd, 3rd, or ≥4th year of working after graduation. Average bedtime, wake time, and TIB (at the time of the investigation and at one year before investigation) were compared using 2 (time points: current vs one year before) × 8 (university grade/work duration: 1st year students to ≥4th year worker) two-way analysis of variance (ANOVA). If the main and/or interaction effect of the university grade or work duration was significant, post-hoc analysis was conducted using the Bonferroni correction. To explore the impact of sleep phase change after graduation on daytime functioning and sleep quality, newly university graduated full-time workers ($n = 117$) were divided into two groups according to the median values of their current bedtime (24:00) and bedtime at one year before (25:00), respectively. Then, CESD, PSQI, MCS, and PCS scores were compared using 2 (earlier/later bedtime at one year before) × 2 (earlier/later current bedtime) ANOVA. The same analyses were conducted on their reported wake time and TIB, using their median at each time point (current wake time, 07:00; wake time at one year before, 08:00; current TIB, 06:30; TIB at one year before, 07:30) for classification.

3. Results

The sleep phase was gradually delayed with advancing grade of university classes; however, it was found to be advanced after graduation (Fig. 1). The two-way ANOVA showed significant interaction effects between grade and time points at bedtime [$F(7, 1064) = 18.05$, $P < 0.001$]. A subsequent simple main effects test showed that habitual bedtimes reported by 1st, 2nd, 3rd, and ≥4th year students at investigation were significantly later than what they reported one year before the investigation. In contrast, newly graduated full-time workers reported an earlier current bedtime than at one year before ($P < 0.001$). In addition, the interaction was significant with regard to wake time, [$F(7, 1064) = 26.41$, $P < 0.001$]. Simple main effects tests showed that the difference between current wake time and that one year before was significant in 1st and ≥4th year students and newly graduated workers ($P < 0.001$ for all the tests). The interaction was also significant for TIB [$F(7, 1064) = 6.015$, $P < 0.001$]. Subsequent simple main effects analyses showed that the difference between current TIB and that one year before was significant only in new graduates ($P < 0.001$).

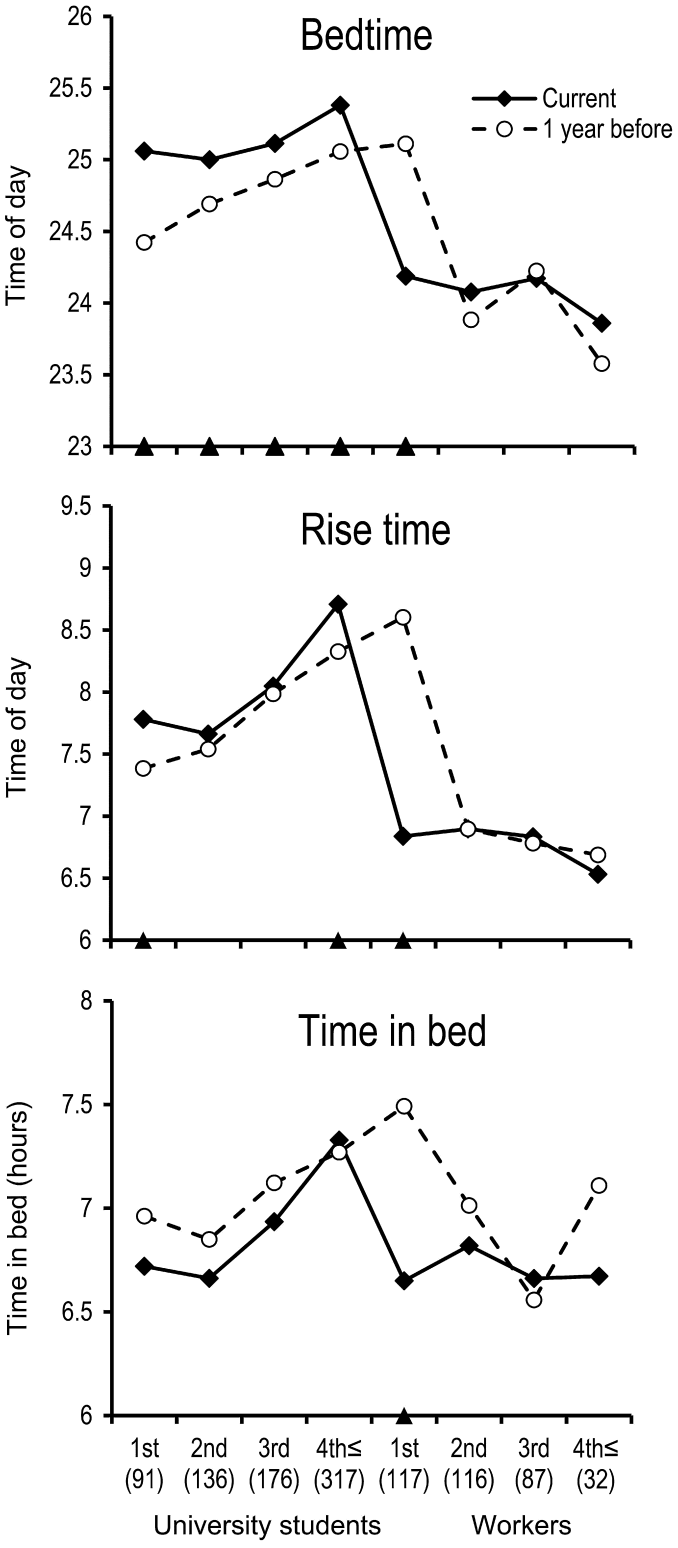

Fig. 1. Reported bedtime (upper panel), wake time (middle panel), and time in bed (lower panel) on weekdays at the time of the investigation and at 1 year before it. Triangles (▲) on the abscissa indicate significant differences between the current and 1-year-before sleep parameter in each year-grade group. Values in parentheses are numbers of participants in each group.

The two-way ANOVA with the data on newly graduated full-time workers revealed that the interaction between current bedtime