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# Association Between Weekend Catch-Up Sleep and Perceived Stress Among Adolescents in the Republic of Korea: A Nationwide Cross-Sectional Study

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Insufficient sleep is common among adolescents in the Republic of Korea because of competitive academic environments. Many students compensate for lack of sleep through weekend catch-up sleep (CUS), however the degree of effectiveness is unclear. This study aimed to determine the association between weekend CUS and perceived stress in a large, school-based Korean adolescent sample. Data from the Korean Youth Risk Behavior Web-based Survey 2020 (KYRBWS) was used. The participants included 46,187 middle and high school students in the Republic of Korea who participated in self-administered questionnaire surveys. Weekend CUS was divided into four categories: 0 h, 0-1 h, 1-2 h, and ≥ 2 h. Odds ratios (ORs) with 95% confidence intervals (CIs) were derived using logistic regression analyses. We found that the risk of perceived stress decreased significantly in weekend CUS groups (0 < CUS < 1 [OR]: 0.879, [95% CI: 0.808-0.957]; 1 ≤ CUS < 2 [OR]: 0.852, [95% CI: 0.785-0.924]; 2 ≥ CUS [OR]: 0.836, [95% CI: 0.775-0.902]) compared to the non-CUS group after adjusting for several confounding variables. Furthermore, the higher CUS group tended to have a lower risk of perceived stress. However, in the Grade 12 participants, in both the unadjusted and adjusted models, the weekend CUS groups did not show a significant association with the risk of perceived stress. Our study showed that weekend CUS is associated with a low risk of perceived stress among Korean adolescents.

**Keywords:** adolescent; odds ratio; sleep; stress; students
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## Introduction

Insufficient sleep is common among adolescents in the Republic of Korea due to its competitive academic environment (Park et al. 2009). Under strong socio-cultural and psychological influences emphasizing the importance of college entrance examinations, high school students in the Republic of Korea reduce their sleep to secure studying time. In a national survey, the average sleep duration of Grade 12 students in the Republic of Korea was found to be only 5.5 h (Ministry of Education 2020). This is less than the 7-9 h of sleep recommended by the National Sleep Foundation (NSF). Due to this unwanted situation, Behaviorally-induced Insufficient Sleep Syndrome (BISS), which is characterized by excessive daytime sleepiness, short habitual sleep duration, and sleeping significantly longer than usual during weekends/holidays, is a common and serious health problem prevalent among adolescents in the Republic of Korea (Lee et al. 2012).

Although the mechanisms of sleep and stress are yet to be fully understood, it is well-established that sufficient sleep is crucial for maintaining the mental and physical

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health of adolescents (Wolfson and Carskadon 1998). During sleep, the Hypothalamic-pituitary-adrenal (HPA) axis is activated to facilitate the stress-controlling system in the body, thereby alleviating stress when required (Román et al. 2006; Meerlo et al. 2008; Vargas and Lopez-Duran 2017; Nollet et al. 2020). In addition to stress relief, sleep is also critical for emotional stability, cognition, attention, psychosocial development, and physical growth (Wolfson and Carskadon 1998; Liu and Zhou 2002; Jayanthi et al. 2015).

Despite common misconceptions, short sleep duration does not always reflect insufficient sleep (Van Dongen et al. 2005). In fact, a longer sleep duration during the weekend compared to weekdays may more accurately reflect the actual sleep time that the body lacks and needs. Short sleep duration can be compensated for by extended weekend sleep (catch-up sleep [CUS]), which has been shown to have beneficial effects, including reduced risk of hypertension, dyslipidemia, and depression (Kim et al. 2021).

Previous studies examined, the relationship between short sleep duration and perceived stress in adults. Kim et al. (2019) showed that stress increased when sleep was insufficient in adults in the Republic of Korea. Another study showed that an increase in objectively measured sleep mitigates negative affective responses to the previous day's stress in adolescents (Chue et al. 2018). However, few studies have investigated the relationship between weekend CUS and perceived stress in adolescents, whose sleep patterns change from infancy, including shorter sleep duration and a greater discrepancy between weekday and weekend sleep (Lee et al. 2012; Chue et al. 2018). In addition, studies examing the link between CUS and depression have not considered stress-related factors that may contribute to depression in adolescents (Koo et al. 2021; Zheng et al. 2024). Given these data, we investigated the relationship between weekend CUS and perceived stress in adolescents in the Republic of Korea.

## Materials and Methods

*Study design and population*

We used data from the Korean Youth Risk Behavior Web-based Survey 2020 (KYRBWS 2020), a cross-sectional, nationwide survey conducted by the Korea Disease Control and Prevention Agency (KDCA). The total number of participants in this survey was 54,948 students, comprised of Grade 7 to 12 students. The survey was conducted between August 3 and November 13, 2020. We excluded individuals who did not respond to questions regarding sleep (n = 8,473). Based on the analysis results of the raw data, we also excluded participants who were outliers because they slept too short or too much on weekdays (< 3 or ≥ 11 h) (n = 288). Thus, we analyzed the data of 46,187 participants as a representative sample (Fig. 1).

*Weekend catch-up sleep (CUS)*

The variable of interest was weekend CUS. The following 4 categories (1. times going to bed on weekdays; 2. wake-up time on weekdays; 3. times going to bed on weekends; 4. wake-up time during weekends) from the KYRBWS 2020 to calculate the daily sleep duration on weekdays and daily sleep duration on weekends. Finally, by subtracting the weekday daily sleep duration from the weekend daily sleep duration, we acquired the weekend CUS in minutes. Then, weekend CUS was divided into four groups: CUS = 0 h group (Group A, n = 4,512), 0 h < CUS < 1 h group (Group B, n = 7,819), 1 h ≤ CUS < 2 h

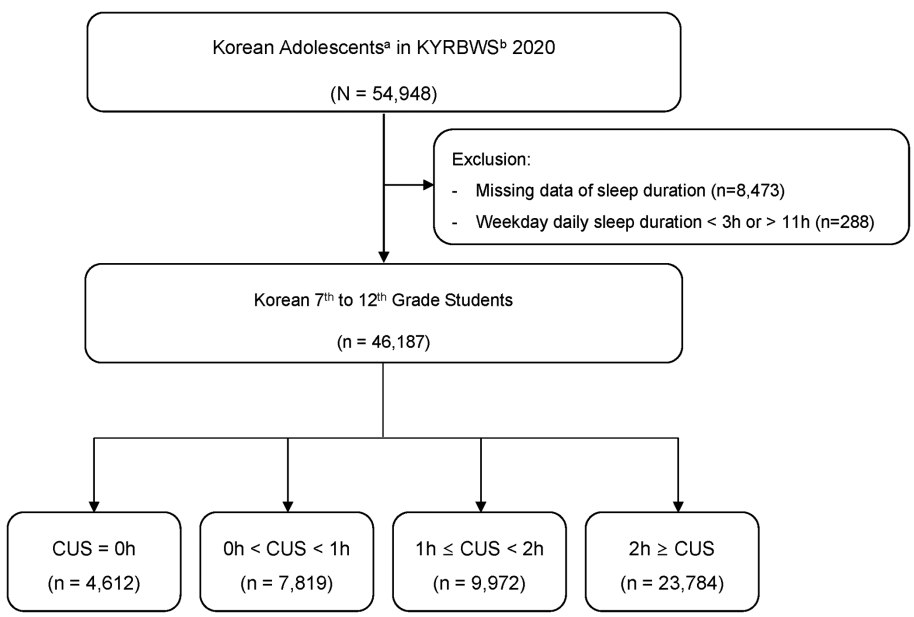


Fig. 1. Schematic diagram depicting study population.
[a]7th to 12th grade; [b]KYRBWS 2020 = Korean Youth Risk Behavior Web-based Survey in 2020; [c]CUS (catch-up sleep) = (weekend daily sleep duration) – (weekday daily sleep duration).

group (Group C, n = 9,972), and 2 h ≥ CUS group (Group D, n = 23,784). The CUS = 0 h group (Group A, n = 4,512) was considered the non-CUS group.

*Perceived stress*

Perceived stress was the dependent variable in this study. To measure this, participants responded to the following question: "How stressed do you feel in your daily life?" Their response options were "feel it very much," "feel it a lot," "feel it a little bit," "hardly feel it," and "do not feel it at all." For the analysis, we categorized individuals whose responses were "feel it very much," and "feel it a lot" as the high perceived stress group. We classified those who responded with "feel it a little bit", "hardly feel it", and "do not feel it at all", as the low or no perceived stress group.

*Socio-demographic variables and covariates*

We also measured several socio-demographic, and health-related characteristics as covariates. The characteristics included sex (male, or female), grade (Grade 7, 8, 9, 10, 11, or 12), body mass index (BMI), ($kg/m^2$), drinking experience (yes, or no), smoking experience (yes, or no), high intensity exercise ( ≥ 3 days or < 3 days response to the question, "In a week, how many days do you exercise for more than 20 minutes until you run out of breath or break a sweat?"), socio-economic status (low, or not low), academic performance (high, moderate, or low), weekday daily sleep duration group (< 7 h, or ≥ 7 h), depressive episode (Yes/No to the question, "For the last 12 months, have you experienced a depressive episode that lasted more than 2 weeks or sorrow that has made you pause during your daily activities?") and experience of being bullied (yes, or no response to the question, "For the last 12 months, have you been treated at a hospital due to bullying by student of the same grade, a senior student, or an adult?").

*Statistical analyses*

All statistical analyses were performed using IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk, N.Y., USA). Analysis of variance (ANOVA) and the chi-squared test were used to analyze continuous and categorical variables across the weekend CUS groups. Logistic regression analyses were used to calculate the odds ratios (ORs), and 95% confidence intervals (CIs) of perceived stress associated with weekend CUS. Adjustments for weekday daily sleep duration (≥ 7 h, or < 7 h) were made. The analysis also included adjustments for relevant covariates, including sex, grade, socio-economic level, academic performance, depressive episodes, and experience of being bullied.

Next, we evaluated the effect modification by subgroup based on grade (Grade 7-11, Grade 12) by including cross-product terms between subjective sleep insufficiency and weekend CUS. Significant differences were observed between the weekend CUS and perceived stress in each CUS group. We performed multivariate logistic regression analyses for each group. A probability level of $p < 0.05$ was considered statistically significant.

*Ethics statement*

Written informed consent was obtained from all participants before the survey, and approval for this study was obtained from the Institutional Review Board (IRB) of the Wonju Severance Christian Hospital, Korea (IRB No. 321339).

## Results

*Demographics and characteristics*

Table 1 shows the baseline characteristics of the participants. The female proportion tended to increase in the high CUS groups (CUS = 0: 35.2%; 0 < CUS < 1: 41.4%; 1 ≤ CUS < 2: 46.7%; 2 ≥ CUS: 53.0%). The percentage of participants in non-CUS group was highest in Grade 7 while the percentage of participants in the ≥ 2 h CUS group was highest in Grade 12. As the participants' school years increased, the percentage in the non-CUS group decreased (Grade 7: 28.6%; Grade 8: 22.1%; Grade 9: 18.1%; Grade 10: 11.3%; Grade 11: 10.3%; Grade 12: 9.5%), and weekend CUS hours tended to increase proportionally.

The non-CUS group performed higher physical activity than weekend CUS groups (high-intensity exercise, CUS = 0: 34.7%, 0 < CUS < 1: 31.2%, 1 ≤ CUS < 2: 29.0%, 2 ≥ CUS: 26.7%). Weekend CUS groups, especially the 0 < CUS < 1 and 1 ≤ CUS < 2 groups, showed significantly higher academic performance. The proportion of weekday daily sleep durations of no less than 7 h tended to decrease substantially in the high CUS groups. The 2 ≥ CUS group showed approximately one-third of the participants of the non-CUS group (CUS = 0: 64.8%, 0 < CUS < 1: 55.0%, 1 ≤ CUS < 2: 42.7%, 2 ≥ CUS: 23.9%).

*Association between weekend CUS and perceived stress*

Logistic regression analyses were performed to test the association between weekend CUS and perceived stress. We adjusted for potential confounding factors. The non-CUS group was used as a reference (Table 2). The 0 < CUS < 1 group had lower risk of perceived stress than the non-CUS group (0 < CUS < 1, OR: 0.919, 95% CI: 0.849-0.994). The 1 ≤ CUS < 2 group also had a lower risk of perceived stress than the non-CUS group, but this was not statistically significant (1 ≤ CUS < 2, OR: 0.974, 95% CI: 0.904-1.050). Unlike the previous two groups, the 2 ≥ CUS group had a higher risk of perceived stress than the non-CUS group (2 ≥ CUS, OR: 1.143, 95% CI: 1.068-1.222) (Table 2, Model 1).

There was a significant association between weekend CUS and perceived stress after adjusting for weekday daily sleep duration of no less than 7 h (Table 2, Model 2). The weekend CUS groups showed a lower risk of perceived stress (0 < CUS < 1, OR: 0.857, 95% CI: 0.792-0.928; 1 < CUS < 2, OR: 0.839, 95% CI: 0.777-0.905; 2 ≥ CUS, OR:

Table 1. Baseline characteristics of participants according to weekend catch-up sleep time.

| Variables | CUS = 0 h (n = 4,612) | 0 h < CUS < 1 h (n = 7,819) | 1 h ≤ CUS < 2 h (n = 9,972) | 2 h ≥ CUS (n = 23,784) | *P* |
|---|---|---|---|---|---|
| Sex, female | 1,624 (35.2%) | 3,236 (41.4%) | 4,659 (46.7%) | 12,602 (53.0%) | < 0.001 |
| Grade | | | | | < 0.001 |
| 7th grade | 1,320 (28.6%) | 1,824 (23.3%) | 1,940 (19.5%) | 3,477 (14.6%) | |
| 8th grade | 1,019 (22.1%) | 1,464 (18.7%) | 1,727 (17.3%) | 3,667 (15.4%) | |
| 9th grade | 836 (18.1%) | 1,318 (16.9%) | 1,670 (16.7%) | 3,785 (15.9%) | |
| 10th grade | 520 (11.3%) | 1,044 (13.4%) | 1,563 (15.7%) | 4,342 (18.3%) | |
| 11th grade | 477 (10.3%) | 1,034 (13.2%) | 1,503 (15.1%) | 4,445 (18.7%) | |
| 12th grade | 440 (9.5%) | 1,135 (14.5%) | 1,569 (15.7%) | 4,068 (17.1%) | |
| BMI, kg/m$^2$ | 22.0 ± 4.0 | 21.5 ± 3.6 | 21.5 ± 3.6 | 21.4 ± 3.6 | < 0.001 |
| Drinking experience (yes) | 1,392 (30.2%) | 2,192 (28.0%) | 2,976 (29.8%) | 8,471 (35.6%) | < 0.001 |
| Smoking experience (yes) | 376 (8.2%) | 552 (7.1%) | 786 (7.9%) | 2,642 (11.1%) | < 0.001 |
| High-intensity exercise (yes) | 1,601 (34.7%) | 2,442 (31.2%) | 2,889 (29.0%) | 6,343 (26.7%) | < 0.001 |
| Socioeconomic status (low) | 619 (13.4%) | 928 (11.9%) | 1,105 (11.1%) | 3,279 (13.8%) | < 0.001 |
| Academic performance | | | | | < 0.001 |
| High | 1,693 (36.7%) | 3,198 (40.9%) | 4,189 (42.0%) | 8,257 (34.7%) | |
| Middle | 1,420 (30.8%) | 2,372 (30.3%) | 3,030 (30.4%) | 7,249 (30.5%) | |
| Low | 1,499 (32.5%) | 2,249 (28.8%) | 2,753 (27.6%) | 8,278 (34.8%) | |
| Weekday daily sleep duration (≥ 7 h) | 2,987 (64.8%) | 4,303 (55.0%) | 4,258 (42.7%) | 5,678 (23.9%) | < 0.001 |
| Depressive episodes (yes) | 1,083 (23.5%) | 1,666 (21.3%) | 2,245 (22.5%) | 6,139 (25.8%) | < 0.001 |
| Experience of being bullied (yes) | 73 (1.6%) | 74 (0.9%) | 100 (1.0%) | 247 (1.0%) | 0.004 |

Statistical analysis by chi-squared test. CUS, catch-up sleep; BMI, body mass index.

0.874, 95% CI: 0.815-0.938).

Model 3 was adjusted for the variables controlled in Model 2 and additionally adjusted for sex, grade, socio-economic status, academic performance, depressive episodes and experience of being bullied. Similarly, the risk of perceived stress decreased significantly in the weekend CUS groups (0 < CUS < 1, OR: 0.879, 95% CI: 0.808-0.957; 1 ≤ CUS < 2, OR: 0.852, 95% CI: 0.785-0.924; 2 ≥ CUS, OR: 0.836, 95% CI: 0.775-0.902) compared to the non-CUS group (Table 2, Model 3). Furthermore, the higher CUS group tended to have lower risk of perceived stress.

Female and low socio-economic status were also significantly associated with higher adjusted ORs for perceived stress. Depressive episodes and the experience of being bullied were linked to significantly higher adjusted ORs for perceived stress (Table 2, Model 3).

*Disparate results in grade 7 - 11 and grade 12 participants*

Another multivariate logistic regression analysis was performed to evaluate the association between weekend CUS and perceived stress, in Grade 12 participants and in Grade 7 - 11 participants. The analyses were adjusted for sex, grade, socio-economic status, academic performance, weekday daily sleep duration, depressive episodes, and experience of being bullied (Table 3, Model 2).

In Grade 12 participants, the weekend CUS groups did not show a significant decrease in the risk of perceived stress (0 < CUS < 1, OR: 1.101, 95% CI: 0.863-1.405; 1 ≤ CUS < 2, OR: 0.996, 95% CI: 0.787-1.261; 2 ≥ CUS, OR: 0.981, 95% CI: 0.786-1.223). On the contrary, in Grade 7 - 11 participants, the weekend CUS groups showed a significant decrease in the risk of perceived stress (0 < CUS < 1, OR: 0.852, 95% CI: 0.778-0.934; 1 ≤ CUS < 2, OR: 0.836, 95% CI: 0.766-0.913; 2 ≥ CUS, OR: 0.822, 95% CI: 0.759-0.891) (Table 3).

## Discussion

Our study showed that the risk of perceived stress among adolescents in the Republic of Korea was lower in the weekend CUS groups than in the non-CUS group. A study on the association between sleep duration and perceived stress in adults in the Republic of Korea demonstrated that stress increases when sleep is insufficient (Kim et al. 2019). Our results are in accordance with previous findings, albeit with weekend CUS as an independent variable and the target population being adolescents in the Republic of Korea. According to the results, the risk of perceived stress, affected by a lack of sleep during weekdays, decreased as weekend CUS, which compensates for the lack of sleep during weekdays, increased.

Weekend CUS may extend beyond reducing the risk of perceived stress. Kim et al. (2021) conducted a study on weekend CUS and depression among high school students in the Republic of Korea. In a similar study, weekend CUS of no less than 2 h reduced the risk of depression (adjusted

Table 2. Odds Ratios (95% Confidence Intervals) for perceived stress.

| Characteristics | Model 1[a] | Model 2[b] | Model 3[c] |
|---|---|---|---|
| Weekend CUS | | | |
| CUS = 0 h | Reference | Reference | Reference |
| 0 h < CUS < 1 h | 0.919 (0.849-0.994)* | 0.857 (0.792-0.928)** | 0.879 (0.808-0.957)* |
| 1 h ≤ CUS < 2 h | 0.974 (0.904-1.050) | 0.839 (0.777-0.905)** | 0.852 (0.785-0.924)** |
| 2 h ≥ CUS | 1.143 (1.068-1.222)** | 0.874 (0.815-0.938)** | 0.836 (0.775-0.902)** |
| Weekday daily sleep duration ( ≥ 7 h) | | 0.514 (0.492-0.538)** | 0.610 (0.579-0.641)** |
| Sex, female | | | 1.521 (1.457-1.587)** |
| Grade | | | |
| 7th grade | | | Reference |
| 8th grade | | | 0.957 (0.889-1.029) |
| 9th grade | | | 0.961 (0.893-1.035) |
| 10th grade | | | 0.894 (0.828-0.964)* |
| 11th grade | | | 1.049 (0.972-1.131) |
| 12th grade | | | 1.222 (1.133-1.318)** |
| Socioeconomic status (low) | | | 1.583 (1.490-1.682)** |
| Academic performance | | | |
| Low | | | Reference |
| Middle | | | 0.835 (0.792-0.881)** |
| High | | | 0.851 (0.809-0.896)** |
| Depressive episodes (yes) | | | 4.398 (4.199-4.607)** |
| Experience of being bullied (yes) | | | 1.847 (1.520-2.244)** |

[a] Model 1, univariate logistic regression, unadjusted.
[b] Model 2, multivariate logistic regression adjusted for weekday daily sleep duration (≥ 7 h).
[c] Model 3, multivariate logistic regression, adjusted for the variables in Model 2 plus sex, grade, socioeconomic status, academic performance, depressive episodes, and experience of being bullied.
*p < 0.05 **p < 0.001.
CUS, catch-up sleep.

Table 3. Odds Ratios (95% Confidence Intervals) for perceived stress in 7th-11th grade and 12th grade.

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| | 7th-11th grade (n = 38,975) | 12th grade (n = 7,812) | 7th-11th grade (n = 38,975) | 12th grade (n = 7,812) |
| Weekend CUS | | | | |
| CUS = 0 h | Reference | Reference | Reference | Reference |
| 0 h < CUS < 1 h | 0.872 (0.801-0.948)* | 1.071 (0.855-1.341) | 0.852 (0.778-0.934)* | 1.101 (0.863-1.405) |
| 1 h ≤ CUS < 2 h | 0.942 (0.869-1.021) | 1.003 (0.808-1.245) | 0.836 (0.766-0.913)** | 0.996 (0.787-1.261) |
| 2 h ≥ CUS | 1.119 (1.042-1.203)* | 1.080 (0.883-1.321) | 0.822 (0.759-0.891)** | 0.981 (0.786-1.223) |

Model 1, univariate logistic regression, unadjusted.
Model 2, multivariate logistic regression, adjusted for sex, grade, socioeconomic status, academic performance, weekday daily sleep duration (≥ 7 h), depressive episodes, and experience of being bullied.
CUS, catch-up sleep.

OR = 0.68, 95% CI = 0.55-0.85) (Koo et al. 2021). In addition, a study by Sun et al. (2019) showed that weekend CUS was associated with depressive symptoms in school-aged children. Choenarom et al. (2005) showed that perceived stress is directly related to the severity of depression. The Republic of Korea has the highest suicide rate among the Organization for Economic Cooperation and Development (OECD) countries, with 24.1 deaths per 100,000 people in 2020 (OECD 2024). According to previous studies, a short sleep duration is associated with depression and suicide (Armstrong et al. 2014; Baiden et al. 2020). Securing weekend CUS may have a preventive effect on depression, which could have positive effects on major health concerns regarding depression and suicidal behavior (Wild et al. 2004). In our study, we found a significantly reduced risk of perceived stress in the weekend

CUS group after adjusting for depressive episodes. Previous cross-sectional studies on the association between CUS and depression did not consider the presence of stress in their analyses. Therefore, further studies are needed to determine the causal relationship between weekend CUS and depression, and how levels of stress are associated with them.

In addition, depression itself has several side effects (Liu et al. 2020) and is directly related to adolescent suicide. Therefore, prevention is crucial (Fombonne et al. 2001), especially considering that the prevalence of depression can be reduced by lowering stress levels (Fernandez et al. 1998). Therefore, in light of our study results, if an appropriate level of CUS reduces stress levels, it is a relatively effective and preemptive preventive measure that can reduce the incidence of depression in countries such as the Republic of Korea, which lack an active treatment culture for depression.

The data in Table 1 show that participants in the ≥ 2 h CUS group slept the least during the weekdays. The proportion of weekday daily sleep duration (no less than 7 h) tended to decrease substantially in the high CUS groups, and this difference was far greater than in other variables (CUS = 0 h group: 64.8%, ≥ 2 h CUS group: 23.9%; Fig. 2). This indicates that CUS over the weekend may have occurred among the study participants as compensation for less sleep during weekdays. Several studies have shown that weekend CUS could serve as a coping mechanism for lack of sleep during weekdays (Carskadon et al. 1998; Chung and Cheung 2008; Liu et al. 2008; Kim et al. 2011; Lee et al. 2016).

As previously mentioned, it is evident that a lack of sleep is correlated with increased perceived stress (Román et al. 2006; Meerlo et al. 2008; Vargas and Lopez-Duran 2017; Nollet et al. 2020). Therefore, we first adjusted for weekday daily sleep duration (Table 2, Model 2). A lower risk of perceived stress was observed in the weekend CUS groups than in the non-CUS group. Subsequently, we adjusted for other confounding variables and found a negative linear correlation between weekend CUS and perceived stress (Table 2, Model 3).

In the Grade 12 participants, in both the unadjusted and adjusted models (Models 1 and 2 in Table 3), the weekend CUS groups did not show a significant correlation with the risk of perceived stress. Grade 12 students in the Republic of Korea comprise a unique group. Owing to the competitive academic environment encouraged by rigorous university entrance exams in the Republic of Korea, students are more susceptible to stress than students in any other school grade. Relentless requirements from the beginning of the academic year cause many Grade 12 students to suffer from chronic stress (Lee et al. 2013; Jarvis et al. 2020). This may have influenced our findings.

Our study had some limitations. First, its cross-sectional design prevented us from inferring causal relationships between CUS and perceived stress. Second, the

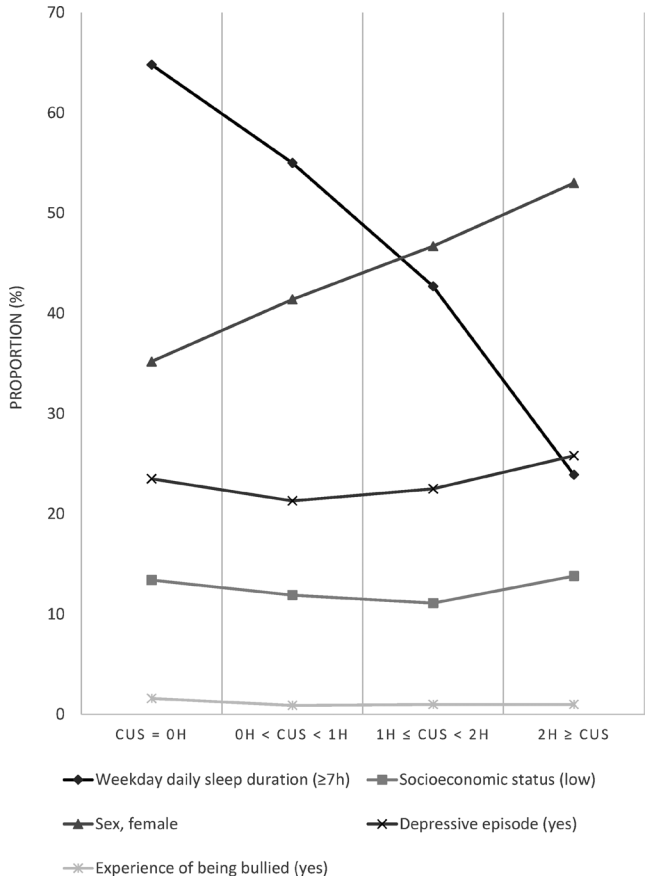


Fig. 2. Proportion of the confounding variables in each CUS group. CUS, catch-up-sleep.

KYRBWS 2020 was evaluated based on participants' online responses. This likely led to several biases, such as memory and confirmation biases, because there was an underlying belief that the respondent's integrity was guaranteed. Instead of self-reported answers, an objective scale for evaluating perceived stress is a better alternative for a more accurate assessment. Third, the responses to the KYRBWS questionnaire studied by Bae et al. (2010) differed between the first and retests (Kim et al. 2016). In this study, the reliability estimates for the KYRBWS questionnaire were generally reliable over time; however, a few indices showed significantly different prevalence rates between the first and second surveys. Hence, the imperfect reproducibility of the results may have caused bias. Fourth, adequate weekend CUS was not sufficient to compensate for other factors related to academic performance that could induce stress in Grade 12. In addition, to determine factors other than CUS that can significantly relieve stress, additional studies are needed to determine the factors that affect the risk of perceived stress in Grade 12 students more than weekend CUS. Finally, we excluded participants who slept too little or too much (less than 3 h or more than 11 h) during the week, and participants who had depressive episodes; however, we did not exclude patients with sleep disorders, narcolepsy, or anxiety disorders that could affect sleep status. This may

have influenced the results of this study.

Despite these limitations, our study had several strengths. First, we used KYRBWS 2020 data, which were collected with the administrative cooperation of the Korean Ministry of Education; therefore, these data are relatively reliable. This data, collected every year since 2005, encompasses all public and private middle school and high school students from all 17 first-tier administrative divisions in the Republic of Korea (Kim et al. 2016). The response rate was maintained at high levels (95%) as the survey was administratively supported by the Ministry of Education, and sampled students participated in anonymous self-administered web-based questionnaires during a designated class period (Kim et al. 2016). Second, by analyzing the data for 46,187 participants, which is relatively large compared to previous studies, we confirmed CUS as an effective factor in predicting the risk of perceived stress, which calls for further studies regarding CUS.

Our study showed that weekend CUS is associated with a low risk of perceived stress among adolescents in the Republic of Korea. Ensuring sufficient daily sleep duration is crucial for preventing perceived stress. However, if this requirement cannot be met, weekend CUS may be a pragmatic alternative. Therefore, initiatives to ensure either adequate daily sleep duration or weekend CUS should be developed on a national scale to promote the full physical, mental, and social well-being of adolescents, whose utmost priority should be to follow a balanced development course.

## Acknowledgments

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## Conflict of Interest

The authors declare no conflict of interest.

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