Short Sleep Duration Among Middle School and High School Students — United States, 2015

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Insufficient sleep among children and adolescents is associated with increased risk for obesity, diabetes, injuries, poor mental health, attention and behavior problems, and poor academic performance (1–4). The American Academy of Sleep Medicine has recommended that, for optimal health, children aged 6–12 years should regularly sleep 9–12 hours per 24 hours and teens aged 13–18 years should sleep 8–10 hours per 24 hours (1). CDC analyzed data from the 2015 national, state, and large urban school district Youth Risk Behavior Surveys (YRBSs) to determine the prevalence of short sleep duration (<9 hours for children aged 6–12 years and <8 hours for teens aged 13–18 years) on school nights among middle school and high school students in the United States. In nine states that conducted the middle school YRBS and included a question about sleep duration in their questionnaire, the prevalence of short sleep duration among middle school students was 57.8%, with state-level estimates ranging from 50.2% (New Mexico) to 64.7% (Kentucky). The prevalence of short sleep duration among high school students in the national YRBS was 72.7%. State-level estimates of short sleep duration for the 30 states that conducted the high school YRBS and included a question about sleep duration in their questionnaire ranged from 61.8% (South Dakota) to 82.5% (West Virginia). The large percentage of middle school and high school students who do not get enough sleep on school nights suggests a need for promoting sleep health in schools and at home and delaying school start times to permit students adequate time for sleep.

The Youth Risk Behavior Surveillance System was designed to estimate the prevalence of health risk behaviors among students that contribute to the leading causes of death and disability in the United States at the national, state, territorial, tribal, and large urban school district levels.* Students complete an anonymous, voluntary, school-based paper-and-pencil questionnaire during a regular class period after the school obtains parental permission according to local procedures. The national high school YRBS is conducted by CDC. It uses a three-stage cluster sample design to obtain a nationally representative sample of students in public and private schools in grades 9–12 (5). In 2015, the student sample size was 15,624.7 The school and student response rates were 69% and 86%, respectively, resulting in an overall response rate of 60%.§

State and large urban school district high school and middle school surveys are conducted by health and education agencies in their states and large urban school districts. State surveys are conducted using data collection methods that are aligned with YRBS methods.† CDC analyzes the data to provide state and national prevalence estimates. State YRBSs are required to use a YRBS-methods-based sample design to be included in CDC’s national analysis. In this investigation, state-level estimates were provided only for those states that used YRBS methods in their surveys.

States that conducted middle school and high school YRBSs and included a question about sleep duration in their questionnaires are listed below: Middle School: Alabama, Colorado, Kentucky, Minnesota, Nebraska, New Mexico, Oregon, South Dakota, Tennessee, West Virginia. High School: Alabama, Colorado, Kentucky, Minnesota, Nebraska, New Mexico, Oregon, South Dakota, Tennessee, West Virginia. When estimating state-level prevalence of short sleep duration, CDC used the state-level prevalence rates from middle school and high school YRBSs that used YRBS methods in their surveys. CDC used the same state-level prevalence rates to estimate the national prevalence of short sleep duration. CDC used the state-level prevalence rates from middle school and high school YRBSs that used YRBS methods in their surveys to estimate the national prevalence of short sleep duration among middle school and high school students. These national estimates are based on 95% confidence intervals.

Short sleep duration among middle school and high school students is prevalent in the United States. Students who do not get enough sleep on school nights suggest a need for promoting sleep health in schools and at home and delaying school start times to permit students adequate time for sleep.

*https://www.cdc.gov/healthyyouth/data/yrbs/overview.htm.

†https://www.cdc.gov/healthyyouth/data/yrbs/pdf/2015/ss6506_updated.pdf.
§Overall response rate = school response rate x student response rate ([number of participating schools/number of eligible sampled schools] x [number of usable questionnaires/number of eligible students sampled]).
departments using a two-stage cluster sample designed to produce representative samples of students in each jurisdiction (5). These surveys are independent of CDC’s national YRBS and, unlike the national YRBS, are representative of only public school students, except in one state. To be included in this report, states and large urban school districts had to 1) have at least a 60% overall response rate, 2) include a question on sleep duration, and 3) provide permission for CDC to include their data. Thirty states and 16 large urban school districts administered a high school YRBS and met these criteria. Across these states, the student sample sizes ranged from 1,313 (South Dakota) to 55,596 (Maryland). The median overall response rate was 66.5% and ranged from 60% (Indiana and North Carolina) to 84% (Virginia). Across these large urban school districts, the high school student sample sizes ranged from 1,413 (Broward County, Florida) to 10,419 (District of Columbia). The median overall response rate was 76.5% and ranged from 64% (District of Columbia) to 88% (San Diego, California).

Nine states and seven large urban school districts administered a middle school YRBS and met these criteria. Across these states, the student sample sizes ranged from 1,640 (Kentucky) to 27,104 (Maryland). The median overall response rate was 76% and ranged from 68% (Maine) to 85% (Hawaii and Virginia). Across these large urban school districts, the middle school student sample sizes ranged from 1,333 (Los Angeles, California) to 4,533 (Duval County, Florida). The median overall response rate was 81% and ranged from 68% (San Francisco, California) to 86% (Orange County, Florida). All data sets were weighted to be representative of students in the jurisdiction.

All students in the national, state, and large urban school district surveys were asked to respond to this question about sleep duration: “On an average school night, how many hours of sleep do you get?” Possible responses were 4 or less hours, 5 hours, 6 hours, 7 hours, 8 hours, 9 hours, and 10 or more hours. Short sleep duration was defined as <9 hours for students aged 6–12 years and <8 hours for those aged 13–18 years. The analytic samples were composed of students who responded to both the sleep duration question and the age question.

Prevalences and 95% confidence intervals (CIs) of short sleep duration on an average school night were calculated overall and by sex, grade, and race/ethnicity for the national high school YRBS and for a combined data set composed of data from the nine states that included the sleep duration question in a middle school YRBS. This combined data set is not nationally representative. The overall prevalence and 95% CI

**In response to the question “How old are you?” middle school students could select from “10 years old or younger,” “11 years old,” “12 years old,” “13 years old,” “14 years old,” “15 years old,” or “16 years old or older”; high school students could select from “12 years old or younger,” “13 years old,” “14 years old,” “15 years old,” “16 years old,” “17 years old,” or “18 years old or older.” High school students who reported being “18 years old or older” were considered to have a short sleep duration if they reported <8 hours of sleep on an average school night.

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https://www.cdc.gov/healthyyouth/data/yrbs/pdf/2015/ss6506_updated.pdf.
of short sleep duration also were calculated separately for each state and large urban school district at both middle school and high school levels. Pairwise differences in short sleep duration prevalence among sex, grade, and race/ethnicity subgroups were considered using t-tests; differences among estimates were considered statistically significant if the t-test p-value was <0.05. Analyses accounted for the weighting of the data and for the complex sampling designs.

The overall prevalence of short sleep duration among middle school students in the nine states combined was 57.8% (Table 1). The distribution of sleep duration was 5.9% for ≤4 hours, 6.0% for 5 hours, 11.0% for 6 hours, 20.0% for 7 hours, 29.9% for 8 hours, 17.2% for 9 hours, and 10.0% for ≥10 hours. The prevalence of short sleep duration in this combined sample was higher among female students (59.6%) than among male students (56.0%). The prevalence of short sleep duration also was highest among students in grade 6 (61.3%), lowest among students in grade 8 (53.1%), and higher among black (61.1%) and Native Hawaiian/Pacific Islander (64.2%) students than among white (56.6%), Hispanic (57.3%), and Asian (55.5%) students. State-specific estimates of short sleep duration ranged from 50.2% (New Mexico) to 64.7% (Kentucky). Prevalence estimates for the seven large urban school districts ranged from 50.2% (San Francisco, California) to 61.8% (Miami-Dade County, Florida).

At the high school level, nationwide, the prevalence of short sleep duration was 72.7% (Table 2). The distribution of sleep duration was 7.5% for ≤4 hours, 12.6% for 5 hours, 22.9% for 6 hours, 29.7% for 7 hours, 20.6% for 8 hours, 5.0% for 9 hours, and 1.7% for ≥10 hours. The prevalence of short sleep duration was higher among female students (56.0%) than among male students (54.6%). The prevalence of short sleep duration also was highest among students in grade 6 (61.3%), and lower among students in grade 8 (53.1%), and higher among black (61.1%) and Native Hawaiian/Pacific Islander (64.2%) students than among white (56.6%), Hispanic (57.3%), and Asian (55.5%) students. State-specific estimates of short sleep duration ranged from 50.2% (New Mexico) to 64.7% (Kentucky). Prevalence estimates for the nine large urban school districts combined and for nine states combined and for the nine states combined also were calculated separately for each state and large urban school district.

**Discussion**

Children and adolescents who do not get the recommended amount of sleep for their age are at increased risk for chronic conditions such as diabetes, obesity, and poor mental health, as well as injuries, attention and behavioral problems, and poor academic performance (1–4). In addition, short sleep duration has been found to be associated with engaging in health- and injury-related risk behaviors among high school students (6, 7). The national high school YRBS has included a question about sleep duration since 2007, and it is used to track the progress of the Healthy People 2020 sleep objective for this population (Sleep Health Objective 3: Increase the proportion

| Site/Characteristic | No.† | Prevalence % (95% CI) |
|---------------------|------|----------------------|
| Nine state surveys combined§ | 52,356 | 57.8 (56.7–58.9) |
| **Sex** | | |
| Female | 26,549 | 59.6 (58.2–61.0) |
| Male | 25,808 | 56.0 (54.6–57.4) |
| **Grade** | | |
| 6 | 14,060 | 61.3 (59.5–63.0) |
| 7 | 19,153 | 59.2 (57.8–60.5) |
| 8 | 18,707 | 53.1 (51.6–54.7) |
| **Race/Ethnicity** | | |
| White¶¶ | 23,434 | 56.6 (54.9–58.4) |
| Black¶¶ | 7,638 | 61.1 (59.0–63.1) |
| Hispanic | 8,384 | 57.3 (55.3–59.2) |
| Asian¶¶ | 2,644 | 55.5 (51.0–59.8) |
| American Indian/Alaska Native¶¶ | 1,302 | 59.4 (55.3–63.4) |
| Native Hawaiian/Pacific Islander¶¶ | 2,075 | 64.2 (59.1–68.9) |
| **State surveys** | | |
| Delaware | 2,883 | 58.8 (56.7–60.9) |
| Florida | 5,472 | 56.9 (54.9–58.9) |
| Hawaii | 5,704 | 61.3 (57.4–65.0) |
| Kentucky | 1,603 | 64.7 (61.7–67.5) |
| Maine | 4,852 | 53.0 (50.8–55.1) |
| Maryland | 24,938 | 58.7 (57.5–59.9) |
| New Mexico | 2,961 | 50.2 (48.2–52.3) |
| Virginia | 2,133 | 56.3 (53.7–58.9) |
| West Virginia | 1,810 | 64.1 (60.7–67.4) |
| **Large urban school district surveys** | | |
| Broward County, Florida | 1,447 | 62.0 (58.7–65.2) |
| Duval County, Florida | 4,259 | 58.5 (56.7–60.2) |
| Houston, Texas | 2,326 | 58.3 (55.5–60.9) |
| Los Angeles, California | 1,223 | 54.2 (50.8–57.5) |
| Miami-Dade County, Florida | 2,129 | 61.8 (58.9–64.6) |
| Orange County, Florida | 1,799 | 53.1 (50.4–55.8) |
| San Diego, California | 1,861 | 50.2 (47.0–53.4) |

**Abbreviation:** CI = confidence interval.

* | Short sleep duration defined as <9 hours for students aged 6–12 years and <8 hours for students aged 13–18 years.
† Unweighted number of survey respondents. Categories might not sum to sample total because of missing responses.
§ A combined data set using data from nine state surveys (Delaware, Florida, Hawaii, Kentucky, Maine, Maryland, New Mexico, Virginia, and West Virginia) that is not nationally representative.
¶¶ Significantly different by sex (p<0.05).
*** Significantly different from Hispanic students (p<0.05).
** Significantly different from Native Hawaiian/Pacific Islander students (p<0.05).
§§ Significantly different from black students (p<0.05).
§§§ Significantly different from white students (p<0.05).
**** Significantly different from Asian students (p<0.05).
TABLE 2. Prevalence of short sleep duration* on an average school night among high school students, nationwide and among 30 states and 16 large urban school districts, by selected characteristics — Youth Risk Behavior Surveys, 2015

| Site/Characteristic | No.† | Prevalence % (95% CI) |
|---------------------|------|-----------------------|
| National survey     | 14,471 | 72.7 (70.4–74.9) |
| **Sex**             |       |                       |
| Female              | 7,250  | 75.6 (73.3–77.7)§ |
| Male                | 7,165  | 69.9 (66.9–72.7)§ |
| **Grade**           |       |                       |
| 9                   | 3,673  | 65.6 (62.6–68.5)§§,†† |
| 10                  | 3,593  | 71.7 (69.2–74.0)§§,†† |
| 11                  | 3,695  | 77.1 (73.5–80.3)§‡‡ |
| 12                  | 3,426  | 77.6 (74.7–80.2)‡‡ |
| **Race/Ethnicity**  |       |                       |
| White               | 6,592  | 72.0 (69.5–74.4)*** ,††† |
| Black**             | 1,381  | 76.5 (72.8–79.9)§§,¶¶,¶¶¶ |
| Hispanic            | 4,729  | 70.2 (66.6–73.5)*** ,††† |
| Asian††             | 606    | 79.3 (72.2–80.5)§§,¶¶,¶¶¶ |
| American Indian/Alaska Native††† | 150 | 75.0 (60.0–85.7) |
| Native Hawaiian/Pacific Islander¶¶¶ | 86 | —**** |

| **State surveys** | | |
| Alabama            | 1,505  | 72.0 (69.1–74.7) |
| Arkansas           | 2,656  | 70.7 (66.3–74.7) |
| California         | 1,894  | 71.0 (65.1–76.3) |
| Connecticut        | 2,167  | 80.1 (78.3–81.9) |
| Delaware           | 2,503  | 75.7 (73.1–78.1) |
| Florida            | 6,057  | 76.9 (75.4–78.3) |
| Hawaii             | 5,528  | 75.3 (72.7–77.8) |
| Illinois           | 3,043  | 76.7 (73.9–79.3) |
| Indiana            | 1,871  | 78.6 (76.2–80.8) |
| Kentucky           | 2,495  | 75.7 (72.7–78.5) |
| Maryland           | 52,043 | 76.2 (75.5–76.9) |
| Massachusetts      | 3,015  | 78.0 (75.7–80.2) |
| Michigan           | 4,717  | 79.8 (77.1–82.2) |
| Missouri           | 1,432  | 72.6 (69.0–75.9) |
| Montana            | 4,371  | 67.4 (65.6–69.2) |
| Nebraska           | 1,449  | 68.1 (64.5–71.4) |
| Nevada             | 1,393  | 75.9 (73.2–78.4) |
| New Hampshire       | 13,903 | 71.6 (70.1–73.1) |
| New Mexico          | 7,787  | 68.3 (66.7–69.8) |
| New York            | 8,129  | 78.1 (75.8–80.3) |
| North Carolina      | 5,683  | 75.0 (71.4–78.3) |
| North Dakota        | 2,094  | 70.5 (67.8–73.0) |
| Oklahoma            | 1,586  | 71.8 (68.5–74.9) |

| Site/Characteristic | No.† | Prevalence % (95% CI) |
|---------------------|------|-----------------------|
| Pennsylvania        | 2,715  | 74.3 (71.9–76.6) |
| South Carolina      | 1,272  | 72.1 (68.0–75.8) |
| South Dakota        | 1,296  | 61.8 (57.6–65.8) |
| Tennessee           | 4,015  | 70.7 (69.1–72.2) |
| Virginia            | 4,264  | 72.8 (70.4–75.1) |
| West Virginia       | 1,561  | 82.5 (79.2–85.3) |
| Wyoming             | 2,329  | 69.8 (67.7–71.7) |
| Boston, Massachusetts | 1,547 | 82.4 (79.8–84.7) |
| Broward County, Florida | 1,327 | 85.6 (83.3–87.6) |
| Cleveland, Ohio     | 1,434  | 80.0 (77.7–82.1) |
| DeKalb County, Georgia | 1,814 | 80.4 (78.3–82.5) |
| District of Columbia | 10,281 | 71.6 (70.5–72.7) |
| Duval County, Florida | 3,153 | 81.1 (79.1–83.0) |
| Houston, Texas      | 2,878  | 75.6 (73.5–77.6) |
| Los Angeles, California | 2,189 | 69.9 (66.3–73.3) |
| Miami-Dade County, Florida | 2,629 | 80.4 (77.9–82.7) |
| New York City, New York | 5,972 | 74.8 (72.4–77.1) |
| Oakland, California | 1,512  | 70.6 (66.7–74.2) |
| Orange County, Florida | 1,421 | 79.3 (76.2–82.1) |
| Palm Beach, Florida | 2,284  | 81.5 (79.2–83.6) |
| Philadelphia, Pennsylvania | 1,464 | 80.3 (77.1–83.2) |
| San Diego, California | 2,249 | 71.9 (68.8–74.9) |
| San Francisco, California | 2,005 | 75.2 (72.3–77.9) |

**Abbreviation:** CI = confidence interval.

† Short sleep duration defined as <9 hours for students aged 6–12 years and <8 hours for students aged 13–18 years.
†† Unweighted number of survey respondents. Categories might not sum to sample total because of missing responses.
§ Significantly different from Hispanic students (p<0.05).
§§ Significantly different from white students (p<0.05).
¶¶ Significantly different from grade 9 (p<0.05).
††† Significantly different from black students (p<0.05).
∗∗∗ Significantly different from grade 10 (p<0.05).
†††† Significantly different from grade 11 (p<0.05).
‡‡‡ Significantly different from grade 12 (p<0.05).
§§§ Significantly different from grade 9 (p<0.05).
¶¶¶ Non-Hispanic.
¶¶¶¶ Significantly different from black students (p<0.05).
¶¶¶¶¶ Significantly different from Asian students (p<0.05).
¶¶¶¶¶¶ Significantly different from white students (p<0.05).
¶¶¶¶¶¶¶ Significantly different from Hispanic students (p<0.05).
**** Unreliable estimate. Denominator <100 students.

As a result, evidence now exists that short sleep duration is prevalent among middle school students as well as high school students. In addition, at both middle and high school levels, in every state and large urban school district with YRBS data about sleep duration, a majority of students reported getting less than the recommended amount of sleep.

The findings in this report are subject to at least four limitations. First, sleep duration was obtained by self-report and was not verified by objective measures such as actigraphy (sensor measurement of motor activity) or polysomnography (sleep study). Second, a national YRBS is not conducted among middle school students. The middle school findings from the combined data set cannot be generalized to the entire United States.

†††https://www.healthypeople.gov/2020/topics-objectives/topic/sleep-health/objectives.
§§§https://www.healthypeople.gov/2020/data/Chart/5260?category=1&bby=Total&fips=-1.

of students in grades 9 through 12 who get sufficient sleep).††† Nationally, no progress has been made toward this objective: the percentage of high school students who get sufficient sleep has substantially decreased from 30.9% in 2009, the baseline year for this objective, to 27.3% in 2015, the latest year of available data.§§§ A question about sleep duration was included for the first time in 2015 in the standard middle school and high school YRBS questionnaires used as the starting point for the state and large urban school district YRBS questionnaires.
Summary

What is already known about this topic?
Insufficient sleep among children and adolescents is associated with an increased risk for obesity, diabetes, injuries, poor mental health, attention and behavior problems, and poor academic performance. Nationwide, approximately two thirds of U.S. high school students report sleeping <8 hours per night on school nights.

What is added by this report?
This is the first report to provide state-level estimates of short sleep duration among middle school and high school students using age-specific recommendations from the American Academy of Sleep Medicine. A majority of both middle school and high school students in states and large urban school districts included in this report get less than the recommended amount of sleep, putting them at an increased risk for several chronic conditions.

What are the implications for public health practice?
The finding that a large percentage of middle school and high school students who do not get enough sleep on school nights provides an opportunity for promoting sleep health in schools, including addition of sleep health to curricula and delaying school start times to permit students adequate time for sleep.

Conflict of Interest
No conflicts of interest were reported.

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