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Short Sleep Duration and Persistent Sadness or Hopelessness Among U.S. High School Students, 2013–2023: A Sex-Specific Comparison of National Trends

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Abstract: This study evaluated how closely the national prevalence of U.S. high school students getting less than eight hours of sleep on an average school night tracked the national prevalence of persistent sadness or hopelessness across the six YRBS survey years from 2013 to 2023, and whether that pattern of co-movement differed between male and female students. This study used data collected by the Youth Risk Behavior Surveillance System (YRBSS), a program run by the Centers for Disease Control and Prevention (CDC) through its biennial Youth Risk Behavior Survey (YRBS). The same correlation was calculated separately for male and female students, using sex-specific prevalence rates for both short sleep duration and persistent sadness or hopelessness. This study hypothesized that the two national trends would move together more closely among female students than among male students. The reported correlations were similar in size: r = .80 among female students and r = .77 among male students. With only six survey years, this descriptive comparison cannot establish whether the relationship differs between the sexes. It also does not show whether a particular student who sleeps less is more likely to report persistent sadness or hopelessness. The findings may be relevant to ongoing discussions about high school start times, though this analysis cannot establish that adjusting school start times would directly reduce depressive symptoms among students.

Keywords: adolescent sleep, depressive symptoms, persistent sadness, sex differences, Youth Risk Behavior Survey

INTRODUCTION

Most high school students do not get at least eight hours of sleep on an average school night. According to the YRBS, in 2013, 31.7% of high school students got at least eight hours of sleep on an average school night, while in 2023, only 23.2% of students did (Centers for Disease Control and Prevention [CDC], n.d.). The National Alliance on Mental Illness (NAMI, n.d.) states that sadness is a normal human emotion, but persistent sadness combined with hopelessness and other symptoms can be a part of major depressive disorder (MDD), or clinical depression. In 2023, the percentage of high school students in the U.S. who self-reported experiencing persistent feelings of sadness or hopelessness during the past year was 39.7%, an increase of 9.8 percentage points from 2013, when 29.9% did (CDC, n.d.). It is important to note that this measure is based on students' own self-reports and is an indicator of depressive symptoms, not a clinical diagnosis of depression.

Major depression is frequently accompanied by sleep disturbances. Sleep disturbances are highly prevalent across mood disorders, and in MDD specifically, about three-quarters of patients report insomnia symptoms, although this estimate is not specific

to adolescents (Nutt et al., 2008). In a 2018 longitudinal study (Conklin et al., 2018) of more than 3,000 adolescents (ages 13–18) in British Columbia, Canada, it was found that chronic sleep deprivation, defined as fewer than eight hours of sleep on school nights at two or more of three measurement points, was associated with higher subsequent depressive symptoms among young women, but was not consistently associated with depressive symptoms among young men. This suggests that the association between short sleep and depressive symptoms may not be uniform across the population, although this does not establish that the association is stronger among all female students.

Both short sleep and persistent sadness or hopelessness have become more common among U.S. high school students from 2013 to 2023. What remains unclear is how closely the two have tracked one another at the national level across that time, and whether that pattern of co-movement differs between male and female students. This study examines that question using YRBS data from 2013 to 2023, and hypothesizes that short sleep duration and persistent sadness or hopelessness will be more closely correlated across this decade among female students than among male students.

LITERATURE REVIEW

Trends in Sleep Duration Among US High School Students

A 2015 study (Keyes et al., 2015) examined responses from over 270,000 U.S. eighth-, tenth-, and twelfth-graders to a Monitoring the Future survey between 1991 and 2012. The results indicated that older students were less likely to report regularly getting at least seven hours of sleep, and girls were less likely than boys to report regularly getting at least seven hours. The same analysis also found that the proportion of people regularly getting at least seven hours of sleep fell during the survey years 1991–2012 in every age group, not just between younger and older students, suggesting that the decline was due to a larger downward trend over time rather than simply the fact that older students sleep less. In 2007, the YRBS started asking adolescents, "On an average school night, how many hours of sleep do you get?" with answer options of four or fewer hours, five hours, six hours, seven hours, eight hours, nine hours, or ten or more hours. In that year, 30.9% of high school students got eight or more hours of sleep (Wheaton et al., 2016). This number was close to the 31.7% recorded six years later, in 2013, so this earlier period does not show a clear, steady decline. This research concentrates on the overall decline in the percentage of high school students who reported getting eight or more hours of sleep on an average school night, which decreased from 31.7% in 2013 to 23.2% in 2023 (CDC, n.d.).

This decline has not happened in isolation. Adolescence brings a natural shift in the body’s internal clock, often called sleep phase delay, which pushes the onset of sleepiness later into the night and can make it harder for teenagers to fall asleep early. Early school start times can conflict with this shift by fixing a wake-up time that leaves too few hours for sleep. In 2014, the American Academy of Pediatrics released a policy statement recommending that middle and high schools start no earlier than 8:30 a.m., citing early start times as a key structural driver of chronic sleep restriction among adolescents (Adolescent Sleep Working Group et al., 2014). A study of school schedules found that 82.3% of U.S. public middle, high, and combined schools started before 8:30 a.m. during the 2011–2012 school year (Wheaton et al., 2015). That figure shows early start times were the norm before this study's window, but this earlier data point cannot confirm that school schedules

stayed unchanged all the way through 2023, so this paper treats early start times as one well-documented, plausible contributor to short sleep rather than a factor measured across the full study period.

Alongside this biological and structural pressure, increased new media screen time has been documented alongside a decline in self-reported adolescent sleep duration from 2009 to 2015 (Twenge et al., 2017). Academic workloads, extracurricular commitments, and part-time jobs may also leave students with less time for sleep. However, Twenge et al. (2017) found that homework and paid work were stable or declining during the years they examined, so increases in those activities cannot be assumed to explain the sleep trend. This study does not test these specific mechanisms individually. Instead, it uses the well-documented decline in sleep duration as the backdrop for a different question: how closely have national sleep and national sadness trends moved together across the 2013-to-2023 decade, and does that co-movement differ by sex?

Trends in Persistent Sadness and Hopelessness Among Adolescents

Depressive symptoms and depression have long been recognized as common mental health concerns of adolescence. This paper focuses specifically on one self-reported YRBS indicator of adolescent mental health, persistent sadness or hopelessness, rather than a clinical diagnosis of depression, while the studies reviewed below also use other measures of depressive symptoms. In 2018, a study (Twenge et al., 2018) analyzed data from the Monitoring the Future survey, where researchers found that depressive symptoms among U.S. adolescents increased notably after 2010, with the rise being most pronounced among girls. That finding is about how common depressive symptoms became, and how quickly that changed for girls specifically; it does not by itself indicate whether the statistical relationship between sleep and depressive symptoms, the question this paper returns to below, is any stronger than it used to be.

More recent national data show the same overall upward pattern. The YRBS measures whether students felt sad or hopeless almost every day for at least two consecutive weeks in the past year and stopped doing some usual activities. The percentage reporting these experiences increased nationally, reaching 42.3% in 2021 before easing slightly to 39.7% by 2023 (CDC, n.d.). This increase did not affect all students equally. Between 2013 and 2023, the rise in persistent sadness was considerably steeper among female students than male students, continuing a longstanding pattern in which depressive symptoms are reported more often by girls (CDC, 2024). By 2023 (CDC, 2024), that gap had grown substantial: 53% of female students reported persistent sadness or hopelessness compared with 28% of male students. The CDC's own trend analysis (CDC, n.d.) of these data describes both rates as having risen from 2013 to 2023, so the increase was not confined to female students, and the rise was larger among girls. Narrowing to the period of interest for the present study, the YRBS recorded an increase in persistent sadness or hopelessness among all U.S. high school students from 29.9% in 2013 to 39.7% in 2023.

This overall increase, coupled with the decline in adolescent sleep described above, raises the question of how the two may be related. Two national trends moving in the same direction do not independently prove that the same students who are sleeping less are also the ones who are reporting more sadness or hopelessness. Instead of assuming parallel

movement, the study is designed to determine how closely the two trends actually move in tandem.

The Association Between Short Sleep Duration and Depressive Symptoms

A substantial body of research has established an association between short sleep duration and depressive symptoms in adolescents. In a prospective study that assessed more than 4,000 adolescents at baseline and followed up with 3,134 one year later, Roberts and Duong (2014) found that sleep deprivation, defined as six hours or less per night, at baseline predicted higher depressive symptoms at follow-up, even after accounting for depression at baseline. That same study also found the relationship to run in the other direction: major depression at baseline predicted one measure of sleep deprivation a year later, although the reverse association was not found for depressive symptoms alone. Still, short sleep predicted later depressive symptoms even after controlling for baseline mood, which suggests that short sleep can precede depressive symptoms in at least one direction of that cycle, though a single observational study cannot establish that this is the primary or only direction of causation. An analysis using national survey estimates points to a similar pattern at the population level. Analyzing national YRBS prevalence rates from 2013 to 2023 across survey years, rather than individual students' paired sleep and mood reports, one study found a strong positive correlation between the national prevalence of inadequate sleep and the national prevalence of persistent sadness or hopelessness among U.S. high school students (Faisal & Kimani, 2025). These findings show that the association between short sleep and depressive symptoms is documented across study designs, with some evidence that it can run in both directions. The studies address different populations and measures, however. This study examines how closely the national trends move together for male and female students separately.

Possible Pathways Linking Sleep and Adolescent Mental Health

Beyond the statistical association, there are plausible biological reasons why short sleep and depressive symptoms would be linked in adolescence specifically. A 2024 review (Chai & Bian, 2024) of the neuroscience literature notes that the brain circuits involved in emotional regulation are still maturing throughout adolescence, though whether this makes teenagers more vulnerable than adults to insufficient sleep remains uncertain. That same review discusses possible effects of sleep loss on the body's stress-response system and dopamine-related reward processing. Much of this evidence comes from animal studies, so it cannot establish the same mechanisms in human adolescents.

Other explanations are possible besides a direct causal pathway from sleep to mood. The relationship could run in the opposite direction, since sleep difficulties can accompany depression, rather than sleep loss being the original cause (Nutt et al., 2008; Roberts & Duong, 2014). It is also possible that a third factor is driving both trends at once. Academic pressure, social media use late at night, and family stress could affect both sleep duration and depressive symptoms, which would make the two appear correlated even if neither directly causes the other. Because YRBS data are cross-sectional and self-reported, this study cannot fully rule out either possibility, and the association documented here should be read as evidence that sleep and mood move together over time, not as proof that treating

one would necessarily change the other. The COVID-19 pandemic, which occurred during the 2013–2023 window this study examines, is one possible example of such a shared influence: a separate CDC survey conducted during January–June 2021 found that 44.2% of high school students reported persistent sadness or hopelessness in the past year (Jones et al., 2022). This was the Adolescent Behaviors and Experiences Survey, not the YRBS, so its estimate is not part of the six-year series analyzed here. Because the pandemic disrupted school schedules, routines, and daily life broadly during this period, any part of the 2013–2023 trend that lines up with the pandemic years could reflect that broader disruption rather than a direct sleep-to-mood pathway specifically.

Sex Differences in the Sleep and Depressive Symptoms Association

Several of the studies discussed above suggest that girls may be more affected than boys, though higher rates of depressive symptoms do not by themselves mean a stronger association with sleep. The 2018 longitudinal study cited earlier (Conklin et al., 2018) found that chronic sleep deprivation was associated with higher subsequent depressive symptoms among adolescent girls but was not consistently associated with depressive symptoms among boys. This suggests that the association deserves closer attention by sex, although a significant result for girls and a nonsignificant result for boys do not alone establish a difference between them. A separate national analysis of YRBS data from 2013 to 2023 found that the rise in persistent sadness or hopelessness over that decade was considerably steeper among female students than male students (CDC, 2024), and the 2018 study of Monitoring the Future data also reported larger post-2010 increases in depressive symptoms among girls (Twenge et al., 2018).

These findings suggest that a single sleep-sadness correlation calculated across all students may obscure differences between male and female students. On the basis of this prior research, this study predicts that national short-sleep and national persistent-sadness rates track one another more closely among girls than among boys across this decade, a prediction examined in the sex-disaggregated analysis reported below.

METHODOLOGY

National, sex-specific prevalence estimates for both measures were obtained directly from the CDC's YRBS Explorer tool (CDC, n.d.) for all six survey years in the study window (2013, 2015, 2017, 2019, 2021, and 2023). For each year and sex, the percentage of students who did not get 8 or more hours of sleep on an average school night (short sleep duration) and the percentage who experienced persistent sadness or hopelessness were recorded. These six paired values were then used to calculate a Pearson correlation coefficient separately for female students and for male students. The comparison is descriptive, since the six survey years may share time trends and the two sex-specific series cover the same calendar years.

RESULTS AND DISCUSSION

Among female students, short sleep duration and persistent sadness or hopelessness were strongly and positively correlated across the six survey years (r = .80). Among male students,

the same two measures were also strongly and positively correlated across the same years (r = .77). Each estimate is based on only six data points, so these coefficients should be interpreted cautiously.

The female correlation was only marginally higher than the male correlation. With only six survey years, the analysis provides limited evidence for comparing the sexes. Shared time trends or events affecting both sleep and mood could also contribute to the correlations.

CONCLUSIONS

This review indicates that both short sleep duration and persistent sadness or hopelessness have increased substantially among U.S. high school students since the early 2010s. The two are consistently associated across observational designs, and some findings suggest that the association may be bidirectional rather than only from sleep to mood. Girls also report a steeper increase in depressive symptoms, and some studies suggest the sleep-symptom link might differ by sex, but these are two separate findings, not one: girls reporting more sadness does not by itself mean sadness is more closely tied to their sleep loss. We utilized national, sex-specific prevalence estimates for each of the six survey years. We found a positive correlation between short sleep duration and persistent sadness or hopelessness for both sexes across the survey years (female r = .80; male r = .77). The correlation in females was somewhat stronger, but with only six survey years it is difficult to tell whether the two trends are more closely associated in female students.

Several limitations should temper how these results are interpreted. This study uses published national YRBS prevalence estimates rather than individual-level records. It measures how closely two population rates move together across survey years, not whether a specific student who sleeps less is more likely to report sadness or hopelessness. Both measures are self-reported, and each survey year is cross-sectional, which limits how confidently this design can speak to which comes first in any given case, even though the Roberts and Duong findings discussed above suggest the relationship can run in both directions. Other events besides a genuine difference in how closely sleep and sadness track one another for boys versus girls could also produce a similar pattern in the data. The COVID-19 pandemic, which occurred during the study period and disrupted daily life, is one possible example. A single correlation computed across all six survey years cannot separate a pandemic-driven disruption in one or two of those years from a more gradual, decade-long pattern tied to rising screen time or other factors. The correlations also do not account for the sampling uncertainty of the prevalence estimates or dependence between survey years.

These limitations do not eliminate the value of the analysis, but they mean its conclusions should be read as evidence about a national trend, not a demonstrated individual-level mechanism. The similar correlations found here do not make adolescent sleep loss any less of a concern: both short sleep and persistent sadness or hopelessness became more common from 2013 to 2023 for both sexes, and that alone is reason enough to take the problem seriously. It is important to be clear about what this analysis can and cannot speak to: it correlates national trends and does not directly evaluate school schedules, sleep interventions, or any other policy response. Analyses using more survey years, including comparisons with and without pandemic-era years, would help determine whether the similar correlations found here for female and male students hold up. This

national, sex-disaggregated comparison shows that short sleep duration and persistent sadness or hopelessness track one another closely for both female and male students. Whether that reflects a causal relationship for any individual student, however, is a question this design cannot answer. Following the same students over time would help investigate it.

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