# Youth Risk Behavior Surveillance — United States, 2019

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# Overview and Methods for the Youth Risk Behavior Surveillance System — United States, 2019

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## Abstract

Health risk behaviors practiced during adolescence often persist into adulthood and contribute to the leading causes of morbidity and mortality in the United States. Youth health behavior data at the national, state, territorial, tribal, and local levels help monitor the effectiveness of public health interventions designed to promote adolescent health. The Youth Risk Behavior Surveillance System (YRBSS) is the largest public health surveillance system in the United States, monitoring a broad range of health-related behaviors among high school students. YRBSS includes a nationally representative Youth Risk Behavior Survey (YRBS) and separate state, local school district, territorial, and tribal school–based YRBSs. This overview report describes the surveillance system and the 2019 survey methodology, including sampling, data collection procedures, response rates, data processing, weighting, and analyses presented in this *MMWR Supplement*. A 2019 YRBS participation map, survey response rates, and student demographic characteristics are included. In 2019, a total of 78 YRBSs were administered to high school student populations across the United States (national and 44 states, 28 local school districts, three territories, and two tribal governments), the greatest number of participating sites with representative data since the surveillance system was established in 1991. The nine reports in this *MMWR Supplement* are based on national YRBS data collected during August 2018–June 2019. A full description of 2019 YRBS results and downloadable data are available (https://www.cdc.gov/healthyyouth/data/yrbs/index.htm).

Efforts to improve YRBSS and related data are ongoing and include updating reliability testing for the national questionnaire, transitioning to electronic survey administration (e.g., pilot testing for a tablet platform), and exploring innovative analytic methods to stratify data by school-level socioeconomic status and geographic location. Stakeholders and public health practitioners can use YRBS data (comparable across national, state, tribal, territorial, and local jurisdictions) to estimate the prevalence of health-related behaviors among different student groups, identify student risk behaviors, monitor health behavior trends, guide public health interventions, and track progress toward national health objectives.

## Introduction

Adolescence is typically a healthy period of life, and CDC reports that youths continue to make better decisions for their health (*1*). However, some high school–aged youths experience disparate health risks that increase the possibility of acquiring a sexually transmitted disease (STD), including human immunodeficiency virus (HIV) infection, and increase opportunities for substance use, mental health problems, and interpersonal violence or self-harm. Risky health behaviors practiced during adolescence often persist into adulthood (*2*). In 2018, CDC reported that the leading causes of death among U.S. adolescents were attributable to motor-vehicle crashes, followed by suicide and homicide (*3*). In contrast, that same year, a separate study reported the leading causes of death among persons of all ages were heart disease, followed by cancer and unintentional injuries (e.g., burns, drowning, falls, poisoning, and motor-vehicle crashes) (*4*).

The Youth Risk Behavior Surveillance System (YRBSS) monitors health behaviors, conditions, and experiences among high school students throughout the United States. The system includes a national Youth Risk Behavior Survey (YRBS), conducted by CDC, and separate state, local school district, territorial, and tribal school–based YRBSs, which are referred to as site-level surveys. YRBSS is designed to monitor priority health risk behaviors that contribute to the leading causes of mortality, morbidity, and social problems among youths and adults. The following categories of behaviors are included in the system: 1) behaviors that contribute to unintentional

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injury and violence; 2) tobacco use; 3) alcohol and other drug use; 4) sexual behaviors that contribute to unintended pregnancy and STD/HIV infection; 5) dietary behaviors; and 6) physical inactivity.

This report describes the 2019 YRBS methodology, including sampling, data collection, processing, weighting, and analyses. Results include a 2019 YRBS participation map, survey response rates (1991–2019), and student demographic characteristics from the national survey. Furthermore, this overview report is one of nine featured in this *MMWR Supplement*. Each report uses YRBS data to assess a priority public health topic among adolescents. In addition to this overview report, this supplement includes national YRBS updates regarding condom and contraceptive use; violence victimization and suicide ideation by sexual identity; interpersonal violence victimization; opioid, alcohol, and other substance use behaviors; suicide ideation and behaviors; tobacco use, including vaping; dietary behaviors and physical activity; and transportation risk behaviors. Each report might not include all national YRBS data related to the topics that were collected in 2019, and this supplement does not include any data from site-level surveys; however, all the data are publicly available. (YRBS data and documentation are available at https://www.cdc.gov/healthyyouth/data/yrbs/data.htm.) Stakeholders and public health practitioners can use YRBS data (comparable across national, state, tribal, and local jurisdictions) to estimate the prevalence of health-related behaviors among different student groups, identify student risk behaviors, monitor health behavior trends, guide public health interventions, and track progress toward national health objectives.

# National YRBS Methodology

## Overview

The national YRBS is conducted biennially during the spring of odd-numbered years and allows CDC to assess how risk behaviors change temporally among the U.S. high school population. The national YRBS provides comparable data across years and allows state and local entities conducting their own YRBS to demonstrate how the behaviors of their youths compare with those at the national level. YRBS is conducted among students in grades 9–12 who attend U.S. public and private schools. A nationally representative sample of schools and a random sample of classes within those schools are selected to participate. The survey is self-administered anonymously by using a computer-scannable questionnaire booklet and takes one class period (approximately 45 minutes) to complete.

## Questionnaire

In 2019, the YRBS questionnaire consisted of 99 questions. Eighty-nine of those questions were included in the standard questionnaire* used by sites. Ten additional questions were added to the standard questionnaire that reflect areas of interest for CDC and other stakeholders, forming the 99-question national YRBS questionnaire. As in all cycles, both the standard questionnaire and additional national-only questions were revised to ensure that emerging and prevailing risk behaviors among high school students were measured. Subject matter experts from CDC and elsewhere proposed changes, additions, and deletions to the questionnaire. New and revised questions were reviewed for format, readability, and clarity and were subjected to cognitive testing. CDC made further refinements to the questions on the basis of those testing results.

All questions, except those assessing height, weight, and race, were multiple choice, with a maximum of eight mutually exclusive response options and only one possible answer per question. The survey questions have undergone test-retest analysis and demonstrated good reliability (5,6). The wording of each question, including recall periods and response options, and operational definitions for each variable, are available by reviewing the 2019 YRBS questionnaire and data user's guide. (YRBSS data and documentation are available at https://www.cdc.gov/healthyyouth/data/yrbs/data.htm.)

## Sampling

The 2019 YRBS sampling frame consisted of all regular public (including charter schools), parochial, and other nonpublic schools with students in at least one of grades 9–12 in the 50 U.S. states and the District of Columbia. Alternative schools, special education schools, schools operated by the U.S. Department of Defense, the Bureau of Indian Education, and vocational schools serving only students who also attended another school were excluded. Schools with an enrollment of ≤40 students across grades 9–12 also were excluded. The sampling frame was based on data sets obtained from Market Data Retrieval, Inc., and the National Center for Education Statistics (NCES). NCES data sets were based on the Common Core of Data (https://nces.ed.gov/ccd) for public schools and the Private School Universe Survey (https://nces.ed.gov/surveys/pss) for nonpublic schools.

A three-stage cluster sampling design was used to produce a nationally representative sample of students in grades 9–12

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* The standard YRBSS questionnaire includes 89 questions. YRBS coordinators (located in CDC-funded states, local school districts, territories, and tribes) voted for or against each proposed change, addition, and deletion. Final content of the standard YRBS questionnaire was decided on the basis of the results of this voting process.

who attend public and private schools. The first-stage sampling frame comprised 1,257 primary sampling units (PSUs), consisting of entire counties, groups of smaller adjacent counties, or parts of larger counties. The 1,257 PSUs were categorized into 16 strata according to their metropolitan statistical area status (e.g., urban or rural) and the percentages of non-Hispanic black (black) and Hispanic students in each PSU. From the 1,257 PSUs, 54 were sampled with probability proportional to overall school enrollment size for that PSU. For the second-stage sampling, secondary sampling units (SSUs) were defined as a physical school with grades 9–12 or a school created by combining nearby schools to provide all four grades. From the 54 PSUs, 162 SSUs were sampled with probability proportional to school enrollment size. To provide adequate coverage of students in small schools, an additional 15 small SSUs were selected from a subsample of 15 PSUs from the 54 PSU sample. These 177 SSUs corresponded to 184 physical schools. The third stage of sampling comprised random sampling of one or two classrooms in each of grades 9–12 from either a required subject (e.g., English or social studies) or a required period (e.g., homeroom or second period). All students in sampled classes were eligible to participate. Schools, classes, and students who refused to participate were not replaced in the sampling design.

## Data Collection Procedures

CDC's Institutional Review Board approved the protocol for the YRBS. Survey procedures were designed to protect students' privacy by allowing for anonymous and voluntary participation. Before survey administration, local parental permission procedures were followed. During survey administration, students completed the self-administered questionnaire during one class period and recorded their responses directly on a computer-scannable booklet.

## Response Rates and Data Processing

For the 2019 YRBS, 13,872 questionnaires were completed in 136 schools. The national data set was cleaned and edited for inconsistencies. Missing data were not statistically imputed. A questionnaire failed quality control when <20 responses remained after editing or when it contained the same answer to ≥15 consecutive questions. Among the 13,872 completed questionnaires, 195 failed quality control and were excluded from analysis, resulting in 13,677 usable questionnaires. The school response rate was 75.1%; the student response rate was 80.3%; and the overall response rate (i.e., [student response rate] × [school response rate]) was 60.3%.

Race/ethnicity was ascertained from two questions: 1) "Are you Hispanic or Latino?" (with response options of

"yes" or "no") and 2) "What is your race?" (with response options of "American Indian or Alaska Native," "Asian," "black or African American," "Native Hawaiian or other Pacific Islander," or "white"). For the second question, students could select more than one response option. For this report, students were classified as Hispanic/Latino and are referred to as Hispanic if they answered "yes" to the first question, regardless of how they answered the second question. Students who answered "no" to the first question and selected only black or African American to the second question were classified as black or African American and are referred to as black. Students who answered "no" to the first question and selected only white to the second question were classified and are referred to as white. Race/ethnicity was classified as missing for students who did not answer the first question and for students who answered "no" to the first question but did not answer the second question.

To obtain a sufficient sample size for analyses of health-related behaviors by sexual identity and sex of sexual contacts, students were divided into groups (Table 1). Students who had no sexual contact were excluded from analyses related to sexual behaviors, female students who had sexual contact with only females were excluded from analyses on condom use and birth control use, and male students who had sexual contact with only males were excluded from analyses on birth control use.

## Weighting

A weight based on student sex, race/ethnicity, and grade was applied to each record to adjust for school and student nonresponse and oversampling of black and Hispanic students. The overall weights were scaled so that the weighted count of students equals the total sample size, and the weighted proportions of students in each grade match the national population proportions. Therefore, weighted estimates are nationally representative of all students in grades 9–12 attending U.S. public and private schools.

## Analytic Methods

Findings presented in this *MMWR Supplement* and Youth Online (https://nccd.cdc.gov/Youthonline/App/Default.aspx), an interactive data analysis tool that allows access to all YRBSS data, follow analytic methods similar to what is described in this overview report. For more information regarding the analyses presented in this supplement (e.g., variables analyzed, custom measures, and data years), see the Methods section in each individual report.

All statistical analyses were conducted on weighted data by using SAS (version 9.4; SAS Institute) and SUDAAN (version 11.0.1; RTI International) software to account for the complex

**TABLE 1. Processing of sexual identity and sex of sexual contacts questions — Youth Risk Behavior Survey, United States, 2019**

| Question | Student response | | Analytic description |
|---|---|---|---|
| **Sexual identity** | | | |
| **Which of the following best describes you?** 1) Heterosexual (straight), 2) gay or lesbian, 3) bisexual, or 4) not sure | Heterosexual (straight) Gay or lesbian or bisexual Not sure | | Heterosexual students Lesbian, gay, or bisexual students Not-sure students |
| **Sex of sexual contacts** | | | |
| **During your life, with whom have you had sexual contact?** 1) I have never had sexual contact, 2) females, 3) males, or 4) females and males | I have never had sexual contact* | | Students who had no sexual contact |
| | **Contact:** Female Male | **Student:** Male Female | Students who had sexual contact with only the opposite sex |
| **What is your sex?** 1) Male or 2) female | **Contact:** Male Females and males Female Females and males | **Student:** Male[†] Male Female[†] Female | Students who had sexual contact with only the same sex or with both sexes |

* Excluded from analyses on sexual behaviors.
[†] Excluded from analyses on birth control use and condom use.

sampling designs. In all reports, prevalence estimates and confidence intervals were computed for variables in the YRBS data set. Pairwise differences between populations (e.g., sex, race/ethnicity, grade, sexual identity, and sex of sexual contacts) were determined using *t*-tests. Prevalence estimates were considered statistically significant if the *t*-test p value was <0.05.

In reports that analyzed data related to temporal trends, prevalence estimates for variables assessed with identically worded questions were examined. Logistic regression analyses were used to account for all available estimates; control for sex, grade, and racial/ethnic changes over time; and assess long-term linear and quadratic trends. A p value associated with the regression coefficient that was <0.05 was considered statistically significant. Linear and quadratic time variables were treated as continuous and were coded by using orthogonal coefficients calculated with PROC IML in SAS. A minimum of 3 survey years was required for calculating linear trends, and a minimum of 6 survey years was required to calculate quadratic trends. Separate regression models were used to assess linear and quadratic trends for every variable. When a significant quadratic trend was identified, Joinpoint software was used to automate identification of the year when the nonlinear (i.e., quadratic) trend changed. Regression models were used to identify linear trends occurring in each segment. Cubic and higher-order trends were not assessed. A quadratic trend indicates a statistically significant but nonlinear trend in prevalence over time. A long-term temporal change that includes a significant linear and quadratic trend demonstrates nonlinear variation (e.g., leveling off or change in direction) in addition to an overall increase or decrease over time.

In reports that analyzed 2-year changes in health-related behaviors, prevalence estimates from 2017 and 2019 were compared by using *t*-tests for variables assessed with identically worded questions in both survey years. Prevalence estimates were considered statistically different if the *t*-test p value was <0.05.

## Data Availability and Dissemination

YRBS data (1991–2019) are available from the YRBSS data and documentation website (https://www.cdc.gov/healthyyouth/data/yrbs/data.htm), as are additional resources, including data documentation and analysis guides. Data are available in both Access and ASCII formats. SAS and SPSS programs are provided for converting the ASCII data into SAS and SPSS data sets. Variables are standardized to facilitate trend analyses and for combining data. YRBSS data are also available online by using Youth Online (https://nccd.cdc.gov/Youthonline/App/Default.aspx), a tool that allows point-and-click data analysis and creation of customized tables, graphs, maps, and fact sheets. Youth Online also performs statistical tests by health topic and filters and sorts data by race/ethnicity, sex, grade, and sexual orientation (sexual identity and sex of sexual contacts). Finally, YRBS Explorer is a new application featuring user-friendly options to view and compare national, state, and local data via tables and graphs (https://yrbs-explorer.services.cdc.gov). Data requests and other YRBSS-related questions can be sent to CDC by using the data request form (https://www.cdc.gov/healthyyouth/data/yrbs/contact.htm).

# State, Local School District, Territorial, and Tribal YRBS Methodology

## Overview

Biennial administration of site-level YRBSs allows state and local education and health agencies to assess how risk behaviors change temporally among the high school population in their respective jurisdiction. Site-level YRBS data provide comparable data across years and allow comparisons of student behaviors across jurisdictions (e.g., national or state). Site-level surveys are conducted among students in grades 9–12 attending public schools by using samples representative of the state, local, territorial, or tribal jurisdiction where they are administered. The survey is self-administered anonymously and takes one class period (approximately 45 minutes) to complete. State and local institutional review boards approved the protocol for their respective YRBSs. Survey methodology for data collection, processing, and analytic methods were the same as those described for the national YRBS.

## Questionnaires

The 2019 YRBS standard questionnaire contained 89 questions and was used as the starting point for site-level YRBS questionnaires. Sites could add or delete questions but were required to use at least 60 of the questions on the standard questionnaire. This flexibility allows YRBS coordinators and other local stakeholders the opportunity to pursue topics of interest by customizing their survey.

## Sampling

Sites used a two-stage cluster sampling design to produce a representative sample of students in grades 9–12 in their jurisdiction. In 41 states, three local school districts, and one territory, in the first sampling stage, public schools with any of grades 9–12 were sampled with probability proportional to school enrollment size. In two states, 25 local school districts, and two territories, all schools in the jurisdiction were selected to participate (i.e., a census of schools). In the second sampling stage, intact classes from either a required subject (e.g., English or social studies) or a required period (e.g., homeroom or second period) were sampled randomly. In three sites (Vermont, the District of Columbia, and Palau), a census of students was eligible to participate.

## Response Rates and Nonresponse Bias Analyses

Before the 2019 YRBS cycle, CDC required a minimum 60% overall response rate for data from a jurisdiction to be weighted. As response rates in federal surveys continue to decline (7), a better understanding of the complex association between nonresponse and nonresponse bias is needed. In 2019, CDC chose three YRBS sites with overall response rates of 50%–60% (Nebraska; Texas; and Spartanburg County, South Carolina) to pilot nonresponse bias analyses to evaluate data representativeness. Because of data limitations, comparisons were limited to responding and nonresponding schools by school size and responding and nonresponding students by grade. Weighted sample and population percentages by grade, sex, and race/ethnicity were also compared. Overall, few statistically significant differences between comparison groups were found, which suggested that the data were generally representative of their respective populations. For the 2019 cycle, CDC used nonresponse bias analysis results to help determine whether data were weighted for sites with overall response rates <60%.

## Weighting

YRBS data were weighted if sites collected data from a representative sample of students (determined either by an overall response rate of ≥60% or nonresponse bias analysis indicating no significant bias). A weight based on student sex, race/ethnicity, and grade was applied to each record to adjust for school and student nonresponse in each jurisdiction. The weighted count of students equals the student population in each jurisdiction. Data from 44 states and 28 local school districts were weighted. In 26 states and 13 local school districts, weighted estimates are representative of all students in grades 9–12 attending regular public schools, and in 13 states and eight local school districts, weighted estimates are representative of regular public school students plus students in grades 9–12 in other types of public schools (e.g., alternative or vocational schools).

## Data Availability and Dissemination

A combined data set including national, state, local school district, territorial, and tribal YRBS data (1991–2019) is available from the YRBSS data and documentation website (https://nccd.cdc.gov/Youthonline/App/Default.aspx). Availability of site data depends on survey participation, data quality, and data-sharing policies. Information about YRBSS data is available at the participation maps and history website (https://www.cdc.gov/healthyyouth/data/yrbs/participation.htm). Data requests

and other YRBS-related questions can be sent to CDC by using the data request form. (The YRBSS question, comment, and data request form is available at https://www.cdc.gov/healthyyouth/data/yrbs/contact.htm.) Site-level YRBS data (from high school and middle school surveys) collected during 1991–2019 are available through Youth Online (https://nccd.cdc.gov/Youthonline/App/Default.aspx) and YRBS Explorer (https://yrbs-explorer.services.cdc.gov).

## YRBS Response Rates and 2019 Demographic Characteristics

During 1991–2019, national YRBS overall response rates remained at >60% (Figure 1). They reached a high of 71% during the 2009 and 2011 YRBS cycles, followed by steady decreases; response rates have remained in the low 60% range during the 2015–2019 cycles. Since 1991, school response rates have varied from 70% to the low 80% range, whereas student participation rates have been consistent at 80%–90%.

Data were weighted to match national population proportions. Thus, 50.6% of students were male, and 26.6% were in 9th grade; 25.5% were in 10th grade; 24.2% were in 11th grade; and 23.5% were in 12th grade (Table 2). In regard to race/ethnicity, the majority of students were no-Hispanic

white (white) (51.2%), followed by Hispanic (26.1%), black (12.2%), and other (10.6%), which is defined as American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, or multiracial but non-Hispanic.

Nationwide, 84.4% of students self-identified as heterosexual, 2.5% as gay or lesbian, and 8.7% as bisexual; 4.5% were not sure of their sexual identity (Table 3). In 2019, 45.4% of students had sexual contact with only the opposite sex, 2.2% with only the same sex, and 4.8% with both sexes; 47.6% had had no sexual contact.

## 2019 Site-Level YRBS Participation and Student Response Rates

In 2019, a total of 44 states, 28 local school districts, three territories, and two tribal governments had representative data (Figure 2). In 2019, the median response rate for state YRBSs with representative data was 65.0% (Figure 3), which has typically remained at 60%–70% since 1991. The median response rate for local school district YRBSs with representative data was 76.5% (Figure 3) and has typically remained at 70%–80% since 1991. Since the inception of YRBSS in 1991, the number of sites with representative data has increased, reaching a high of 77 in 2019 (Figure 4).

**FIGURE 1. Overall, school, and student response rates for the national Youth Risk Behavior Surveys — United States, 1991–2019**
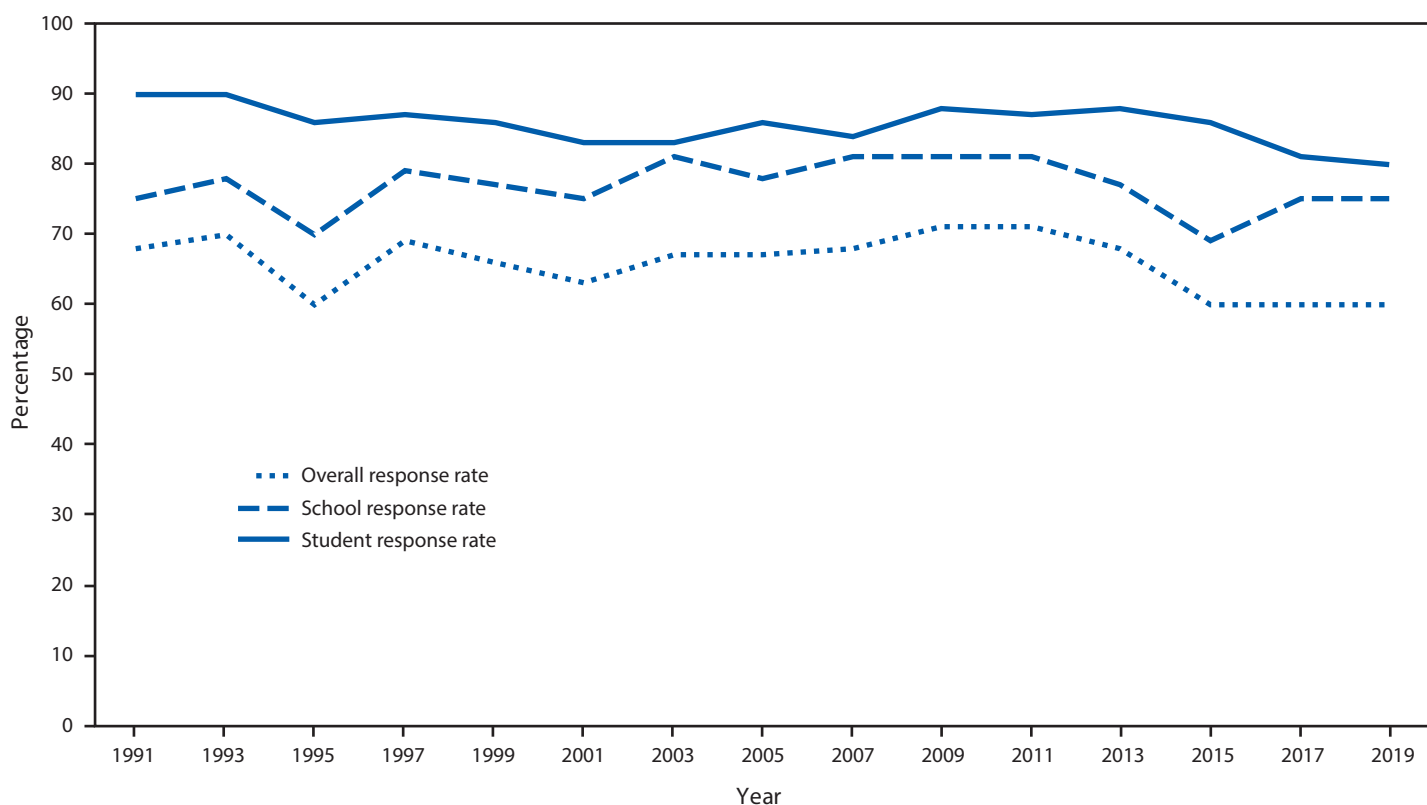
**TABLE 2. Youth Risk Behavior Survey student demographic characteristics — United States, 2019**

| Characteristic | No. (%) |
|---|---|
| Participating schools | 136 (100) |
| Student sample size | 13,677* (100) |
| **Response rates** | |
| Schools | (75.1) |
| Students | (80.3) |
| Total | (60.3) |
| **Sex[†]** | |
| Male | 6,641 (50.6) |
| Female | 6,885 (49.4) |
| **Race/Ethnicity[†,§]** | |
| White, non-Hispanic | 6,668 (51.2) |
| Black, non-Hispanic | 2,040 (12.2) |
| Hispanic | 3,038 (26.1) |
| Other | 1,493 (10.6) |
| **Grade[†,§]** | |
| 9 | 3,637 (26.6) |
| 10 | 3,717 (25.5) |
| 11 | 3,322 (24.2) |
| 12 | 2,850 (23.5) |

* Among the 13,872 completed questionnaires, 195 failed quality control and were excluded from analysis, resulting in 13,677 usable questionnaires.
[†] Does not included students who responded "ungraded" or "other grade."
[§] Percentages might not total 100% because of rounding.

## Discussion

YRBSS is the largest public health surveillance system in the United States, monitoring multiple health-related behaviors among high school students. Since 1991, YRBSS has collected data from approximately 4.9 million high school students in approximately 2,100 separate surveys. Survey response rates have remained slightly above 60%, since YRBSS inception. Consistent and relatively high response rates allow for long-term trend analyses of student health behaviors and experiences. During the 2019 cycle, 78 separate jurisdictions successfully collected YRBS data from a broad diversity of high school students. Nationally representative data from adolescents of various demographic profiles (e.g., sex, race and ethnicity, sexual identity) provide information regarding disparities in health-related behaviors and highlight long-term trends in the prevalence of these behaviors.

In 2019, CDC launched the Public Health Data Modernization Initiative to enhance the potential of using data for disease detection and elimination. The initiative envisions a future in which data drives action efficiently, flexibly, rapidly, and with impact. CDC leverages technology, knowledge, leadership, access, and collaboration to harness the life-saving power of data. YRBSS has both longstanding and newly implemented features that align with the modernization initiative. CDC scientists provide technical support to help state and local education and health agencies administer their YRBS. Flexibility in the questionnaire design process allows stakeholders to collect data of interest across student populations. Detailed YRBS site reports are rapidly returned to state and local departments of health and education, often within 16 weeks of survey administration. In 2019, YRBSS reach (measured by the number of sites with representative data) has increased to 78 sites including the national survey, the most in YRBSS history. These data will help identify student risk behaviors, affect decision-making, and guide public health interventions.

The public release of YRBS data coincides with the publication of this nine-part *MMWR Supplement* and is an agencywide collaboration. Subject matter experts from selected CDC programs contributed to this supplement to highlight public health concerns among U.S. high school students. YRBS data dissemination is managed through online requests, Youth Online, and YRBS Explorer. This year, CDC updated Youth Online to strengthen data presentation, improve user experience, and ultimately expand reach for YRBS data. These improvements to data dissemination will improve YRBS access, expand usage, and maximize impact.

CDC continually works to strengthen YRBSS, and new developments are under way. In 2019, CDC launched a project to update reliability testing for the national YRBS questionnaire. As other school-based surveys move toward

**TABLE 3. Number and percentage of students, by sexual identity and sex of sexual contacts — Youth Risk Behavior Survey, United States, 2019**

| | Total | | Male | | Female | |
|---|---|---|---|---|---|---|
| Characteristic | No. (%) | 95% CI | No. (%) | 95% CI | No. (%) | 95% CI |
| **Sexual identity** | | | | | | |
| Heterosexual | 10,853 (84.4) | 83.4–85.3 | 5,728 (91.2) | 90.1–92.3 | 5,048 (77.6) | 75.9–79.3 |
| Gay or lesbian | 380 (2.5) | 2.1–3.0 | 157 (2.1) | 1.6–2.7 | 211 (2.9) | 2.3–3.6 |
| Bisexual | 1,151 (8.7) | 8.0–9.4 | 201 (3.4) | 2.8–4.1 | 929 (13.9) | 12.7–15.2 |
| Not sure | 591 (4.5) | 3.9–5.0 | 223 (3.2) | 2.7–3.9 | 350 (5.6) | 4.7–6.6 |
| **Sex of sexual contacts** | | | | | | |
| Opposite sex only | 4,856 (45.4) | 42.8–48.1 | 2,642 (49.5) | 46.2–52.8 | 2,214 (41.3) | 38.7–44.0 |
| Same sex only | 292 (2.2) | 1.8–2.7 | 99 (1.6) | 1.2–2.0 | 193 (2.8) | 2.2–3.6 |
| Both sexes | 526 (4.8) | 4.2–5.5 | 90 (1.8) | 1.4–2.3 | 436 (7.8) | 6.7–9.1 |
| No sexual contact | 4,953 (47.6) | 44.8–50.4 | 2,346 (47.1) | 43.9–50.4 | 2,607 (48.0) | 45.1–50.9 |

**Abbreviation:** CI = confidence interval.

**FIGURE 2. State, local school district, territorial, and tribal government Youth Risk Behavior Surveys — selected U.S. sites, 2019**



## Limitations

Reports in this supplement include a limitations section describing the analyses pertaining to that particular report. In general, YRBSS findings are subject to at least six limitations. First, these data apply only to youths who attend school and therefore are not representative of all persons in this age group. In 2019, approximately 5% of high school–aged youths (ages 14–17 years) were not enrolled in school (9). Those youths might engage in riskier health behaviors than their peers, and

electronic platforms (e.g., computer, smart phone, or tablet), some site-level YRBSs have also transitioned to electronic survey administration. CDC recently completed pilot testing for a tablet-based survey administration of the YRBS questionnaire and is considering using tablets for future YRBSs. Finally, CDC is exploring innovative analytic methods to stratify YRBS data by school-level socioeconomic status and geographic location. A recent study using this approach reported students attending schools in low socioeconomic areas were more likely to experience violence, poor emotional well-being, and suicidality (8).

those behaviors are not captured in the school-administered YRBS. Second, the extent of underreporting or overreporting of health-related behaviors cannot be determined, although the survey questions demonstrate good test–retest reliability (5,6). Third, not all states and local school districts administer YRBS, and those that did administer it might not include all the standard questions on their YRBS questionnaire; therefore, data for certain variables are not available for some sites. Fourth, YRBS data analyses are based on cross-sectional surveys and can only provide an indication of association, not causality. Moreover, the survey is descriptive and not designed to explain the reasons behind any observed trends. Fifth, limitations exist related to assessment of sexual and gender identity. Students might not be fully aware of their sexual identity at the time of assessment or might not have understood the sexual identity question. The category of students who are not sure of their sexual identity might encompass students who are unsure of their sexuality, students who were uncomfortable answering the question, or students who did not understand the question. In addition, although some sites asked questions about transgender students, the national YRBS does not include a question about gender identity; therefore, national prevalence

**FIGURE 3. National, state, and local school district Youth Risk Behavior Survey response rates — United States and selected U.S. sites, 1991–2019\***



* Does not include Youth Risk Behavior Survey data from U.S. territories and tribal governments.

estimates for this population of students cannot be assessed. Finally, a limitation exists regarding the aggregation of race and ethnicity data. The national YRBS aggregates these data into broad categories of white, black, and Hispanic. All other students are classified as "other." More detailed racial/ethnic information, as published elsewhere, provides valuable data regarding health disparities among high school students (*10*).

## Conclusion

YRBSS is the best source for quality data at the national, state, territorial, tribal, and local school district levels for monitoring health-related behaviors that contribute to the leading causes of mortality and morbidity among U.S. high school students and that can lead to health problems as adults. A recent report from the National Academies of Sciences, Engineering, and Medicine used YRBS as its data source on the basis of the strengths of the system (*11*). In 2019, in addition to the national data, 44 states, 28 local school districts, three territories, and two tribal governments received data representative of their high school student populations.

This overview report describes YRBSS methods for guiding the analyses presented in this *MMWR Supplement*. A full

description of 2019 YRBS results and downloadable data are available (https://www.cdc.gov/healthyyouth/data/yrbs/index.htm).

### Conflicts of Interest

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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**FIGURE 4. Number of states, local school districts, territories, and tribal governments with representative Youth Risk Behavior Survey data, by year of survey — selected U.S. sites, 1991–2019**
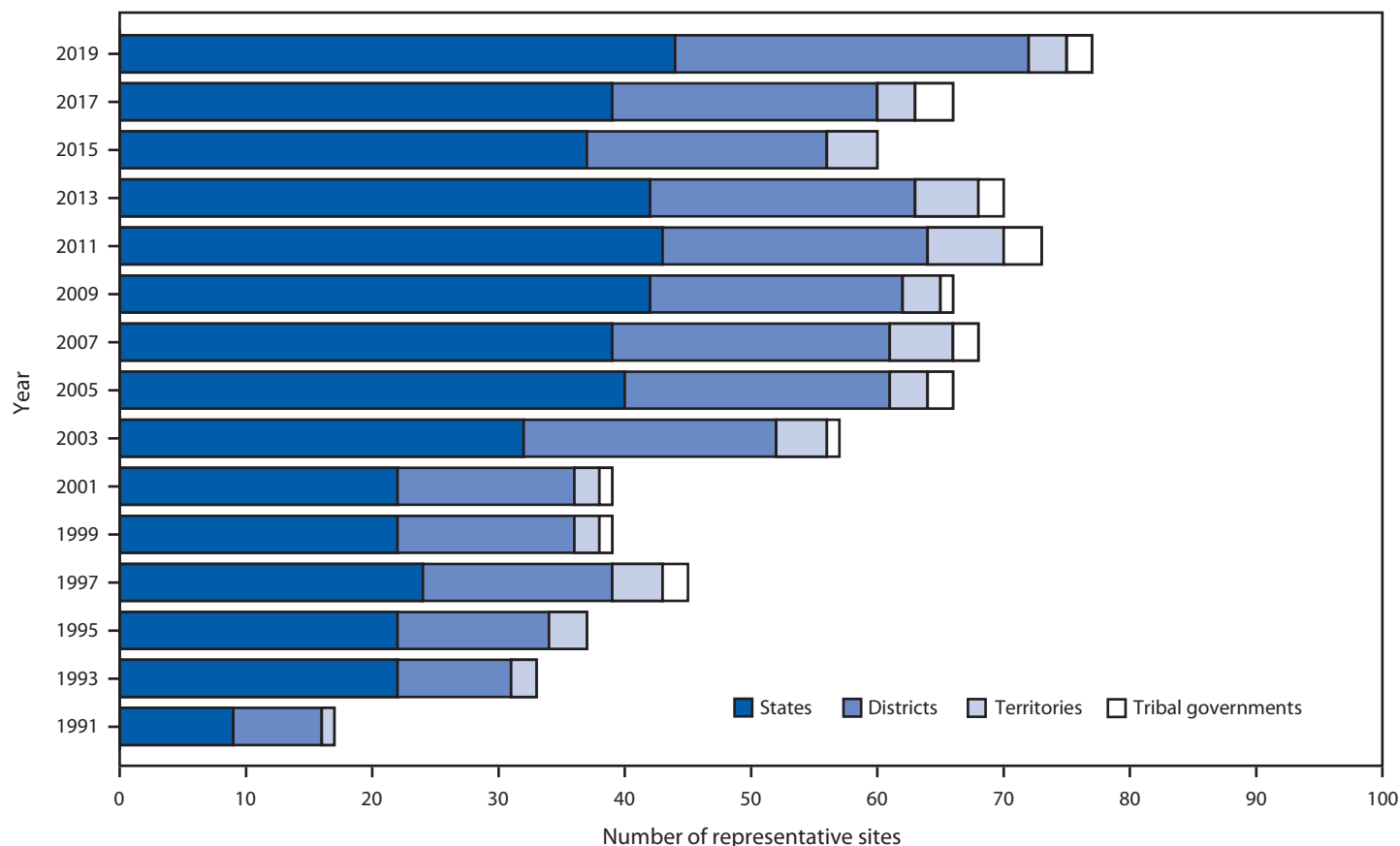
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# Condom and Contraceptive Use Among Sexually Active High School Students — Youth Risk Behavior Survey, United States, 2019

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## Abstract

Preventing unintended pregnancy and sexually transmitted diseases (STDs), including human immunodeficiency virus (HIV) infection, among adolescents is a public health priority. This report presents prevalence estimates for condom and contraceptive use among sexually active U.S. high school students from the 2019 Youth Risk Behavior Survey. Behaviors examined included any condom use, primary contraceptive method use, and condom use with a more effective contraceptive method, all reported at last sexual intercourse. Analyses were limited to sexually active students (i.e., those who had sexual intercourse with one or more persons during the 3 months before the survey). Except for any condom use, students reporting only same-sex sexual contact were excluded from analyses. Weighted prevalence estimates were calculated, and bivariate differences in prevalence were examined by demographic characteristics (sex, race/ethnicity, and grade) and other sexual risk behaviors (age of sexual initiation, previous 3-month and lifetime number of sex partners, and substance use before last sexual intercourse). Nationwide, 27.4% of high school students reported being sexually active (n = 3,226). Among sexually active students who reported having had sexual contact with someone of the opposite sex (n = 2,698), most students (89.7%) had used a condom or a primary contraceptive method at last sexual intercourse. Prevalence of any condom use at last sexual intercourse was 54.3%, and condoms were the most prevalent primary contraceptive method (43.9% versus 23.3% for birth control pills; 4.8% for intrauterine device [IUD] or implant; and 3.3% for shot, patch, or ring). Approximately 9% had used condoms with an IUD, implant, shot, patch, ring, or birth control pills. Using no pregnancy prevention method was more common among non-Hispanic black (23.2%) and Hispanic (12.8%) students compared with non-Hispanic white students (6.8%); compared with Hispanic students, using no pregnancy prevention method was more common among non-Hispanic black students. Prevalence of condom use was consistently lower among students with other sexual risk behaviors. Results underscore the need for public health professionals to provide quality sexual and reproductive health education and clinical services for preventing unintended pregnancy and STDs/HIV and decreasing disparities among sexually active youths.

## Introduction

Preventing unintended pregnancy and sexually transmitted diseases (STDs), including human immunodeficiency virus (HIV) infection, is a U.S. public health priority, particularly among adolescents (*1*). U.S. birth rates among youths aged 15–19 years have decreased to record lows; evidence suggests that increasing use of a range of contraceptive options, including intrauterine devices (IUDs) and implants, also known as long-acting reversible contraception, is a contributing factor (*2*). However, U.S. birth rates among adolescents remain higher than rates in comparable Western industrialized nations (*3*). In 2018, U.S. birth rates for persons aged 15–17

and 18–19 years were 7.2 and 32.3 births per 1,000 females, respectively (*4*). Moreover, racial/ethnic, geographic, and socioeconomic disparities persist (*4*). For example, in 2018, birth rates among non-Hispanic black (black) (26.3) and Hispanic (26.7) persons aged 15–19 years were almost two times the rate for non-Hispanic white (white) (12.1) persons (*4*).

Contraceptive methods vary in effectiveness and highly and moderately effective methods do not prevent STDs, which disproportionately affect adolescents (*5*). Highly effective reversible contraceptive methods (IUDs and implants) are associated with a <1% failure rate during the first year of typical use; moderately effective contraceptive methods (injectables, patches, rings, and birth control pills) are associated with a 4%–7% failure rate during the first year of typical use; and less effective methods (condoms, diaphragm, and spermicides) are associated with a >10% failure rate during the first year of typical use (*6*). Condoms, although categorized as a less

effective method of pregnancy prevention (*6*), remain vital for STD/HIV prevention and promoting condom use is particularly important given increasing STD rates in the United States (*5*). Professional medical organizations (*7,8*) and federal agencies, including CDC, recommend using condoms for STD/HIV prevention with a more effective method of contraception for optimal protection against unintended pregnancy (*9*). However, recent decreases in condom use have been documented, and the proportion of adolescents using condoms with more effective methods of contraception has been consistently low, with recent national estimates of approximately 9% of sexually active high school students (*10*).

Because of these challenges to pregnancy- and STD/HIV-prevention goals, monitoring condom and contraceptive use behaviors among sexually active youths is essential. This study reports prevalence estimates from the 2019 Youth Risk Behavior Survey (YRBS) for any condom use at last sexual intercourse among sexually active U.S. high school students. In addition, prevalence estimates of primary contraceptive method use and condom use with more effective methods of contraception at last sexual intercourse among sexually active students who had sexual contact with the opposite sex during their lifetime are reported. Variations in these behaviors by demographic characteristics and sexual risk behaviors were examined to support public health professionals in implementing quality sexual and reproductive health education and clinical services that prevent STDs/HIV and unintended pregnancy.

# Methods

## Data Source

This report includes data from the 2019 YRBS, a cross-sectional, school-based survey conducted biennially since 1991. Each survey year, CDC collects data from a nationally representative sample of public and private school students in grades 9–12 in the 50 U.S. states and the District of Columbia. Additional information about YRBS sampling, data collection, response rates, and processing is available in the overview report of this supplement (*11*). The prevalence estimates for all sexual behavior questions for the overall study population and by sex, race/ethnicity, grade, and sexual orientation are available at https://nccd.cdc.gov/youthonline/App/Default.aspx. The full YRBS questionnaire is available at https://www.cdc.gov/healthyyouth/data/yrbs/pdf/2019/2019_YRBS-National-HS-Questionnaire.pdf.

## Measures

Behaviors analyzed included any condom use, primary contraceptive method, and condom use with more effective methods of contraception, all reported at last sexual intercourse. Any condom use was assessed by the question, "The last time you had sexual intercourse, did you or your partner use a condom?" Response options included the following: I have never had sexual intercourse, yes, or no. Primary contraceptive method was assessed through a separate question, "The last time you had sexual intercourse, what one method did you or your partner use to prevent pregnancy?" Respondents could select only one response from the following list of options: I have never had sexual intercourse; no method was used to prevent pregnancy; birth control pills; condoms; an IUD (such as Mirena or ParaGard) or implant (such as Implanon or Nexplanon); a shot (such as Depo-Provera), patch (such as Ortho Evra), or birth control ring (such as NuvaRing); withdrawal or some other method; or not sure. Dichotomous (yes versus no) variables for each response option were created, except for "not sure"; although participants selecting this response (n = 93; 3.9%) were included in the analytic sample, prevalence estimates for this category are not reported.

A dichotomous (yes versus no) variable for any condom use with an IUD, implant, shot, patch, ring, or birth control pills was constructed by using the separate items for any condom use and primary contraceptive method at last sexual intercourse. These two items were also used to create the following dichotomous (yes versus no) indicators: condom use only (yes to any condom use and condoms or no method for pregnancy prevention); highly or moderately effective contraceptive use only (no to any condom use and an IUD, implant, shot, patch, ring, or birth control pills for pregnancy prevention); withdrawal or some other contraceptive method use only (no to any condom use and withdrawal or some other method for pregnancy prevention); and use of no condom and no primary contraceptive method (no to any condom use and no method for pregnancy prevention).

Condom and contraceptive use were examined by demographic characteristics and sexual risk behaviors. Demographic characteristics included sex (female or male), race/ethnicity (non-Hispanic white [white], non-Hispanic black [black], or Hispanic; other/multiple responses are not reported), and grade (9, 10, 11, or 12). Four dichotomous sexual risk behaviors were created: age of sexual initiation (<13 years versus ≥13 years); lifetime number of sex partners (1–3 versus ≥4); number of sex partners during the previous 3 months (1 versus ≥2); and alcohol or drug use before last sexual intercourse (yes versus no).

## Analysis

The analytic sample was restricted to sexually active students (i.e., those who reported having had sexual intercourse with one or more persons during the 3 months before the survey). Analyses involving pregnancy prevention methods excluded students who only had same-sex sexual contacts during their lifetime, on the basis of an item about respondents' sex ("What is your sex?" with response options including female or male) and another item assessing the sex of sexual contacts ("During your life, with whom have you had sexual contact?" with response options including I have never had sexual contact, females, males, and females and males).

All analyses were conducted using SUDAAN (version 11.0.0; RTI International) to account for the complex sampling design. Weighted prevalence estimates and 95% confidence intervals were calculated for each outcome. Chi-square statistics were used to examine bivariate differences by demographic characteristics and sexual risk behaviors. For significant overall differences by race/ethnicity and grade, $t$-tests were used to identify pairwise differences. Differences were considered significant if $p < 0.05$.

## Results

Among the 27.4% of sexually active students (n = 3,226), approximately half were female (52.2%) and white (52.3%); approximately one third were in grade 12 (36.9%) (Table 1). Regarding sexual risk behaviors among those sexually active students, 7.0% had sexual intercourse for the first time before age 13 years (3.0% of all YRBS respondents reported having had sexual intercourse for the first time before age 13 years); 26.9% had sexual intercourse with ≥4 persons during their lifetime (8.6% of all YRBS respondents reported having had sexual intercourse with ≥4 persons during their lifetime); 20.5% had sexual intercourse with ≥2 persons during the previous 3 months; and 21.2% had drunk alcohol or used drugs before last sexual intercourse.

Among sexually active students, prevalence of any condom use at last sexual intercourse was 54.3% (Table 2). Among sexually active students who reported having had sexual contact with someone of the opposite sex (i.e., excluding those who reported only same-sex sexual contact) (n = 2,698), condoms (43.9%) were the most prevalent primary pregnancy prevention method, based on responses to the distinct item assessing pregnancy prevention method, followed by birth control pills (23.3%); withdrawal or other method (10.1%); IUD or implant (4.8%); and shot, patch, or ring (3.3%). (Of participants excluded from the analytic sample for primary

method of pregnancy prevention, 95 students reported having had only same-sex sexual contact and 433 students did not answer the questions, "What is your sex?" or "During your life, with whom have you had sexual contact?") Approximately one tenth (10.7%) had not used a pregnancy prevention method at last sexual intercourse; 9.1% had used a condom with an IUD, implant, shot, patch, ring, or birth control pills at last sexual intercourse. Prevalence of condom and IUD or implant use (<1.0%) and condom and shot, patch, or ring use (<1.0%) was lower than condom and birth control pills use (7.5%).

Prevalence estimates for mutually exclusive categories that reflect both pregnancy and STD/HIV prevention effectiveness and account for any condom use in addition to a primary pregnancy prevention method indicate that condom use only was most common (44.3%), followed by highly or moderately effective contraceptive method use only (22.2%) (Figure). Prevalence of condom use with an IUD, implant, shot, patch, ring, or birth control pills (9.1%) was similar to prevalence of using withdrawal or other method only (9.5%) and using no condom and no primary pregnancy prevention method (10.3%).

Analyses revealed significant differences in any condom use and primary pregnancy prevention method at last sexual intercourse by demographic characteristics (Table 2). By sex, no differences occurred in not using any method of pregnancy prevention (i.e., no method); however, differences were identified in type of method used. Compared with male students' report of contraceptive use by their female partner, prevalence as reported by female students was higher for shot, patch, or ring (4.5% versus 2.1%) and birth control pills (26.1% versus 20.2%). In contrast, prevalence of condom use as the primary method for pregnancy prevention reported by male students (49.4%) was higher than female students' report of condom use by their male partner (38.8%), as was any condom use at last sexual intercourse (60.0% versus 49.6%).

A similar pattern emerged when examining prevalence of any condom and primary contraceptive method use by grade. The prevalence of using no method was the same across grades; however, differences occurred in method type. Any condom use and condom use as the primary pregnancy prevention method was more prevalent in lower versus higher grades. In contrast, use of an IUD or implant; birth control pills; and condom with an IUD or implant, shot, patch, ring, or birth control pills was typically more prevalent in higher versus lower grades. For example, condom use as the primary pregnancy prevention method was more common among students in grades 9 (55.3%), 10 (47.7%), and 11 (45.3%) versus students in grade 12 (37.4%) (and grade 9 versus grade 11), whereas IUD or implant use was less common among 9th-grade

**TABLE 1. Prevalence of demographic characteristics and sexual risk behaviors among sexually active\* high school students — Youth Risk Behavior Survey, United States, 2019**

| Characteristic | No.† (%§) | 95% CI |
|---|---|---|
| **Sex** | | |
| Female | 1,679 (52.2) | 49.4–55.0 |
| Male | 1,510 (47.8) | 45.0–50.6 |
| **Race/Ethnicity¶** | | |
| Black, non-Hispanic | 474 (11.2) | 8.9–14.0 |
| Hispanic | 771 (28.4) | 22.3–35.5 |
| White, non-Hispanic | 1,602 (52.3) | 46.4–58.1 |
| **Grade** | | |
| 9 | 389 (11.3) | 9.8–13.0 |
| 10 | 741 (21.4) | 19.3–23.6 |
| 11 | 967 (30.4) | 27.8–33.2 |
| 12 | 1,089 (36.9) | 33.4–40.4 |
| **Sexual risk behavior** | | |
| Had sexual intercourse before age 13 years | 242 (7.0) | 5.7–8.5 |
| Had sexual intercourse with ≥4 persons during their lifetime | 854 (26.9) | 24.3–29.7 |
| Had sexual intercourse with ≥2 persons during the previous 3 months | 658 (20.5) | 18.5–22.7 |
| Had drunk alcohol or used drugs before last sexual intercourse | 652 (21.2) | 18.8–23.9 |

**Abbreviation:** CI = confidence interval.
\* Defined as having had sexual intercourse with at least one person during the 3 months before the survey (n = 3,226).
† Unweighted.
§ Weighted estimates.·
¶ Race/ethnicity values do not total 100% because "other/multiple" responses are not reported (i.e., American Indian/Alaska Native, Asian, Native Hawaiian/Other Pacific Islander, and multiple race).

students (<1.0%), compared with students in grades 10 (3.3%), 11 (3.2%), and 12 (8.2%). Prevalence of IUD or implant use among 10th- and 11th-grade students was also lower than among 12th-grade students.

In contrast with sex and grade, not using a pregnancy prevention method differed by race/ethnicity, with higher prevalence of no method among black (23.2%) and Hispanic (12.8%) students, compared with white students (6.8%); compared with Hispanic students, using no pregnancy prevention method was more common among black students. Additional racial/ethnic differences in type of method were identified, with the general pattern that prevalence of using a more effective method of contraception was lower among black and Hispanic students compared with white students. Specifically, prevalence among black and Hispanic students was lower than among white students for use of an IUD or implant (2.0% and 1.6% versus 6.7%, respectively); birth control pills (12.1% and 15.5% versus 29.7%, respectively); and condom use with an IUD, implant, shot, patch, ring, or birth control pills (7.5% and 4.8% versus 12.4%, respectively). In contrast, prevalence of withdrawal or other method use was higher among black (13.9%) and Hispanic (13.1%) students than among white students (7.7%). Condom use as the primary method for pregnancy prevention was higher among Hispanic students (49.6%), compared with black (37.2%) and white (42.3%) students, and any condom use at last sexual intercourse was higher among Hispanic (56.2%) and white (55.8%) students compared with black students (48.2%).

Differences by sexual risk behaviors in the prevalence of using no contraceptive method and in the type of method used, including any condom use, also were observed (Table 3). Comparing students who had initiated sex before age 13 years with students who had not, differences in no method use were not significant; however, prevalence was lower for any condom use at last sexual intercourse (40.9% versus 55.4%), condom use as the primary method of pregnancy prevention (30.4% versus 44.8%), and withdrawal or other method use (5.5% versus 10.4%). Students who had ≥4 lifetime partners had higher prevalence of no method use (14.7% versus 9.2%) and lower prevalence of any condom use (46.6% versus 57.1%); condom use as the primary pregnancy prevention method (36.2% versus 46.6%); and condom use with an IUD, implant, shot, patch, ring, or birth control pills (6.5% versus 10.1%) compared with students who had <4 lifetime sex partners. A similar pattern was observed for students who reported having had ≥2 recent partners, although no significant differences in no method use were observed. Comparing students who had drunk alcohol or used drugs before last sexual intercourse with students who had not, use of no method was higher (14.7% versus 9.6%), whereas any condom use (47.4% versus 56.0%) and condom use as the primary pregnancy prevention method (39.3% versus 45.1%) were lower.

## Discussion

This report provides the most recent nationally representative estimates of condom and contraceptive use among sexually

**TABLE 2. Prevalence of condom and primary contraceptive use at last sexual intercourse among sexually active\* high school students, by demographic characteristics — Youth Risk Behavior Survey, United States, 2019**

| Demographic characteristic | Any condom use[†] %[§] (95% CI) | p value[¶] | Primary contraceptive method | | | | | | | | | | | | Condoms and IUD, implant, shot, patch, ring, or birth control pills %[§] (95% CI) | p value[¶] |
| | | | IUD or implant %[§] (95% CI) | p value[¶] | Shot, patch, or ring %[§] (95% CI) | p value[¶] | Birth control pills %[§] (95% CI) | p value[¶] | Condom %[§] (95% CI) | p value[¶] | Withdrawal or other method %[§] (95% CI) | p value[¶] | No method %[§] (95% CI) | p value[¶] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | 54.3 (52.0–56.6) | NA | 4.8 (3.3–7.0) | NA | 3.3 (2.3–4.7) | NA | 23.3 (19.8–27.2) | NA | 43.9 (40.6–47.3) | NA | 10.1 (8.5–12.0) | NA | 10.7 (8.8–12.8) | NA | 9.1 (7.4–11.2) | NA |
| **Sex** | NA | <0.01 | NA | 0.20 | NA | <0.05 | NA | <0.01 | NA | <0.01 | NA | 0.34 | NA | 0.21 | NA | 0.10 |
| Female | 49.6 (45.6–53.6) | NA | 5.6 (4.0–7.6) | NA | 4.5 (2.9–6.8) | NA | 26.1 (22.1–30.5) | NA | 38.8 (34.0–44.0) | NA | 10.8 (8.9–13.0) | NA | 11.9 (9.1–15.3) | NA | 10.3 (8.3–12.7) | NA |
| Male | 60.0 (57.0–63.0) | NA | 4.0 (2.1–7.4) | NA | 2.1 (1.2–3.6) | NA | 20.2 (16.4–24.7) | NA | 49.4 (45.8–53.1) | NA | 9.3 (7.1–12.2) | NA | 9.3 (7.1–12.1) | NA | 7.9 (5.8–10.7) | NA |
| **Grade** | NA | <0.05 | NA | <0.01 | NA | 0.29 | NA | <0.01 | NA | <0.01 | NA | 0.20 | NA | 0.63 | NA | <0.01 |
| 9 | 61.3\*\* (54.6–67.5) | NA | 0.1\*\*,††,§§ (0.0–0.7) | NA | 2.4 (0.9–6.2) | NA | 10.9\*\*,†† (6.0–19.1) | NA | 55.3\*\*,†† (47.4–62.9) | NA | 10.6 (6.9–15.9) | NA | 14.1 (9.1–21.2) | NA | 4.7\*\* (2.7–8.2) | NA |
| 10 | 55.4 (50.2–60.4) | NA | 3.3\*\* (2.0–5.6) | NA | 2.1 (1.0–4.4) | NA | 18.2\*\*,†† (13.4–24.3) | NA | 47.7\*\* (41.2–54.3) | NA | 12.5 (9.5–16.4) | NA | 10.5 (7.2–15.1) | NA | 7.0\*\* (4.7–10.3) | NA |
| 11 | 56.3 (51.9–60.6) | NA | 3.2\*\* (1.8–5.8) | NA | 4.2 (2.6–6.7) | NA | 25.8 (21.0–31.3) | NA | 45.3\*\* (39.4–51.4) | NA | 7.9 (5.9–10.5) | NA | 10.1 (7.9–12.8) | NA | 8.9 (6.1–12.9) | NA |
| 12 | 50.3 (46.9–53.8) | NA | 8.2 (5.5–12.2) | NA | 3.6 (2.0–6.3) | NA | 27.7 (23.3–32.5) | NA | 37.4 (33.4–41.6) | NA | 10.3 (7.9–13.3) | NA | 10.2 (6.9–14.9) | NA | 11.6 (8.9–15.0) | NA |
| **Race/Ethnicity** | NA | <0.05 | NA | <0.01 | NA | 0.07 | NA | <0.01 | NA | <0.01 | NA | <0.01 | NA | <0.01 | NA | <0.01 |
| Black, non-Hispanic | 48.2¶¶,\*\*\* (43.2–53.3) | NA | 2.0¶¶ (1.0–4.0) | NA | 5.4 (2.9–9.9) | NA | 12.1¶¶ (8.7–16.5) | NA | 37.2\*\*\* (31.2–43.6) | NA | 13.9¶¶ (8.4–22.2) | NA | 23.2¶¶,\*\*\* (19.2–27.7) | NA | 7.5¶¶ (5.1–10.8) | NA |
| Hispanic | 56.2 (52.0–60.3) | NA | 1.6¶¶ (0.7–3.4) | NA | 1.4 (0.6–3.2) | NA | 15.5¶¶ (11.5–20.5) | NA | 49.6¶¶ (44.7–54.4) | NA | 13.1¶¶ (10.0–17.0) | NA | 12.8¶¶ (9.1–17.8) | NA | 4.8¶¶ (3.1–7.4) | NA |
| White, non-Hispanic | 55.8 (52.9–58.6) | NA | 6.7 (5.0–9.0) | NA | 4.0 (2.5–6.4) | NA | 29.7 (25.7–34.0) | NA | 42.3 (38.2–46.5) | NA | 7.7 (6.1–9.8) | NA | 6.8 (5.3–8.6) | NA | 12.4 (10.1–15.2) | NA |

**Abbreviations:** CI = confidence interval; IUD = intrauterine device; NA = not applicable.

\* Defined as having had sexual intercourse with at least one person during the 3 months before the survey (n = 3,226). Except for any condom use at last sexual intercourse, students reporting only same-sex sexual contact use were excluded; therefore, the analytic sample was restricted to sexually active students who reported having had sexual contact with someone of the opposite sex (n = 2,698). Among sexually active students, excluding those who only had same-sex sexual contact, a total of 93 (3.9%) students answered the pregnancy prevention question "not sure"; findings are not presented for this group.

† Any condom use at last sexual intercourse was measured by a separate item from condoms as the primary method used for preventing pregnancy.

§ Weighted estimates.

¶ Significance is defined as p<0.05, by chi-square test.

\*\* Significantly different than grade 12, by linear contrast *t*-test.

†† Significantly different than grade 11, by linear contrast *t*-test.

§§ Significantly different than grade 10, by linear contrast *t*-test.

¶¶ Significantly different than white, non-Hispanic race/ethnicity, by linear contrast *t*-test.

\*\*\* Significantly different than Hispanic race/ethnicity, by linear contrast *t*-test.

active U.S. high school students. In addition, notable differences in these behaviors by demographic characteristics and sexual risk behaviors are identified that can support implementation of interventions to improve condom and contraceptive use among adolescents most in need. Doing so will help to achieve unintended pregnancy and STD/HIV prevention goals, including reducing disparities by race/ethnicity.

Overall, most (89.7%) sexually active students (excluding those who only reported same-sex sexual contact) used a condom or a primary contraceptive method at last sexual intercourse, yet approximately one fifth (19.8%) reported using withdrawal or some other method only or no condom and no primary contraceptive method. Moreover, prevalence estimates by method type, as well as differences by demographic characteristics and sexual risk behaviors, underscore the importance of meeting the unintended pregnancy and STD/HIV prevention needs of all sexually active high school students.

Only 9.1% of sexually active students (excluding those who only reported same-sex sexual contact) reported having used a condom with a more effective contraceptive method, which is the recommended approach for preventing both unintended pregnancy and STDs/HIV because the most effective forms of contraception confer no STD/HIV protection (7–9). Although use of condoms alone can prevent both adverse outcomes and was the most prevalent method used, only approximately half of sexually active students reported any condom use at last sexual intercourse, which is concerning given the high risk for STDs among this population (5). Moreover, condoms are categorized as a less effective pregnancy prevention method, given that they are associated with a 13.0% pregnancy risk during the first year of typical use (6), and prevalence of any highly or moderately effective method use at last sexual intercourse was only 31.4%.

**FIGURE. Prevalence of condom and primary contraceptive use\* at last sexual intercourse among sexually active† high school students — Youth Risk Behavior Survey, United States, 2019**
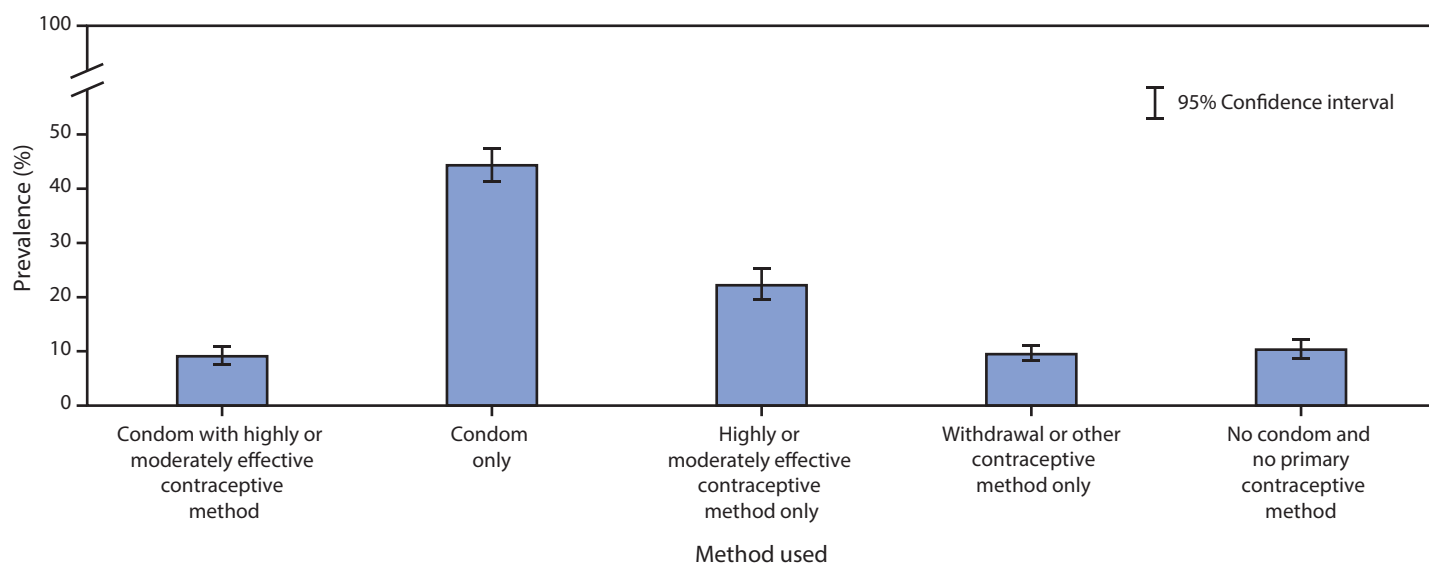


\* **Condom with highly or moderately effective contraceptive method** = students who responded "yes" to any condom use at last sexual intercourse and intrauterine device or implant; shot, patch, or ring; or birth control pills (i.e., highly or moderately effective methods) as primary pregnancy prevention method. **Condom** only = students who responded "yes" to any condom use at last sexual intercourse and condom or no method as primary pregnancy prevention method. **Highly or moderately effective contraceptive method only** = students who responded "no" to any condom use at last sexual intercourse and intrauterine device or implant; shot, patch, or ring; or birth control pills (i.e., highly or moderately effective methods) as primary pregnancy prevention method. **Withdrawal or other contraceptive method only** = students who responded "no" to any condom use at last sexual intercourse and withdrawal or some other method as primary pregnancy prevention method. **No condom and no primary contraceptive method** = students who responded "no" to any condom use at last sexual intercourse and no method of pregnancy prevention.
† Defined as having had sexual intercourse with at least one person during the 3 months before the survey (n = 2,698). Students reporting only same-sex sexual contact were excluded from the analytic sample.

Notable demographic differences in condom and contraceptive use warrant particular attention. Compared with white students, black and Hispanic students had higher prevalence of no pregnancy prevention method use and lower prevalence of highly and moderately effective contraceptive method use. Black students also had lower prevalence of any condom use at last sexual intercourse than white and Hispanic students. On the basis of these findings and the documented racial/ethnic disparities in birth and STD rates among adolescents (*4,5*), meeting the unintended pregnancy and STD/HIV prevention needs of black and Hispanic youths is vital. Understanding and addressing structural barriers that might contribute to the observed differences are important next steps. As for grade, differences indicate that younger students are more likely to use condoms, whereas older students are more likely to use an IUD or implant, birth control pills, and condoms with a more effective contraceptive method. Therefore, improving younger adolescents' knowledge of, comfort with, and access to the most effective methods of pregnancy and STD/HIV prevention is needed. Whereas findings related to race/ethnicity and grade have clear practice implications, patterns by sex might largely reflect reporting differences on the basis of who uses a given method. As compared with female students, the proportion of male students reporting condom use was higher, and the proportion reporting their partners' use of shot, patch, or ring, and birth control pill use

was lower. For the latter female-controlled methods, self-report by females is considered more accurate (*12*).

Finally, differences in condom and contraceptive use by sexual risk behaviors reveal that use of preventive strategies is suboptimal among high school students who engage in those behaviors. The general pattern was that students with a given risk indicator, compared with those without, had lower prevalence of condom use and higher prevalence of using no method of contraception, although not all differences were significant. Such findings might reflect potential disempowerment in sexual interactions (*13*) and the challenge of using condoms correctly and consistently while under the influence of alcohol or drugs (*14*). Because number of partners is an indicator of STD/HIV risk, findings that students with ≥2 recent or ≥4 lifetime partners had lower prevalence of condom use, alone or with a highly or moderately effective contraceptive method, are particularly concerning.

Collectively, these findings from the 2019 YRBS highlight the importance of programmatic efforts that can improve condom and contraceptive use among adolescents. The effectiveness of sexual risk reduction education is well documented (*15*); because of given decreasing attention to condom-related topics in school-based instruction (*16*), efforts to strengthen implementation are warranted. Such education should ensure that highly and

**TABLE 3. Prevalence of condom and primary contraceptive use at last sexual intercourse among sexually active\* high school students, by sexual risk behaviors — Youth Risk Behavior Survey, United States, 2019**

| Sexual risk behavior | Any condom use† %§ (95% CI) | Any condom use† p value¶ | Primary contraceptive method — IUD or implant %§ (95% CI) | IUD or implant p value¶ | Shot, patch, or ring %§ (95% CI) | Shot, patch, or ring p value¶ | Birth control pills %§ (95% CI) | Birth control pills p value¶ | Condom %§ (95% CI) | Condom p value¶ | Withdrawal or other method %§ (95% CI) | Withdrawal or other method p value¶ | No method %§ (95% CI) | No method p value¶ | Condom and IUD, implant, shot, patch, ring, or birth control pills %§ (95% CI) | p value¶ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Had sexual intercourse before age 13 years** | NA | <0.05 | NA | 0.05 | NA | 0.83 | NA | 0.81 | NA | <0.05 | NA | <0.05 | NA | 0.05 | NA | 0.12 |
| Yes | 40.9 (30.4–52.4) | NA | 2.6 (1.1–6.0) | NA | 3.0 (1.0–8.2) | NA | 22.1 (13.4–34.1) | NA | 30.4 (19.3–44.2) | NA | 5.5 (2.9–10.3) | NA | 22.8 (12.6–37.7) | NA | 4.8 (1.7–13.3) | NA |
| No | 55.4 (52.9–57.9) | NA | 5.0 (3.4–7.2) | NA | 3.4 (2.3–4.9) | NA | 23.4 (19.7–27.5) | NA | 44.8 (41.4–48.3) | NA | 10.4 (8.6–12.5) | NA | 9.8 (8.0–12.0) | NA | 9.4 (7.6–11.6) | NA |
| **Had sexual intercourse with ≥4 persons during their lifetime** | NA | <0.01 | NA | <0.01 | NA | 0.60 | NA | 0.43 | NA | <0.01 | NA | 0.32 | NA | <0.05 | NA | <0.05 |
| Yes | 46.6 (42.9–50.2) | NA | 7.4 (5.0–10.8) | NA | 2.9 (1.6–5.2) | NA | 21.5 (17.0–26.9) | NA | 36.2 (31.0–41.7) | NA | 11.5 (8.7–15.0) | NA | 14.7 (10.9–19.6) | NA | 6.5 (4.3–9.8) | NA |
| No | 57.1 (54.3–59.8) | NA | 3.9 (2.6–5.8) | NA | 3.5 (2.3–5.4) | NA | 23.9 (19.7–28.6) | NA | 46.6 (43.1–50.1) | NA | 9.6 (7.7–11.9) | NA | 9.2 (7.3–11.7) | NA | 10.1 (8.1–12.4) | NA |
| **Had sexual intercourse with ≥2 persons during the previous 3 months** | NA | <0.01 | NA | 0.69 | NA | <0.05 | NA | 0.13 | NA | <0.05 | NA | 0.14 | NA | 0.20 | NA | <0.01 |
| Yes | 47.1 (43.1–51.1) | NA | 5.0 (3.1–8.0) | NA | 1.7 (0.6–4.5) | NA | 19.9 (15.1–25.8) | NA | 39.3 (35.1–43.7) | NA | 12.7 (9.2–17.3) | NA | 14.0 (9.5–20.0) | NA | 5.2 (3.2–8.4) | NA |
| No | 56.2 (53.4–58.9) | NA | 4.7 (3.3–6.8) | NA | 3.7 (2.6–5.3) | NA | 24.1 (20.4–28.3) | NA | 45.1 (41.3–48.9) | NA | 9.4 (7.7–11.4) | NA | 9.8 (8.2–11.7) | NA | 10.1 (8.3–12.4) | NA |
| **Had drunk alcohol or used drugs before last sexual intercourse** | NA | <0.05 | NA | 0.35 | NA | 0.35 | NA | 0.10 | NA | <0.05 | NA | 0.68 | NA | <0.05 | NA | 0.10 |
| Yes | 47.4 (42.0–52.9) | NA | 5.7 (3.6–8.9) | NA | 2.3 (1.1–5.1) | NA | 20.5 (16.2–25.7) | NA | 39.3 (33.4–45.5) | NA | 10.6 (7.4–15.0) | NA | 14.7 (11.0–19.3) | NA | 6.4 (3.9–10.5) | NA |
| No | 56.0 (53.1–58.8) | NA | 4.7 (3.1–6.9) | NA | 3.5 (2.3–5.4) | NA | 24.0 (20.4–28.1) | NA | 45.1 (41.7–48.6) | NA | 9.7 (7.9–11.9) | NA | 9.6 (7.6–12.2) | NA | 9.6 (7.6–12.1) | NA |

**Abbreviations:** CI = confidence interval; IUD = intrauterine device; NA = not applicable.
\* Defined as having had sexual intercourse with at least one person during the 3 months before the survey (n = 3,226). Except for any condom use at last sexual intercourse, students reporting only same-sex sexual contact use were excluded; therefore, the analytic sample was restricted to sexually active students who reported having had sexual contact with someone of the opposite sex (n = 2,698). Among sexually active students, excluding those who only had same-sex sexual contact, a total of 93 (3.9%) students answered the pregnancy prevention question "not sure"; findings are not presented for this group.
† Any condom use at last sexual intercourse was measured by a separate item from condoms as the primary method used for preventing pregnancy.
§ Weighted estimates.
¶ Statistical significance is defined as p<0.05, by chi-square test.

moderately effective contraceptive methods are clearly addressed, including in earlier grades (e.g., middle school). Doing so in the context of broader education about health services might be a developmentally appropriate approach.

Engaging directly with communities most affected by unintended pregnancy and STD/HIV can be one strategy to help identify and address social determinants of health that contribute to disparities in condom and contraceptive use. Furthermore, education and clinical services can be delivered through community- and school-based programs tailored to serve young persons most in need. Fostering community–clinic partnerships through youth-serving organizations is one strategy for reaching the most vulnerable adolescents. Such partnerships can help address barriers and improve access to sexual and reproductive health care, either through referral or service integration (17).

In addition to access, delivery of comprehensive, client-centered, and adolescent-friendly care by well-trained providers is essential. For example, same-day initiation of long-acting reversible contraception methods (i.e., providing the method during the initial appointment) is a best practice that can facilitate adolescents' access to these methods (17). Another example is provider counseling about condom use with more effective contraceptive methods, which has been associated with adolescents' use of this prevention strategy (18). Integrating unintended pregnancy and STD/HIV prevention in school-, clinic-, and community-based health promotion likely requires explicit attention to individual prevention goals as well as preferences related to the various prevention strategies (19).

# Limitations

General limitations for the YRBS are available in the overview report of this supplement (*11*). The findings in this report are subject to at least five additional limitations. First, male students' report of their female partners' contraceptive use might not be accurate (*11*). Second, distinguishing the intended purpose of condom use in relation to pregnancy and STD/HIV prevention is not feasible. Although YRBS assesses condom use as a primary method for pregnancy prevention, condom use for STD/HIV prevention is not explicitly measured. Third, condom use with a more effective contraceptive method might be underestimated because respondents could only select one method of pregnancy prevention at last sexual intercourse. Fourth, the estimates for highly and moderately effective contraception could be underestimated if respondents viewed a less effective option (i.e., condoms or withdrawal or some other method) as their primary contraceptive method used at last sexual intercourse. Finally, because the sex of last sex partner is not measured, the analytic sample might include students with same-sex partners at last sexual intercourse for whom pregnancy prevention is not needed.

# Conclusion

Ongoing national surveillance will remain important to understanding the population-level effects of public health and clinical approaches to preventing unintended pregnancy and STDs/HIV among young persons. To complement these efforts, implementation science and observational research should address unresolved questions (e.g., young men's role in condom and contraceptive use, barriers and facilitators to integration of pregnancy and STD/HIV prevention, and effective strategies for addressing disparities, including racial/ethnic differences). Taken together, these data can be used to improve condom and contraceptive use for all sexually active adolescents.

### Conflicts of Interest

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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# Trends in Violence Victimization and Suicide Risk by Sexual Identity Among High School Students — Youth Risk Behavior Survey, United States, 2015–2019

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## Abstract

Lesbian, gay, and bisexual (LGB) youths continue to experience more violence victimization and suicide risk than heterosexual youths; however, few studies have examined whether the proportion of LGB youths affected by these outcomes has varied over time, and no studies have assessed such trends in a nationally representative sample. This report analyzes national trends in violence victimization and suicide risk among high school students by self-reported sexual identity (LGB or heterosexual) and evaluates differences in these trends among LGB students by sex (male or female) and race/ethnicity (non-Hispanic black, non-Hispanic white, or Hispanic). Data for this analysis were derived from the 2015, 2017, and 2019 cycles of CDC's Youth Risk Behavior Survey (YRBS), a cross-sectional, school-based survey conducted biennially since 1991. Logistic regression models assessed linear trends in prevalence of violence victimization and indicators of suicide risk among LGB and heterosexual students during 2015–2019; in subsequent models, sex-stratified (controlling for race/ethnicity and grade) and race/ethnicity-stratified (controlling for sex and grade) linear trends were examined for students self-identifying as LGB during 2015–2019. Results demonstrated that LGB students experienced more violence victimization and reported more suicide risk behaviors than heterosexual youths. Among LGB youths, differences in the proportion reporting violence victimization and suicide risk by sex and race/ethnicity were found. Across analyses, very few linear trends in these outcomes were observed among LGB students. Results highlight the continued need for comprehensive intervention strategies within schools and communities with the express goal of reducing violence victimization and preventing suicide risk behaviors among LGB students.

## Introduction

Lesbian, gay, and bisexual (LGB) youths experience more violence victimization and suicide risk than heterosexual youths (*1–3*). In 2015, CDC's Youth Risk Behavior Surveillance System (YRBSS) added two new questions to the national questionnaire regarding sexual identity and sexual behavior. These questions facilitated the first nationally representative estimates of the health behaviors and experiences of sexual minority youths (students who identify as LGB or those who have sexual contact with persons of the same or both sexes) and affirmed the presence of substantial health disparities (i.e., differences in health outcomes between social groups driven by unequal social or environmental circumstances) in violence victimization and suicide risk between LGB and heterosexual youths . Findings from the 2017 Youth Risk Behavior Survey

(YRBS) revealed that LGB high school students experienced more bullying at school (33% among LGB students and 17% among heterosexual students), more sexual dating violence by dating partners (LGB, 16%; heterosexual, 6%), and more suicide attempts (LGB, 23%; heterosexual, 5%) (*3*) than their heterosexual peers.

Notably, the 2019 YRBS data collection cycle presented the first opportunity for examining linear trends in violence victimization and suicide risk trends for LGB students across time in a nationally representative sample. Few studies have examined whether prevalence of violence victimization and suicide risk varies among LGB youths over time (*4*). School environments in the United States might be improving in their ability to meet the needs of LGB youths (*5*); for example, recent surveillance data from CDC's 2018 School Health Profiles, which include representative data from 43 states, provide evidence that many schools are implementing supportive practices. In the 2018 School Health Profiles, an average of 78.5% of schools across U.S. states included in the sample reported identifying safe spaces for LGB and transgender

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and questioning youths, and an average of 96.1% of schools across these states prohibited harassment based on a student's perceived or actual sexual orientation or gender identity (6). A recent study (4) that pooled local YRBS data during 2009–2017 to examine trends in suicide risk found that reports among LGB youths of suicide risk might be decreasing but that LGB students still are as much as three times more likely to have attempted suicide than heterosexual students. National U.S. trends have not been estimated.

LGB youths are a heterogenous population with intersecting social identities (e.g., sex, race/ethnicity, or gender identity), and important differences might exist among LGB youths regarding risk for violence and suicide. For example, LGB females appear to be at higher risk for dating and sexual violence than LGB males (7,8). In examinations of racial/ethnic differences among LGB youths, clear patterns of differences in experiences of violence victimization and suicide risk are less consistent (9,10). For example, one study of interpersonal violence among sexual minorities reported that physical victimization from an intimate partner was 1–4 times higher among non-white youths than among white youths (9). Another study reported that non-Hispanic white and Hispanic LGB youths were more likely to be bullied than non-Hispanic white heterosexual youths but that non-Hispanic black LGB youths were not more likely to be bullied than non-Hispanic white heterosexual youths (10). This same study reported that all LGB youths, regardless of race/ethnicity, were at increased risk for suicidal ideation (10). More systematic evaluations of the within-group differences in violence victimization and suicide risk behaviors among sexual minority youths are warranted.

This analysis contributes to the evidence base regarding LGB students, violence victimization, and suicide risk. YRBS data were used to examine national trends in violence victimization and suicide risk among high school students by self-reported sexual identity and evaluated differences among LGB students by sex and race/ethnicity. The analysis was guided by the following four questions:

1. How did the prevalence of violence victimization and suicide risk among LGB students vary during 2015–2019?
2. To what extent did violence victimization and suicide risk trends differ from these trends among heterosexual students during the same period?
3. Among LGB students, to what extent did violence victimization and suicide risk trends vary by sex (male or female)?
4. Among LGB students, to what extent did violence victimization and suicide risk trends vary by race/ethnicity (non-Hispanic black, non-Hispanic white, or Hispanic)?

# Methods

## Data Source

This report includes data from the 2015 (n = 15,624), 2017 (n = 14,765), and 2019 (n = 13,677) cycles of the national YRBS (pooled n = 44,066), a cross-sectional, school-based survey conducted biennially since 1991. Each survey year, CDC collects data from a nationally representative sample of public and private school students in grades 9–12 in the 50 U.S. states and the District of Columbia. Additional information about YRBS sampling, data collection, response rates, and processing is available in the overview report of this supplement (11). The prevalence estimates for all questions on violence victimization and suicide risk for the overall study population and by sex, race/ethnicity, grade, and sexual orientation are available at https://nccd.cdc.gov/youthonline/App/Default.aspx. The full YRBS questionnaire is available at https://www.cdc.gov/healthyyouth/data/yrbs/pdf/2019/2019_YRBS-National-HS-Questionnaire.pdf.

## Measures

All measures analyzed for this report are provided (Table 1). Students responded to seven questions about violence victimization, including ever experiencing forced sexual intercourse; experiencing sexual dating violence, physical dating violence, bullying at school, electronic bullying, and being threatened or injured with a weapon at school during the previous 12 months; and missing school because of feeling unsafe at or on the way to or from school during the previous 30 days. Students responded to five questions about suicide risk during the previous 12 months, including having felt persistently sad or hopeless; having seriously considered suicide; and having made a suicide plan, having attempted suicide, or having made a suicide attempt that had to be treated by a doctor or nurse. Students responded to five demographic questions relating to sex, sexual identity, grade, race, and ethnicity, which were used as covariates and to create relevant strata in all trend analyses.

## Analysis

Data from the 2015, 2017, and 2019 national YRBS were examined for trends in the prevalence among LGB students in experiences of violence victimization and indicators of suicide risk. Data were analyzed by using SAS (version 9.4; SAS Institute) and SUDAAN (version 11.0.0; RTI International) to account for the complex sampling designs. Data were assessed using complete case analysis; missing data were not imputed. All outcomes were dichotomized as either yes or no, ≥1 time

**TABLE 1. Measures for demographic characteristics, violence victimization, and suicide risk behaviors among high school students — Youth Risk Behavior Survey, United States, 2019**

| Construct | Measure |
|---|---|
| **Demographic characteristics** | |
| Sexual identity | Which of the following best describes you?<br>A. Heterosexual (straight)<br>B. Gay or lesbian<br>C. Bisexual<br>D. Not sure |
| Sex at birth | What is your sex?<br>A. Female<br>B. Male |
| Race | What is your race? (*Select one or more responses.*)<br>A. American Indian or Alaska Native<br>B. Asian<br>C. Black or African American<br>D. Native Hawaiian or Other Pacific Islander<br>E. White |
| Ethnicity | Are you Hispanic or Latino?<br>A. Yes<br>B. No |
| Grade | In what grade are you?<br>A. 9th grade<br>B. 10th grade<br>C. 11th grade<br>D. 12th grade<br>E. Ungraded or other grade |
| **Violence victimization*** | |
| Forced sex | Have you ever been physically forced to have sexual intercourse when you did not want to? |
| Sexual dating violence | During the past 12 months, how many times did someone you were dating or going out with force you to do sexual things that you did not want to do? (Count such things as kissing, touching, or being physically forced to have sexual intercourse.) |
| Physical dating violence | During the past 12 months, how many times did someone you were dating or going out with physically hurt you on purpose? (Count such things as being hit, slammed into something, or injured with an object or weapon.) |
| Bullying at school | During the past 12 months, have you ever been bullied on school property? |
| Electronic bullying | During the past 12 months, have you ever been electronically bullied? (Count being bullied through texting, Instagram, Facebook, or other social media.) |
| Felt unsafe at, to, or from school | During the past 30 days, on how many days did you not go to school because you felt you would be unsafe at school or on your way to or from school? |
| Threatened or injured with a weapon at school | During the past 12 months, how many times has someone threatened or injured you with a weapon, such as a gun, knife, or club, on school property? |
| **Suicide risk behaviors*** | |
| Persistent feelings of sadness/hopelessness | During the past 12 months, did you ever feel so sad or hopeless almost every day for 2 weeks or more in a row that you stopped doing some usual activities? |
| Seriously considered suicide | During the past 12 months, did you ever seriously consider attempting suicide? |
| Made a suicide plan | During the past 12 months, did you make a plan about how you would attempt suicide? |
| Attempted suicide | During the past 12 months, how many times did you actually attempt suicide? |
| Suicide attempt requiring medical treatment | If you attempted suicide during the past 12 months, did any attempt result in an injury, poisoning, or overdose that had to be treated by a doctor or nurse? |

* All violence victimization and suicide risk measures were dichotomized as either "yes" (i.e., ≥1 time, ≥1 day) or "no" (i.e., 0 days, 0 times).

or 0 times, or ≥1 day or 0 days. Weighted prevalence estimates with 95% confidence intervals (CIs) were calculated by using Taylor series linearization to produce nationally representative prevalence estimates for each survey year.

Logistic regression models were used to assess linear trends in the prevalence of violence victimization and indicators of suicide risk among LGB and heterosexual students for 2015–2019, controlling for sex, race/ethnicity, and grade. Main effects odds ratios (ORs) comparing LGB students with heterosexual students also were calculated for the 2015–2019

period. In subsequent models, sex-stratified (controlling for race/ethnicity and grade) and race/ethnicity-stratified (controlling for sex and grade) linear trends, were examined for students self-identifying as LGB on the survey. Main effects ORs comparing sex and race/ethnicity groups also were calculated for these subsequent regression models. Linear trends were considered statistically significant if $p < 0.05$. Main effects ORs were considered statistically significant if 95% CIs did not include 1.0.

# Results

## Violence Victimization

Among all students (Table 2), LGB students had greater odds of violence victimization than heterosexual students across all seven indicators, as evidenced by statistically significant main effects of sexual identity on each indicator (Table 2). Among LGB students, the percentage who reported experiencing physical dating violence during 2015–2019 significantly decreased from 17.5% to 13.1%. No other violence victimization outcomes varied significantly among LGB students in this period.

Among LGB students stratified by sex (Table 3), male students reported greater odds of feeling unsafe at or on the way to or from school (aOR: 1.61) and being threatened or injured with a weapon (aOR: 1.54) than female students. Conversely, male LGB students reported reduced odds of electronic bullying (aOR: 0.71), sexual dating violence (aOR: 0.66), and forced sex (aOR: 0.51) than female LGB students. Among male LGB students, the percentage reporting being threatened or injured with a weapon at school significantly increased from 2015 (11.6%) to 2019 (15.9%), as did the percentage reporting forced sex (2015: 8.0%; 2019: 15.6%). Among female LGB students, the percentage reporting physical dating violence significantly decreased from 2015 (16.9%) to 2019 (12.1%).

Among LGB students stratified by race (Table 4), non-Hispanic black (black) and Hispanic students reported higher odds of feeling unsafe at or on the way to or from school than non-Hispanic white (white) students (aOR: 1.63 and aOR: 1.46, respectively), and black students also reported greater odds of being threatened or injured with a weapon than white students (aOR: 1.60). With regard to bullying, black and Hispanic LGB students reported reduced odds of both bullying at school (black, aOR: 0.31; Hispanic, aOR: 0.56) and electronic bullying (black, aOR: 0.41; Hispanic, aOR: 0.55), compared with white LGB students. Black LGB students also reported reduced odds of sexual dating violence, compared with white LGB students (aOR: 0.44). The only significant trend among violence models stratified by race/ethnicity was among Hispanic LGB students, who had reduced percentage of reporting experiencing physical dating violence in 2019 (9.8%), compared with 2015 (22.6%).

## Suicide Risk

Among all students (Table 2), LGB students had greater odds of suicide risk than heterosexual students across all five indicators, as evidenced by significant main effects for each variable. The percentage of LGB students reporting these outcomes did not vary significantly during 2015–2019.

Among LGB students stratified by sex (Table 3), male students had lower odds of all five suicide risk indicators than female students. Among female LGB students, the percentage reporting suicide attempts decreased significantly from 2015 (32.8%) to 2019 (23.6%). All other trends in suicide risk in these sex-stratified models remained stable.

Among LGB students stratified by race (Table 4), black and Hispanic students had lower odds than white students of reporting persistent feelings of sadness or hopelessness (black, aOR: 0.42; Hispanic, aOR: 0.69) and seriously considering attempting suicide (black, aOR: 0.43; Hispanic, aOR: 0.65). Black LGB students also had lower odds than white LGB students of making a suicide plan (aOR: 0.61). The percentage of LGB students reporting these outcomes in the race/ethnicity-stratified models did not vary significantly during 2015–2019.

# Discussion

Overall, these results underscore that LGB students continue to have a greater prevalence of violence victimization and suicidal behavior than their heterosexual peers. The higher prevalence of violence and suicide among LGB students is consistent with results from other studies regarding sexual minorities and minority stress (12,13). Minority stress is the preeminent framework for understanding disparities among sexual minorities and refers to the process by which social stigma directed toward LGB and other nonheterosexual persons is enacted through external stressors (e.g., violence, discrimination, or harassment) and internal stressors (e.g., identity concealment or expectations of rejection) (12). Both types of stress shape mental and physical health (12,14), and the impact of violence victimization on LGB youths (15) and its connection to elevated suicide risk is well-documented (16). LGB students' disproportionate experience of violence victimization and suicide risk, compared with their heterosexual peers in this study, underscores the continued relevance of minority stress among LGB youths and the continued public health need for action that addresses these sizeable disparities.

Notably, the proportion of LGB students experiencing violence victimization or suicide risk remained fairly stable during 2015–2019. One exception is reports of physical dating violence; fewer LGB students reported experiencing physical dating violence in 2019 than in 2015. This downward trajectory of physical dating violence appears to be a continuation of an already documented population trend of a decrease in experiences of dating violence among adolescents (17), and its detection among LGB youths is promising. Regarding suicide risk, a recent study examined local trends since 2009 and

**TABLE 2. Trends in the prevalence of violence victimization and suicide risk behaviors among high school students, by self-identified sexual identity — Youth Risk Behavior Survey, United States, 2015–2019***

| Health risk behavior | Main effect<br>aOR (95% CI) | 2015<br>% (95% CI) | 2017<br>% (95% CI) | 2019<br>% (95% CI) | Linear trend<br>Beta | p value[†] |
|---|---|---|---|---|---|---|
| **Violence victimization** | | | | | | |
| Feeling unsafe at school (past 30 days) | | | | | | |
| Lesbian, gay, or bisexual | 1.98 (1.70–2.30) | 12.5 (10.2–15.3) | 10.0 (8.1–12.3) | 13.5 (11.0–16.5) | 0.0619 | 0.65 |
| Heterosexual | 1.0 (Ref.) | 4.6 (3.9–5.4) | 6.1 (5.1–7.3) | 7.5 (6.3–8.9) | 0.3749 | 0.00 |
| Threatened or injured with a weapon at school (past 12 months) | | | | | | |
| Lesbian, gay, or bisexual | 2.09 (1.80–2.43) | 10.0 (7.9–12.7) | 9.4 (7.4–11.8) | 11.9 (9.3–15.2) | 0.2463 | 0.12 |
| Heterosexual | 1.0 (Ref.) | 5.1 (4.5–5.9) | 5.4 (4.8–6.0) | 6.3 (5.5–7.3) | 0.1629 | 0.02 |
| Bullied at school (past 12 months) | | | | | | |
| Lesbian, gay, or bisexual | 2.10 (1.87–2.37) | 34.2 (29.6–39.0) | 33.0 (27.4–39.0) | 32.0 (29.5–34.6) | −0.0847 | 0.28 |
| Heterosexual | 1.0 (Ref.) | 18.8 (17.3–20.3) | 17.1 (16.1–18.2) | 17.1 (15.7–18.7) | −0.0800 | 0.10 |
| Electronically bullied (past 12 months) | | | | | | |
| Lesbian, gay, or bisexual | 1.94 (1.72–2.20) | 28.0 (24.0–32.3) | 27.1 (23.1–31.4) | 26.6 (23.3–30.2) | −0.0775 | 0.43 |
| Heterosexual | 1.0 (Ref.) | 14.2 (13.1–15.3) | 13.3 (12.4–14.4) | 14.1 (12.9–15.4) | −0.0047 | 0.92 |
| Physical dating violence (past 12 months) | | | | | | |
| Lesbian, gay, or bisexual | 2.06 (1.77–2.40) | 17.5 (14.4–21.2) | 17.2 (14.3–20.5) | 13.1 (10.5–16.1) | −0.2264 | 0.04 |
| Heterosexual | 1.0 (Ref.) | 8.3 (7.5–9.3) | 6.4 (5.8–7.1) | 7.2 (6.2–8.3) | −0.1448 | 0.047 |
| Sexual dating violence (past 12 months) | | | | | | |
| Lesbian, gay, or bisexual | 2.08 (1.69–2.57) | 22.7 (18.0–28.2) | 15.8 (12.3–20.1) | 16.4 (12.7–20.9) | −0.2420 | 0.15 |
| Heterosexual | 1.0 (Ref.) | 9.1 (8.2–10.0) | 5.5 (4.8–6.3) | 6.7 (5.9–7.5) | −0.2785 | <0.001 |
| Forced sexual intercourse (lifetime) | | | | | | |
| Lesbian, gay, or bisexual | 3.31 (2.90–3.77) | 17.8 (14.4–21.8) | 21.9 (19.0–25.0) | 19.4 (16.2–23.1) | 0.0650 | 0.59 |
| Heterosexual | 1.0 (Ref.) | 5.4 (4.6–6.4) | 5.4 (4.7–6.2) | 5.5 (4.9–6.2) | 0.0200 | 0.82 |
| **Suicide risk behaviors** | | | | | | |
| Persistent feelings of sadness or hopelessness (past 12 months) | | | | | | |
| Lesbian, gay, or bisexual | 3.60 (3.22–4.03) | 60.4 (55.1–65.4) | 63.0 (59.5–66.5) | 66.3 (62.2–70.2) | 0.1566 | 0.13 |
| Heterosexual | 1.0 (Ref.) | 26.4 (24.6–28.4) | 27.5 (25.9–29.2) | 32.2 (30.8–33.7) | 0.1949 | 0.00 |
| Seriously considered attempting suicide (past 12 months) | | | | | | |
| Lesbian, gay, or bisexual | 4.51 (4.07–4.99) | 42.8 (38.4–47.3) | 47.7 (43.7–51.8) | 46.8 (43.1–50.6) | 0.0936 | 0.26 |
| Heterosexual | 1.0 (Ref.) | 14.8 (13.7–15.9) | 13.3 (12.5–14.3) | 14.5 (13.4–15.7) | −0.0242 | 0.62 |
| Made a suicide plan (past 12 months) | | | | | | |
| Lesbian, gay, or bisexual | 4.28 (3.84–4.77) | 38.2 (34.0–42.6) | 38.0 (34.5–41.7) | 40.2 (36.6–44.0) | 0.0646 | 0.45 |
| Heterosexual | 1.0 (Ref.) | 11.9 (10.8–13.1) | 10.4 (9.3–11.7) | 12.1 (11.1–13.1) | 0.0031 | 0.96 |
| Attempted suicide (past 12 months) | | | | | | |
| Lesbian, gay, or bisexual | 4.54 (3.89–5.28) | 29.4 (25.7–33.3) | 23.0 (18.6–28.0) | 23.4 (20.0–27.1) | −0.1901 | 0.06 |
| Heterosexual | 1.0 (Ref.) | 6.4 (5.6–7.3) | 5.4 (4.6–6.4) | 6.4 (5.6–7.4) | −0.0148 | 0.85 |
| Suicide attempt requiring medical treatment (past 12 months) | | | | | | |
| Lesbian, gay, or bisexual | 3.78 (3.02–4.73) | 9.4 (7.3–12.1) | 7.5 (5.7–9.8) | 6.3 (4.8–8.3) | −0.2852 | 0.07 |
| Heterosexual | 1.0 (Ref.) | 2.0 (1.5–2.7) | 1.7 (1.4–2.1) | 1.7 (1.4–2.2) | −0.1197 | 0.40 |

**Abbreviations:** aOR = adjusted odds ratio; CI = confidence interval; Ref. = referent group.
* Logistic regression models were used to assess linear trends in the prevalence of violence victimization, and indicators of suicide risk among lesbian, gay, or bisexual students and heterosexual students for 2015–2019, controlling for sex, race/ethnicity, and grade.
[†] Statistical significance is defined as p<0.05 or a 95% CI that does not include 1.0.

reported a decrease in reported suicide risk behaviors among LGB students (*4*). The national trends reported in this analysis warrant continued monitoring over time to assess whether the downward trajectory in local contexts (*4*) reflects the general trajectory of suicide risk and LGB youths nationally.

Results from sex-stratified models highlight important differences between male and female experiences of violence victimization among LGB students. In this sample, male LGB students were more likely to report feeling unsafe at school and being threatened with a weapon; conversely, female LGB students were more likely to report bullying both at school and electronically. This finding is consistent with observational studies of bullying during adolescence; males tend to report more physical forms of bullying and harassment, whereas

females tend to report experiencing more verbal and social bullying (*18*). In addition, female LGB students had a greater prevalence of sexual dating violence and forced sex than male LGB students. This sex difference is also consistent with what is known about dating and sexual violence among LGB youths (*7*) and mirrors national trends in dating and sexual violence, in which females are consistently disproportionately affected by these types of victimization (*19*).

Of concern, the percentage of male LGB students who reported being threatened or injured with a weapon at school and who reported forced sexual intercourse significantly increased over time. Although both male and female LGB students are negatively affected by violence, these percentages highlight an increasing trend in violence among male LGB

**TABLE 3. Trends in violence victimization and suicide risk behaviors among lesbian, gay, and bisexual high school students, by sex and sexual identity — Youth Risk Behavior Survey, United States, 2015–2019***

| Health risk behavior | Main effect<br>aOR (95% CI) | 2015<br>% (95% CI) | 2017<br>% (95% CI) | 2019<br>% (95% CI) | Linear trend<br>Beta | Linear trend<br>p value[†] |
|---|---|---|---|---|---|---|
| **Violence victimization** | | | | | | |
| Feeling unsafe at school (past 30 days) | | | | | | |
|   Gay or bisexual male | 1.61 (1.14–2.28) | 15.5 (9.5–24.4) | 12.3 (7.4–19.6) | 18.3 (12.4–26.1) | 0.1623 | 0.55 |
|   Lesbian or bisexual female | 1.0 (Ref.) | 10.8 (8.6–13.5) | 9.1 (6.9–11.9) | 11.5 (9.5–14.0) | 0.0435 | 0.72 |
| Threatened or injured with a weapon at school (past 12 months) | | | | | | |
|   Gay or bisexual male | 1.54 (1.14–2.08) | 11.6 (7.5–17.5) | 14.6 (9.8–21.2) | 15.9 (11.4–21.8) | 0.3973 | 0.04 |
|   Lesbian or bisexual female | 1.0 (Ref.) | 9.1 (6.6–12.4) | 7.4 (5.6–9.7) | 10.6 (8.1–13.9) | 0.1944 | 0.29 |
| Bullied at school (past 12 months) | | | | | | |
|   Gay or bisexual male | 0.86 (0.69–1.08) | 26.3 (19.4–34.7) | 35.0 (25.4–45.9) | 31.7 (25.7–38.4) | 0.0942 | 0.58 |
|   Lesbian or bisexual female | 1.0 (Ref.) | 37.2 (32.7–42.0) | 32.2 (26.9–38.1) | 32.0 (28.6–35.7) | –0.1550 | 0.09 |
| Electronically bullied (past 12 months) | | | | | | |
|   Gay or bisexual male | 0.71 (0.57–0.89) | 22.4 (16.3–30.1) | 22.3 (16.5–29.4) | 25.5 (18.7–33.8) | 0.0786 | 0.71 |
|   Lesbian or bisexual female | 1.0 (Ref.) | 30.5 (26.0–35.4) | 28.5 (24.4–33.1) | 27.1 (23.7–30.7) | –0.1076 | 0.28 |
| Physical dating violence (past 12 months) | | | | | | |
|   Gay or bisexual male | 1.06 (0.72–1.58) | 19.9 (12.9–29.4) | 16.8 (10.0–27.0) | 15.9 (9.4–25.6) | –0.0798 | 0.78 |
|   Lesbian or bisexual female | 1.0 (Ref.) | 16.9 (13.9–20.4) | 16.9 (13.5–21.0) | 12.1 (9.3–15.6) | –0.2638 | 0.04 |
| Sexual dating violence (past 12 months) | | | | | | |
|   Gay or bisexual male | 0.66 (0.44–0.98) | 20.9 (12.7–32.6) | 13.5 (7.5–23.0) | 10.3 (5.6–18.3) | –0.4638 | 0.20 |
|   Lesbian or bisexual female | 1.0 (Ref.) | 22.6 (18.0–27.9) | 16.3 (12.8–20.6) | 18.2 (13.6–23.8) | –0.2166 | 0.18 |
| Forced sexual intercourse (lifetime) | | | | | | |
|   Gay or bisexual male | 0.51 (0.38–0.68) | 8.0 (4.8–13.1) | 15.6 (10.3–22.9) | 15.6 (10.7–22.0) | 0.4388 | 0.047 |
|   Lesbian or bisexual female | 1.0 (Ref.) | 21.1 (17.0–25.9) | 23.7 (20.6–27.2) | 21.0 (17.3–25.4) | –0.0203 | 0.87 |
| **Suicide risk behaviors** | | | | | | |
| Persistent feelings of sadness or hopelessness (past 12 months) | | | | | | |
|   Gay or bisexual male | 0.39 (0.33–0.47) | 43.9 (35.9–52.3) | 45.5 (38.9–52.2) | 53.5 (46.3–60.4) | 0.2667 | 0.12 |
|   Lesbian or bisexual female | 1.0 (Ref.) | 66.5 (61.4–71.2) | 68.8 (65.1–72.2) | 70.5 (66.6–74.2) | 0.1167 | 0.25 |
| Seriously considered attempting suicide (past 12 months) | | | | | | |
|   Gay or bisexual male | 0.59 (0.47–0.73) | 32.7 (23.6–43.3) | 37.0 (31.5–42.8) | 40.4 (33.9–47.2) | 0.1960 | 0.30 |
|   Lesbian or bisexual female | 1.0 (Ref.) | 46.6 (42.1–51.1) | 51.0 (46.1–55.9) | 49.0 (44.8–53.3) | 0.0553 | 0.55 |
| Made a suicide plan (past 12 months) | | | | | | |
|   Gay or bisexual male | 0.57 (0.46–0.71) | 27.0 (20.3–34.9) | 28.7 (22.8–35.5) | 33.0 (26.4–40.3) | 0.2350 | 0.21 |
|   Lesbian or bisexual female | 1.0 (Ref.) | 42.0 (37.1–47.2) | 40.8 (36.8–45.0) | 42.4 (38.4–46.4) | 0.0130 | 0.89 |
| Attempted suicide (past 12 months) | | | | | | |
|   Gay or bisexual male | 0.73 (0.55–0.96) | 19.4 (13.6–27.0) | 18.3 (11.5–27.9) | 23.8 (17.8–31.1) | 0.1626 | 0.45 |
|   Lesbian or bisexual female | 1.0 (Ref.) | 32.8 (28.1–37.9) | 23.7 (19.4–28.5) | 23.6 (20.0–27.6) | –0.2929 | 0.01 |
| Suicide attempt requiring medical treatment (past 12 months) | | | | | | |
|   Gay or bisexual male | 0.63 (0.42–0.97) | 7.0 (3.6–13.1) | 3.8 (1.9–7.3) | 5.9 (3.2–10.6) | –0.2535 | 0.53 |
|   Lesbian or bisexual female | 1.0 (Ref.) | 10.3 (7.8–13.4) | 8.2 (6.2–10.7) | 6.6 (5.0–8.7) | –0.2977 | 0.05 |

**Abbreviations:** aOR = adjusted odds ratio; CI = confidence interval; Ref. = referent group.
* Logistic regression models were used to assess linear trends in the prevalence of violence victimization and indicators of suicide risk among lesbian, gay, and bisexual high school students, by sex and self-identified sexual identity for 2015–2019, controlling for race/ethnicity and grade.
[†] Statistical significance is defined as p<0.05 or a 95% CI that does not include 1.0.

students. Among adults, gay men are at greater risk for physical violence than lesbians (20), and the increasing prevalence in these types of violence among male LGB students might suggest an increasing disparity between sexual minority men and women in violence victimization. Continued monitoring of this trend is needed, in both adolescent and adult populations. Female LGB students reported fewer experiences of physical dating violence over time, whereas male LGB students' reports of experiencing physical dating violence remained stable. This pattern might indicate that the overall reduction in physical dating violence in the population is not occurring among sexual minority males, which might be supported by the data regarding being threatened or injured with a weapon and experiencing forced sex. An assessment of the ways that violence in schools and in dating relationships affects sexual minority males is warranted, both through research to understand underlying mechanisms and in practice to ensure violence prevention programming is directly addressing the needs of sexual minority males.

Despite a trend of decreasing suicide attempts among LGB females during 2015–2019, LGB females consistently reported more suicide risk behaviors than LGB males. This pattern echoes larger population trends in which both adult and youth females report more suicidal ideation than adult and youth males (21). Notably, this same literature finds that males experience more deaths by suicide (i.e., completed suicide attempts) than females (21); thus, an important remaining question for LGB youths is whether these sex-specific patterns

**TABLE 4. Trends in violence victimization and suicide risk behaviors among lesbian, gay, and bisexual high school students, by race/ethnicity — Youth Risk Behavior Survey, United States, 2015–2019***

| Health risk behavior | Main effect | 2015 | 2017 | 2019 | Linear trend | |
|---|---|---|---|---|---|---|
| | aOR (95% CI) | % (95% CI) | % (95% CI) | % (95% CI) | Beta | p value[†] |
| **Violence victimization** | | | | | | |
| Feeling unsafe at school (past 30 days) | | | | | | |
| Black, non-Hispanic | 1.63 (1.13–2.35) | 17.8 (11.4–26.6) | 12.5 (7.4–20.4) | 15.2 (8.3–26.2) | −0.0269 | 0.93 |
| Hispanic | 1.46 (1.07–1.99) | 15.6 (11.5–21.0) | 12.4 (8.4–18.0) | 13.7 (9.5–19.5) | −0.0688 | 0.75 |
| White, non-Hispanic | 1.0 (Ref.) | 9.0 (6.7–12.0) | 8.6 (6.4–11.6) | 11.1 (8.0–15.1) | 0.1309 | 0.41 |
| Threatened or injured with a weapon at school (past 12 months) | | | | | | |
| Black, non-Hispanic | 1.60 (1.07–2.41) | 15.6 (8.0–28.1) | 15.7 (11.7–20.7) | 12.9 (7.2–22.0) | −0.0494 | 0.89 |
| Hispanic | 0.89 (0.63–1.27) | 9.0 (5.5–14.3) | 9.4 (6.7–13.0) | 7.7 (4.9–11.8) | −0.1270 | 0.61 |
| White, non-Hispanic | 1.0 (Ref.) | 8.2 (5.5–12.0) | 7.1 (4.9–10.1) | 12.9 (8.6–18.9) | 0.4292 | 0.09 |
| Bullied at school (past 12 months) | | | | | | |
| Black, non-Hispanic | 0.31 (0.22–0.44) | 21.4 (12.2–34.7) | 17.2 (10.6–26.9) | 18.2 (12.2–26.2) | −0.0651 | 0.82 |
| Hispanic | 0.56 (0.45–0.70) | 31.2 (25.1–38.0) | 26.6 (21.0–33.1) | 27.6 (23.2–32.5) | −0.1077 | 0.44 |
| White, non-Hispanic | 1.0 (Ref.) | 42.2 (34.8–50.0) | 40.8 (32.8–49.3) | 37.6 (33.6–41.7) | −0.1265 | 0.31 |
| Electronically bullied (past 12 months) | | | | | | |
| Black, non-Hispanic | 0.41 (0.31–0.54) | 17.0 (12.6–22.6) | 16.3 (12.1–21.5) | 20.5 (12.5–31.6) | 0.1336 | 0.61 |
| Hispanic | 0.55 (0.42–0.71) | 24.8 (17.8–33.4) | 17.7 (13.3–23.2) | 25.4 (20.1–31.5) | 0.0619 | 0.75 |
| White, non-Hispanic | 1.0 (Ref.) | 36.0 (29.1–43.5) | 36.0 (30.1–42.4) | 28.2 (22.8–34.1) | −0.2484 | 0.09 |
| Physical dating violence (past 12 months) | | | | | | |
| Black, non-Hispanic | 1.19 (0.81–1.75) | 14.2 (8.8–22.2) | 23.8 (15.5–34.7) | 11.6 (7.0–18.6) | −0.1425 | 0.53 |
| Hispanic | 1.13 (0.83–1.54) | 22.6 (16.3–30.4) | 19.1 (14.2–25.2) | 9.8 (5.8–16.2) | −0.7080 | 0.003 |
| White, non-Hispanic | 1.0 (Ref.) | 15.3 (11.9–19.5) | 14.1 (10.4–18.7) | 13.8 (10.6–17.6) | −0.0883 | 0.55 |
| Sexual dating violence (past 12 months) | | | | | | |
| Black, non-Hispanic | 0.44 (0.27–0.72) | 20.4 (11.5–33.7) | 6.4 (3.3–12.0) | 10.3 (5.5–18.7) | −0.7987 | 0.11 |
| Hispanic | 0.97 (0.68–1.39) | 23.0 (14.8–34.1) | 18.6 (11.4–29.0) | 18.3 (11.3–28.2) | −0.2334 | 0.41 |
| White, non-Hispanic | 1.0 (Ref.) | 22.3 (16.8–29.1) | 18.2 (13.7–23.8) | 16.7 (11.8–23.1) | −0.2426 | 0.21 |
| Forced sexual intercourse (lifetime) | | | | | | |
| Black, non-Hispanic | 0.92 (0.66–1.29) | 16.0 (8.3–28.7) | 23.9 (17.7–31.6) | 15.4 (9.8–23.4) | 0.0759 | 0.77 |
| Hispanic | 1.10 (0.85–1.43) | 24.0 (18.7–30.3) | 21.8 (17.6–26.8) | 19.1 (13.3–26.7) | −0.2740 | 0.17 |
| White, non-Hispanic | 1.0 (Ref.) | 15.5 (11.5–20.6) | 21.0 (16.8–26.1) | 21.3 (16.6–26.9) | 0.2531 | 0.12 |
| **Suicide risk behaviors** | | | | | | |
| Persistent feelings of sadness or hopelessness (past 12 months) | | | | | | |
| Black, non-Hispanic | 0.42 (0.33–0.55) | 44.8 (35.2–54.7) | 52.1 (42.6–61.4) | 51.1 (44.6–57.5) | 0.1107 | 0.56 |
| Hispanic | 0.69 (0.54–0.89) | 58.2 (50.6–65.5) | 61.2 (52.9–69.0) | 64.1 (56.0–71.4) | 0.1766 | 0.30 |
| White, non-Hispanic | 1.0 (Ref.) | 67.4 (60.3–73.8) | 66.3 (60.9–71.3) | 71.6 (65.7–76.8) | 0.1679 | 0.24 |
| Seriously considered attempting suicide (past 12 months) | | | | | | |
| Black, non-Hispanic | 0.43 (0.34–0.55) | 34.4 (25.7–44.3) | 28.4 (21.3–36.7) | 35.1 (29.2–41.4) | −0.0389 | 0.85 |
| Hispanic | 0.65 (0.54–0.79) | 40.7 (34.7–46.9) | 45.3 (38.7–52.0) | 39.2 (33.2–45.6) | −0.0625 | 0.63 |
| White, non-Hispanic | 1.0 (Ref.) | 48.9 (42.2–55.7) | 54.1 (50.4–57.6) | 52.4 (47.1–57.7) | 0.0959 | 0.44 |
| Made a suicide plan (past 12 months) | | | | | | |
| Black, non-Hispanic | 0.61 (0.46–0.82) | 32.9 (23.6–43.7) | 24.1 (16.8–33.2) | 36.0 (28.8–43.9) | 0.0564 | 0.81 |
| Hispanic | 0.86 (0.69–1.06) | 37.9 (31.3–45.0) | 35.5 (29.5–42.0) | 40.0 (32.8–47.7) | 0.0765 | 0.62 |
| White, non-Hispanic | 1.0 (Ref.) | 40.1 (34.5–46.0) | 42.8 (37.7–48.0) | 40.3 (35.8–45.0) | 0.0044 | 0.97 |
| Attempted suicide (past 12 months) | | | | | | |
| Black, non-Hispanic | 0.97 (0.70–1.34) | 29.2 (23.1–36.1) | 20.7 (12.5–32.3) | 27.2 (18.0–38.8) | 0.0293 | 0.91 |
| Hispanic | 1.06 (0.83–1.37) | 31.4 (26.4–36.9) | 24.6 (18.3–32.2) | 23.2 (17.3–30.4) | −0.2610 | 0.12 |
| White, non-Hispanic | 1.0 (Ref.) | 28.6 (23.1–34.7) | 21.8 (16.4–28.4) | 22.3 (18.1–27.3) | −0.2078 | 0.13 |
| Suicide attempt requiring medical treatment (past 12 months) | | | | | | |
| Black, non-Hispanic | 0.83 (0.50–1.40) | 5.9 (3.2–10.7) | 6.4 (3.1–12.9) | 7.3 (3.0–16.6) | 0.2889 | 0.50 |
| Hispanic | 1.20 (0.83–1.75) | 13.3 (9.2–19.0) | 8.7 (5.2–14.3) | 6.8 (4.3–10.5) | −0.4683 | 0.05 |
| White, non-Hispanic | 1.0 (Ref.) | 9.3 (6.4–13.2) | 7.5 (5.2–10.8) | 5.6 (3.5–8.7) | −0.3545 | 0.11 |

**Abbreviations:** aOR = adjusted odds ratio; CI = confidence interval; Ref. = referent group.
* Logistic regression models were used to assess linear trends in the prevalence of violence victimization and indicators of suicide risk among lesbian, gay, and bisexual high school students, by race/ethnicity for 2015–2019, controlling for sex and grade.
[†] Statistical significance is defined as p<0.05 or a 95% CI that does not include 1.0.

in deaths by suicide hold in this group; however, reliable data regarding sexual orientation and rates of death by suicide are unavailable. Such data could aid in further illuminating how LGB youths are affected by suicide risk behaviors and guide interventions for addressing this public health concern.

In models stratified by race/ethnicity, black and Hispanic LGB students were more likely to feel unsafe and were more likely to be threatened or injured with a weapon than white LGB students. This finding might highlight black and Hispanic LGB students being at greater risk for the forms of victimization

that directly compromise physical safety (*18*). Conversely, white LGB students were more likely to report school and electronic bullying, indicating they might be at greater risk for verbal and social victimization. Although the types of racial/ethnic disparities in violence victimization presented in this report do not mirror those reported in previous studies (*9*,*10*), these findings underscore that differences by race/ethnicity among sexual minority youths exist. Schools seeking to address victimization through policies and practices designed to address safety concerns for LGB students can benefit from acknowledging differences in the experiences of LGB youths across races/ethnicities and ensuring all youths are served through these intervention strategies.

Regarding suicide risk, although a significantly lower percentage of black and Hispanic LGB youths reported feeling sad and hopeless or considering suicide than white LGB youths, no differences existed among races/ethnicities in suicide attempts or medically serious suicide attempts. These findings are similar to those from other studies highlighting that all LGB youths are at increased risk for suicide, regardless of race/ethnicity (*10*) and might again highlight the mental health impact of minority stress among all racial/ethnic groups (*12*).

## Limitations

General limitations for the YRBS are available in the overview report of this supplement (*11*). The findings in this report are subject to at least five additional limitations. First, although three cycles of national data to examine trends among LGB youths are available, the brief 2015–2019 period might be inadequate to assess trends. Continued monitoring of these indicators over time to detect progress regarding disparities experienced by LGB high school students is needed. Second, the overall proportion of students identifying as LGB was small: 2015, 8.3% (n = 1,246); 2017, 10.9% (n = 1,494); and 2019, 11.7% (n = 1,531). Therefore, these analyses might be underpowered for detecting statistical differences in trends in models stratified by sex and race/ethnicity. As more data are collected from LGB youths in future cycles of the national YRBS, pooling data across cycles to improve statistical power will be essential for increasing the likelihood of detecting trends in stratified models. Third, this report does not include differences in violence victimization and suicide risk for students who identified their sexual identity as "not sure" or across sexual behavior categories; future studies might benefit from assessing these youths to further understand the experiences of sexual minority students, violence victimization, and suicide risk. Fourth, by pooling 2015–2019 data, the aOR for the difference between groups on all outcomes might mask heterogeneity over time within each subpopulation (e.g., the size of the difference between LGB and heterosexual students might vary between years); however, a disparity between LGB and heterosexual students on these outcomes has been observed since sexual identity data began to be collected on the national YRBS in 2015. Finally, three survey measures had relatively large amounts of missing data in 2019: forced sex (approximately 2,400 observations), sexual dating violence (approximately 3,400 observations), and attempted suicide with injury (approximately 4,900 observations). Most of these missing data can be attributed to some selected schools administering YRBS questionnaire versions that did not include these questions. Consequently, not all students in the national sample were given the opportunity to answer these questions and were counted as missing.

## Conclusion

These findings highlight the continued need for policies and practices within school environments that reduce victimization and bolster the mental health of LGB students. Substantial evidence exists for the role of antiharassment policies, gay-straight alliances (or other student-led clubs designed to support sexual minority students), and programs aimed at improving staff support of LGB students in improving school environments for these students (*22*). In addition to in-school programs and policies, schools might consider engagement with community organizations and stakeholders to collaborate on implementation of comprehensive violence and suicide prevention strategies that address a range of risk and protective factors at the individual, relationship, community, and societal levels. Comprehensive packages designed to inform these prevention efforts are available from CDC (https://www.cdc.gov/violenceprevention/pub/technical-packages.html). For example, comprehensive approaches to suicide reduction help to prevent suicide risk, support persons at increased risk, prevent reattempts, and help survivors of suicide loss. When refining such practices to meet the needs of LGB students, special consideration of the impact of physical violence on LGB males, suicide risk among LGB females, and the interactions between race/ethnicity and these outcomes is warranted. Furthermore, continued monitoring of these disparities between LGB and heterosexual students over time is needed until these disparities can be eradicated.

### Conflicts of Interest

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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# Interpersonal Violence Victimization Among High School Students — Youth Risk Behavior Survey, United States, 2019

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## Abstract

Adolescent interpersonal violence victimization is an adverse childhood experience and a serious public health problem for youths, their families, and communities. Violence victimization includes dating violence, sexual violence, and bullying. Youth Risk Behavior Survey data for 2019 were used to examine physical and sexual dating violence; sexual violence by anyone; and bullying victimization, whether on school property or electronic, of U.S. high school students by sex, race/ethnicity, and sexual identity. In addition, this report explores frequency of dating violence and frequency of sexual violence among students who reported these forms of victimization and presents composites of dating violence and bullying. Findings reveal that 8.2% of students reported physical dating violence; 8.2% reported sexual dating violence; 10.8% reported sexual violence by anyone, of which 50% of cases were by a perpetrator other than a dating partner; 19.5% reported bullying on school property; and 15.7% reported electronic bullying victimization during the previous 12 months. Approximately one in eight students reported any dating violence, and one in four reported any bullying victimization. Female students; lesbian, gay, and bisexual students; and students not sure of their sexual identity reported the highest prevalence estimates across all five violence victimization types, any and both forms of dating violence, and any bullying victimization. Non-Hispanic white students reported the highest prevalence of bullying victimization. Among students experiencing physical or sexual dating violence or sexual violence by anyone, the most common frequency reported was one time during the previous year; higher frequency was more prevalent among male students compared with female students. These findings provide a contextual understanding of the prevalence of interpersonal violence of U.S. high school students, highlighting those with highest prevalence. Findings can be used by public health professionals to guide prevention efforts with youths in schools and communities.

## Introduction

Interpersonal violence, or aggression perpetrated by another person, including dating violence, sexual violence, and bullying, is a serious problem for students, schools, and communities. Violence can reoccur across the lifespan and is associated with multiple health effects and negative health behaviors (e.g., risky sexual behaviors, substance misuse, and physical health symptoms) (*1*). Victimization often begins during adolescence and can be viewed as an adverse childhood experience (ACE). For example, nationally representative data from adults during 2015 indicate that 43.2% of females and 51.3% of males who had been raped were first raped before age 18 years (*2*). Prevalence studies of adolescents confirm this finding. For example, a survey of students in grades 7–12 found that 56% of females and 48% of males reported some form of sexual violence victimization by a peer (e.g., unwelcome comments, touching, or being forced to do something sexual) during the 2010–11 school year (*3*). Approximately 20% of adolescents reported physical dating violence and 9% reported sexual dating violence (*4*). These studies indicate that sexual violence during adolescence occurs inside and outside of the dating context. In addition, 20% of students in grades 6–12 reported bullying victimization during the 2017 school year (*5*).

Scientific literature indicates that certain groups (e.g., females, racial/ethnic minorities, and sexual minority youths) disproportionately experience interpersonal violence during adolescence (*1*). For instance, in a sample of northeastern 10th-grade students, sexual minority youths reported more bullying, sexual violence, and dating violence victimization than heterosexual youths, with sexual minority females reporting particularly high levels (91% of sexual minority females and 79% of sexual minority males reported at least

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one form of victimization) (6). Furthermore, in a study of sexual violence victimization of college students, females had higher odds of victimization than did males, and non-Hispanic black (black) students and students of other races/ethnicities had higher odds of victimization than did non-Hispanic white (white) students; moreover, these racial differences were greater for males. For females, Hispanics had lower odds of sexual violence victimization than whites, and for males, no substantial differences existed between Hispanics and whites (7). Understanding these disparities in the experience of violence victimization is crucial for identifying those at highest risk and for guiding prevention efforts. Contextual factors also are valuable in describing victimization (e.g., frequency of victimization or co-occurrences of violence subtypes). These factors increase understanding of these violence types and further contextualize prevalence estimates. For example, in a report using 2013 data, approximately 21% of female and 10% of male high school students who reported dating in the previous year experienced sexual or physical dating violence, and 6% of females and 3% of males experienced both physical and sexual dating violence (8).

This report presents 2019 prevalence estimates for dating violence, sexual violence, and bullying victimization of U.S. high school students by sex, race/ethnicity, and sexual identity, and includes frequency of dating violence and sexual violence victimization by demographic characteristics. Combined prevalence of different forms of dating violence and bullying also is presented to provide the most current estimates of each violence type. These findings can guide prevention efforts in addressing adolescent interpersonal violence at different levels of the social ecology (i.e., individual, relationship, and community or societal levels).

# Methods

## Data Source

This report includes data from CDC's 2019 Youth Risk Behavior Survey (YRBS), a cross-sectional, school-based survey conducted biennially since 1991. Each survey year, CDC collects data from a nationally representative sample of public and private school students in grades 9–12 in the 50 U.S. states and the District of Columbia (N = 13,677). Additional information about YRBS sampling, data collection, response rates, and processing is available in the overview report of this supplement (9). The prevalence estimates for all violence questions for the overall study population and by sex, race/ethnicity, grade, and sexual orientation are available at https://nccd.cdc.gov/youthonline/App/Default.aspx. The full YRBS questionnaire is available at https://www.cdc.gov/healthyyouth/data/yrbs/pdf/2019/2019_YRBS-National-HS-Questionnaire.pdf.

## Measures

This analysis included five standard measures of violence victimization and three composite variables created from those standard measures. The standard measures included 1) having experienced physical dating violence, 2) having experienced sexual dating violence, 3) having experienced sexual violence by anyone, 4) having been bullied on school property, and 5) having been bullied electronically (Table 1). For each of these five standard measures, dichotomous categories were created: ≥1 time versus 0 times for all sexual violence and dating violence measures and "yes" versus "no" for both bullying

TABLE 1. Violence victimization measures — Youth Risk Behavior Survey, United States, 2019

| Violence victimization | Questionnaire item | Coding for analysis |
|---|---|---|
| Physical dating violence victimization | "During the past 12 months, how many times did **someone you were dating or going out with** physically hurt you on purpose? (Count such things as being hit, slammed into something, or injured with an object or weapon.)" [Question excludes students who did not date or go out with anyone during the previous 12 months.] | ≥1 time versus 0 times; 1 time, 2 or 3 times, ≥4 times |
| Sexual dating violence victimization* | "During the past 12 months, how many times did **someone you were dating or going out with** force you to do sexual things that you did not want to do? (Count such things as kissing, touching, or being physically forced to have sexual intercourse.)" [Question excludes students who did not date or go out with anyone during the previous 12 months.] | ≥1 time versus 0 times; 1 time, 2 or 3 times, ≥4 times |
| Sexual violence victimization by anyone[†] | "During the past 12 months, how many times did **anyone** force you to do sexual things that you did not want to do? (Count such things as kissing, touching, or being physically forced to have sexual intercourse.)" | ≥1 time versus 0 times; 1 time, 2 or 3 times, ≥4 times |
| Bullied on school property | "During the past 12 months, have you ever been bullied on school property?" | Yes versus no |
| Electronically bullied | "During the past 12 months, have you ever been electronically bullied?" | Yes versus no |

**Abbreviation:** YRBS = Youth Risk Behavior Survey.
* A total of 3,324 students had missing data for this variable, mostly attributed to the use of different versions of the YRBS questionnaire that did not include the sexual violence questions in certain selected schools.
[†] A total of 3,439 students had data missing for this variable, mostly attributed to the use of different versions of the YRBS questionnaire that did not include the sexual violence questions in certain selected schools.

victimization measures. The manner in which the data were collected (see Limitations) means that approximately 25% of respondents were missing data for sexual violence victimization by anyone (3,439) out of a sample of 13,677 students. The denominators for dating violence victimization measures are students who reported dating during the 12 months before the survey (66.1% [n = 8,703 students] for physical dating violence victimization and 66.2% [n = 6,847 students] for sexual dating violence victimization), whereas the denominator for the sexual violence by anyone and bullying victimization measures are the full sample of students for which data were available. Three of these standard measures included levels of victimization frequency. For each of three measures (i.e., physical dating violence, sexual dating violence, and sexual violence by anyone), frequencies were collapsed into three levels: 1 time, 2 or 3 times, or ≥4 times.

The two dating violence victimization measures were combined into composite measures: experienced any dating violence victimization and experienced both physical and sexual dating violence victimization. Because of the manner in which the data were collected, approximately 25% of respondents were missing data for sexual dating violence victimization (3,324 observations out of a sample of 13,677 students). When calculating the "any dating violence victimization" measure, responses missing data for either the sexual or the physical dating violence measure were removed from the analysis. Any "yes" responses to either the physical dating violence measure or the sexual dating violence measure were combined for the numerator, with all responses without missing data as the denominator. Similarly, to create the "both physical and sexual dating violence" measure, "yes" responses to both physical dating violence and sexual dating violence were required for the numerator, with all nonmissing responses in the denominator. A similar strategy was also used for creating a bullying victimization "any" measure. "Any bullying victimization" included any "yes" response to either experiencing bullying at school or experiencing electronic bullying, with all nonmissing responses in the denominator. The option of exploring "both bullying at school and electronic bullying" was not pursued. Use of personal electronic devices in the school setting is increasing; therefore, the amount of overlap between electronic bullying and bullying at school might be considerable and combining these items could result in an overestimate of their prevalence. Additional analysis examined overlap between the sexual dating violence measure and the sexual violence by anyone measure.

Three demographic characteristics were included in the analyses: student sex (male or female), race/ethnicity (white, black, Hispanic, or other), and sexual identity (heterosexual; lesbian, gay, or bisexual [LGB]; or not sure). Although students of multiple or other race/ethnicity are included in these analyses, data are not presented for this group because small sample sizes and unknown heterogeneity within this group resulted in limited interpretability.

## Analysis

Weighted prevalence estimates and corresponding 95% confidence intervals were determined for all violence victimization measures. Comparisons by demographic characteristics were conducted with the chi-square test (p<0.05). When differences among groups were demonstrated, additional *t*-tests were performed to determine pairwise differences between groups. Differences between prevalence estimates were considered statistically significant if the *t*-test p value was <0.05 for main effects (sex, race/ethnicity, or sexual identity).

## Results

Among the approximately two thirds of U.S. high school students who reported dating during the 12 months before the survey, 8.2% reported experiencing physical dating violence, and 8.2% experienced sexual dating violence (Table 2). Sexual violence victimization perpetrated by anyone during the 12 months before the survey was reported by 10.8% of students. When comparing the sexual dating violence measure with the sexual violence by anyone measure, half (50%) of the 10.8% of students who reported sexual violence by anyone were victimized only by someone other than a dating partner. Experiences of bullying victimization during the 12 months before the survey varied, with 15.7% of students reporting experiencing electronic bullying and 19.5% reporting bullying on school property. For all violence victimization measures, the prevalence varied by both sex and sexual identity, and variation by race/ethnicity was only observed for bullying victimization. Specifically, female students, LGB students, and students not sure of their sexual identity consistently had the highest prevalence across all five of the violence victimization indicators. In addition, compared with Hispanic or black students, white students had the highest prevalence of experiencing bullying victimization at school and electronic bullying. The prevalence of electronic bullying among Hispanic students was also significantly greater than the prevalence among black students.

Among students who experienced physical dating violence, sexual dating violence, or sexual violence by anyone during the previous year, the most common frequency reported was 1 time for each (Figure). The pattern of frequency for violence victimization differed by type of victimization. The distribution of frequency for physical dating violence victimization was U-shaped, with

**TABLE 2. Percentage of high school students who experienced violence victimization,* by demographic characteristics and type of violence — Youth Risk Behavior Survey, United States, 2019**

| Characteristic | Experienced physical dating violence[†] | | Experienced sexual dating violence[§] | | Experienced sexual violence by anyone[¶] | |
|---|---|---|---|---|---|---|
| | % (95% CI) | p value** | % (95% CI) | p value** | % (95% CI) | p value** |
| **Total** | **8.2 (7.2–9.4)** | **NA** | **8.2 (7.4–9.1)** | **NA** | **10.8 (9.9–11.7)** | **NA** |
| **Sex** | | | | | | |
| Female | 9.3 (8.0–10.8) | 0.01 | 12.6 (11.2–14.2) | <0.01 | 16.6 (15.1–18.2) | <0.01 |
| Male | 7.0[††] (5.8–8.4) | NA | 3.8[††] (3.1–4.7) | NA | 5.2[††] (4.4–6.1) | NA |
| **Race/Ethnicity** | | | | | | |
| White, non-Hispanic | 7.5 (6.4–8.7) | 0.43 | 8.1 (6.9–9.6) | 0.11 | 10.2 (9.1–11.4) | 0.23 |
| Black, non-Hispanic | 8.2 (6.1–10.8) | NA | 6.2 (4.5–8.6) | NA | 10.3 (8.0–13.1) | NA |
| Hispanic | 8.9 (7.4–10.8) | NA | 8.7 (6.9–10.8) | NA | 12.2 (10.6–14.0) | NA |
| **Sexual identity** | | | | | | |
| Heterosexual | 7.2 (6.2–8.3) | 0.01 | 6.7 (5.9–7.5) | <0.01 | 9.0 (8.2–9.9) | <0.01 |
| Lesbian, gay, or bisexual | 13.1[§§] (10.5–16.1) | NA | 16.4[§§] (12.7–20.9) | NA | 21.5[§§] (18.2–25.2) | NA |
| Not sure | 16.9[§§] (11.1–24.9) | NA | 15.0[§§] (9.5–23.0) | NA | 16.2[§§] (11.7–22.0) | NA |
| **Characteristic** | **Bullied on school property** | | **Electronically bullied** | | — | — |
| **Total** | **19.5 (18.2–20.9)** | **NA** | **15.7 (14.6–16.9)** | **NA** | — | — |
| **Sex** | | | | | | |
| Female | 23.6 (21.8–25.5) | <0.01 | 20.4 (18.9–22.0) | <0.01 | — | — |
| Male | 15.4[§§] (14.0–16.9) | NA | 10.9[††] (9.6–12.4) | NA | — | — |
| **Race/Ethnicity** | | | | | | |
| White, non-Hispanic | 23.1 (21.4–24.8) | <0.01 | 18.6 (17.1–20.2) | <0.01 | — | — |
| Black, non-Hispanic | 15.1[¶¶] (13.1–17.4) | NA | 8.6[¶¶] (7.4–10.0) | NA | — | — |
| Hispanic | 14.8[¶¶] (12.8–17.1) | NA | 12.7[¶¶,***] (11.1–14.5) | NA | — | — |
| **Sexual identity** | | | | | | |
| Heterosexual | 17.1 (15.7–18.7) | <0.01 | 14.1 (12.9–15.4) | <0.01 | — | — |
| Lesbian, gay, or bisexual | 32.0[§§] (29.5–34.6) | NA | 26.6[§§] (23.3–30.2) | NA | — | — |
| Not sure | 26.9[§§] (22.2–32.2) | NA | 19.4[§§,†††] (15.5–24.0) | NA | — | — |

**Abbreviations:** CI = confidence interval; NA = not applicable; YRBS = Youth Risk Behavior Survey.

 * During the 12 months before the survey.
 [†] Being physically hurt on purpose (counting such things as being hit, slammed into something, or injured with an object or weapon) by someone they were dating or going out with, ≥1 time, among the 66.1% (n = 8,703) of students nationwide who dated or went out with someone during the 12 months before the survey.
 [§] Being forced to do "sexual things" (counting such things as kissing, touching, or being physically forced to have sexual intercourse) they did not want to do by someone they were dating or going out with, ≥1 time, among the 66.2% (n = 6,847) of students nationwide who dated or went out with someone during the 12 months before the survey. Of 13,677 students, this variable was missing for 3,324, mostly attributed to the use of different versions of the YRBS questionnaire that did not include the sexual violence questions in certain selected schools. This resulted in complete data for 10,353 students, of which 66.2% (6,847) reported dating in the 12 months before the survey.
 [¶] Being forced to do "sexual things" (counting such things as kissing, touching, or being physically forced to have sexual intercourse) they did not want to do by anyone, ≥1 time, during the 12 months before the survey. Data were missing for 3,439 students for this variable, mostly attributed to the use of different versions of the YRBS questionnaire that did not include the sexual violence questions in certain selected schools.
 ** Chi-square test (p<0.05).
 [††] Significantly different from female students, based on t-test (p<0.05).
 [§§] Significantly different from heterosexual students, based on t-test (p<0.05).
 [¶¶] Significantly different from white students, based on t-test (p<0.05).
 *** Significantly different from black students, based on t-test (p<0.05).
 [†††] Significantly different from lesbian, gay, or bisexual students, based on t-test (p<0.05).

the highest levels of frequency at 1 time and ≥4 times, whereas for both sexual dating violence victimization and sexual violence victimization by anyone, the most common frequency was 1 time, with a decreasing prevalence as the frequency increased.

The frequency of physical and sexual dating violence varied significantly by sex (Table 3). Specifically, the prevalence of physical dating violence was significantly greater at higher frequency levels (≥4 times) among male students compared with female students (41.6% versus 21.6%, respectively). This frequency distribution pattern was similar for sexual dating violence. The prevalence at the higher end of frequency for sexual dating violence was significantly greater for male
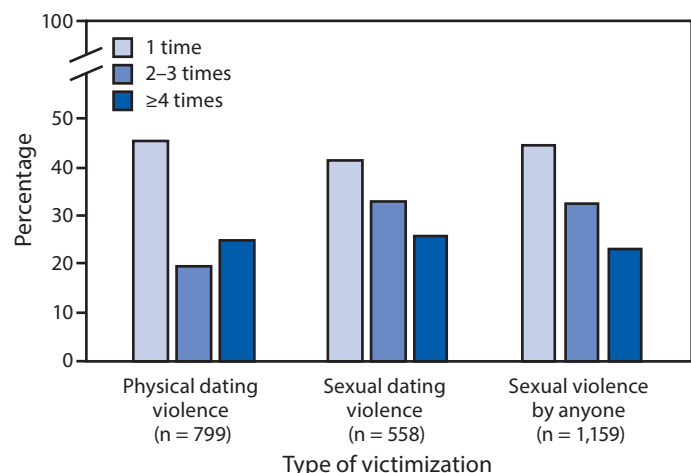
students compared with female students (41.0% versus 20.8%, respectively). Higher frequency (≥4 times) was also reported for sexual violence by anyone for male students compared with female students (33.9% versus 18.6%, respectively). No significant differences existed by race/ethnicity in frequency of physical and sexual dating violence or sexual violence by anyone. These analyses could not include sexual identity because of limited data (i.e., group counts <30).

Overall, 12.2% of students experienced any type of dating violence victimization, and 3.0% experienced both types (Table 4). Both dating violence composite measures varied substantially by sex and sexual identity but not by race/ethnicity.

The prevalence of the dating violence composite variables was significantly greater for female students compared with male students (16.4% versus 8.2% for any dating violence type; 3.8% versus 2.1% for both dating violence types). Students who did not identify as heterosexual had substantially greater prevalence of both dating violence composites. For any type of

dating violence, the prevalence was 22.3% for LGB students and 18.7% for students who were not sure of their sexual identity versus 10.5% for heterosexual students. For both types of dating violence, the prevalence was 5.8% for LGB students and 9.4% for students not sure of their sexual identity versus 2.4% for heterosexual students.

The prevalence of experiencing any type of bullying victimization was 24.8% (Table 4), and prevalence varied significantly by sex, race/ethnicity, and sexual identity. The prevalence of experiencing any bullying victimization was significantly greater for female students compared with male students (30.2% versus 19.2%, respectively) and significantly greater for white (28.8%) compared with black (18.0%) or Hispanic (19.2%) students. Both LGB students (39.5%) and students not sure of their sexual identity (32.7%) had significantly higher prevalence of any bullying compared with heterosexual students (22.2%), with LGB students reporting greater prevalence than students not sure of their sexual identity.

## Discussion

This report describes the 2019 prevalence and frequency of different forms of interpersonal violence victimization experienced by U.S. high school students. Similar to

**FIGURE. Percentage of high school students who experienced violence, by type of victimization (physical dating violence, sexual dating violence, or sexual violence by anyone) and by number of times during the previous year — Youth Risk Behavior Survey, United States, 2019**



**TABLE 3. Frequency of types of violence victimization,* by demographic characteristics among high school students reporting experiencing specific types of violence — Youth Risk Behavior Survey, United States, 2019**

| | Sex | | | Race/Ethnicity | | | |
|---|---|---|---|---|---|---|---|
| Type of violence victimization | Male % (95% CI) | Female % (95% CI) | p value[†] | White, non-Hispanic % (95% CI) | Black, non-Hispanic % (95% CI) | Hispanic % (95% CI) | p value[†] |
| Experienced physical dating violence[§] | NA | NA | <0.01 | NA | NA | NA | 0.21 |
| 1 time | 38.0 (32.2–44.2) | 51.7 (44.2–59.2) | NA | 47.9 (39.7–56.2) | 47.5 (37.6–57.7) | 40.9 (31.3–51.3) | NA |
| 2 or 3 times | 20.4 (14.2–28.4) | 26.7 (21.6–32.5) | NA | 25.5 (18.7–33.8) | 16.7 (10.3–25.9) | 27.0 (19.5–36.0) | NA |
| ≥4 times | 41.6 (34.6–48.9) | 21.6 (16.9–27.1) | NA | 26.6 (20.1–34.3) | 35.8 (25.0–48.2) | 32.1 (24.9–40.3) | NA |
| Experienced sexual dating violence[¶] | NA | NA | 0.05 | NA | NA | NA | 0.39 |
| 1 time | 33.3 (23.8–44.4) | 44.0 (36.5–51.8) | NA | 42.2 (33.7–51.2) | 29.0 (15.5–47.6) | 45.0 (33.3–57.3) | NA |
| 2 or 3 times | 25.7 (16.8–37.2) | 35.2 (28.4–42.6) | NA | 32.3 (25.8–39.4) | 38.6 (23.8–56.0) | 33.3 (22.3–46.5) | NA |
| ≥4 times | 41.0 (28.0–55.3) | 20.8 (15.3–27.6) | NA | 25.5 (18.8–33.7) | 32.4 (15.4–55.7) | 21.6 (14.4–31.2) | NA |
| Experienced sexual violence by anyone** | NA | NA | 0.006 | NA | NA | NA | 0.36 |
| 1 time | 36.6 (28.7–45.4) | 47.3 (42.8–52.0) | NA | 47.6 (41.2–54.1) | 39.7 (30.0–50.2) | 44.0 (36.6–51.6) | NA |
| 2 or 3 times | 29.5 (21.8–38.6) | 34.1 (29.9–38.5) | NA | 31.2 (26.3–36.6) | 34.9 (27.1–43.7) | 34.5 (28.1–41.6) | NA |
| ≥4 times | 33.9 (25.3–43.8) | 18.6 (15.2–22.5) | NA | 21.2 (16.1–27.4) | 25.4 (17.1–36.0) | 21.5 (15.7–28.7) | NA |

**Abbreviations:** CI = confidence interval; NA = not applicable; YRBS = Youth Risk Behavior Survey.
* During the 12 months before the survey.
† Chi-square test (p<0.05).
§ Being physically hurt on purpose (counting such things as being hit, slammed into something, or injured with an object or weapon) by someone they were dating or going out with, ≥1 time, among the 66.1% (n = 8,703) of students nationwide who dated or went out with someone during the 12 months before the survey.
¶ Being forced to do "sexual things" (counting such things as kissing, touching, or being physically forced to have sexual intercourse) they did not want to do by someone they were dating or going out with, ≥1time, among the 66.2% (n = 6,847) of students nationwide who dated or went out with someone during the 12 months before the survey. Of 13,677 students, this variable was missing for 3,324, mostly attributed to the use of different versions of the YRBS questionnaire that did not include the sexual violence questions in certain selected schools. This resulted in complete data for 10,353 students, of which 66.2% (6,847) reported dating in the 12 months before the survey.
** Being forced to do "sexual things" (counting such things as kissing, touching, or being physically forced to have sexual intercourse) they did not want to do by anyone during the 12 months before the survey. These data were missing for 3,439 students for this variable, mostly attributed to the use of different versions of the YRBS questionnaire that did not include the sexual violence questions in certain selected schools.

**TABLE 4. Percentage of high school students who experienced any dating violence or both physical and sexual dating violence\* and any form of bullying victimization,[†] by demographic characteristics — Youth Risk Behavior Survey, United States, 2019**

| Characteristic | Dating violence composite variables | | | | Bullying victimization composite | |
| --- | --- | --- | --- | --- | --- | --- |
| | Experienced any dating violence[§] | | Experienced both physical and sexual dating violence[¶] | | Experienced any bullying\*\* | |
| | % (95% CI) | p value[††] | % (95% CI) | p value[††] | % (95% CI) | p value[††] |
| Total | 12.2 (11.3–13.3) | NA | 3.0 (2.5–3.7) | NA | 24.8 (23.4–26.3) | NA |
| **Sex** | | | | | | |
| Female | 16.4 (14.7–18.2) | <0.01 | 3.8 (3.0–5.0) | 0.006 | 30.2 (28.4–32.1) | <0.01 |
| Male | 8.2[§§] (7.1–9.4) | NA | 2.1[§§] (1.6–2.9) | NA | 19.2[§§] (17.6–20.9) | NA |
| **Race/Ethnicity** | | | | | | |
| White, non-Hispanic | 12.1 (10.8–13.5) | 0.42 | 2.8 (2.2–3.5) | 0.51 | 28.8 (26.9–30.7) | <0.01 |
| Black, non-Hispanic | 10.6 (7.9–14.1) | NA | 3.0 (1.7–5.2) | NA | 18.0[¶¶] (15.7–20.6) | NA |
| Hispanic | 12.7 (11.1–14.6) | NA | 3.3 (2.1–5.1) | NA | 19.2[¶¶] (17.4–21.1) | NA |
| **Sexual identity** | | | | | | |
| Heterosexual | 10.5 (9.5–11.6) | <0.01 | 2.4 (2.0–2.9) | 0.007 | 22.2 (20.6–23.8) | <0.01 |
| Lesbian, gay, or bisexual | 22.3\*\*\* (17.9–27.5) | NA | 5.8\*\*\* (3.9–8.4) | NA | 39.5\*\*\* (36.6–42.5) | NA |
| Not sure | 18.7\*\*\* (13.2–26.0) | NA | 9.4\*\*\* (5.0–16.9) | NA | 32.7\*\*\*,[†††] (27.6–38.3) | NA |

**Abbreviations:** CI = confidence interval; NA = not applicable.
 \* During the 12 months before the survey, among students who dated or went out with someone during the 12 months before the survey.
 [†] During the 12 months before the survey.
 [§] Combined any "yes" responses to physical dating violence and sexual dating violence. Because of the manner in which this variable was calculated, missing values in both the physical dating violence and sexual dating violence measures resulted in 3,355 missing values in the "experienced any dating violence" composite measure.
 [¶] Combined where responses to both physical dating violence and sexual dating violence were "yes." Because of the manner in which this variable was calculated, the missing values in both the physical dating violence and sexual dating violence measures resulted in 3,355 missing observations in the "experienced both physical and sexual dating violence" composite measure.
 \*\* Combined any "yes" responses to bullied at school and electronic bullying.
 [††] Chi-square test (p<0.05).
 [§§] Significantly different from female students, based on *t*-test (p<0.05).
 [¶¶] Significantly different from white, non-Hispanic students, based on *t*-test (p<0.05).
 \*\*\* Significantly different from heterosexual students, based on *t*-test (p<0.05).
 [†††] Significantly different from lesbian, gay, or bisexual students, based on *t*-test (p<0.05).

findings from previous YRBSs (https://www.cdc.gov/violenceprevention/pdf/2012FindingsonSVinYouth-508.pdf), physical dating violence, sexual dating violence, sexual violence by anyone, bullying on school property, and electronic bullying victimization are adverse childhood experiences (ACEs) that are occurring at high rates. Examining their prevalence individually and in combination by key demographic characteristics provides an overall observation and contextual understanding of interpersonal violence experienced by U.S. high school students and helps identify disparities in health and safety among U.S. youths, which can guide prevention efforts.

All five types of victimization, including any or both forms of dating violence and any form of bullying, were more common among female and sexual minority students, highlighting their more frequent victimization. These findings are consistent with previous studies that reported disparities in interpersonal violence victimization, particularly dating violence and sexual violence, by sex and sexual identity (6,7). Although findings did not reveal substantially greater prevalence for racial/ethnic minority youths for the forms of violence examined, research has consistently shown that racial/ethnic minority youths are

at greater risk for homicides and other community violence victimization (https://www.cdc.gov/violenceprevention/pub/technical-packages.html). Disparities in health and risk for violence have been linked to sexism, homophobia, and structural disadvantage (10).

Half of students who reported sexual violence victimization by anyone did not report sexual violence by a dating partner, indicating that students who experience sexual violence are often victimized by someone other than a dating partner. This finding is consistent with previous research (3) documenting that sexual violence happening in school during adolescence is frequently perpetrated by peers and not necessarily by dating partners. Indeed, perpetrators of sexual violence during youth can be acquaintances, family members, persons in a position of authority, and strangers, in addition to dating partners (https://www.cdc.gov/violenceprevention/pdf/2012FindingsonSVinYouth-508.pdf). This indicates that efforts might need to be focused on preventing sexual violence both inside and outside the context of dating relationships to be most helpful.

Males who experienced dating violence or sexual violence reported high frequencies of victimization (≥4 times during

the previous year) substantially more often than did females. That is, although male students do not report higher prevalence of victimization than do female students, when they do report it, they report experiencing it at a higher frequency. Previous research has documented that, among youths at high risk (i.e., previously exposed to violence in the home or community), adolescent males reported higher frequency of victimization than did females for sexual dating violence (*11*). However, male adolescents might also be more likely to disclose dating violence and sexual violence when the victimization has happened more than once.

In this study, bullying victimization was the only type of violence victimization examined for which racial/ethnic differences existed, with substantially higher prevalence occurring among white students compared with black or Hispanic students. This result for bullying is supported in part by previous research (*12*). In addition, Hispanic students reported substantially higher prevalence of electronic bullying victimization compared with black students. Other research has indicated that black students might underreport bullying victimization when presented with a definition-based measure of bullying that includes a form of the word "bully," as is used in YRBS, as opposed to behaviorally specific measures that describe the victimization behaviors but do not use the word "bully" (*13*). The measurement of bullying in this study might have differentially affected reporting across racial/ethnic groups.

Overall, these findings highlight the importance of early engagement in effective, evidence-based efforts for preventing violence victimization and perpetration before they begin or stopping them from continuing. Findings from this study also demonstrate substantial differences in exposure to these types of violence by sex, race/ethnicity, and sexual identity, highlighting the need for prevention efforts that address the unique needs of these groups. To help communities focus their prevention efforts on what works and to address risk and protective factors for violence and other ACEs across the social ecology, CDC developed a series of technical packages that identify key violence prevention strategies and approaches on the basis of the best available research evidence. (CDC's technical packages for violence prevention are available at https://www.cdc.gov/violenceprevention/pub/technical-packages.html.) This series includes packages focused on sexual violence, intimate partner violence (including dating violence), and youth violence (including bullying). *Preventing Adverse Childhood Experiences (ACEs): Leveraging the Best Available Evidence* compiles evidence focused on ACEs from across the technical packages (https://www.cdc.gov/violenceprevention/pdf/preventingACES.pdf).

Multiple evidence-based interpersonal violence prevention approaches are directly related to the findings in this study. For example, social-emotional learning programs that support development of skills for communication, emotion regulation, empathy, and respect and that target risk factors for interpersonal violence (e.g., impulsivity or drug use) have been reported to decrease adolescent sexual violence perpetration and homophobic name-calling, with indirect effects on peer bullying, cyberbullying, and sexual harassment perpetration when mediated by delinquency (*14*,*15*). By addressing shared risk and protective factors across types of violence, social-emotional learning programs can build the skills youths need for engaging in healthy relationships with family, peers, dating partners, and others, thus preventing multiple forms of adolescent interpersonal violence and long-term consequences into adulthood. In addition, bystander programs teach youths how to safely act when they see behaviors that increase risk for violence and change social norms within their peer groups. Although originally conceptualized as a means of challenging heterosexist attitudes to prevent sexual and dating violence (*16*), such programs might also prevent other forms of adolescent violence, including bullying and violence targeting sexual, gender, and racial minorities by focusing the training on recognizing and challenging these specific harmful attitudes and behaviors (*17*,*18*).

Modifying the social and physical environment in schools and neighborhoods might improve safety and reduce risk for violence for more of the population than individual- or relationship-level approaches alone. For example, one school-based prevention approach that includes a building-level intervention (e.g., addressing physical areas in the school identified by students as less safe) has been reported to reduce sexual violence victimization and perpetration by peers and dating partners (*19*). In addition, the development of safe and supportive environments in schools that promote protective factors (e.g., school connectedness and professional development regarding lesbian, gay, bisexual, and transgender [LGBT] youths) can help create accepting school environments for LGBT youths and reduce the risk for bullying and other violence (*20*). Results from this report indicate that LGB youths, specifically, are at a disproportionately higher risk for interpersonal violence victimization compared with heterosexual youths. As of 2019, gender identity has not been assessed by the YRBS nationwide. However, during 2017, gender identity was assessed in YRBSs conducted in 10 states and nine large urban school districts; these data show that transgender students consistently report greater prevalence of violence victimization than their cisgender peers (*21*).

Promotion of gay-straight alliances and support of LGBT students can help provide these youths with an accepting school environment, which might also reduce the risk for school-based violence against these youths (*22*). (Information about CDC's current school health programs is available at https://www.cdc.gov/healthyyouth/fundedprograms/1807/resources.htm.)

CDC is engaged in ongoing research and programmatic activities for expanding the research evidence and adding to the knowledge base of effective primary prevention programs, policies, and practices available to communities for preventing interpersonal violence among youths. For example, CDC's *Dating Matters: Strategies to Promote Healthy Teen Relationships* is a comprehensive adolescent dating violence prevention model. *Dating Matters* includes multiple integrated prevention strategies that address risk factors for youths and their families, schools, and neighborhoods with demonstrated effects on adolescent dating violence, bullying, and peer violence in middle school. (Additional information about *Dating Matters* is available at https://www.cdc.gov/violenceprevention/intimatepartnerviolence/datingmatters/index.html.)

In addition, since 2001, CDC has provided funding for primary prevention of sexual violence through the Rape Prevention and Education Program to state health departments in all 50 states, the District of Columbia, and four U.S. territories. Funded organizations implement initiatives that address youths in their communities, including community- and societal-level approaches (e.g., improving education and leadership opportunities for girls). (Additional information about the Rape Prevention and Education Program is available at https://www.cdc.gov/violenceprevention/sexualviolence/rpe/index.html.) CDC also sponsors youth violence prevention research through its National Centers of Excellence in Youth Violence Prevention. Their goal is to build the scientific infrastructure and community partnerships necessary for stimulating new youth violence prevention research and practice across the country, including a focus on the impact of structural factors (e.g., housing, education, or systemic discrimination) that limit access to positive social determinants of health.

Prevention of interpersonal violence among adolescents might be most successful when a comprehensive strategy is used that addresses these ACEs at multiple levels of the social ecology simultaneously and recognizes that these different forms of victimization can be co-occurring (*1*). The findings reported here also highlight the importance of acknowledging the disproportionate prevalence of these forms of victimization on certain youths (i.e., females and sexual minorities) and addressing these disparities in prevention efforts.

## Limitations

General limitations for the YRBS are available in the overview report of this supplement (*9*).The findings in this report are subject to at least five additional limitations. First, substantial overlap likely existed in the measures that examined experiences of sexual violence victimization (i.e., sexual dating violence victimization and sexual violence victimization by anyone), and among the bullying victimization measures (i.e., electronic bullying and bullied at school). For these reasons, composites for the sexual violence measures and a "both" composite for bullying (i.e., experienced both electronic bullying and bullying at school) were not created. Second, because of the breadth of topics included in the YRBS, violence victimization subtype measures included in the YRBS tend to be broad in nature and, in this study, were assessed by single items. More specific and detailed measures of violence victimization would allow for a comprehensive analysis of the prevalence and overlap between different forms of interpersonal violence victimization. Third, the YRBS bullying items include the word "bullied," which might have decreased disclosure (*13*). Fourth, the interpersonal violence victimization types that could be included in this study (i.e., dating violence, sexual violence, and bullying), as a whole, do not reflect the breadth of interpersonal violence victimization experienced by youths (i.e., other forms of youth violence experienced in the community) and might partially explain why few racial/ethnic differences were found. Finally, the sexual violence measures (and composite measures that were created with the sexual violence measures) in this report had a relatively large amount of missing data (approximately 3,400 observations) in 2019. Most of this missing data can be attributed to the use of different versions of the YRBS questionnaire that did not include the sexual violence questions in certain selected schools. Consequently, not all students in the national sample were given the opportunity to answer the sexual violence questions and were counted as missing. When constructing the composite measures for any dating violence, and both physical and sexual dating violence victimization, the analytic sample was restricted to students who had complete data for both physical and sexual dating violence victimization, which reduced the potential for biased estimates.

## Future Directions

To increase understanding of the differential experiences of adolescent interpersonal violence victimization, future research that focuses in more detail on the demographic groups highlighted in this study can be beneficial. For example, on the basis of these findings, additional research

to better understand the characteristics and consequences of these forms of interpersonal violence on sexual minority youths is warranted. Research exploring sex differences in the frequency of victimization across additional types of violence can add to the findings reported here. Future studies that include more detailed measures of dating violence, sexual violence, and bullying for capturing and isolating understudied subtypes of these forms of violence (e.g., psychological dating violence, nonconsensual sexting, or relational bullying) would increase knowledge of the full prevalence of these forms of violence among youths. Finally, studies that examine the co-occurrence and cumulative impact of different forms of violence victimization during adolescence and into adulthood can guide more comprehensive prevention efforts.

# Conclusion

Interpersonal violence victimization experiences of high school students are a form of ACEs and represent a substantial public health problem in the United States. Multiple forms of interpersonal violence, including dating violence, sexual violence, and bullying, negatively affect youths and can continue to have damaging effects throughout a person's life. The findings in this report are consistent with those in previous studies about disparities in interpersonal violence victimization by demographic characteristics; the report also provides additional insight about the specific groups of students who are at highest risk for particular types of interpersonal violence and who might benefit most from prevention efforts. In addition, the findings increase understanding of the contextual factors associated with interpersonal violence victimization (e.g., frequency, location, and co-occurrence of subtypes) and can guide how violence prevention professionals select and implement prevention approaches for addressing dating violence, sexual violence, and bullying. Prevention approaches at the individual, relationship, and school or community levels (e.g., those that seek to increase youths' skills in preventing violence, change social norms related to violence, and modify the physical and social environment in schools and communities to increase protection against violence) are crucial for building a comprehensive strategy to reduce interpersonal violence victimization among youths.

## Conflicts of Interest

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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# Prescription Opioid Misuse and Use of Alcohol and Other Substances Among High School Students — Youth Risk Behavior Survey, United States, 2019

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## Abstract

Adolescence is an important period of risk for substance use initiation and substance use–related adverse outcomes. To examine youth substance use trends and patterns, CDC analyzed data from the 2009–2019 Youth Risk Behavior Survey. This report presents estimated prevalence of current (i.e., previous 30-days) marijuana use, prescription opioid misuse, alcohol use, and binge drinking and lifetime prevalence of marijuana, synthetic marijuana, cocaine, methamphetamine, heroin, injection drug use, and prescription opioid misuse among U.S. high school students. Logistic regression and Joinpoint analyses were used to assess 2009–2019 trends. Prevalence of current and lifetime substance use by demographics, frequency of use, and prevalence of co-occurrence of selected substances among students reporting current prescription opioid misuse are estimated using 2019 data. Multivariable logistic regression analysis was used to determine demographic and substance use correlates of current prescription opioid misuse. Current alcohol, lifetime cocaine, methamphetamine, heroin, and injection drug use decreased during 2009–2019. Lifetime use of synthetic marijuana (also called synthetic cannabinoids) decreased during 2015–2019. Lifetime marijuana use increased during 2009–2013 and then decreased during 2013–2019. In 2019, 29.2% reported current alcohol use, 21.7% current marijuana use, 13.7% current binge drinking, and 7.2% current prescription opioid misuse. Substance use varied by sex, race/ethnicity, grade, and sexual minority status (lesbian, gay, or bisexual). Use of other substances, particularly current use of alcohol (59.4%) and marijuana (43.5%), was common among students currently misusing prescription opioids. Findings highlight opportunities for expanding evidence-based prevention policies, programs, and practices that aim to reduce risk factors and strengthen protective factors related to youth substance use, in conjunction with ongoing initiatives for combating the opioid crisis.

## Introduction

Substance use and associated adverse outcomes contribute to substantial morbidity, mortality, and economic costs to society each year in the United States (1). Data from national surveys indicate the majority of adolescents will engage in some form of substance use before they graduate from high school (https://www.samhsa.gov/data/report/2018-nsduh-detailed-tables). During adolescence, areas of the brain associated with emotional responses and reward systems develop before those associated with executive functioning, judgement, and decision making (2). This uneven maturation results in increased susceptibility for engaging in risky and impulsive behaviors, including substance use, and increases

vulnerability to reinforcing and rewarding effects of substances (2,3). Preventing or delaying substance use initiation among youths can reduce later risk for substance use and substance use disorders (1,3,4). Beyond the individual negative effects of substance use during youth and into adulthood, substance use among youths also increases the likelihood for negative consequences that affect peers, families, and communities (5). Youth substance use is associated with increased risk for delinquency, academic underachievement, teenage pregnancy, sexually transmitted diseases, perpetrating or experiencing violence, injuries, and mental health problems (1,3–6).

As the United States confronts its decades-long opioid overdose epidemic (1,2), preventing opioid misuse among youth is a public health imperative. Previous research has documented that misuse of prescription opioids among youths is associated with multiple adverse health outcomes and risk behaviors, including use of alcohol and other illicit drugs, injection drug use, suicidal ideation, youth violence,

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delinquency, having four or more lifetime sexual partners, not using a condom at last sexual intercourse, increased risk for acquisition of human immunodeficiency virus infection and sexually transmitted diseases (6), and increasing overdoses (7). Studies also have demonstrated that prescription opioid misuse among youths is strongly linked with subsequent initiation and use of heroin and increased risk for injecting prescription opioids and developing an opioid use disorder (8–10).

Preventing substance use among youths is necessary because of the health and social effects of youth substance use. To inform substance use prevention initiatives and to improve understanding of youth substance use patterns, including misuse of prescription opioids and other substances, this analysis 1) examines trends and patterns in substance use among high school students overall and by demographic characteristics, 2) characterizes the frequency of use of specific substances among high school students, 3) explores co-occurring substance use among high school students who misuse prescription opioids, and 4) examines the demographic and substance use correlates of prescription opioid misuse among high school students. Findings from this analysis can help inform efforts by public health practitioners, clinicians, and the substance use prevention community to expand the implementation of evidence-based prevention policies, programs, and practices that aim to reduce risk factors and strengthen protective factors related to youth substance use.

# Methods

## Data Source

This report includes data from CDC's 2009–2019 Youth Risk Behavior Survey (YRBS), a cross-sectional, school-based survey conducted biennially since 1991. Each survey year, CDC collects data from a nationally representative sample of public- and private-school students in grades 9–12 in the 50 U.S. states and the District of Columbia. Additional information about YRBS sampling, data collection, response rates, and processing is available in the overview report of this supplement (11). The prevalence estimates for all substance use questions for the overall study population and by sex, race/ethnicity, grade, and sexual orientation are available at https://nccd.cdc.gov/youthonline/App/Default.aspx. The full YRBS questionnaire is available at https://www.cdc.gov/healthyyouth/data/yrbs/pdf/2019/2019_YRBS-National-HS-Questionnaire.pdf.

## Measures

This report addresses four current (i.e., previous 30 days before the survey) and seven lifetime substance use behaviors. The four current substance use behaviors include 1) marijuana use (ascertained by the question, "During the past 30 days, how many times did you use marijuana?"), 2) alcohol use ("During the past 30 days, on how many days did you have at least one drink of alcohol?"), 3) binge drinking ("During the past 30 days, on how many days did you have 4 or more drinks of alcohol in a row, that is, within a couple of hours [if you are a female] or 5 or more drinks of alcohol in a row, that is, within a couple of hours [if you are a male]?"), and 4) prescription opioid misuse ("During the past 30 days, how many times have you taken prescription pain medicine without a doctor's prescription or differently than how a doctor told you to use it?"). The current prescription opioid misuse question is new for the 2019 YRBS, providing opportunities to explore substance use patterns and individual characteristics associated with this variable for the first time.

The seven lifetime substance use behaviors include 1) marijuana use ("During your life, how many times have you used marijuana?"), 2) synthetic marijuana (also called synthetic cannabinoids) use ("During your life, how many times have you used synthetic marijuana?"), 3) cocaine use ("During your life, how many times have you used any form of cocaine, including powder, crack, or freebase?"), 4) methamphetamine use ("During your life, how many times have you used methamphetamines [also called speed, crystal meth, crank, ice, or meth]?"), 5) heroin use ("During your life, how many times have you used heroin [also called smack, junk, or China White]?"), 6) prescription opioid misuse ("During your life, how many times have you taken prescription pain medicine without a doctor's prescription or differently than how a doctor told you to use it?"), and 7) injection drug use ("During your life, how many times have you used a needle to inject any illegal drug into your body?").

Substance use behaviors were dichotomized to indicate current or lifetime use versus no use. With three exceptions, frequency of use for each substance was categorized as 1–2 times, 3–9 times, 10–39 times, or ≥40 times. Frequency of current alcohol use and current binge drinking were categorized as 1–2 days, 3–9 days, 10–19 days, or ≥20 days. For injection drug use, frequency of use was categorized as 1 time or ≥2 times.

Four demographic characteristics were included in the analysis: sex (male or female), race/ethnicity (non-Hispanic white [white], non-Hispanic black [black], Hispanic, or other), grade (9/10 or 11/12), and sexual identity (heterosexual; lesbian, gay, or bisexual; or not sure). Students reporting "other" race/ethnicity are included in all analyses; however, data are not presented for that group because of limited interpretability.

## Analysis

First, annual prevalence of each substance use behavior was estimated for all years with available data. Second, to identify temporal trends, logistic regression analyses were used to model linear and quadratic time effects while controlling for sex, grade, and racial/ethnic group changes over time; for significant quadratic time effects, Joinpoint software was used to identify the year the trend changed direction (*11*). Trends were assessed during 2009–2019 for current alcohol, current marijuana, lifetime marijuana, lifetime cocaine, lifetime methamphetamine, lifetime heroin, and lifetime injection drug use. Synthetic marijuana use was first assessed by YRBS in 2015; therefore, trend analysis for this variable was conducted for 2015–2019. Third, to identify 2-year changes in substance use behaviors, prevalence estimates from 2017 and 2019 were compared by using *t*-tests; changes were considered statistically different if the p value was <0.05.

Four additional analyses were conducted by using 2019 YRBS data only. First, prevalence estimates and associated 95% confidence intervals (CIs) for each substance use behavior were calculated by demographic characteristics. Statistically significant pairwise differences between demographic groups for each of the substance use behaviors were determined by *t*-tests; differences were considered statistically significant if the p value was <0.05. Second, to examine frequency of use among students who reported engaging in each substance use behavior, prevalence estimates and 95% CIs of students reporting each frequency of use category were calculated. Third, prevalence estimates of co-occurring use of selected substances among students reporting current prescription opioid misuse were estimated. Finally, multivariable logistic regression analysis was used to determine demographic and substance use correlates of current prescription opioid misuse. Because the use of one substance is generally strongly associated with use of one or more other substances, it is important to account for multiple substance use behaviors during the modeling process. Therefore, all demographic and substance use variables were included in a single model to examine the independent effect of each variable on current prescription opioid misuse. This modeling strategy is consistent with previous research examining substance use behaviors among youths (*6*).

To improve model stability during multivariable analyses, three composite substance use variables were created. A composite variable regarding alcohol consumption was created with three levels: 1) no previous 30-day use, 2) previous 30-day use (current drinking but no binge drinking), and 3) previous 30-day binge alcohol use. A marijuana composite variable also was created with three levels: 1) no lifetime use, 2) lifetime use but no previous 30-day use, and 3) previous

30-day use. A composite lifetime use of cocaine, heroin, or methamphetamine variable was created by combining answers of "1 or more times" for each of the three constituent variables. Because substance use variables are known to be highly correlated with each other, the Variance Inflation Factor was used to assess multicollinearity. None was observed (i.e., no values >10).

Adjusted prevalence ratios (aPRs) and corresponding 95% CIs were calculated; estimates were considered statistically significant if the 95% CI did not include 1.0. All analyses were conducted by using SAS-callable SUDAAN (version 11.0.1; RTI International) to account for survey weights and the complex sample design of the YRBS. No imputation methods were used for data that were missing.

## Results

Substance use was common among U.S. high school students during 2019 and varied by substance, year, and demographic groups (Table 1). Among current substance use measures, the highest prevalence estimates were for alcohol (29.2%) and marijuana use (21.7%). Current binge drinking was reported by 13.7% of high school students, and 7.2% reported current prescription opioid misuse. Among lifetime use measures, marijuana use was reported by 36.8% of high school students, followed by misuse of prescription opioids (14.3%) and use of synthetic marijuana (7.3%), cocaine (3.9%), methamphetamine (2.1%), or heroin (1.8%). Lifetime injection drug use was reported by 1.6% of high school students.

Trend data were available for eight of the 11 substance use measures included in the analyses. Among these measures, current alcohol use, lifetime cocaine, lifetime methamphetamine, lifetime heroin, and lifetime injection drug use decreased during 2009–2019. Lifetime use of synthetic marijuana decreased during 2015–2019. The prevalence of lifetime marijuana use increased during 2009–2013 (36.8%–40.7%) and then decreased during 2013–2019 (40.7%–36.8%). No statistically significant changes from 2017 to 2019 were observed for any of the substance use behaviors.

Compared with females, males had a significantly higher prevalence of lifetime use of cocaine (4.9% versus 2.7%), methamphetamine (2.7% versus 1.5%), heroin (2.3% versus 1.0%), and injection drug use (2.1% versus 1.1%) (Table 2). Compared with males, females had a significantly higher prevalence of current alcohol use (31.9% versus 26.4%), binge drinking (14.6% versus 12.7%), current prescription opioid misuse (8.3% versus 6.1%), and lifetime prescription opioid misuse (16.1% versus 12.4%). Among racial/ethnic groups,

**TABLE 1. Prevalence of and trends in prevalence of lifetime and current use of specific substances and use behaviors among high school students — Youth Risk Behavior Survey, United States, 2009–2019**

| Behavior | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 | Linear change* | Quadratic change* | Change from 2017 to 2019[†] |
|---|---|---|---|---|---|---|---|---|---|
| **Current use[§]** | | | | | | | | | |
| Marijuana | 20.8 | 23.1 | 23.4 | 21.7 | 19.8 | 21.7 | No change | No change | No change |
| Alcohol | 41.8 | 38.7 | 34.9 | 32.8 | 29.8 | 29.2 | Decreased 2009–2019 | No change | No change |
| Binge drinking | — | — | — | — | 13.5 | 13.7 | NA[¶] | NA[¶] | No change |
| Prescription opioid misuse | — | — | — | — | — | 7.2 | NA[¶] | NA[¶] | NA[¶] |
| **Lifetime use** | | | | | | | | | |
| Marijuana | 36.8 | 39.9 | 40.7 | 38.6 | 35.6 | 36.8 | No change | Increased 2009–2013 Decreased 2013–2019 | No change |
| Cocaine | 6.4 | 6.8 | 5.5 | 5.2 | 4.8 | 3.9 | Decreased 2009–2019 | No change | No change |
| Methamphetamine | 4.1 | 3.8 | 3.2 | 3.0 | 2.5 | 2.1 | Decreased 2009–2019 | No change | No change |
| Heroin | 2.5 | 2.9 | 2.2 | 2.1 | 1.7 | 1.8 | Decreased 2009–2019 | No change | No change |
| Injection drug use | 2.1 | 2.3 | 1.7 | 1.8 | 1.5 | 1.6 | Decreased 2009–2019 | No change | No change |
| Synthetic marijuana | — | — | — | 9.2 | 6.9 | 7.3 | Decreased 2015-2019 | NA[¶] | No change |
| Prescription opioid misuse | — | — | — | — | 14.0 | 14.3 | NA[¶] | NA[¶] | No change |

**Abbreviation:** NA = not available.
* Based on trend analyses by using a logistic regression model controlling for sex, race/ethnicity, and grade (p<0.05).
[†] Based on *t*-test analysis (p<0.05).
[§] Previous 30 days before the survey.
[¶] Insufficient years of data to assess trends.

**TABLE 2. Prevalence of lifetime and current use of specific substances and use behaviors among high school students, by demographic characteristics — Youth Risk Behavior Survey, United States, 2019**

| | Sex | | Race/Ethnicity | | | Grade | | Sexual identity | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Behavior | Male (n = 6,641) % (95% CI) | Female (n = 6,885) % (95% CI) | White, non-Hispanic (n = 6,668) % (95% CI) | Black, non-Hispanic (n = 2,040) % (95% CI) | Hispanic (n = 3,038) % (95% CI) | 9/10 (n = 7,354) % (95% CI) | 11/12 (n = 6,172) % (95% CI) | Heterosexual (n = 10,853) % (95% CI) | LGB (n = 1,531) % (95% CI) | Not sure (n = 591) % (95% CI) |
| **Current use*** | | | | | | | | | | |
| Marijuana | 22.5 (20.6–24.5) | 20.8 (18.7–23.1) | 22.1 (19.9–24.6) | 21.7 (19.1–24.5) | 22.4 (20.4–24.6) | 17.1 (15.5–18.8) | 26.6[†] (23.6–29.7) | 20.9 (19.0–23.0) | 31.1[§] (27.4–35.1) | 19.5[¶] (14.8–25.3) |
| Alcohol | 26.4 (24.4–28.6) | 31.9[**] (29.6–34.3) | 34.2 (31.7–36.8) | 16.8[††] (13.5–20.7) | 28.4[††,§§] (26.1–30.8) | 22.8 (20.6–25.2) | 36.0[†] (33.8–38.3) | 28.8 (26.8–30.8) | 33.9[§] (29.8–38.2) | 25.3[¶] (20.0–31.4) |
| Binge drinking | 12.7 (11.0–14.6) | 14.6[**] (13.2–16.2) | 17.3 (15.1–19.7) | 6.2[††] (4.2–9.2) | 12.4[††,§§] (11.0–14.0) | 8.9 (7.4–10.7) | 18.8[†] (17.0–20.8) | 13.4 (12.0–15.0) | 15.6 (12.8–18.8) | 13.1 (9.0–18.8) |
| Prescription opioid misuse | 6.1 (5.3–7.1) | 8.3[**] (7.0–9.9) | 5.5 (4.4–6.9) | 8.7[††] (6.5–11.6) | 9.8[††] (8.2–11.6) | 7.0 (5.8–8.4) | 7.3 (6.1–8.8) | 6.4 (5.4–7.5) | 12.0[§] (9.6–14.9) | 11.5[§] (8.2–15.9) |
| **Lifetime use** | | | | | | | | | | |
| Marijuana | 37.0 (34.2–40.0) | 36.5 (34.1–38.9) | 36.8 (33.9–39.8) | 37.5 (34.0–41.1) | 39.2 (36.5–41.9) | 29.2 (26.7–31.8) | 44.8[†] (41.5–48.2) | 36.0 (33.3–38.7) | 49.6[§] (45.1–54.1) | 27.5[§,¶] (22.4–33.3) |
| Cocaine | 4.9 (4.2–5.8) | 2.7[**] (2.0–3.7) | 2.9 (2.2–3.7) | 4.0 (2.7–5.9) | 5.6[††] (4.5–6.9) | 2.8 (2.0–3.7) | 5.0[†] (4.1–6.1) | 3.3 (2.7–4.0) | 7.0[§] (4.8–10.1) | 7.6[§] (4.3–12.9) |
| Methamphetamine | 2.7 (2.1–3.4) | 1.5[**] (1.0–2.2) | 1.2 (0.9–1.6) | 3.8[††] (2.4–6.0) | 2.7[††] (1.8–4.0) | 1.5 (1.0–2.3) | 2.6[†] (1.9–3.3) | 1.5 (1.2–1.9) | 5.0[§] (3.1–7.9) | 6.1[§] (3.4–10.8) |
| Heroin | 2.3 (1.8–3.1) | 1.0[**] (0.6–1.8) | 0.9 (0.6–1.2) | 3.4[††] (2.2–5.3) | 2.4[††] (1.5–3.9) | 1.6 (1.0–2.5) | 1.8 (1.3–2.5) | 1.2 (0.9–1.6) | 3.8[§] (2.1–7.0) | 6.2[§] (3.4–11.0) |
| Injection drug use | 2.1 (1.5–2.9) | 1.1[**] (0.6–1.9) | 0.8 (0.6–1.2) | 2.9[††] (1.5–5.5) | 2.5[††] (1.8–3.5) | 1.6 (1.1–2.3) | 1.5 (1.0–2.4) | 1.1 (0.8–1.6) | 3.5[§] (2.1–5.7) | 5.1[§] (2.5–10.2) |
| Synthetic marijuana | 7.2 (6.2–8.4) | 7.4 (6.2–8.7) | 6.7 (5.6–8.0) | 5.7 (4.4–7.4) | 9.8[††,§§] (8.6–11.3) | 6.2 (5.3–7.3) | 8.3[†] (7.2–9.7) | 6.7 (5.8–7.7) | 11.6[§] (9.0–14.7) | 10.4 (6.9–15.5) |
| Prescription opioid misuse | 12.4 (11.0–14.1) | 16.1[**] (14.1–18.4) | 12.7 (10.9–14.7) | 15.3 (12.9–18.1) | 16.0 (13.5–18.8) | 13.6 (11.9–15.5) | 14.9 (13.2–16.7) | 12.7 (11.2–14.4) | 23.9[§] (19.9–28.3) | 19.1[§] (14.6–24.5) |

**Abbreviations:** CI = confidence interval; LGB = lesbian, gay, or bisexual.
* Previous 30 days before the survey.
[†] Significantly different from 9/10 grade students, based on *t*-test analysis (p<0.05).
[§] Significantly different from heterosexual students, based on *t*-test analysis (p<0.05).
[¶] Significantly different from lesbian, gay, or bisexual students, based on *t*-test analysis (p<0.05).
[**] Significantly different from male students, based on *t*-test analysis (p<0.05).
[††] Significantly different from white students, based on *t*-test analysis (p<0.05).
[§§] Significantly different from black students, based on *t*-test analysis (p<0.05).

notable differences in prevalence estimates were identified for current use of alcohol, binge drinking, current prescription opioid misuse, and lifetime use of cocaine, methamphetamine, heroin, injection drug use, and synthetic marijuana. However, no clear pattern emerged. For example, the prevalence of current prescription opioid misuse was significantly lower among white students (5.5%) compared with black (8.7%) or Hispanic students (9.8%). Conversely, the prevalence of current alcohol use was lower among black students (16.8%) compared with white (34.2%) or Hispanic students (28.4%).

Approximately half of the substance use behaviors varied substantially by grade, with consistently higher prevalence among 11th- and 12th-grade students compared with 9th- and 10th-grade students for current marijuana use, current alcohol use and binge drinking, lifetime marijuana use, lifetime cocaine use, lifetime methamphetamine use, and lifetime synthetic marijuana. Prevalence of all but one of the substance use behaviors (i.e., binge drinking) varied considerably by sexual identity. Students who identified as lesbian, gay, or bisexual had a higher prevalence of all substance use behaviors, except binge drinking, compared with students who identified as heterosexual. Similarly, students who identified as not sure of their sexual identity also had higher prevalence of approximately

half of the substance use behaviors compared with heterosexual students, including current prescription opioid misuse, lifetime cocaine use, lifetime methamphetamine use, lifetime heroin use, lifetime injection drug use, and lifetime prescription opioid misuse. However, students who identified as not sure of their sexual identity had lower prevalence of certain substance use behaviors compared with students identifying as lesbian, gay, or bisexual, including current marijuana use, current alcohol use, and lifetime marijuana use.

Frequency of use (i.e., number of times used or number of days used) varied across specific substance use behaviors (Table 3). Among students reporting marijuana use during the 30 days before the survey (i.e., current use), 18.0% reported using it ≥40 times; 23.5%, 10–39 times; 21.8%, 3–9 times; and 36.7%, 1–2 times. For current prescription opioid misuse, 9.8% reported misuse ≥40 times; 13.7%, 10–39 times; 23.3%, 3–9 times, and 53.2%, 1–2 times. Among students reporting lifetime use of specific substances, marijuana had the highest percentage of students reporting use ≥40 times (33.6%), followed by heroin (32.9%), methamphetamine (27.9%), and cocaine (16.1%). Lifetime prescription opioid misuse and lifetime synthetic cannabinoid use were the two substances with the highest percentages reporting use 1–2 times (48.8%

**TABLE 3. Frequency of lifetime and current use among high school students reporting use of specific substances — Youth Risk Behavior Survey, United States, 2019**

| Behavior | Frequency | | | |
|---|---|---|---|---|
| | 1–2 times<br>% (95% CI) | 3–9 times<br>% (95% CI) | 10–39 times<br>% (95% CI) | ≥40 times<br>% (95% CI) |
| **Current use*** | | | | |
| Marijuana (n = 2,946) | 36.7 (33.7–39.8) | 21.8 (19.7–24.1) | 23.5 (21.4–25.8) | 18.0 (15.1–21.3) |
| Prescription opioid misuse (n = 661) | 53.2 (47.9–58.5) | 23.3 (18.9–28.3) | 13.7 (11.0–16.9) | 9.8 (6.3–14.8) |
| **Lifetime use** | | | | |
| Marijuana (n = 4,219) | 24.6 (22.4–27.1) | 20.9 (19.3–22.6) | 20.8 (19.2–22.5) | 33.6 (30.5–36.9) |
| Prescription opioid misuse (n = 2,000) | 48.8 (45.7–51.9) | 24.7 (22.4–27.2) | 15.9 (14.0–18.1) | 10.6 (8.8–12.7) |
| Synthetic marijuana (n = 955) | 48.8 (44.9–52.6) | 20.8 (17.8–24.3) | 18.5 (14.9–22.8) | 11.9 (9.2–15.3) |
| Cocaine (n = 557) | 45.0 (38.7–51.5) | 20.3 (15.7–25.9) | 18.5 (14.4–23.6) | 16.1 (11.8–21.7) |
| Methamphetamine (n = 351) | 42.9 (34.7–51.5) | 15.5 (10.8–21.7) | 13.7 (9.0–20.3) | 27.9 (19.1–39.0) |
| Heroin (n = 316) | 31.7 (24.4–40.1) | 18.6 (12.8–26.2) | 16.9 (11.8–23.6) | 32.9 (21.7–46.3) |

| Behavior | Frequency | | | |
|---|---|---|---|---|
| | 1–2 days<br>% (95% CI) | 3–9 days<br>% (95% CI) | 10–19 days<br>% (95% CI) | ≥20 days<br>% (95% CI) |
| **Current use** | | | | |
| Alcohol use (n = 3,669) | 54.8 (52.6–57.0) | 36.6 (34.4–38.8) | 5.1 (4.1–6.4) | 3.5 (2.6–4.7) |
| Binge drinking (n = 1,657) | 61.2 (56.5–65.7) | 31.1 (27.7–34.7) | 4.1 (2.7–6.2) | 3.6 (2.4–5.3) |

| Behavior | Frequency | |
|---|---|---|
| | 1 time<br>% (95% CI) | ≥2 times<br>% (95% CI) |
| **Lifetime use** | | |
| Injection drug use (n = 200) | 47.8 (35.4–60.4) | 52.2 (39.6–64.6) |

**Abbreviation:** CI = confidence interval.
* Previous 30 days before the survey.

each), followed by cocaine (45.0%), and methamphetamine (42.9%). Among students reporting current alcohol use or current binge drinking, more than half of students (54.8% and 61.2%, respectively) reported those behaviors on 1–2 days. Among students who had ever injected drugs (1.2%), 47.8% reported injecting drugs 1 time, and 52.2% reported injecting drugs ≥2 times.

Students reporting current prescription opioid misuse commonly indicated use of other substances (Figure). Overall, 43.5% of students reporting current prescription opioid misuse also reported current marijuana use, 59.4% reported current alcohol use, and 30.3% reported current binge drinking. Lifetime use of other substances among students reporting current prescription opioid misuse was 62.9% for marijuana, 30.3% for synthetic marijuana, 20.5% for cocaine, 15.0% for methamphetamine, and 14.0% for heroin. Approximately 12.4% of students reporting current prescription opioid misuse also reported lifetime injection drug use.

In adjusted analyses, current prescription opioid misuse varied by sex, race/ethnicity, and sexual identity (Table 4). Specifically, males were significantly less likely to report engaging in current prescription opioid misuse (aPR: 0.69; 95% CI: 0.57–0.84) compared with females (referent group); black and Hispanic students were significantly more likely to have engaged in prescription opioid misuse (black students, aPR: 1.49; 95% CI: 1.05–2.10; Hispanic students, aPR: 1.52; 95% CI: 1.12–2.05) compared with white students (referent group); and students identifying as lesbian, gay, or bisexual were more likely to report current prescription opioid misuse (aPR: 1.35; 95% CI: 1.02–1.79) compared with students identifying as heterosexual (referent group). All substance use behaviors included in the model, except for marijuana use, were significantly associated with current prescription opioid misuse, ranging from aPR = 2.13 (95% CI: 1.59–2.86) for lifetime synthetic marijuana use and aPR = 2.13 (95% CI: 1.58–2.86) for previous 30-day binge drinking, to aPR = 5.08 (95% CI: 2.72–9.49) for lifetime injection drug use.

## Discussion

This report provides key insights into substance use behaviors of U.S. high school students during 2009–2019. Encouraging findings include decreasing prevalence of current alcohol use and decreases in the prevalence of lifetime use of marijuana, cocaine, methamphetamine, heroin, synthetic marijuana, and injection drug use. However, the findings in this report underscore that substance use among high school students remains common, with approximately one in three students reporting current alcohol, one in five reporting current marijuana use, and one in seven reporting current binge drinking. Because of the ongoing U.S. opioid crisis, of particular concern are the high rates of lifetime (one in seven students) and current prescription opioid misuse (one in 14 students) and high rates of co-occurring substance use among students currently misusing prescription opioids.

Notable demographic differences and patterns in substance use among high school students are identified in this report. Specifically, males had substantially higher rates of cocaine, methamphetamine, heroin, and injection drug use compared with females, and females had substantially higher rates of current alcohol use and current binge drinking. In addition, females had higher rates of current prescription opioid misuse compared with males, and this pattern persisted in multivariable models where males had lower adjusted prevalence ratios for current prescription opioid misuse compared with females. Differences also occurred in substance use patterns across racial/ethnic groups. For example, black and Hispanic students reported higher rates of current prescription opioid misuse compared with white students; in contrast, white students reported the highest rates of current alcohol use and binge drinking, followed by Hispanic and black students. These substance use patterns by racial/ethnic groups are similar to those identified in other U.S. youth substance use surveys (https://www.samhsa.gov/data/report/2018-nsduh-detailed-tables). This heterogeneity in substance use patterns among demographic groups can be used to guide development of tailored and targeted prevention messages and interventions.

Particularly noteworthy were the universally elevated rates of substance use among self-identified sexual minority youths compared with heterosexual youths, which is consistent with previous research (12). In addition to findings regarding broader substance use patterns, this report provides actionable information on prescription opioid misuse among high school students that can be applied to ongoing efforts for preventing opioid misuse, use disorders, and overdoses. Specifically, the high rates of co-occurring substance use, especially alcohol and marijuana use, among students currently misusing prescription opioids highlights the importance of prevention efforts that focus on general substance use risk and protective factors. Notably, these associations are not limited to high school students because binge drinking and marijuana use are associated with increased prescription opioid misuse among both adults and adolescents (13). Finally, sexual minority youths also had significantly higher prevalence of current prescription opioid misuse even after controlling for other demographic and substance use characteristics, which is consistent with their overall pattern of higher rates of substance use in this study. It also further emphasizes the importance of identifying tailored prevention strategies to address disparities among this vulnerable population.

**FIGURE. Percentage of co-occurring substance use behaviors among high school students who reported previous 30-day prescription opioid misuse\* — Youth Risk Behavior Survey, United States, 2019**
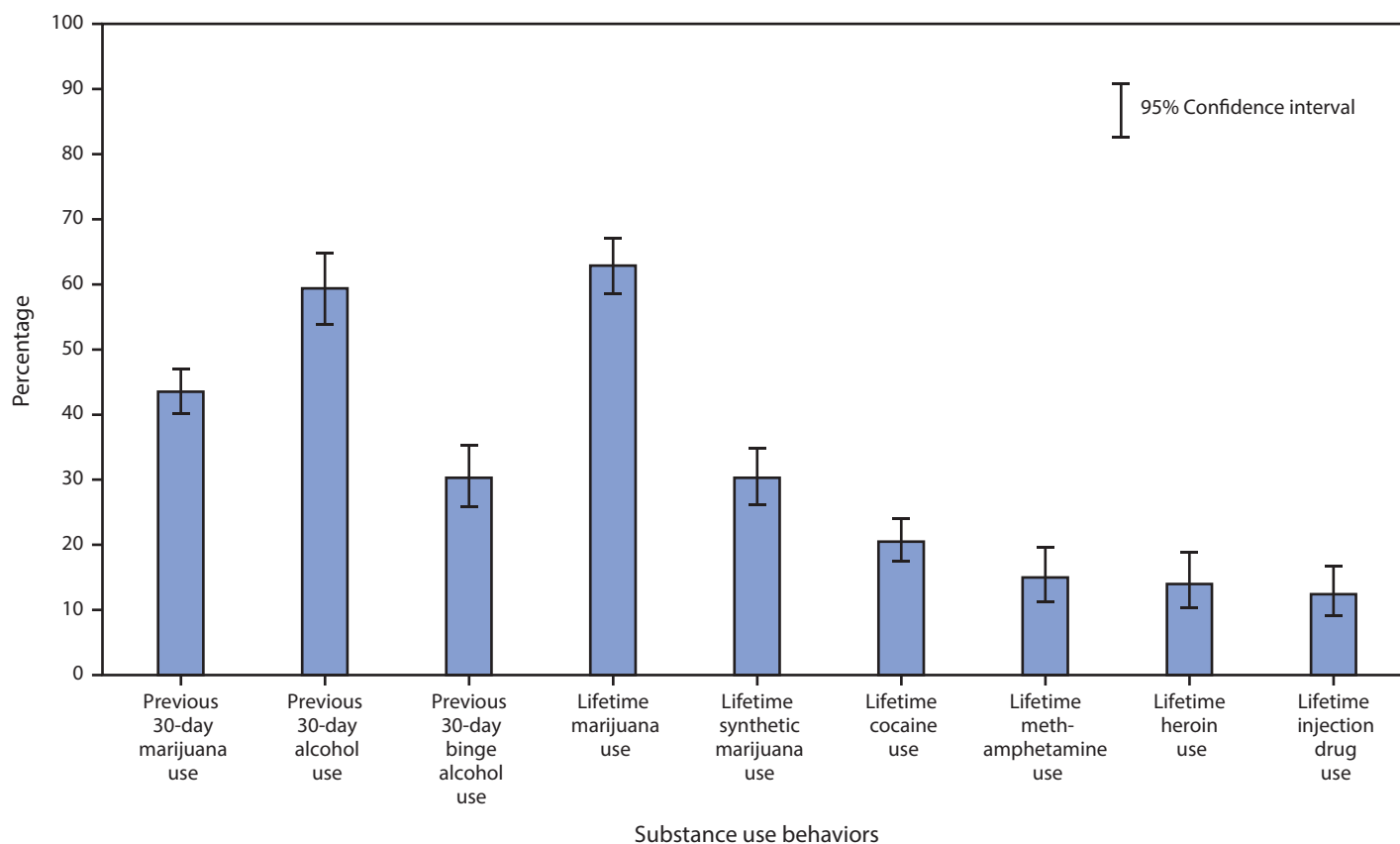


\* Unweighted N = 661.

Scientific evidence for the effective prevention of substance use indicates the importance of interventions that target risk and protective factors at the individual, family, and community levels to maximize their public health impact (*1–3*). Risk factors include adverse childhood experiences at the individual level, limited parental monitoring and involvement and active substance use in the home at the family level, and easy availability and accessibility to alcohol and other substances and community norms favorable toward use of alcohol and other substances at the community level (*1,2,5*). In addition, studies have demonstrated that youth alcohol use is associated with adult alcohol use, and that both community-level and individual-level alcohol use are affected by population-level alcohol policies (e.g., those that reduce the availability and accessibility of alcohol and increase its price) (*14*).

The ability to reach young persons during early elementary ages, before they begin using substances, and throughout adolescence makes the school environment well-suited for prevention programming. School-based substance use prevention programs that focus on broad-based skill building (e.g., psychosocial development, life-skills development, and

social-emotional learning and connectedness) have greater promise than substance-specific programs (*15,16*). In addition, multifaceted programs that incorporate aspects of individual, school, and family interventions (e.g., the Promoting School-community-university Partnerships to Enhanced Resilience [PROSPER] program and Communities That Care [CTC]) have demonstrated effectiveness at reducing or preventing youth substance use (*17,18*).

Broader prevention policies for changing the environment in which youths live (e.g., those that reduce the availability of substances) can also be used as part of a comprehensive approach for reducing youth substance use. The U.S. Community Preventive Services Task Force recommends certain population-level strategies (e.g., increasing alcohol taxes and regulating the number and concentration of places that sell alcohol as interventions for reducing excessive alcohol use, including alcohol use among youths) (https://www.thecommunityguide. org/resources/what-works-preventing-excessive-alcohol-consumption). Enhanced enforcement of existing substance use policies (e.g., prescription drug monitoring programs that are used universally with near–real-time data and laws

**TABLE 4. Multivariable logistic regression model examining individual-level characteristics associated with previous 30-day prescription opioid misuse among high school students — Youth Risk Behavior Survey, United States, 2019**

| Characteristic | Adjusted* prevalence ratios (95% CI) |
|---|---|
| **Demographics** | |
| Sex | |
| Female | Referent |
| Male | 0.69 (0.57–0.84) |
| Race/Ethnicity | |
| White, non-Hispanic | Referent |
| Black, non-Hispanic | 1.49 (1.05–2.10) |
| Hispanic | 1.52 (1.12–2.05) |
| Grade | |
| 9 or 10 | Referent |
| 11 or 12 | 0.85 (0.66–1.10) |
| **Sexual identity** | |
| Heterosexual | Referent |
| Lesbian, gay, or bisexual | 1.35 (1.02–1.79) |
| Not sure | 1.37 (0.86–2.17) |
| **Substance use and use behaviors** | |
| Alcohol use | |
| No previous 30-day use | Referent |
| Previous 30-day nonbinge drinking | 2.28 (1.63–3.19) |
| Previous 30-day binge drinking | 2.13 (1.58–2.86) |
| Marijuana use | |
| No lifetime use | Referent |
| Lifetime use, but no previous 30-day use | 1.21 (0.89–1.65) |
| Previous 30-day use | 1.31 (0.95–1.80) |
| Lifetime synthetic marijuana use | |
| No | Referent |
| Yes | 2.13 (1.59–2.86) |
| Lifetime use of cocaine, heroin, or methamphetamine | |
| No | Referent |
| Yes | 2.49 (1.89–3.27) |
| Lifetime injection drug use | |
| No | Referent |
| Yes | 5.08 (2.72–9.49) |

**Abbreviation:** CI = confidence interval.
* Adjusted prevalence ratios were calculated from a single logistic regression model that included all covariates listed in this table.

prohibiting sales of alcohol to persons aged <21 years) also can help reduce substance use among youths (*19,20*). In addition, strategies for expanding access to evidence-based pain treatment and improving prescribing of prescription opioids through safer prescribing practices can help reduce opioid misuse and overdoses. Improving opioid prescribing can have dual benefits by reducing the environmental availability of prescription opioids for diversion and misuse and reducing the risk for misuse associated with the prescription of opioids to youths (*2*).

## Limitations

General limitations for the YRBS are available in the overview report of this supplement (*11*). The findings in this report are subject to at least three additional limitations. First, the questions assessing lifetime and current prescription opioid misuse refer to prescription pain medicine; however, the questions provide examples of opioid-containing prescription medications only. Therefore, if students considered nonopioid prescription pain medications when answering, an overestimation of prescription opioid misuse prevalence might have occurred. Second, many of the substance use questions included common street names for drugs; however, newly introduced street names or street names specific to certain geographic areas were not included, which might have resulted in underreporting of substance use behaviors. Finally, there was variation in the amount of missing data for some substance use variables (e.g., the largest amount missing was for current prescription opioid misuse [5,000 missing observations]). Missing data might result from a variety of factors, such as students choosing not to answer questions or inconsistent responses to similar questions that are set to missing during the data cleaning process (*11*). In addition, schools selected to participate in the national YRBS and in a state or local YRBS only complete the local version of the survey; as a result, questions included on the national survey but not the local survey are set to missing.

## Conclusion

The findings in this report indicate that youth substance use has declined in recent years; however, substance use, including misuse of prescription opioids, remains common among U.S. high school students. Opportunities exist for bringing to scale evidence-based policies, programs, and practices that aim to reduce risk factors and strengthen protective factors among youths in conjunction with initiatives already underway for combating the U.S. opioid overdose epidemic. Disproportionately affected populations (e.g., sexual minority youths) might benefit from tailored substance use interventions combined with more widespread implementation of broader population-level policy strategies.

### Conflicts of Interest

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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# Suicidal Ideation and Behaviors Among High School Students — Youth Risk Behavior Survey, United States, 2019

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## Abstract

Suicide is the second leading cause of death among high school-aged youths 14–18 years after unintentional injuries. This report summarizes data regarding suicidal ideation (i.e., seriously considered suicide) and behaviors (i.e., made a suicide plan, attempted suicide, and made a suicide attempt requiring medical treatment) from CDC's 2019 Youth Risk Behavior Survey. Results are reported overall and by sex, grade, race/ethnicity, sexual identity, and sex of sexual contacts, overall and within sex groups. Trends in suicide attempts during 2009–2019 are also reported by sex, race/ethnicity, and grade. During 2009–2019, prevalence of suicide attempts increased overall and among female, non-Hispanic white, non-Hispanic black, and 12th-grade students. Data from 2019 reflect substantial differences by demographics regarding suicidal ideation and behaviors. For example, during 2019, a total of 18.8% of students reported having seriously considered suicide, with prevalence estimates highest among females (24.1%); white non-Hispanic students (19.1%); students who reported having sex with persons of the same sex or with both sexes (54.2%); and students who identified as lesbian, gay, or bisexual (46.8%). Among all students, 8.9% reported having attempted suicide, with prevalence estimates highest among females (11.0%); black non-Hispanic students (11.8%); students who reported having sex with persons of the same sex or with both sexes (30.3%); and students who identified as lesbian, gay, or bisexual (23.4%). Comprehensive suicide prevention can address these differences and reduce prevalence of suicidal ideation and behaviors by implementing programs, practices, and policies that prevent suicide (e.g., parenting programs), supporting persons currently at risk (e.g., psychotherapy), preventing reattempts (e.g., emergency department follow-up), and attending to persons who have lost a friend or loved one to suicide.

## Introduction

Suicidal behavior presents a major challenge to public health in the United States and globally (1). Although fatal (i.e., suicide) and nonfatal (e.g., suicide attempts) suicidal behaviors are a public health concern across the life span, they are of particular concern for youths and young adults aged 10–24 years. During 2018, a total of 48,344 persons (all ages) died from suicide, and suicide was the 10th leading cause of death overall in the United States, accounting for approximately 1.7% of all deaths (2). Among high school–aged youths (14–18 years), 2,039 suicides occurred that year, making it the second leading cause of death for this age group after unintentional injuries (n = 2,590). Suicide accounted for approximately 33.9% or approximately one of every three injury-related deaths among this age group (2). During 2009–2018, suicide rates among youths aged 14–18 years

increased by 61.7% from 6.0 to 9.7 per 100,000 population (2). Although suicide is a major public health problem, many more youths make suicide attempts and struggle with suicidal ideation. For example, during 2018, according to data from a nationally representative sample of emergency departments (EDs), approximately 95,000 youths aged 14–18 years visited EDs for self-harm injuries (2).

One objective of the *Healthy People 2020* Mental Health and Mental Disorders is to reduce suicide attempts by adolescents that resulted in an injury, poisoning, or overdose that had to be treated by a doctor or nurse (3). The Youth Risk Behavior Survey (YRBS) monitors six categories of priority health behaviors and experiences among adolescents, with four questions specifically related to suicide (4). This report summarizes 2019 YRBS data regarding suicidal ideation and behaviors among high school students and presents trends in suicide attempts among this population during 2009–2019. The report is intended for decision-makers, prevention program practitioners, and those who work in youth-serving organizations so that they can identify vulnerable youths and take appropriate action to direct prevention resources to those young persons.

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# Methods

## Data Source

This report includes data from the 2009–2019 cycles of the YRBS, a cross-sectional, school-based survey conducted biennially since 1991. Each survey year, CDC collects data from a nationally representative sample of public and private school students in grades 9–12 in the 50 U.S. states and the District of Columbia. Additional information about YRBS sampling, data collection, response rates, and processing is available in the overview report of this supplement (*4*). The overview report also includes information about the classification of sexual identity and sex of sexual contacts and standard data analysis methods. The prevalence estimates for all suicidal ideation and behavior questions for the overall study population and by sex, race/ethnicity, grade, and sexual orientation are available at https://nccd.cdc.gov/youthonline/App/Default.aspx. The full YRBS questionnaire is available at https://www.cdc.gov/healthyyouth/data/yrbs/pdf/2019/2019_YRBS-National-HS-Questionnaire.pdf.

## Measures

Four suicidal ideation and behavior variables are included in this report. Suicidal ideation was measured with the question, "During the past 12 months, did you ever seriously consider attempting suicide?" Making a suicide plan was measured with the question, "During the past 12 months, did you make a plan about how you would attempt suicide?" (These two questions had "yes" or "no" response options.) Suicide attempts were measured with the question, "During the past 12 months, how many times did you actually attempt suicide?" Suicide attempts were assessed by frequency of attempts, but the variable was dichotomized into yes or no responses for analytic purposes. Lastly, students were asked, "If you attempted suicide during the past 12 months, did any attempt result in an injury, poisoning, or overdose that had to be treated by a doctor or nurse?" This question is referred to in this report as, "made a suicide attempt requiring medical treatment." The response options for the last question were, "I did not attempt suicide during the past 12 months," "yes," or "no"; however, this variable was also dichotomized into yes or no responses for analysis.

## Analysis

Analyses of these suicidal ideation and behavior variables included examining associations between each item and demographic characteristics, including sex (male/female), race/ethnicity (non-Hispanic white [white], non-Hispanic black [black], or Hispanic), grade (9, 10, 11, or 12), sexual identity (heterosexual; lesbian, gay, or bisexual [LGB]; or not sure), or sex of sexual contacts (sexual contact with only the opposite sex, sexual contact with only the same sex or both sexes, and no sexual contact). Associations by race/ethnicity, grade, sexual identity, and sex of sexual contacts were calculated for the overall study population but also separately for male and female students. Statistical differences were determined by using chi-square analyses at the p <0.05 level of significance. Linear trends for 2009–2019 were examined for attempted suicide by sex, race/ethnicity, and grade. All analyses of suicidal ideation and behaviors were conducted among the full sample, and analysis of behavior variables was not limited to students who reported suicidal ideation (i.e., analysis conducted among the full sample). Additional information about the methods used to conduct YRBS trend analyses are provided in the overview report of this supplement (*4*).

# Results

## Suicidal Ideation and Behaviors, Overall and by Sex

During the 12 months before the survey, 18.8% of students nationwide reported seriously considered attempting suicide (prevalence significantly higher among female [24.1%] than male [13.3%] students), and among students nationwide, 15.7% of students had made a plan about how they would attempt suicide (prevalence significantly higher among female [19.9%] than male [11.3%] students), and 8.9% of students had attempted suicide ≥1 time (prevalence significantly higher among female [11.0%] than male [6.6%] students) (Table 1). Nationwide, 2.5% of students had made a suicide attempt requiring medical treatment, with a prevalence significantly higher among female (3.3%) than male (1.7%) students.

## Suicidal Ideation and Behaviors by Race/ Ethnicity and Grade, Overall and by Sex

Overall, a significant difference occurred in having seriously considered attempting suicide by race/ethnicity (white: 19.1%; black: 16.9%; Hispanic: 17.2%) (Table 2), with a significant difference by race/ethnicity among male students (white: 13.8%; black: 10.7%; Hispanic: 11.4%) but not among female students. No significant differences (overall or by sex) occurred in having seriously considered attempting suicide by grade.

Among students reporting having made a suicide plan, a significant difference occurred by race and ethnicity overall (white: 15.7%; black: 15.0%; Hispanic: 14.7%) but not among male or female students. No significant difference occurred in

TABLE 1. Percentage of high school students who had seriously considered attempting suicide, had made a suicide plan, had attempted suicide, or had made a suicide attempt requiring medical treatment during the 12 months before the survey, by sex — Youth Risk Behavior Survey, United States, 2019

| Behavior | Female<br>% (95% CI) | Male<br>% (95% CI) | Total<br>% (95% CI) | Chi-square<br>(p value) |
|---|---|---|---|---|
| Seriously considered attempting suicide | | | | 97.922 (<0.001) |
| Yes | 24.1 (22.3–26.0) | 13.3 (12.2–14.5) | **18.8 (17.6–20.0)** | NA |
| No | 75.9 (74.0–77.7) | 86.7 (85.5–87.8) | **81.2 (80.0–82.4)** | NA |
| Made a suicide plan | | | | 109.568 (<0.001) |
| Yes | 19.9 (18.4–21.6) | 11.3 (10.3–12.4) | **15.7 (14.6–16.9)** | NA |
| No | 80.1 (78.4–81.6) | 88.7 (87.6–89.7) | **84.3 (83.1–85.4)** | NA |
| Attempted suicide | | | | 27.037 (<0.001) |
| Yes | 11.0 (9.7–12.5) | 6.6 (5.5–8.1) | **8.9 (7.9–10.0)** | NA |
| No | 89.0 (87.5–90.3) | 93.4 (91.9–94.5) | **91.1 (90.0–92.1)** | NA |
| Made a suicide attempt requiring medical treatment* | | | | 10.313 (0.003) |
| Yes | 3.3 (2.6–4.2) | 1.7 (1.3–2.3) | **2.5 (2.1–3.0)** | NA |
| No | 96.7 (95.8–97.4) | 98.3 (97.7–98.7) | **97.5 (97.0–97.9)** | NA |

**Abbreviations:** CI = confidence interval; NA = not applicable.
* Made a suicide attempt that resulted in an injury, poisoning, or overdose that had to be treated by a doctor or nurse.

having made a suicide plan by grade overall or among female students, but a significant difference was identified among male students (9th grade: 9.5%; 10th grade: 10.4%; 11th grade: 12.1%; 12th grade: 13.6%). Students who had attempted suicide were significantly different by race/ethnicity overall (white: 7.9%; black: 11.8%; Hispanic: 8.9%) and among female students (white: 9.4%; black: 15.2%; Hispanic: 11.9%) but not among male students. No significant differences existed in having attempted suicide by grade (overall or by sex). In addition, no significant difference in having made a suicide attempt requiring medical treatment was noted by race/ethnicity or grade, overall or by sex.

## Suicidal Ideation and Behaviors by Sexual Identity and Sex of Sexual Contacts, Overall and by Sex

A significant difference occurred in having seriously considered attempting suicide by sexual identity overall (heterosexual: 14.5%; LGB: 46.8%; not sure: 30.4%) (Table 3) and among both female (heterosexual: 18.0%; LGB: 49.0%; not sure: 35.9%) and male (heterosexual: 11.4%; LGB: 40.4%; not sure: 21.7%) students. Similarly, having seriously considered attempting suicide varied by sex of sexual contacts, overall (had sexual contact with only the opposite sex: 19.4%; had sexual contact with only the same sex or both sexes: 54.2%; had no sexual contact: 13.0%), among female (had sexual contact with only the opposite sex: 25.3%; had sexual contact with only the same sex or both sexes: 59.2%; had no sexual contact: 16.2%), and among male (had sexual contact with only the same sex or both sexes: 39.1%; had no sexual contact: 9.7%) students.

Overall, a significant difference occurred in having made a suicide plan by sexual identity (heterosexual: 12.1%; LGB: 40.2%; not sure: 23.9%), with a significant difference among both female (heterosexual: 14.6%; LGB: 42.4%; not sure: 28.1%) and male (heterosexual: 9.9%; LGB: 33.0%; not sure: 17.4%) students. Similarly, a significant difference was noted among students having made a suicide plan by sex of sexual contacts, overall (had sexual contact with only the opposite sex: 16.5%; had sexual contact with only the same sex or both sexes: 44.0%; had no sexual contact: 10.9%), with a significant difference among both female (had sexual contact with only the opposite sex: 20.7%; had sexual contact with only the same sex or both sexes: 48.2%; had no sexual contact: 13.8%) and male (had sexual contact with only the opposite sex: 12.9%; had sexual contact with only the same sex or both sexes: 31.2%; had no sexual contact: 7.9%) students.

A significant difference existed in having attempted suicide by sexual identity, overall (heterosexual: 6.4%; LGB: 23.4%; not sure: 16.1%) and among both female (heterosexual: 7.9%; LGB: 23.6%; not sure: 15.2%) and male (heterosexual: 5.1%; LGB: 23.8%; not sure: 16.4%) students. Similarly, a significant difference was identified in having attempted suicide by sex of sexual contacts, overall (had sexual contact with only the opposite sex: 9.3%; had sexual contact with only the same sex or both sexes: 30.3%; no sexual contact: 4.8%), with a significant difference among both female (had sexual contact with only the opposite sex: 11.4%; had sexual contact with only the same sex or both sexes: 31.4%; no sexual contact: 6.1%) and male (had sexual contact with only the opposite sex: 7.5%; had sexual contact with only the same sex or both sexes: 26.5%; no sexual contact: 3.5%) students.

Finally, a significant difference occurred in having made a suicide attempt requiring medical treatment by sexual identity,

**TABLE 2. Percentage of high school students who had seriously considered attempting suicide, had made a suicide plan, had attempted suicide, or had made a suicide attempt requiring medical treatment during the 12 months before the survey, by sex, race/ethnicity, and grade — Youth Risk Behavior Survey, United States, 2019**

| Behavior | Female % (95% CI) | Chi-square (p value) | Male % (95% CI) | Chi-square (p value) | Total % (95% CI) | Chi-square (p value) |
|---|---|---|---|---|---|---|
| **Seriously considered attempting suicide** | | | | | | |
| Race/Ethnicity | —* | 1.504 (0.230) | — | 4.989 (0.005) | — | 5.870 (0.002) |
| White, non-Hispanic | 24.3 (21.9–26.9) | — | 13.8 (12.3–15.3) | — | **19.1 (17.6–20.8)** | — |
| Black, non-Hispanic | 23.7 (20.7–27.1) | — | 10.7 (8.2–13.7) | — | **16.9 (15.3–18.7)** | — |
| Hispanic | 22.7 (19.3–26.5) | — | 11.4 (9.8–13.3) | — | **17.2 (15.2–19.4)** | — |
| Grade | — | 0.209 (0.889) | — | 0.790 (0.507) | — | 0.820 (0.491) |
| 9 | 23.7 (20.7–27.0) | — | 11.9 (9.9–14.2) | — | **17.7 (15.7–19.8)** | — |
| 10 | 23.6 (20.3–27.3) | — | 13.2 (11.1–15.8) | — | **18.5 (16.1–21.1)** | — |
| 11 | 24.9 (22.5–27.6) | — | 13.6 (11.5–16.0) | — | **19.3 (17.7–21.1)** | — |
| 12 | 24.0 (20.7–27.6) | — | 14.9 (12.4–17.7) | — | **19.6 (17.5–21.9)** | — |
| **Made a suicide plan** | | | | | | |
| Race/Ethnicity | — | 1.652 (0.194) | — | 2.358 (0.087) | — | 3.043 (0.041) |
| White, non-Hispanic | 19.2 (16.9–21.8) | — | 12.0 (10.6–13.5) | — | **15.7 (14.1–17.4)** | — |
| Black, non-Hispanic | 20.4 (17.6–23.5) | — | 10.1 (7.3–13.9) | — | **15.0 (12.9–17.5)** | — |
| Hispanic | 19.6 (16.9–22.6) | — | 9.6 (8.0–11.4) | — | **14.7 (13.0–16.7)** | — |
| Grade | — | 0.461 (0.711) | — | 3.195 (0.035) | — | 0.652 (0.587) |
| 9 | 20.4 (17.9–23.2) | — | 9.5 (7.9–11.4) | — | **14.8 (13.1–16.6)** | — |
| 10 | 20.3 (17.2–23.7) | — | 10.4 (8.6–12.4) | — | **15.4 (13.4–17.7)** | — |
| 11 | 20.4 (17.6–23.5) | — | 12.1 (10.3–14.2) | — | **16.4 (14.5–18.5)** | — |
| 12 | 18.5 (15.7–21.6) | — | 13.6 (11.4–16.1) | — | **16.2 (14.3–18.3)** | — |
| **Attempted suicide** | | | | | | |
| Race/Ethnicity | — | 2.973 (0.044) | — | 1.505 (0.229) | — | 2.866 (0.050) |
| White, non-Hispanic | 9.4 (7.8–11.3) | — | 6.4 (5.1–7.8) | — | **7.9 (6.9–9.1)** | — |
| Black, non-Hispanic | 15.2 (10.8–20.9) | — | 8.5 (5.6–12.9) | — | **11.8 (8.7–15.9)** | — |
| Hispanic | 11.9 (9.0–15.6) | — | 5.5 (3.9–7.6) | — | **8.9 (7.1–11.1)** | — |
| Grade | — | 1.878 (0.150) | — | 0.384 (0.765) | — | 0.311 (0.817) |
| 9 | 12.8 (10.7–15.3) | — | 6.0 (4.5–7.9) | — | **9.4 (7.9–11.1)** | — |
| 10 | 11.0 (9.1–13.3) | — | 6.5 (4.7–9.0) | — | **8.8 (7.4–10.5)** | — |
| 11 | 10.4 (8.1–13.3) | — | 6.7 (5.2–8.8) | — | **8.6 (7.1–10.4)** | — |
| 12 | 9.4 (6.9–12.6) | — | 7.3 (5.2–10.0) | — | **8.5 (6.8–10.6)** | — |
| **Made a suicide attempt requiring medical treatment[†]** | | | | | | |
| Race/Ethnicity | — | 0.446 (0.721) | — | 1.583 (0.210) | — | 1.387 (0.262) |
| White, non-Hispanic | 2.9 (1.9–4.4) | — | 1.2 (0.8–1.9) | — | **2.1 (1.5–2.8)** | — |
| Black, non-Hispanic | 3.8 (2.3–6.2) | — | 2.9 (1.5–5.5) | — | **3.3 (2.2–4.9)** | — |
| Hispanic | 3.6 (2.6–4.9) | — | 2.3 (1.4–3.9) | — | **3.0 (2.3–3.8)** | — |
| Grade | — | 0.406 (0.750) | — | 0.571 (0.638) | — | 0.274 (0.844) |
| 9 | 3.3 (2.3–4.8) | — | 1.3 (0.7–2.3) | — | **2.3 (1.7–3.1)** | — |
| 10 | 3.6 (2.3–5.5) | — | 1.7 (0.9–3.3) | — | **2.7 (1.8–3.9)** | — |
| 11 | 2.7 (1.7–4.3) | — | 2.0 (1.2–3.2) | — | **2.3 (1.7–3.3)** | — |
| 12 | 3.4 (2.2–5.3) | — | 1.9 (1.0–3.9) | — | **2.7 (2.0–3.7)** | — |

**Abbreviation:** CI = Confidence interval.
* Not applicable.
[†] Made a suicide attempt that resulted in an injury, poisoning, or overdose that had to be treated by a doctor or nurse.

overall (heterosexual: 1.7%; LGB: 6.3%; not sure: 5.2%) and among both female (heterosexual: 2.3%; LGB: 6.6%; not sure: 3.8%) and male (heterosexual: 1.3%; LGB: 5.9%; not sure: 7.6%) students. A significant difference also was noted in having made a suicide attempt requiring medical treatment by sex of sexual contacts, overall (had sexual contact with only the opposite sex: 2.6%; had sexual contact with only the same sex or both sexes: 10.2%; had no sexual contact: 1.0%) and among both female (had sexual contact with only the opposite sex: 3.4%; had sexual contact with only the same sex or both

sexes: 10.4%; had no sexual contact: 1.4%) and male (had sexual contact with only the opposite sex: 1.9%; had sexual contact with only the same sex or both sexes: 9.4%; had no sexual contact: 0.5%) students.

## Trends in Suicide Attempts, Overall and by Sex, Race/Ethnicity, and Grade

Among the total student population, the percentage of students who had attempted suicide ≥1 time during the

**TABLE 3. Percentage of high school students who had seriously considered attempting suicide, had made a suicide plan, had attempted suicide, or had made a suicide attempt requiring medical treatment during the 12 months before the survey, by sex, sexual identity, and sex of sexual contacts — Youth Risk Behavior Survey, United States, 2019**

| Behavior | Female % (95% CI) | Chi-square (p value) | Male % (95% CI) | Chi-square (p value) | Total % (95% CI) | Chi-square (p value) |
|---|---|---|---|---|---|---|
| **Seriously considered attempting suicide** | | | | | | |
| Sexual identity | — | 75.728 (<0.001) | — | 22.231 (<0.001) | — | 88.194 (<0.001) |
| Heterosexual | 18.0 (16.3–20.0) | —* | 11.4 (10.4–12.6) | — | **14.5 (13.4–15.7)** | — |
| LGB | 49.0 (44.8–53.3) | — | 40.4 (33.9–47.1) | — | **46.8 (43.1–50.6)** | — |
| Not sure | 35.9 (29.5–42.9) | — | 21.7 (14.8–30.5) | — | **30.4 (25.4–35.9)** | — |
| Sex of sexual contacts | — | 64.007 (<0.001) | — | 13.972 (<0.001) | — | 66.938 (<0.001) |
| Opposite sex only | 25.3 (22.8–28.0) | — | 14.6 (12.9–16.5) | — | **19.4 (17.6–21.4)** | — |
| Same sex only or both  sexes | 59.2 (52.5–65.6) | — | 39.1 (29.3–49.9) | — | **54.2 (49.0–59.3)** | — |
| No sexual contact | 16.2 (14.2–18.3) | — | 9.7 (8.1–11.7) | — | **13.0 (11.8–14.3)** | — |
| **Made a suicide plan** | | | | | | |
| Sexual identity | — | 66.568 (<0.001) | — | 19.732 (<0.001) | — | 90.368 (<0.001) |
| Heterosexual | 14.6 (13.2–16.0) | — | 9.9 (8.9–11.0) | — | **12.1 (11.1–13.1)** | — |
| LGB | 42.4 (38.4–46.4) | — | 33.0 (26.4–40.3) | — | **40.2 (36.6–44.0)** | — |
| Not sure | 28.1 (22.1–35.0) | — | 17.4 (11.8–24.8) | — | **23.9 (19.4–29.0)** | — |
| Sex of sexual contacts | — | 56.442 (<0.001) | — | 18.435 (<0.001) | — | 62.470 (< 0.001) |
| Opposite sex only | 20.7 (18.4–23.3) | — | 12.9 (11.5–14.6) | — | **16.5 (14.9–18.1)** | — |
| Same sex only or both sexes | 48.2 (42.8–53.6) | — | 31.2 (23.8–39.7) | — | **44.0 (39.7–48.4)** | — |
| No sexual contact | 13.8 (12.3–15.6) | — | 7.9 (6.7–9.4) | — | **10.9 (9.8–12.1)** | — |
| **Attempted suicide** | | | | | | |
| Sexual identity | — | 26.919 (<0.001) | — | 15.972 (<0.001) | — | 40.352 (<0.001) |
| Heterosexual | 7.9 (6.6–9.4) | — | 5.1 (4.2–6.3) | — | **6.4 (5.6–7.4)** | — |
| LGB | 23.6 (20.0–27.6) | — | 23.8 (17.8–31.1) | — | **23.4 (20.0–27.1)** | — |
| Not sure | 15.2 (9.6–23.3) | — | 16.4 (9.9–26.0) | — | **16.1 (11.1–22.8)** | — |
| Sex of sexual contacts | — | 58.123 (<0.001) | — | 12.379 (<0.001) | — | 66.202 (<0.001) |
| Opposite sex only | 11.4 (9.5–13.5) | — | 7.5 (5.8–9.6) | — | **9.3 (7.9–10.8)** | — |
| Same sex only or both sexes | 31.4 (27.0–36.1) | — | 26.5 (17.5–38.0) | — | **30.3 (25.9–35.0)** | — |
| No sexual contact | 6.1 (4.8–7.8) | — | 3.5 (2.6–4.8) | — | **4.8 (4.0–5.8)** | — |
| **Made a suicide attempt requiring medical treatment**[†] | | | | | | |
| Sexual identity | — | 7.893 (0.001) | — | 5.592 (0.008) | — | 13.034 (<0.001) |
| Heterosexual | 2.3 (1.6–3.2) | — | 1.3 (0.9–1.9) | — | **1.7 (1.4–2.2)** | — |
| LGB | 6.6 (5.0–8.7) | — | 5.9 (3.2–10.6) | — | **6.3 (4.8–8.3)** | — |
| Not sure | 3.8 (1.6–8.4) | — | 7.6 (3.6–15.2) | — | **5.2 (3.0–9.0)** | — |
| Sex of sexual contacts | — | 14.728 (<0.001) | — | 10.517 (<0.001) | — | 23.046 (<0.001) |
| Opposite sex only | 3.4 (2.4–4.8) | — | 1.9 (1.3–2.9) | — | **2.6 (2.0–3.3)** | — |
| Same sex only or both sexes | 10.4 (7.5–14.2) | — | 9.4 (4.9–17.6) | — | **10.2 (7.6–13.4)** | — |
| No sexual contact | 1.4 (0.8–2.4) | — | 0.5 (0.3–1.1) | — | **1.0 (0.6–1.5)** | — |

**Abbreviations:** CI = confidence interval; LGB = lesbian, gay, or bisexual.
* Not applicable.
[†] Made a suicide attempt that resulted in an injury, poisoning, or overdose that had to be treated by a doctor or nurse.

12 months before the survey experienced a significant linear increase from 6.3% during 2009 to 8.9% during 2019 (Figure 1–3). Among female students, a significant linear increase (from 8.1% to 11.0%) occurred in the prevalence of having attempted suicide. No significant linear change was observed for the prevalence of having attempted suicide among male students. By race/ethnicity, significant linear increases in having attempted suicide were observed for white (from 5.0% to 7.9%) and black (from 7.9% to 11.8%) but not Hispanic students. By grade, a significant linear increase in having attempted suicide was observed only for 12th-grade students (from 4.2% to 8.5%).

## Discussion

During 2019, approximately one in five (18.8%) youths had seriously considered attempting suicide, one in six (15.7%) had made a suicide plan, one in 11 (8.9%) had made an attempt, and one in 40 (2.5%) had made a suicide attempt requiring medical treatment. Linear trends in suicide attempts have increased during 2009–2019 overall and among certain demographic groups.

The 2019 YRBS data highlight considerable differences in suicidal ideation, plans, attempts, and attempts requiring medical treatment. Consistent with previous research, during 2019, females had more suicidal ideation, suicide plans, and suicide attempts, including attempts requiring medical

**FIGURE 1. Percentage of high school students who attempted suicide during the 12 months before the survey, overall and by sex — Youth Risk Behavior Survey, United States, 2009–2019**
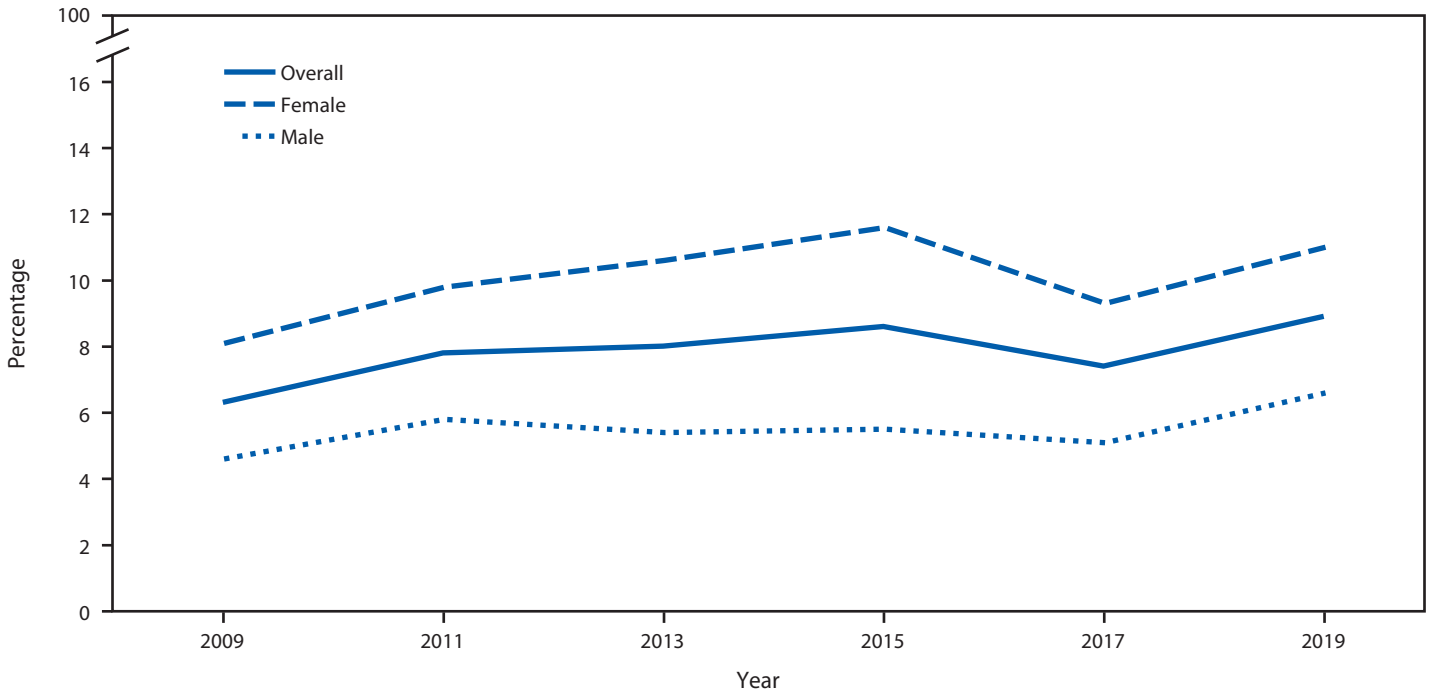


**FIGURE 2. Percentage of high school students who attempted suicide during the 12 months before the survey, by race/ethnicity — Youth Risk Behavior Survey, United States, 2009–2019**
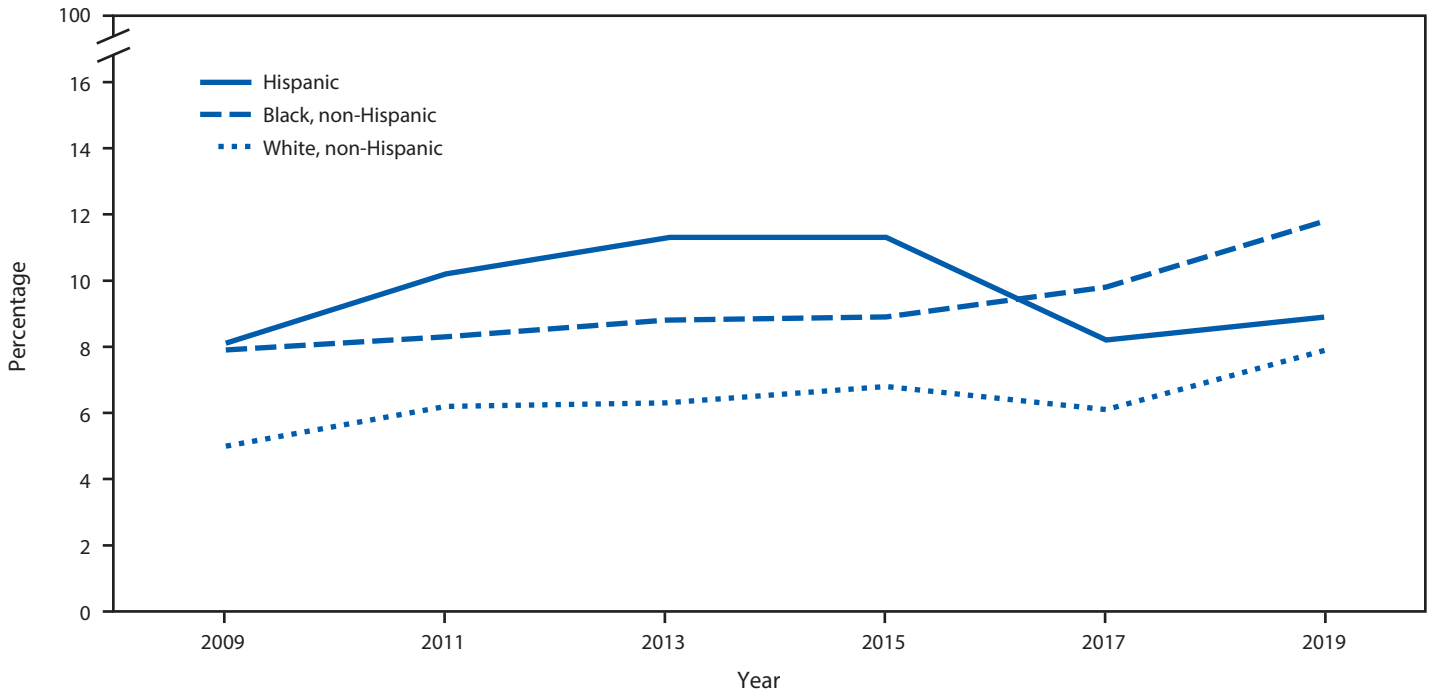
**FIGURE 3. Percentage of high school students who attempted suicide during the 12 months before the survey, by grade — Youth Risk Behavior Survey, United States, 2009–2019**
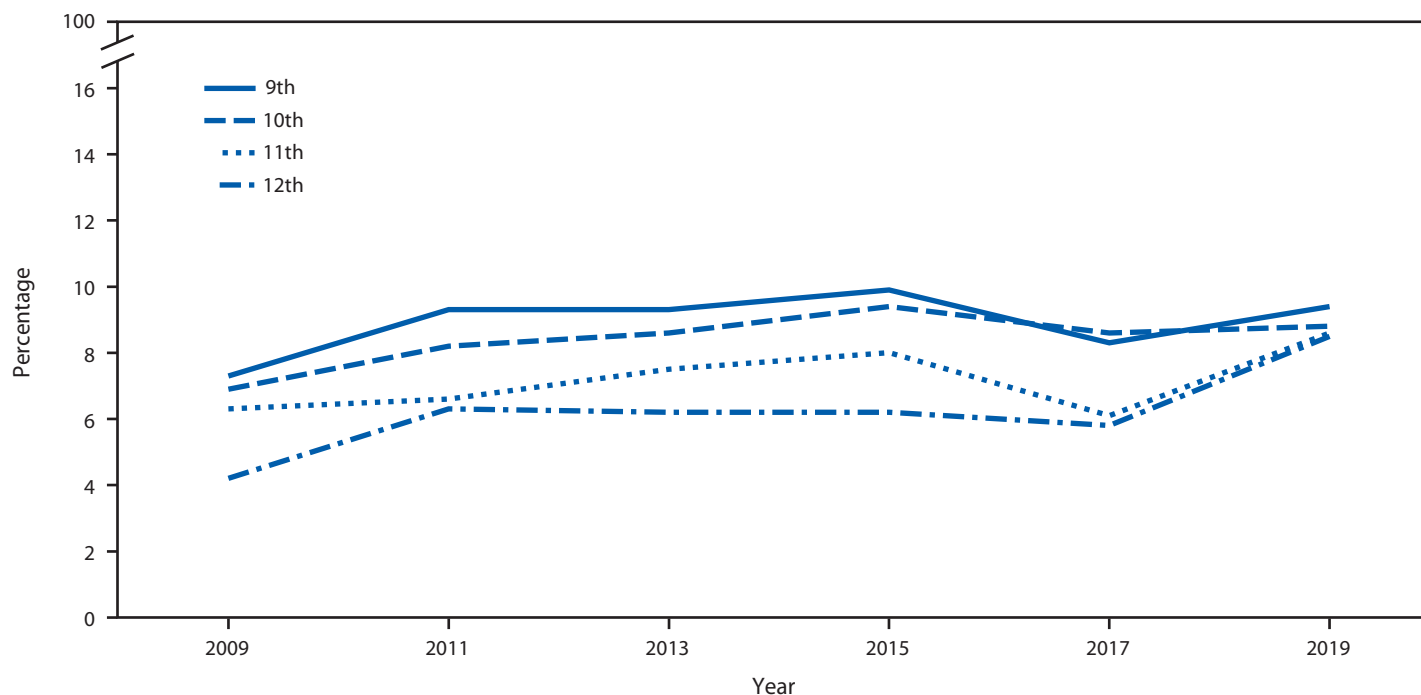


treatment, than males (*5*). Certain racial/ethnic differences also were identified. For example, black male students had the lowest prevalence estimates of suicidal ideation. Regarding suicide attempts, black students (male and female) had the highest prevalence estimates. This finding is consistent with previous research (*6*). Also consistent with previous research are the study findings regarding sexual orientation and sex of sexual contacts (*5*). Namely, prevalence estimates of suicidal ideation, suicide plans, attempts, and attempts requiring medical treatment were highest among sexual minority youths, those who identified as LGB, and youths who reported having had sexual contact with the same or with both sexes during 2019.

Adolescence is a developmental stage often characterized by rapid and extensive physical and psychosocial changes (*7*). It also represents a time for expanded identity development, with sexual identity development representing a complex, multidimensional, and often stressful process for youths (*8*). The potential dissonance between sexual identity and behavior and the social rejection sexual minority youths often experience can contribute to increased suicidal ideation and behaviors along with an increased risk for suicide (*9,10*). Because of the high prevalence of suicidal ideation and behaviors among sexual minority youths, additional research is needed to determine how best to support this vulnerable group. Such research might evaluate strategies designed to reduce sexual minority stress (e.g., discrimination and victimization resulting from sharing one's sexual orientation) (*11*) and unhealthy behaviors

(e.g., substance use) and the resultant impact on suicidal ideation and behaviors.

Suicide attempts are a known risk factor for and the greatest predictor of death by suicide (*12*), which is the rationale for investigating trends only on this outcome. The number of children and adolescents who sought medical treatment at EDs for suicide attempts increased sharply from 2007 (540,000) to 2015 (960,000) (*13*). Either a linear increase or no change in suicide attempts by variables reported here (i.e., sex, race/ethnicity, and grade) was identified for 2009–2019. Although for a different period (1991–2017), other researchers also have reported that suicide attempts among black students increased significantly (*6*). More specifically, previous findings indicated that suicide attempts increased at an accelerating rate among black females, and black male youths had a substantial increase in attempts requiring medical treatment during the period (*6*). Future studies are needed to continue monitoring trends in suicidal ideation and behavior for black students and other race/ethnicity groups. For example, such studies might include more detailed analyses among the American Indian/ Alaska Native youth population who have been reported to be at increased risk for suicidal behaviors (*6*).

In this analysis, one notable finding emerged by sex and grade; a substantial increase in making a suicide plan occurred among males as grade increased. To address this trend, schools can consider a sex-by-grade–specific approach to implementing suicide prevention or intervention activities.

# Limitations

General limitations for the YRBS are available in the overview report of this supplement (*4*). The findings in this report are subject to at least one additional limitation. This analysis is conducted among all students (i.e., does not separate ideation from behaviors); suicide patterns might differ between those who experienced suicidal ideation and those who did not.

# Future Directions

To address the health differences in suicidal ideation and behaviors observed by student demographics and to decrease these outcomes overall, a comprehensive approach to suicide prevention, including programs, practices, and policies based on the best available evidence, is needed. Such an approach addresses the range of risk and protective factors occurring across the individual, relationship, community, and societal levels. A comprehensive approach also seeks to prevent suicide risk, identify and support youths at increased risk, prevent attempts and reattempts, and help survivors of suicide loss (i.e., those grieving the death of a friend or loved one). States and communities, including school communities, can use strategies with such best available evidence as that documented in the CDC Preventing Suicide Technical Package (*14*).

Preventing adverse childhood experiences (e.g., child maltreatment) can help reduce suicide risk among adolescents through strategies that promote safe, stable, nurturing relationships and environments in childhood (*15*). Other strategies in a comprehensive approach to suicide prevention include supporting families by strengthening economic supports and teaching coping and problem-solving skills among children, adolescents, and their parents; promoting connectedness between youths and their schools, teachers, peers, and family; creating protective environments in schools and at home (e.g., limiting access to such lethal means among students at risk as medications and firearms); promoting help-seeking behaviors; reducing stigma; and training teachers and adults in recognizing signs of suicide and responding effectively through referrals to evidence-based treatment (e.g., cognitive-behavioral therapy) (*14*). Finally, schools and the media should respond to and report on suicides in ways that are supportive and responsible (e.g., not sensationalizing deaths), thereby avoiding additional suicides (i.e., suicide contagion) (*14*).

# Conclusion

Suicide is a leading cause of death among youths; however, many more youths are at risk for suicide as a result of experiencing suicidal ideation, making suicide plans, and attempting suicide, making a focus on nonfatal suicidal behavior a crucial public health priority. During 2009–2019, trends in suicide attempts among adolescents increased overall and among many demographic groups. Prevalence estimates of suicidal ideation, suicide plans, attempts, and attempts requiring medical treatment were highest among sexual minority youths and youths who reported having had sexual contact with the same or with both sexes. Regarding differences by race/ethnicity, black students had the highest prevalence estimates for attempted suicide. Factors at the individual, relationship, community, and societal levels likely contribute to the differences in suicide attempts among different racial/ethnic groups and sexual minority youths and the differences observed by sex and grade. More research is needed to better understand the risk and protective factors to determine which suicide prevention strategies might best serve each group. The findings in this report underscore the importance of a comprehensive approach to suicide prevention, which would provide necessary support to those at risk, decrease suicidal ideation and behaviors, and ultimately prevent suicide among youths and save lives.

## Conflicts of Interest

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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# Tobacco Product Use Among High School Students — Youth Risk Behavior Survey, United States, 2019

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## Abstract

Tobacco product use is the leading cause of preventable disease, disability, and death in the United States. This report used data from the 2019 Youth Risk Behavior Survey to assess the following among U.S. high school students: ever use of cigarettes and electronic vapor products, current use (≥1 day during the 30 days before the survey) of tobacco products, frequent use (≥20 days during the 30 days before the survey) among current users of tobacco products, trends in use over time, and usual source of electronic vapor products among current electronic vapor product users. In 2019, a total of 50.1% of U.S. high school students had ever used electronic vapor products, and 24.1% had ever tried cigarette smoking. Current electronic vapor product use was 32.7%, current cigarette smoking was 6.0%, current cigar smoking was 5.7%, and current smokeless tobacco use was 3.8%. Approximately 36.5% of students were current users of any tobacco product, and 8.2% were current users of two or more tobacco products. Frequent use among users of individual products was 32.6% for electronic vapor products, 28.5% for smokeless tobacco, 22.2% for cigarettes, and 18.4% for cigars. Among current electronic vapor product users who were aged ≤17 years, the most commonly reported source was borrowing them from someone else (42.8%). Significant decreases occurred in current cigarette smoking (1991: 27.5%; 2019: 6.0%), cigar smoking (1997: 22.0%; 2019: 5.7%), and smokeless tobacco use (2017: 5.5%; 2019: 3.8%). However, significant increases occurred in current electronic vapor product use (2015: 24.1%; 2019: 32.7%) and any tobacco product use (2017: 19.5%; 2019: 36.5%). Although current cigarette smoking, cigar smoking, and smokeless tobacco use has decreased among high school students, the increased prevalence of electronic vapor product use among youths is concerning. Continued surveillance for all tobacco product use is warranted for guiding and evaluating public health policy at the local, state, tribal, and national levels.

## Introduction

Smoking is the leading cause of preventable premature disease and death in the United States (1). An estimated 88% of adult daily cigarette smokers report first trying cigarette smoking before age 18 years (2). Previous reports indicate decreases in current cigarette smoking (i.e., use during the 30 days before the survey) among U.S. high school students from a high of 36.4% in 1997 to 8.8% in 2017 (3). However, there are a variety of tobacco products, including smokeless tobacco products, cigars, and most recently, electronic vapor products (e.g., e-cigarettes).

Electronic vapor products have evolved since entering the U.S. marketplace in 2007. Initial products were disposable, resembled the size and shape of conventional cigarettes, and used free-base nicotine; however, newer products are rechargeable, resemble common objects (e.g., USB flash drives), and typically deliver nicotine salts (4,5), which allow higher levels of nicotine to be inhaled more easily by the user (6). Sales of these newer generation, or "pod-mod," products have increased in the United States during recent years. For example, sales of JUUL, the most commonly sold e-cigarette in the United States since December 2017, increased approximately 600% during 2016–2017 from 2.2 million unit sales to 16.2 million unit sales (7). By December 2018, JUUL accounted for an estimated 76% of the $322.1 million total e-cigarettes sales that occurred that month in the United States (8). The popularity of these electronic vapor products among youths is likely the result of multiple factors, including advertising exposure, availability of youth-appealing flavors, curiosity, and social exposure through friends and others (4–6).

In 2014, prevalence of electronic vapor product use among high school students surpassed prevalence of cigarette smoking (9), and according to data from the 2017 Youth Risk Behavior Survey (YRBS), 13.2% of high school students had used electronic vapor products during the previous 30 days (3). These findings align with increases in use observed in other national surveys of youth in the United States. For example, according to the National Youth Tobacco Survey (NYTS),

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current electronic vapor product use among high school students increased 78% (11.7% to 20.8%) during 2017–2018 (*9*).

Youth use of tobacco products in any form is unsafe (*1,4*). Cigarette smoking harms nearly every organ in the body, and smokeless tobacco product use is associated with multiple health risks, including cancers of the mouth (*1*). Moreover, the aerosol in electronic vapor products can contain harmful ingredients, including heavy metals, ultrafine particles, and nicotine (*4*). Nicotine is highly addictive, can harm the developing adolescent brain, and can prime the brain for addiction to other drugs (*4,10*). In addition, a growing body of scientific literature suggests that youths who use e-cigarettes are more likely to smoke conventional cigarettes in the future (*4,10*).

Surveillance for tobacco product use among youths is crucial for guiding and evaluating tobacco control strategies at local, state, tribal, and national levels. This report presents the latest data from the 2019 YRBS to assess the following among U.S. high school students: ever use of cigarettes and electronic vapor products; current use (≥1 day during the 30 days before the survey) of tobacco products (electronic vapor products, cigarettes, cigars [cigars/cigarillos/little cigars], smokeless tobacco [chewing tobacco, snuff, dip, snus, or dissolvable tobacco products], any tobacco product, and two or more products); frequent use (≥20 days during the 30 days before the survey) of tobacco products among current users of those products; trends in tobacco product use over time; and usual source of obtaining electronic vapor products among current electronic vapor product users.

## Methods

### Data Source

This report includes data from the 1991–2019 cycles of CDC's national YRBS, a cross-sectional, school-based survey conducted biennially since 1991. Each survey year, CDC collects data from a nationally representative sample of public and private school students in grades 9–12 in the 50 U.S. states and the District of Columbia. Additional information about YRBS sampling, data collection, response rates, and processing is available in the overview report for this supplement (*11*). The prevalence estimates for all tobacco product use questions for the overall study population and by sex, race/ethnicity, grade, and sexual orientation are available at https://nccd.cdc.gov/youthonline/App/Default.aspx. The full YRBS questionnaire is available at https://www.cdc.gov/healthyyouth/data/yrbs/pdf/2019/2019_YRBS-National-HS-Questionnaire.pdf.

## Measures

Ever use, which was defined as having used the product at least one time during their lifetime, was assessed for two distinct tobacco products: cigarettes and electronic vapor products. Ever cigarette smoking was assessed by the question, "Have you ever tried cigarette smoking, even one or two puffs?" Ever electronic vapor product use was assessed by the question, "Have you ever used an electronic vapor product?" with a preamble that read, "The next 3 questions ask about electronic vapor products, such as JUUL, Vuse, MarkTen, and blu. Electronic vapor products include e-cigarettes, vapes, vape pens, e-cigars, e-hookahs, hookah pens, and mods."

Current use (≥1 day during the 30 days before the survey) was assessed for four tobacco products: 1) current electronic vapor product use was assessed by the question, "During the past 30 days, on how many days did you use an electronic vapor product?" 2) current cigarette smoking was assessed by the question, "During the past 30 days, on how many days did you smoke cigarettes?" 3) current cigar smoking was assessed by the question, "During the past 30 days, on how many days did you smoke cigars, cigarillos, or little cigars?" and 4) current smokeless tobacco use was assessed by the question, "During the past 30 days, on how many days did you use chewing tobacco, snuff, dip, snus, or dissolvable tobacco products, such as Copenhagen, Grizzly, Skoal, or Camel Snus? (Do not count any electronic vapor products.)" Response options for each of the four questions were 0 days, 1–2 days, 3–5 days, 6–9 days, 10–19 days, 20–29 days, and all 30 days. Among current users of each individual product, frequent use was also calculated. Frequent use was defined as having used the respective product on ≥20 days during the 30 days before the survey.

Two composite measures were also investigated in this analysis. Any current tobacco product use was defined as any use of electronic vapor products, cigarettes, cigars, or smokeless tobacco during the 30 days before the survey. Use of two or more products was defined as current use of two or more of the four assessed tobacco products.

Respondents also were asked how they usually obtained electronic vapor products by the question (referred to as source hereinafter), "During the past 30 days, how did you usually get your own electronic vapor products? (Select only one response.)" Response options were as follows: I did not use any electronic vapor products during the past 30 days; I bought them in a store such as a convenience store, supermarket, discount store, gas station, or vape store; I got them on the Internet; I gave someone else money to buy them for me; I borrowed them from someone else; a person who can legally buy these products gave them to me; I took them from a store

or another person; or I got them some other way. Analysis of this variable was limited to current electronic vapor product users.

The demographic characteristics of students analyzed for this report included sex (female or male), grade (9, 10, 11, or 12), age (≤15 years, 16 or 17 years, or ≥18 years), and sexual identity (heterosexual; lesbian, gay, or bisexual; or not sure). In addition, students were classified into four racial/ethnic categories: non-Hispanic white (white); non-Hispanic black (black); Hispanic or Latino of any race (Hispanic); and other or multiple races (non-Hispanic). The numbers of students in the other or multiple racial/ethnic groups were too small to produce statistically stable estimates; therefore, those data are not presented as a separate group in this report but were retained in the overall analytic sample.

## Analysis

Prevalence of use for each respective tobacco product was estimated for all years for which data were available. For 2019, statistically significant pairwise differences by sex, grade, race/ethnicity, age, and sexual identity were determined for each of the assessed tobacco product use behaviors by using *t*-tests. For each tobacco product, changes in prevalence were compared for 2017 and 2019 by using *t*-tests. In addition, *t*-tests were used to compare how students who were ≤17 years and ≥18 years usually obtained their electronic vapor products; these age groups were used because age 18 years was the federal legal age of sale for tobacco products at the time of the survey. Prevalence estimates were considered statistically different if the p value was <0.05.

To identify temporal trends, logistic regression analyses were used to model linear and quadratic time effects while controlling for sex, grade, and race/ethnicity. Linear time effects were analyzed for current electronic vapor products use (2015–2019), and both linear and quadratic time effects were analyzed for current cigarette smoking (1991–2019) and current cigar smoking (1997–2019). Because of substantial changes in the question wording for smokeless tobacco products in 2017, trends were not assessed for smokeless tobacco. Additional information about the methods used to conduct YRBS trend analyses are provided in the overview report of this supplement (*11*).

## Results

Among U.S. high school students in 2019, a total of 50.1% (95% confidence interval [CI]: 48.1–52.2) had ever used electronic vapor products, and 24.1% (CI: 21.3–27.0) had ever tried cigarette smoking (data not shown). Prevalence of current use was 32.7% for electronic vapor products, 6.0% for

cigarettes, 5.7% for cigars, and 3.8% for smokeless tobacco. In addition, 36.5% of students had currently used any tobacco products, and 8.2% had currently used two or more tobacco products (Table 1).

Prevalence of tobacco product use varied by demographic groups, with current use of cigarettes, cigars, smokeless tobacco, and two or more tobacco products being higher among male students than female students. Although differences in tobacco product use varied by grade, prevalence of current use of each individual product, any tobacco product, and two or more tobacco products was higher among 12th-grade students than 9th-grade students. Prevalence of current use of electronic vapor products, cigarettes, any tobacco product, and two or more tobacco products was higher among white and Hispanic students than black students, and the prevalence of electronic vapor products and any tobacco product use was higher among white than Hispanic students. Prevalence of current cigar use was higher among students aged ≥18 years than those aged 16 or 17 years and those aged ≤15 years. For all other individual products, any tobacco product, and two or more tobacco products, prevalence increased in each age category. Among sexual identity groups, prevalence of electronic vapor product use was higher among heterosexual students and lesbian, gay, or bisexual students than not-sure students. Prevalence of current use of cigarettes, cigars, any tobacco product, and two or more tobacco products was higher among lesbian, gay, or bisexual students than heterosexual students. Finally, the prevalence of any tobacco product use was higher among lesbian, gay, or bisexual students than not-sure students.

In 2019, among the 32.7% of current electronic vapor product users, 32.6% were frequent users; among the 5.7% current cigarette smokers, 22.2% were frequent users; among the 3.8% current cigar smokers, 18.4% were frequent users; and among the 6.0% current smokeless tobacco product users, 28.5% were frequent users. From 2017 to 2019, among current electronic vapor product users, a significant increase occurred in frequent use (from 25.1% to 32.6%), and among current cigarette smokers, a significant decrease occurred in frequent use (from 30.0% in 2017 to 22.2% in 2019) (Figure 1). No significant changes in frequent use of smokeless tobacco or cigars were observed among users of these products from 2017 to 2019.

The usual source of electronic vapor products among current users varied by age (Table 2). Among current electronic vapor product users who were aged ≤17 years, the most commonly reported usual source of electronic vapor products was borrowing them from someone else (42.8%). Among those aged ≥18 years, the most commonly reported source was buying them in a store (56.4%). Compared with students aged ≤17 years, a higher prevalence of students aged ≥18 years

**TABLE 1. Percentage of high school students who were current tobacco users, by selected characteristics and type of tobacco product — Youth Risk Behavior Survey, United States, 2019**

| Characteristic | Electronic vapor products*<br>% (95% CI) | Cigarettes[†]<br>% (95% CI) | Cigars[§]<br>% (95% CI) | Smokeless tobacco[¶]<br>% (95% CI) | Any tobacco product**<br>% (95% CI) | ≥2 products[††]<br>% (95% CI) |
|---|---|---|---|---|---|---|
| **Total** | **32.7 (30.7–34.8)** | **6.0 (5.0–7.2)** | **5.7 (4.8–6.7)** | **3.8 (3.2–4.6)** | **36.5 (33.6–39.5)** | **8.2 (7.0–9.5)** |
| **Sex**[§§] | | | | | | |
| Male | 32.0 (29.7–34.3) | 6.9 (5.7–8.4) | 7.4 (6.4–8.6) | 5.8 (4.7–7.1) | 36.3 (33.3–39.3) | 10.4 (9.0–11.9) |
| Female | 33.5 (30.9–36.1) | 4.9 (3.8–6.4) | 3.8 (2.8–5.1) | 1.6 (1.2–2.1) | 36.6 (33.1–40.2) | 5.8 (4.5–7.5) |
| **Grade**[¶¶] | | | | | | |
| 9 | 25.0 (22.8–27.4) | 3.8 (2.8–5.1) | 3.8 (2.7–5.2) | 2.0 (1.4–3.0) | 27.7 (24.8–30.9) | 5.3 (4.2–6.6) |
| 10 | 30.5 (27.3–33.8) | 5.2 (3.9–6.9) | 4.7 (3.5–6.2) | 3.6 (2.6–5.0) | 34.3 (30.3–38.6) | 7.3 (5.6–9.6) |
| 11 | 35.9 (32.3–39.8) | 5.9 (4.5–7.7) | 6.0 (4.6–7.8) | 3.9 (3.0–5.1) | 39.8 (35.7–44.1) | 8.4 (6.7–10.4) |
| 12 | 40.4 (37.5–43.4) | 9.0 (7.6–10.7) | 8.5 (6.9–10.4) | 5.5 (4.3–7.1) | 45.0 (41.3–48.7) | 11.9 (10.3–13.7) |
| **Race/Ethnicity**\*\*\* | | | | | | |
| Black, non-Hispanic | 19.7 (16.9–22.8) | 3.3 (2.3–4.6) | 5.3 (4.1–6.8) | 2.8 (1.8–4.4) | 24.7 (21.3–28.4) | 4.8 (3.7–6.2) |
| Hispanic | 31.2 (28.6–33.8) | 6.0 (4.3–8.4) | 6.1 (4.7–8.0) | 3.1 (2.3–4.3) | 33.8 (31.1–36.7) | 7.9 (6.2–10.0) |
| White, non-Hispanic | 38.3 (36.0–40.7) | 6.7 (5.3–8.4) | 5.9 (4.7–7.4) | 4.4 (3.3–5.7) | 42.0 (38.3–45.9) | 9.5 (7.8–11.5) |
| **Age group (yrs)**[†††] | | | | | | |
| ≤15 | 25.9 (24.1–27.9) | 4.2 (3.2–5.4) | 4.2 (3.1–5.6) | 2.7 (2.0–3.8) | 29.1 (26.2–32.1) | 5.8 (4.6–7.2) |
| 16 or 17 | 35.2 (32.3–38.3) | 6.0 (4.8–7.4) | 5.7 (4.5–7.0) | 3.7 (3.0–4.6) | 38.8 (35.2–42.4) | 8.4 (6.8–10.1) |
| ≥18 | 42.8 (39.0–46.7) | 10.9 (8.6–13.6) | 10.2 (8.1–12.7) | 7.2 (5.5–9.2) | 49.1 (44.9–53.4) | 14.2 (12.0–16.7) |
| **Sexual identity**[§§§] | | | | | | |
| Heterosexual | 32.8 (30.5–35.2) | 5.2 (4.3–6.3) | 5.2 (4.4–6.1) | 3.7 (3.1–4.4) | 36.1 (33.1–39.2) | 7.8 (6.7–9.0) |
| Lesbian, gay, or bisexual | 34.1 (30.8–37.6) | 10.4 (7.8–13.7) | 8.1 (5.9–11.1) | 3.2 (2.0–5.2) | 40.3 (36.2–44.4) | 10.4 (8.0–13.5) |
| Not sure | 24.9 (19.8–30.7) | 7.4 (4.8–11.3) | 7.2 (4.3–12.0) | 5.5 (3.1–9.5) | 30.0 (23.3–37.6) | 8.1 (5.4–11.9) |

**Abbreviation:** CI = confidence interval.

* Percentage of students who used an electronic vapor product, including e-cigarettes, e-cigars, e-pipes, vape pipes, vaping pens, e-hookahs, and hookah pens (e.g., blu, NJOY, Vuse, MarkTen, Logic, Vapin Plus, eGo, and Halo), on ≥1 day during the 30 days before the survey.

[†] Percentage of students who smoked cigarettes on ≥1 day during the 30 days before the survey.

[§] Percentage of students who smoked cigars, cigarillos, or little cigars on ≥1 day during the 30 days before the survey.

[¶] Percentage of students who used smokeless tobacco, including chewing tobacco, snuff, dip, snus, or dissolvable tobacco products (e.g., Red Man, Levi Garrett, Beechnut, Skoal, Skoal Bandits, Copenhagen, Camel Snus, Marlboro Snus, General Snus, Ariva, Stonewall, or Camel Orbs), but not including any electronic vapor products, on ≥1 day during the 30 days before the survey.

** Percentage of students who smoked cigarettes or cigars or used smokeless tobacco or an electronic vapor product, on ≥1 day during the 30 days before the survey.

[††] Percentage of students who used ≥2 of the following tobacco products: cigarettes, cigars (cigars, cigarillos, or little cigars), an electronic vapor product, or smokeless tobacco, on ≥1 day during the 30 days before the survey.

[§§] Sex pairwise comparisons assessed by $t$-test ($p<0.05$): for cigarettes, cigars, smokeless tobacco, and ≥2 products, male students were significantly different ($p<0.05$) from female students.

[¶¶] Grade pairwise comparisons assessed by $t$-test ($p<0.05$): for electronic vapor products and any tobacco product: all pairwise comparisons were significantly different ($p<0.05$); for cigarettes, cigars, and ≥2 products: 12th grade was significantly different ($p<0.05$) than 9th, 10th, and 11th grades; 11th grade was significantly different ($p<0.05$) than 9th grade; for smokeless tobacco: 12th grade was significantly different ($p<0.05$) than 9th, 10th, and 11th grades; 10th and 11th grades were significantly different ($p<0.05$) than 9th grade.

\*\*\* Race/ethnicity pairwise comparisons assessed by $t$-test ($p<0.05$): for electronic vapor products and any tobacco product: all pairwise comparisons were significantly different ($p<0.05$); for cigarettes and ≥2 products: white and Hispanic were significantly different ($p<0.05$) than black.

[†††] Age pairwise comparisons assessed by $t$-test ($p<0.05$): for electronic vapor products, cigarettes, smokeless tobacco, any tobacco product, and ≥2 products: all pairwise comparisons were significantly different ($p<0.05$); for cigars: ≥18 years was significantly different ($p<0.05$) than 16–17 years and ≤15 years.

[§§§] Sexual identity pairwise comparisons assessed by $t$-test ($p<0.05$): for electronic vapor products: heterosexual and lesbian, gay, or bisexual were significantly different ($p<0.05$) than not-sure students; for cigarettes, cigars, and ≥2 products: lesbian, gay, or bisexual was significantly different ($p<0.05$) than heterosexual; for any tobacco product: lesbian, gay, or bisexual was significantly different ($p<0.05$) than heterosexual and not-sure students.

usually bought electronic vapor products in a store. In contrast, compared with older students, a higher prevalence of students aged ≤17 years got them on the Internet, gave someone else money to buy them, borrowed them from someone else, got them from a person who could legally buy them, or got them some other way.

Trend analyses indicated that during 2015–2019, a significant linear increase occurred in prevalence of current electronic vapor products use (from 24.1% to 32.7%) (Figure 2). Trend analyses also indicated that during 1991–2019, a significant linear decrease in current cigarette smoking was observed (from 27.5% to 6.0%). A significant quadratic trend in cigarette smoking also was identified: a 6-year increase in prevalence (from 27.5% in 1991 to 36.4% in 1997) was followed by a 22-year decrease (from 36.4% in 1997 to 6.0% in 2019). Additionally, during 1997–2019, a significant linear decrease (from 22.0% to 5.7%) occurred in the overall prevalence of current cigar smoking. A significant quadratic trend also was identified: a 16-year decrease in prevalence (from 22.0% in 1997 to 12.6% in 2013) was followed by another 6-year decrease, but at a different rate of decrease (from 12.6% in 2013 to 5.7% in 2019).

During 2017–2019, a significant increase occurred in current electronic vapor products use (from 13.2% to 32.7%) and

**FIGURE 1. Prevalence of frequent tobacco use\* among current users, by type of tobacco product† — Youth Risk Behavior Survey, United States, 2017 and 2019§**
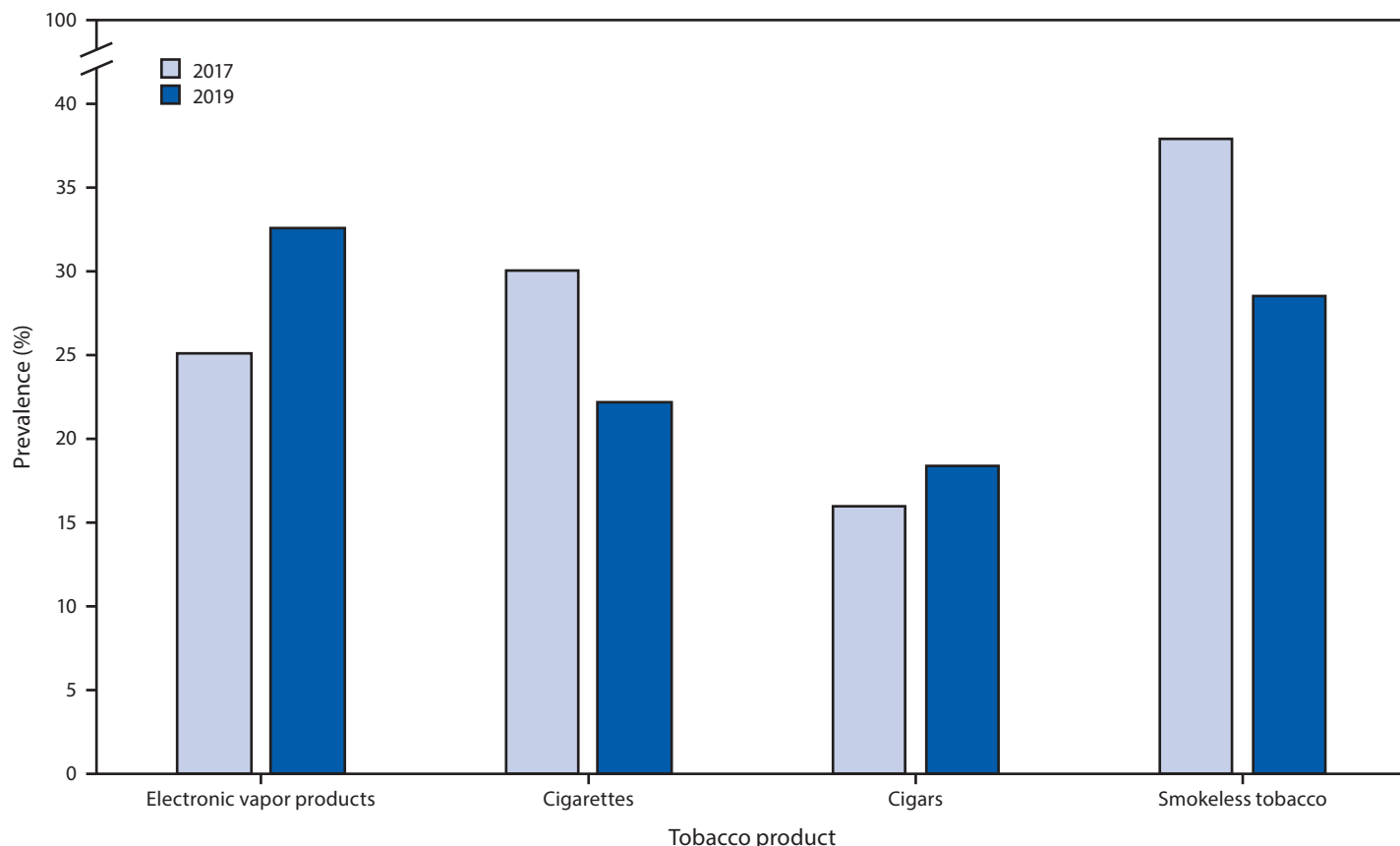


* Frequent use was defined as use on ≥20 days during the 30 days before the survey.
† Frequent use was assessed among respondents who reported current use (on ≥1 day during the 30 days before the survey) of each tobacco product. In 2017, among the 13.2% of students nationwide who used electronic vapor products on ≥1 day during the 30 days before the survey; among the 8.8% of students nationwide who smoked cigarettes on ≥1 day during the 30 days before the survey; among the 8.0% of students nationwide who smoked cigars on ≥1 day during the 30 days before the survey; among the 5.5% of students nationwide who used smokeless tobacco on ≥1 day during the 30 days before the survey. In 2019, among the 32.7% of students nationwide who used electronic vapor products on ≥1 day during the 30 days before the survey; among the 6.0% of students nationwide who smoked cigarettes on ≥1 day during the 30 days before the survey; among the 5.7% of students nationwide who smoked cigars on ≥1 day during the 30 days before the survey; among the 3.8% of students nationwide who used smokeless tobacco on ≥1 day during the 30 days before the survey.
§ Differences from 2017 to 2019 were assessed by *t*-test (p<0.05): A significant increase occurred in frequent use of electronic vapor products; a significant decrease occurred in frequent use of cigarettes; and no change occurred in frequent use of cigars/cigarillos/little cigars and smokeless tobacco.

any tobacco product use (from 19.5% to 36.5%). During 2017–2019, significant decreases were observed in current cigarette smoking (from 8.8% to 6.0%), current cigar smoking (from 8.0% to 5.7%), and current smokeless tobacco use (from 5.5% to 3.8%). No change occurred in use of two or more tobacco products during 2017–2019.

## Discussion

In 2019, a total of 36.5% of high school students currently used any tobacco product, with electronic vapor products being the most commonly used product. This reflects an increase in use of electronic vapor products from 2017 to 2019, findings that are consistent with those from other national surveillance

systems, including NYTS (*9*,*12*) and Monitoring the Future (*13*). For example, NYTS results demonstrated that, among high school students, e-cigarette use increased from 11.7% in 2017 to 27.5% in 2019 (*9*,*12*). These increases align with the increasing popularity of newer electronic vapor product devices, including JUUL (*7*). The dramatic increase in electronic vapor product use among high school students has led to increases in overall tobacco product use among U.S. youths, erasing gains made in previous years and leading the U.S. Surgeon General to declare youth e-cigarette use an epidemic in the United States (*10*).

Use of any tobacco product among youth is unsafe, regardless of frequency of use or number of products used. Although the 2019 national YRBS results indicate that most current youth tobacco product users are infrequent users, variations exist by

**TABLE 2. Usual source\* of obtaining electronic vapor products among current electronic vapor product users,[†] by age — Youth Risk Behavior Survey, United States, 2019**

| Usual source | Age group[§] | |
|---|---|---|
| | ≥18 yrs | ≤17 yrs |
| | % (95% CI) | % (95% CI) |
| Bought them in a store (e.g., a convenience store, supermarket, discount store, gas station, or vape store) | 56.4 (51.0–1.6) | 8.1 (6.8–9.6) |
| Got them on the Internet | 1.8 (0.9–3.4) | 3.6 (2.8–4.6) |
| Gave someone else money to buy them for me | 3.1 (1.5–6.1) | 21.3 (19.5–23.2) |
| Borrowed them from someone else | 27.5 (23.4–32.0) | 42.8 (40.2–45.4) |
| A person who can legally buy these products gave them to me | 3.9 (2.4–6.3) | 11.1 (9.9–12.3) |
| Took them from a store or another person | 2.0 (0.8–5.0) | 1.6 (1.1–2.4) |
| Got them some other way | 5.4 (3.3–8.8) | 11.6 (10.1–13.4) |

**Abbreviation:** CI = confidence interval.
\* Students were limited to selecting only one response.
[†] Including e-cigarettes, e-cigars, e-pipes, vape pipes, vaping pens, e-hookahs, or hookah pens (e.g., blu, NJOY, Vuse, MarkTen, Logic, Vapin Plus, eGo, and Halo) among students who used electronic vapor products during the 30 days before the survey.
[§] Comparisons between age groups were assessed by *t*-test (p<0.05). All comparisons were statistically different with the exception of "took them from a store or another person."

product; for example, frequent use ranged from 18.4% for cigars to 32.6% for electronic vapor products. In addition, these results indicate that frequent use of electronic vapor products increased during 2017–2019; whereas frequent use of other products decreased or did not change. Even infrequent tobacco product use, particularly cigarette smoking, is predictive of progression to daily smoking (*14*). Nearly all tobacco products include nicotine, and even infrequent use of tobacco products has been linked to symptoms of nicotine dependence (*15*). Further, 8.2% of high school students currently used two or more tobacco products in 2019. Multiple tobacco product use is associated with substance use disorders (*16*) and might increase nicotine exposure and risk for nicotine dependence (*15*).

In 2019, electronic vapor product users aged ≤17 years usually obtained their products from social sources (e.g., by borrowing them from someone). This is consistent with results from both the Population Assessment of Tobacco and Health Study and NYTS, which also determined that social sources were the most common way for adolescents to obtain electronic vapor products (*17,18*). These social sources might include older students who are of legal age for purchasing the products in their state or community. In 2016, electronic vapor products were deemed to be tobacco products under the Family Smoking Prevention Tobacco Control Act (https://www.federalregister.gov/documents/2016/05/10/2016-10685/deeming-tobacco-products-to-be-subject-to-the-federal-food-drug-and-cosmetic-act-as-amended-by-the), thus setting the federal minimum purchase age for electronic vapor products at 18 years. However, on December 20, 2019, federal legislation increased the minimum age of sales of tobacco products from 18 to 21 years nationwide; the law does not preempt more stringent state or local age of sale laws (https://www.fda.gov/tobacco-products/retail-sales-tobacco-products/selling-tobacco-products-retail-stores). Before this federal law, 19 states, the District of Columbia, Guam, and Palau had enacted laws that increased the age of sale for tobacco products to 21 years, including 13 laws enacted during 2019 (*19*). Such laws might limit the ability for high school students to obtain tobacco products from their peers, including those older students who were of legal age to purchase these products in their state or community before the law's implementation.

Multiple factors continue to promote and influence tobacco product use among youths, including exposure to tobacco product advertising and imagery through media, as well as the availability of flavored tobacco products. The sustained and comprehensive implementation of population-based strategies, in coordination with the regulation of tobacco products by the U.S. Food and Drug Administration (FDA), can reduce all forms of tobacco product use and initiation among U.S. youths. Such strategies include increasing the price of tobacco products, implementing comprehensive smoke-free policies, implementing advertising and promotion restrictions and national antitobacco public education media campaigns, restricting youth access to flavored tobacco products, and implementing policies that increase the minimum age of purchase for tobacco products to 21 years (*1,2,4,10*). In addition to population-level policies for preventing and reducing initiation of tobacco product use among youths, tools from the National Cancer Institute (e.g., https://teen.smokefree.gov) and the Truth Initiative (e.g., https://truthinitiative.org/thisisquitting) provide resources to help youth quit tobacco product use.

## Limitations

Limitations for YRBS overall are available in the overview report of this supplement (*11*). This report is subject to at least three additional limitations. First, changes in question wording for smokeless tobacco use in 2017 prohibit comparability with previous years' data and long-term trend analyses for prevalence of smokeless tobacco use, any tobacco product use, and use of two or more tobacco products. Second, the question addressing how students usually obtained electronic vapor products requires that respondents select only one response, although they might have obtained these products through multiple sources; therefore, the full scope of the sources students use to access these products

**FIGURE 2. Prevalence of current tobacco product use, by year — Youth Risk Behavior Survey, United States, 1991–2019\***
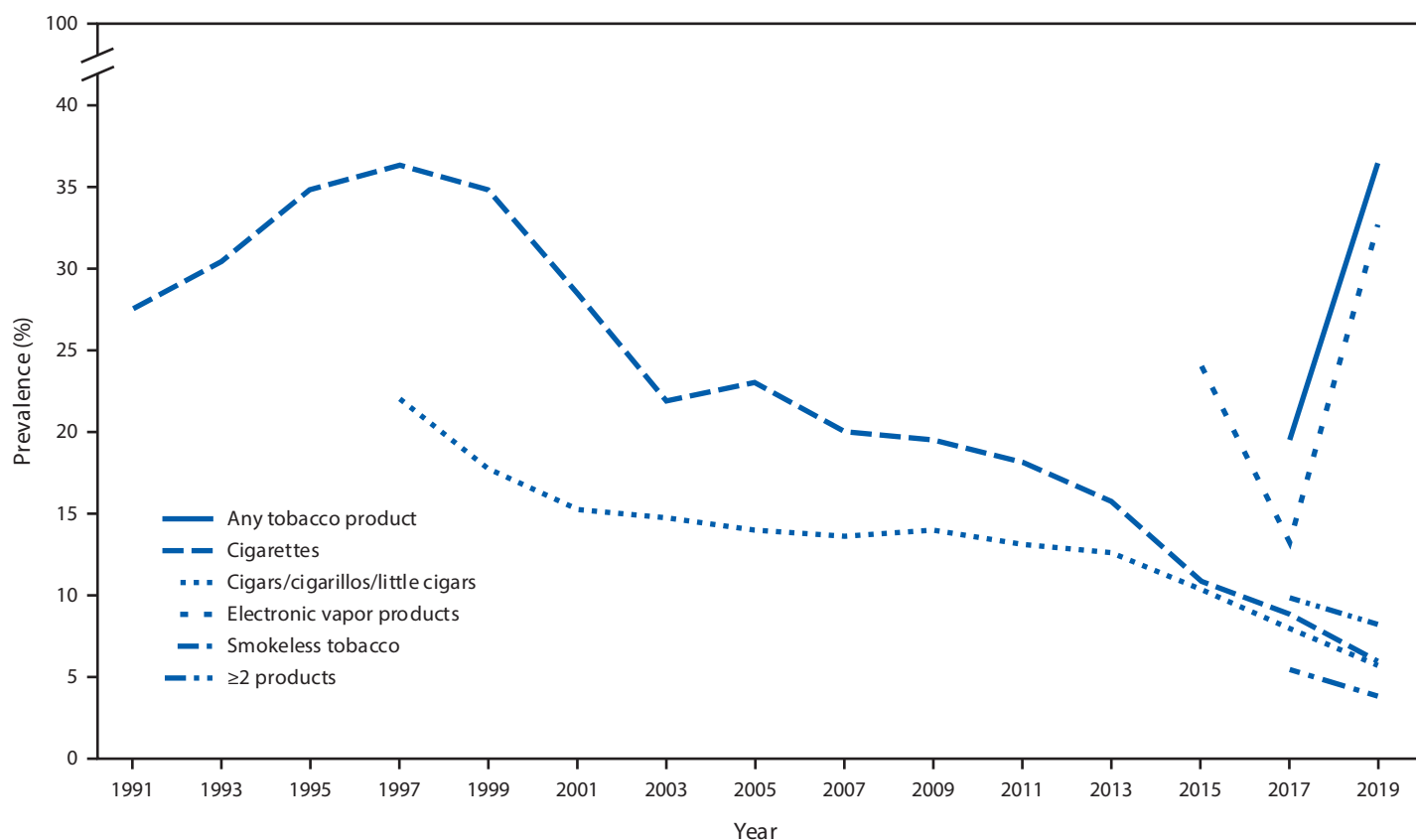


\* Logistic regression analyses were used to model linear and quadratic time effects while controlling for sex, grade, and race/ethnicity. Electronic vapor products: significant linear increase (2015–2019); cigarettes: significant linear decrease (1991–2019); significant quadratic trend: increase during 1991–1997, decrease during 1997–2019; cigars/cigarillos/little cigars: significant linear decrease (1997–2019); significant quadratic trend: decrease 1997–2013; decrease 2013–2019 (different rate of decrease). Differences from 2017 to 2019 were assessed by *t*-test (p<0.05): A significant increase occurred in use of electronic vapor products and any tobacco product; a significant decrease occurred in use of cigarettes, cigars/cigarillos/little cigars and smokeless tobacco; and no change occurred in use of ≥2 products.

might not have been addressed. Finally, the questions related to electronic vapor products and cigars do not specifically exclude the possibility of marijuana use in either product (e.g., blunt use).

## Conclusion

Although current use of cigarettes, cigars, and smokeless tobacco among U.S. high school students has decreased, tobacco product usage has evolved, and the increasing prevalence of electronic vapor product use among youths during recent years is concerning. Implementing evidence-based tobacco control strategies, combined with FDA's regulatory efforts, is important for preventing and reducing all forms of tobacco product use among youths. In addition, continued surveillance of all tobacco products is warranted for guiding and evaluating public health policy at the local, state, tribal, and national levels.

## Conflicts of Interest

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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# Dietary and Physical Activity Behaviors Among High School Students — Youth Risk Behavior Survey, United States, 2019

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## *Abstract*

Establishing healthy dietary and physical activity patterns among youths is an important public health strategy for improving health and preventing chronic diseases; however, few adolescents meet U.S. government recommendations for dietary or physical activity behaviors, and disparities by sex and race/ethnicity exist. CDC analyzed data from the 2019 Youth Risk Behavior Survey to update estimates of dietary and physical activity behaviors among U.S. high school students overall and by sex and race/ethnicity. In addition, 2-year comparisons (2017 and 2019) and trends in prevalence of these behaviors during 2009–2019 were examined. In 2019, overall, during the 7 days before the survey, 41.8% of students had eaten fruit or drunk 100% fruit juices <1 time/day; 40.7% had eaten vegetables <1 time/day; and 16.7% had not eaten breakfast on all 7 days. Moreover, although 57.4% of students had played on ≥1 sports team during the 12 months before the survey, less than half of students had been physically active for ≥60 minutes/day on all 7 days (23.2%), had exercised to strengthen or tone their muscles on ≥3 days/week (49.5%), had met both aerobic and muscle-strengthening physical activity guidelines (16.5%), or had attended physical education classes on all 5 days in an average school week (25.9%). Trend data indicate limited progress in shifting dietary and physical activity behaviors. That is, with the exception of decreases in the percentage of students who had consumed soda ≥1 time/day (2009: 29.2%; 2019: 15.1%), sports drinks ≥1 time/day (2015: 13.8%; 2019: 10.6%), and <3 glasses/day of plain water (2015: 50.5%; 2019: 44.6%), high school students' dietary and physical activity behaviors have not improved and, in certain cases, have worsened. These findings support the need for multicomponent approaches, including policy and environmental changes, and opportunities for adolescents to learn about and practice making healthy choices.

## Introduction

Nutrition and physical activity are important for optimal growth and development and chronic disease prevention. Approximately half of U.S. adults have a chronic disease that is related to inadequate diet quality and physical activity, including type 2 diabetes, cardiovascular diseases, or obesity (*1*). Such diseases can affect productivity and quality of life and contribute to high health-care costs. Dietary and physical activity behaviors develop during childhood and can create a trajectory that continues into adulthood (*1,2*). Establishing healthy dietary and physical activity behaviors early in life is a vital public health strategy for promoting lifelong physical health.

The U.S. government establishes recommendations for healthy dietary and physical activity patterns for persons of different ages, including adolescents. The *Dietary Guidelines*

*for Americans 2015–2020* outlines key recommendations for following a healthy eating pattern within calorie levels that are appropriate for a person's age, sex, height, weight, and physical activity level (*1*). Recommendations include eating a variety of vegetables, fruits, and whole grains, and limiting sodium, added sugars, and saturated and *trans* fats.

The *Physical Activity Guidelines for Americans*, 2nd Edition, recommends that children and adolescents ages 6–17 years engage in ≥60 minutes of moderate-to-vigorous physical activity daily (*2*). Most of this daily physical activity should be aerobic activity, whereas muscle- and bone-strengthening physical activity should each be done ≥3 days each week (*2*).

Previous data indicate that most adolescents are not meeting recommendations for healthy eating (*1*) or physical activity (*3*), which increases the risk for chronic diseases later in life. In addition, disparities by sex and race/ethnicity exist (*4*). To update national estimates of dietary and physical activity behaviors among U.S. high school students overall and by sex and race/ethnicity and to determine how these behaviors have changed over time, CDC analyzed data from the 2019 Youth Risk Behavior Survey (YRBS) and examined trends in

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prevalence of these behaviors during the previous 10 years. Public health and school health researchers and practitioners can use these findings to inform policies and practices that support healthy eating and physical activity among adolescents.

# Methods

## Data Source

This report includes data from the 2009–2019 cycles of the YRBS, a cross-sectional, school-based survey conducted biennially since 1991. Each survey year, CDC collects data from a nationally representative sample of public and private school students in grades 9–12 in the 50 U.S. states and the District of Columbia. Additional information about YRBS sampling, data collection, response rates, and processing is available in the overview report of this supplement (5). The prevalence estimates for all physical activity, nutrition, and body weight questions for the overall study population and by sex, race/ethnicity, grade, and sexual orientation are available at https://nccd.cdc.gov/youthonline/App/Default.aspx. The full YRBS questionnaire is available at https://www.cdc.gov/healthyyouth/data/yrbs/pdf/2019/2019_YRBS-National-HS-Questionnaire.pdf.

## Measures

The student demographic characteristics analyzed included sex (female or male) and race/ethnicity. Students were classified into four racial/ethnic categories: non-Hispanic white (white); non-Hispanic black (black); Hispanic or Latino of any race (Hispanic); and other or multiple races. The numbers of students in the other or multiple racial/ethnic groups were too small for meaningful analysis; therefore, findings for those groups are not presented; however, the corresponding data remain in the analytic sample. This analysis included six dietary variables and five physical activity variables (Table 1). The dietary variables included the following: during the 7 days before the survey, had eaten fruit or drunk 100% fruit juices <1 time/day, had eaten vegetables <1 time/day, had not eaten breakfast on all 7 days, had drunk soda or pop ≥1 time/day (not counting diet soda or diet pop), had drunk a sports drink ≥1 time/day, and had drunk <3 glasses/day of plain water. The physical activity variables included the following: during the 7 days before the survey, had been physically active for a total of ≥60 minutes/day on all 7 days, had exercised to strengthen or tone muscles on ≥3 days, had met both aerobic and muscle-strengthening physical activity guidelines (defined as being physically active for a total of ≥60 minutes/day on all 7 days and doing exercises to strengthen or tone muscles on ≥3 days),

had attended physical education classes on all 5 days in an average school week, and had played on ≥1 sports team during the 12 months before the survey.

## Analysis

Prevalence estimates and 95% confidence intervals for each 2019 dietary and physical activity behavior were calculated overall and for each sex and racial/ethnic group. Statistically significant pairwise differences by sex and race/ethnicity were determined by $t$-tests. In addition, prevalence of each dietary and physical activity behavior was compared for 2017 with 2019 by using $t$-tests. Differences between prevalence estimates were considered statistically significant if the $t$-test p value was <0.05.

To identify 10-year temporal trends, logistic regression analyses were used to model linear and quadratic time effects while controlling for sex, grade (9, 10, 11, and 12), and racial/ethnic changes over time (6). All variables had data available for 2009–2019, except for did not eat breakfast on all 7 days; were physically active for a total of ≥60 minutes/day on all 7 days; did exercises to strengthen or tone muscles on ≥3 days and met both aerobic and muscle-strengthening physical activity guidelines, which had data for 2011–2019 only; and drank a sports drink ≥1 time/day and drank <3 glasses/day of plain water, which had data for 2015–2019 only. Additional information about the methods used to conduct YRBS trend analyses are provided in the overview report of this supplement (5).

# Results

## Dietary Behaviors

### Overall

In 2019, nationwide, 41.8% of students had eaten fruit or drunk 100% fruit juices <1 time/day; 40.7% had eaten vegetables <1 time/day; 16.7% had not eaten breakfast on all 7 days; 15.1% had drunk sugar-sweetened soda or pop ≥1 time/day (not counting diet soda or diet pop); 10.6% had drunk a sports drink ≥1 time/day; and 44.6% had drunk <3 glasses/day of plain water (Table 2). A higher percentage of male students than female students had drunk sugar-sweetened soda or pop ≥1 time/day (18.2% versus 11.7%) and had drunk a sports drink ≥1 time/day (14.0% versus 7.1%). A higher percentage of black students than white and Hispanic students had eaten fruit or drunk 100% fruit juices <1 time/day (47.8% versus 42.1% and 39.5%, respectively), had eaten vegetables <1 time/day (54.8% versus 35.5% and 46.8%, respectively), had drunk a sports drink ≥1 time/day (15.6% versus 9.3%

**TABLE 1. Question wording and details for included dietary and physical activity behavior variables — Youth Risk Behavior Survey, United States, 2019**

| Variable | Question | Response options | Years of data available for 10-year trend analysis | Coding for analysis |
|---|---|---|---|---|
| **Dietary behaviors** | | | | |
| Ate fruit or drank 100% fruit juices <1 time/day | During the past 7 days, how many times did you . . . <br>• drink 100% fruit juices such as orange juice, apple juice, or grape juice? (Do not count punch, Kool-Aid, sports drinks, or other fruit-flavored drinks.) <br>• eat fruit? (Do not count fruit juice.) | I did not [drink 100% fruit juice]/[eat fruit] during the past 7 days, 1–3 times during the past 7 days, 4–6 times during the past 7 days,1 time/day, 2 times/day, 3 times/day, or ≥4 times/day | 2009–2019 | <1 time/day versus ≥1 time/day |
| Ate vegetables <1 time/day | During the past 7 days, how many times did you eat . . . <br>• green salad? <br>• potatoes? (Do not count French fries, fried potatoes, or potato chips.) <br>• carrots? <br>• other vegetables? (Do not count green salad, potatoes, or carrots.) | I did not eat [green salad]/[potatoes]/[carrots]/[other vegetables] during the past 7 days, 1–3 times during the past 7 days, 4–6 times during the past 7 days, 1 time/day, 2 times/day, 3 times/day, or ≥4 times/day | 2009–2019 | <1 time/day versus ≥1 time/day |
| Did not eat breakfast on all 7 days | During the past 7 days, on how many days did you eat breakfast? | 0 days, 1 day, 2 days, 3 days, 4 days, 5 days, 6 days, or 7 days | 2011–2019 | <7 days versus 7 days |
| Drank soda or pop ≥1 time/day | During the past 7 days, how many times did you drink a can, bottle, or glass of soda or pop, such as Coke, Pepsi, or Sprite? (Do not count diet soda or diet pop.) | I did not drink soda or pop during the past 7 days, 1–3 times during the past 7 days, 4–6 times during the past 7 days, 1 time/day, 2 times/day, 3 times/day, or ≥4 times/day | 2009–2019 | ≥1 time/day versus <1 time/day |
| Drank a sports drink ≥1 time/day | During the past 7 days, how many times did you drink a can, bottle, or glass of a sports drink, such as Gatorade or Powerade? (Do not count low-calorie sports drinks such as Propel or G2.) | I did not drink sports drinks during the past 7 days, 1–3 times during the past 7 days, 4–6 times during the past 7 days, 1 time/day, 2 times/day, 3 times/day, or ≥4 times/day | 2015–2019 | ≥1 time/day versus <1 time/day |
| Drank <3 glasses/day of plain water | During the past 7 days, how many times did you drink a bottle or glass of plain water? (Count tap, bottled, and unflavored sparkling water.) | I did not drink water during the past 7 days, 1–3 times during the past 7 days, 4–6 times during the past 7 days, 1 time per day, 2 times per day, 3 times/day, or ≥4 times/day | 2015–2019 | ≥3 times/day versus <3 times/day |
| **Physical activity behaviors** | | | | |
| Were physically active for a total of ≥60 minutes/day on all 7 days | During the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day? (Add up all the time you spent in any kind of physical activity that increased your heart rate and made you breathe hard some of the time.) | 0 days, 1 day, 2 days, 3 days, 4 days, 5 days, 6 days, or 7 days | 2011–2019 | 7 days versus <7 days |
| Did exercises to strengthen or tone muscles on ≥3 days | During the past 7 days, on how many days did you do exercises to strengthen or tone your muscles, such as push-ups, sit-ups, or weightlifting? | 0 days, 1 day, 2 days, 3 days, 4 days, 5 days, 6 days, or 7 days | 2011–2019 | ≥3 days versus <3 days |
| Met both aerobic and muscle-strengthening physical activity guidelines | [See "were physically active for a total of ≥60 minutes/day on all 7 days" and "did exercises to strengthen or tone muscles on ≥3 days."] | Not applicable | 2011–2019 | Physically active for ≥60 minutes/day on all 7 days *and* did exercises to strengthen or tone muscles on ≥3 days versus physically active for <60 minutes/day on all 7 days *or* did exercises to strengthen or tone muscles on <3 days |
| Attended physical education classes on all 5 days | In an average week when you are in school, on how many days do you go to physical education (PE) classes? | 0 days, 1 day, 2 days, 3 days, 4 days, or 5 days | 2009–2019 | ≥5 days versus <5 days |
| Played on ≥1 sports team | During the past 12 months, on how many sports teams did you play? (Count any teams run by your school or community groups.) | 0 teams, 1 team, 2 teams, or ≥3 teams | 2009–2019 | ≥1 team versus <1 team |

TABLE 2. Percentage of high school students who engaged in selected dietary and physical activity behaviors, by sex and race/ethnicity — Youth Risk Behavior Survey, United States, 2019

| | | Sex | | Race/Ethnicity | | |
|---|---|---|---|---|---|---|
| Variable | Total<br>% (95% CI) | Female<br>% (95% CI) | Male<br>% (95% CI) | White,<br>non-Hispanic<br>% (95% CI) | Black,<br>non-Hispanic<br>% (95% CI) | Hispanic<br>% (95% CI) |
| **Dietary behaviors** | | | | | | |
| Ate fruit or drank 100% fruit juices <1 time/day* | **41.8 (39.8–43.8)** | 43.0 (40.7–45.4) | 40.6 (38.2–43.1) | 42.1 (39.2–45.1) | 47.8[†,§] (43.6–51.9) | 39.5 (36.7–42.3) |
| Ate vegetables <1 time/day[¶] | **40.7 (38.0–43.4)** | 40.4 (37.2–43.6) | 41.1 (38.1–44.3) | 35.5 (33.2–37.8) | 54.8[†,§] (50.1–59.4) | 46.8[†] (41.8–52.0) |
| Did not eat breakfast on all 7 days during the 7 days before the survey | **16.7 (15.3–18.1)** | 16.7 (15.2–18.3) | 16.6 (14.9–18.4) | 15.3 (13.9–16.8) | 21.1[†] (17.3–25.6) | 16.9 (14.1–20.0) |
| Drank sugar-sweetened soda or pop ≥1 time/day** | **15.1 (13.1–17.2)** | 11.7 (9.9–13.8) | 18.2[††] (15.9–20.8) | 15.2 (12.7–18.0) | 16.9 (13.5–21.0) | 16.1 (13.1–19.6) |
| Drank a sports drink ≥1 time/day[§§] | **10.6 (9.2–12.3)** | 7.1 (5.7–8.8) | 14.0[††] (11.9–16.4) | 9.3 (7.7–11.2) | 15.6[†,§] (12.9–18.8) | 11.9[†] (10.2–13.8) |
| Drank <3 glasses/day of plain water[¶¶] | **44.6 (42.7–46.5)** | 44.1 (42.0–46.1) | 45.0 (42.3–47.6) | 44.2 (41.7–46.7) | 54.8[†,§] (49.0–60.4) | 44.2 (41.8–46.7) |
| **Physical activity behaviors** | | | | | | |
| Were physically active for a total of ≥60 minutes/day on all 7 days*** | **23.2 (21.9–24.6)** | 15.4 (14.2–16.6) | 30.9[††] (28.9–33.1) | 25.6 (24.1–27.2) | 21.1[†] (17.6–25.2) | 20.9[†] (18.6–23.5) |
| Did exercises to strengthen or tone muscles on ≥3 days[†††] | **49.5 (47.6–51.3)** | 39.7 (37.2–42.4) | 59.0[††] (56.8–61.0) | 50.8 (48.2–53.4) | 47.0 (42.7–51.2) | 48.1 (44.5–51.9) |
| Met both aerobic and muscle-strengthening physical activity guidelines[§§§] | **16.5 (14.6–18.6)** | 10.1 (8.7–11.6) | 23.1[††] (20.4–26.0) | 18.4 (15.8–21.4) | 13.4[†] (9.5–18.4) | 16.0 (13.7–18.6) |
| Went to physical education classes on all 5 days[¶¶¶] | **25.9 (21.5–31.0)** | 22.8 (17.9–28.5) | 28.9[††] (24.6–33.7) | 24.3 (18.8–30.7) | 23.8 (17.4–31.7) | 29.9 (24.5–36.0) |
| Played on ≥1 sports team**** | **57.4 (54.3–60.4)** | 54.6 (51.1–58.0) | 60.2[††] (56.9–63.4) | 62.0 (58.1–65.7) | 56.1[†] (51.4–60.7) | 51.6[†] (46.5–56.6) |

**Abbreviation:** CI = confidence interval.
* Such as orange juice, apple juice, or grape juice, not counting punch, Kool-Aid, sports drinks, or other fruit-flavored drinks during the 7 days before the survey.
[†] Significantly different than white students based on *t*-test analysis (p<0.05).
[§] Significantly different than Hispanic students based on *t*-test analysis (p<0.05).
[¶] Green salad, potatoes (not counting French fries, fried potatoes, or potato chips), carrots, or other vegetables during the 7 days before the survey.
** Such as Coke, Pepsi, or Sprite, not counting diet soda or diet pop, during the 7 days before the survey.
[††] Significantly different than female students based on *t*-test analysis (p<0.05).
[§§] Such as Gatorade or PowerAde, not counting low-calorie sports drinks such as Propel water or G2, during the 7 days before the survey.
[¶¶] Counting tap, bottled, and unflavored sparkling water during the 7 days before the survey.
*** Adding up time spent in any kind of physical activity that increased their heart rate and made them breathe hard some of the time during the 7 days before the survey.
[†††] Such as push-ups, sit-ups, or weightlifting during the 7 days before the survey.
[§§§] Were physically active for ≥60 minutes/day on all 7 days and did exercises to strengthen or tone muscles on ≥3 of the 7 days before the survey.
[¶¶¶] In an average week when the student was in school.
**** Counting any teams run by their school or community groups during the 12 months before the survey.

and 11.9%, respectively), and had drunk <3 glasses/day of plain water (54.8% versus 44.2% and 44.2%, respectively). In addition, a higher percentage of Hispanic students than white students had eaten vegetables <1 time/day (46.8% versus 35.3%) and had drunk a sports drink ≥1 time/day (11.9% versus 9.3%), and a higher percentage of black students than white students had not eaten breakfast on all 7 days (21.1% versus 15.3%).

## Trends

Trend analyses indicated that, during 2009–2019, a significant linear increase occurred in the percentage of students who had eaten fruit or drunk 100% fruit juices <1 time/day overall and among female, male, white, black, and Hispanic students (Table 3). Significant quadratic trends were not identified except among black students. The percentage of black students who had eaten fruit or drunk 100% fruit juices <1 time/day did not change during 2009–2015 and

then increased during 2015–2019. During 2017–2019, the percentage of students who had eaten fruit or drunk 100% fruit juices <1 time/day increased among male students and black students.

During 2009–2019, a significant linear increase occurred in the percentage of students who had eaten vegetables <1 time/day overall and among male, white, and black students. Significant quadratic trends were not identified, except among black students. The percentage of black students who had eaten vegetables <1 time/day did not change during 2009–2015 and then increased during 2015–2019.

During 2011–2019, a significant linear increase occurred in the percentage of students who had not eaten breakfast on all 7 days overall and among female, male, and white students. During 2017–2019, the percentage of students who had not eaten breakfast on all 7 days increased among students overall and among female, male, white, and black students.

**TABLE 3. Percentage of high school students who engaged in selected dietary behaviors, by sex, race/ethnicity, and survey year — Youth Risk Behavior Survey, United States, 2009–2019**

| Behavior | Prevalence (%) | | | | | | Linear change* | Quadratic change* | Change during 2017–2019[†] |
|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 | | | |
| **Ate fruit or drank 100% fruit juices <1 time/day[§]** | | | | | | | | | |
| **Total** | **35.2** | **36.0** | **37.4** | **36.7** | **39.2** | **41.8** | **Increased during 2009–2019** | **None** | **None** |
| Female | 37.6 | 38.4 | 40.0 | 37.9 | 41.8 | 43.0 | Increased during 2009–2019 | None | None |
| Male | 33.0 | 33.9 | 34.7 | 35.4 | 36.7 | 40.6 | Increased during 2009–2019 | None | Increased |
| White, non-Hispanic | 34.4 | 35.8 | 39.3 | 37.0 | 40.4 | 42.1 | Increased during 2009–2019 | None | None |
| Black, non-Hispanic | 39.2 | 36.4 | 36.5 | 37.8 | 39.3 | 47.8 | Increased during 2009–2019 | None during 2009–2015 Increased during 2015–2019 | Increased |
| Hispanic | 35.6 | 35.3 | 35.0 | 35.9 | 37.6 | 39.5 | Increased during 2009–2019 | None | None |
| **Ate vegetables <1 time/day[¶]** | | | | | | | | | |
| **Total** | **37.3** | **37.7** | **38.5** | **39.0** | **40.6** | **40.7** | **Increased during 2009–2019** | **None** | **None** |
| Female | 38.4 | 38.4 | 38.7 | 40.0 | 40.7 | 40.4 | None | None | None |
| Male | 36.3 | 37.2 | 38.5 | 38.0 | 40.6 | 41.1 | Increased during 2009–2019 | None | None |
| White, non-Hispanic | 32.7 | 34.3 | 35.2 | 35.8 | 37.2 | 35.5 | Increased during 2009–2019 | None | None |
| Black, non-Hispanic | 48.8 | 45.7 | 48.1 | 47.5 | 50.6 | 54.8 | Increased during 2009–2019 | None during 2009–2015 Increased during 2015–2019 | None |
| Hispanic | 45.9 | 43.6 | 43.1 | 43.5 | 43.9 | 46.8 | None | None | None |
| **Did not eat breakfast on all 7 days during the 7 days before the survey** | | | | | | | | | |
| **Total** | **—**** | **13.1** | **13.7** | **13.8** | **14.1** | **16.7** | **Increased during 2011–2019** | **—[††]** | **Increased** |
| Female | —** | 13.9 | 13.8 | 14.2 | 14.5 | 16.7 | Increased during 2011–2019 | —[††] | Increased |
| Male | —** | 12.3 | 13.5 | 13.3 | 13.6 | 16.6 | Increased during 2011–2019 | —[††] | Increased |
| White, non-Hispanic | —** | 12.0 | 11.5 | 12.0 | 12.8 | 15.3 | Increased during 2011–2019 | —[††] | Increased |
| Black, non-Hispanic | —** | 16.1 | 16.0 | 18.0 | 15.2 | 21.1 | None | —[††] | Increased |
| Hispanic | —** | 14.4 | 17.4 | 14.7 | 16.0 | 16.9 | None | —[††] | None |
| **Drank sugar-sweetened soda or pop ≥1 time/day[§§]** | | | | | | | | | |
| **Total** | **29.2** | **27.8** | **27.0** | **20.4** | **18.7** | **15.1** | **Decreased during 2009–2019** | **None during 2009–2013 Decreased during 2013–2019** | **Decreased** |
| Female | 23.3 | 24.0 | 24.1 | 16.4 | 15.4 | 11.7 | Decreased during 2009–2019 | None during 2009–2013 Decreased during 2013–2019 | Decreased |
| Male | 34.6 | 31.4 | 29.9 | 24.3 | 22.3 | 18.2 | Decreased during 2009–2019 | None | Decreased |
| White, non-Hispanic | 29.0 | 28.8 | 29.0 | 19.7 | 19.6 | 15.2 | Decreased during 2009–2019 | None | Decreased |
| Black, non-Hispanic | 33.7 | 28.0 | 30.2 | 22.7 | 21.5 | 16.9 | Decreased during 2009–2019 | None | None |
| Hispanic | 28.1 | 27.0 | 22.6 | 21.7 | 17.0 | 16.1 | Decreased during 2009–2019 | None | None |

See table footnotes on the next page.

TABLE 3. (*Continued*) Percentage of high school students who engaged in selected dietary behaviors, by sex, race/ethnicity, and survey year — Youth Risk Behavior Survey, United States, 2009–2019

| Behavior | Prevalence (%) | | | | | | Linear change* | Quadratic change* | Change during 2017–2019[†] |
|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 | | | |
| **Drank a sports drink ≥1 time/day[¶¶]** | | | | | | | | | |
| Total | —** | —** | —** | 13.8 | 12.4 | 10.6 | Decreased during 2015–2019 | —[††] | None |
| Female | —** | —** | —** | 8.8 | 8.2 | 7.1 | None | —[††] | None |
| Male | —** | —** | —** | 18.7 | 16.9 | 14.0 | Decreased during 2015–2019 | —[††] | Decreased |
| White, non-Hispanic | —** | —** | —** | 12.4 | 10.7 | 9.3 | Decreased during 2015–2019 | —[††] | None |
| Black, non-Hispanic | —** | —** | —** | 19.7 | 21.1 | 15.6 | None | —[††] | Decreased |
| Hispanic | —** | —** | —** | 15.7 | 13.5 | 11.9 | Decreased during 2015–2019 | —[††] | None |
| **Drank <3 glasses/day of plain water\*\*\*** | | | | | | | | | |
| Total | —** | —** | —** | 50.5 | 48.7 | 44.6 | Decreased during 2015–2019 | —[††] | Decreased |
| Female | —** | —** | —** | 51.9 | 48.8 | 44.1 | Decreased during 2015–2019 | —[††] | Decreased |
| Male | —** | —** | —** | 49.0 | 48.6 | 45.0 | Decreased during 2015–2019 | —[††] | Decreased |
| White, non-Hispanic | —** | —** | —** | 50.1 | 48.8 | 44.2 | Decreased during 2015–2019 | —[††] | Decreased |
| Black, non-Hispanic | —** | —** | —** | 60.9 | 52.7 | 54.8 | None | —[††] | None |
| Hispanic | —** | —** | —** | 49.7 | 47.5 | 44.2 | Decreased during 2015–2019 | —[††] | Decreased |

* Based on trend analyses by using a logistic regression model controlling for sex, race/ethnicity, and grade ($p<0.05$).
[†] Based on *t*-test analysis ($p<0.05$).
[§] Such as orange juice, apple juice, or grape juice, not counting punch, Kool-Aid, sports drinks, or other fruit-flavored drinks, during the 7 days before the survey.
[¶] Green salad, potatoes (not counting French fries, fried potatoes, or potato chips), carrots, or other vegetables during the 7 days before the survey.
** Data not available. Question not asked in that year.
[††] Insufficient years of data to assess quadratic trends.
[§§] Such as Coke, Pepsi, or Sprite, not counting diet soda or diet pop, during the 7 days before the survey.
[¶¶] Such as Gatorade or PowerAde, not counting low-calorie sports drinks such as Propel water or G2, during the 7 days before the survey.
*** Counting tap, bottled, and unflavored sparkling water during the 7 days before the survey.

During 2009–2019, a significant linear decrease occurred in the percentage of students who had drunk sugar-sweetened soda or pop ≥1 time/day overall and among female, male, white, black, and Hispanic students (Figure 1). Significant quadratic trends were identified overall and among female students. Overall and among female students, the percentage of students who had drunk sugar-sweetened soda or pop ≥1 time/day did not change during 2009–2013 and then decreased during 2013–2019. During 2017–2019, the percentage of students who had drunk sugar-sweetened soda or pop ≥1 time/day decreased overall and among female, male, and white students.

During 2015–2019, a significant linear decrease occurred in the percentage of students who had drunk a sports drink ≥1 time/day overall and among male, white, and Hispanic students (Figure 2). During 2017–2019, the percentage of students who had drunk a sports drink ≥1 time/day decreased among male students and black students.

During 2015–2019, a significant linear decrease occurred in the percentage of students who had drunk <3 glasses/day of plain water overall and among female, male, white, and
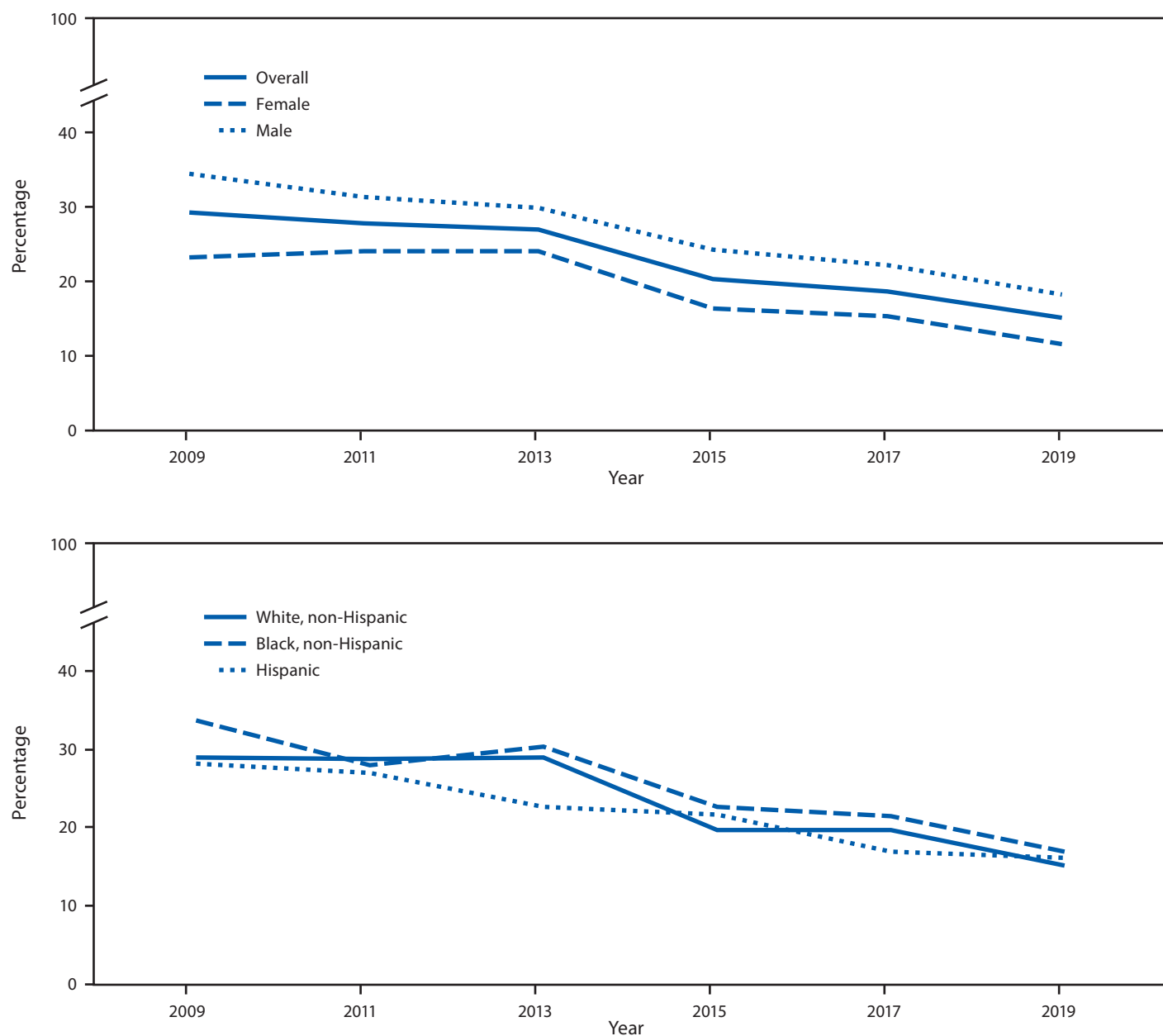
Hispanic students. During 2017–2019, the percentage of students who had drunk <3 glasses/day of plain water decreased overall and among female, male, white, and Hispanic students.

## Physical Activity Behaviors

### Overall

In 2019, nationwide, 23.2% of students had been physically active for ≥60 minutes/day on all 7 days; 49.5% had exercised to strengthen or tone their muscles on ≥3 days/week; 16.5% had met both aerobic and muscle-strengthening physical activity guidelines; 25.9% had attended physical education classes on all 5 days in an average school week; and 57.4% had played on ≥1 sports team (Table 2). A higher percentage of male students than female students had been physically active for ≥60 minutes/day on all 7 days (30.9% versus 15.4%), had exercised to strengthen or tone muscles on ≥3 days (59.0% versus 39.7%), had met both aerobic and muscle-strengthening physical activity guidelines (23.1% versus 10.1%), had

**FIGURE 1. Percentage of high school students who had drunk sugar-sweetened soda or pop ≥1 time per day during the 7 days before the survey, overall and by sex and race/ethnicity\* — Youth Risk Behavior Survey, United States, 2009–2019**



\* During 2009–2019, a significant linear decrease was observed in the percentage of students who had drunk sugar-sweetened soda or pop ≥1 time/day overall and among female, male, white, black, and Hispanic students. Based on trend analyses by using a logistic regression model controlling for sex, race/ethnicity, and grade (p<0.05).

attended physical education classes on all 5 days in an average school week (28.9% versus 22.8%), and had played on ≥1 sports team (60.2% versus 54.6%) (Figure 3). A higher percentage of white students than black students had been physically active for ≥60 minutes/day on all 7 days (25.6% versus 21.1%), had met both aerobic and muscle-strengthening physical activity guidelines (18.4% versus 13.4%), and had played on ≥1 sports team (62.0% versus 56.1%). In addition,

a higher percentage of white students than Hispanic students had been physically active for ≥60 minutes/day on all 7 days (25.6% versus 20.9%) and had played on ≥1 sports team (62.0% versus 51.6%) (Table 2).

## Trends

During 2011–2019, a significant linear decrease occurred in the percentage of students who had been physically active

**FIGURE 2. Percentage of high school students who had drunk a sports drink ≥1 time per day during the 7 days before the survey, overall and by sex and race/ethnicity\* — Youth Risk Behavior Survey, United States, 2015–2019**
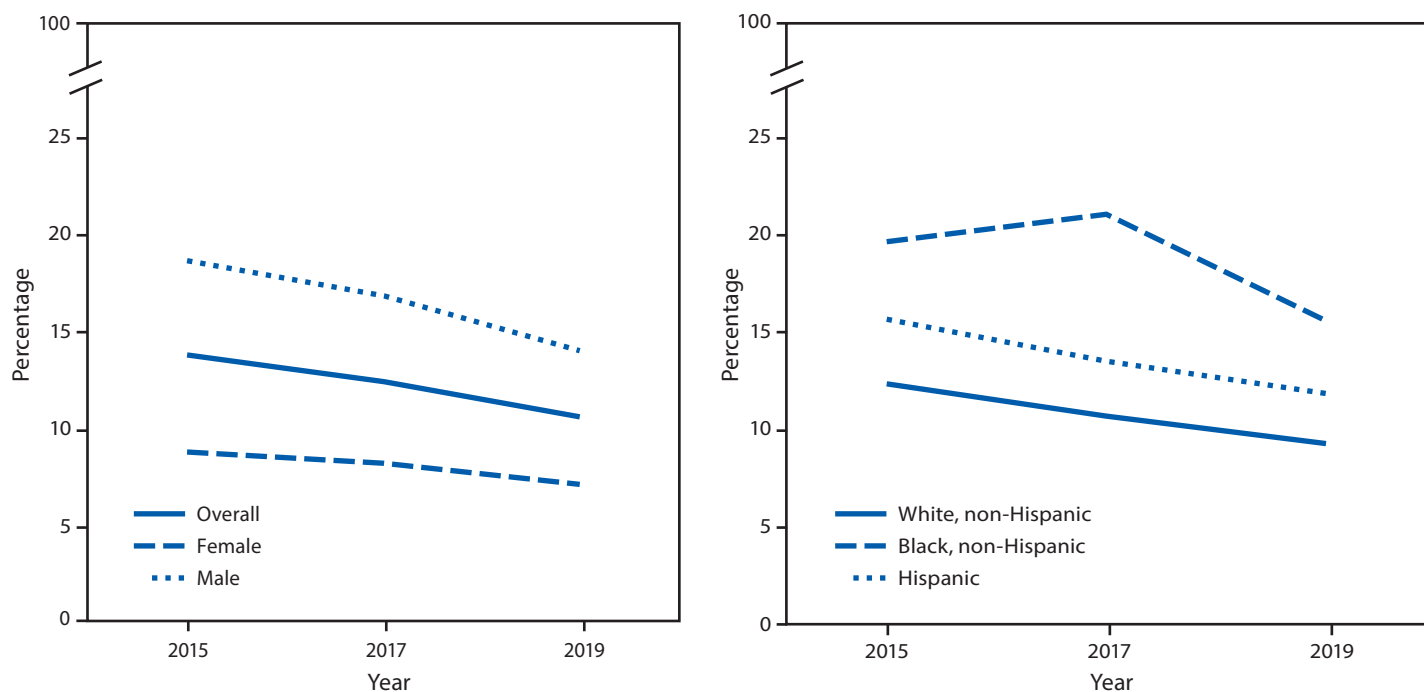


\* During 2015–2019, a significant linear decrease was observed in the percentage of students who had drunk a sports drink ≥1 time/day overall and among male, white, and Hispanic students. Based on trend analysis by using a logistic regression model controlling for sex, race/ethnicity, and grade (p<0.05).

for ≥60 minutes/day on all 7 days overall and among female, male, white, black, and Hispanic students (Table 4). During 2017–2019, the percentage of students who had been physically active for ≥60 minutes/day on all 7 days decreased overall and among male students and Hispanic students.

During 2011–2019, a significant linear decrease occurred in the percentage of students who had exercised to strengthen or tone their muscles on ≥3 days/week overall and among male, white, black, and Hispanic students. During 2017–2019, no significant changes occurred in the percentage of students who had exercised to strengthen or tone their muscles on ≥3 days/week overall or among the sex or racial/ethnic groups.

During 2011–2019, a significant linear decrease occurred in the percentage of students who had met both aerobic and muscle-strengthening physical activity guidelines overall and among female, male, white, and black students. During 2017–2019, the percentage of students who had met both aerobic and muscle-strengthening physical activity guidelines did not significantly change overall but decreased among male students and Hispanic students.

During 2009–2019 and during 2017–2019, no significant linear changes occurred in the percentage of students who had attended physical education classes on all 5 days in an average school week or had played on ≥1 sports team overall or among the sex and racial/ethnic groups, except among female students.

Among female students, a significant linear decrease occurred in the percentage who had attended physical education classes on all 5 days in an average school week.

## Discussion

With the exception of decreases in the percentages of students who had consumed soda ≥1 time/day, sports drinks ≥1 time/day, and <3 glasses/day of plain water, high school students' dietary and physical activity behaviors have not improved during the previous 10 years and, in certain cases, have worsened. This is cause for concern because healthy dietary and physical activity behaviors are important for growth and development, academic outcomes, and prevention of chronic diseases, including type 2 diabetes, heart disease, hypertension, and obesity (1,7). Recent data demonstrate that approximately one in five adolescents have prediabetes, which increases the risk for type 2 diabetes and cardiovascular diseases (8). In addition, data from the National Health and Nutrition Examination Survey reveal that, in the United States during 2007–2008, approximately 18.1% of youths aged 12–19 years had obesity and this increased to 20.6% during 2015–2016 (9). In this analysis, in which differences by race/ethnicity exist, black and Hispanic high school students have poorer dietary and physical activity behaviors, compared

**FIGURE 3. Percentage\* of high school students who had engaged in physical activity[†] and physical education during the 7 days before the survey, overall and by sex[§] — Youth Risk Behavior Survey, United States, 2019**
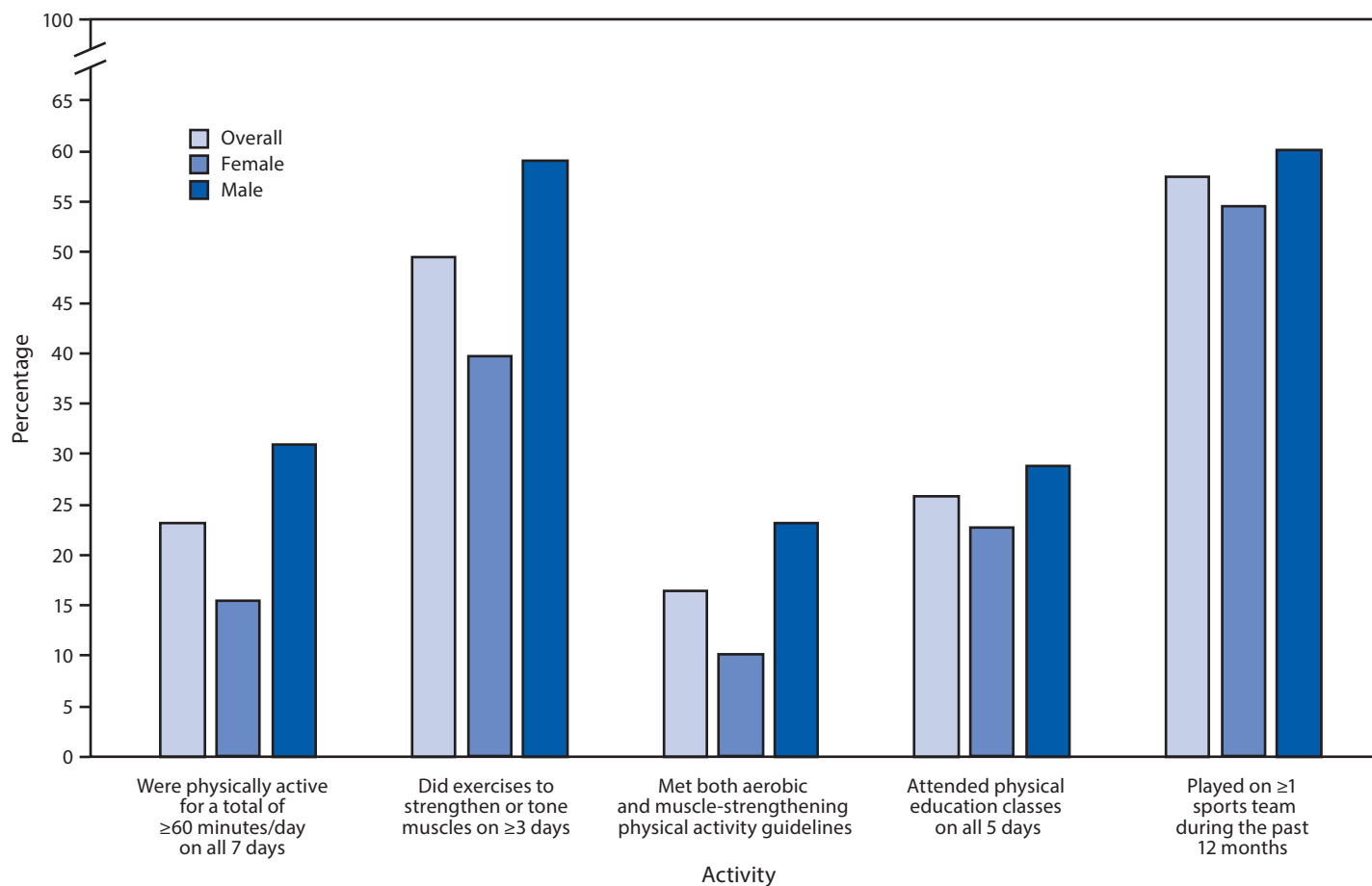


\* Bars represent the percentage of respondents with a "yes" response, overall and by sex.
[†] The "met both aerobic and muscle-strengthening physical activity guidelines" variable is defined as being physically active for a total of ≥60 minutes/day on all 7 days and doing exercises to strengthen or tone muscles on ≥3 days during the 7 days before the survey (**Source:** U.S. Department of Health and Human Services. Physical activity guidelines for Americans. 2nd ed. Washington, DC: US Department of Health and Human Services; 2018. https://www.hhs.gov/fitness/be-active/physical-activity-guidelines-for-americans/index.html).
[§] In 2019, a significantly higher percentage of male than female students had been physically active for ≥60 minutes/day on all 7 days during the 7 days before the survey, had exercised to strengthen or tone muscles on ≥3 days during the 7 days before the survey, had met the aerobic and muscle-strengthening physical activity guidelines during the 7 days before the survey, had attended physical education classes on all 5 days in an average school week when the student was in school, and had played on ≥1 sports team during the past 12 months. Based on *t*-test analysis (p<0.05).

with white high school students. These findings also indicate that male students have poorer dietary behaviors but better physical activity behaviors than do female students. Addressing dietary and physical activity behaviors can benefit all students and is especially important for those with increased risk for chronic diseases (e.g., students from low-income families and racial/ethnic minorities).

## Dietary Behaviors

No improvements occurred in fruit or vegetable consumption during 2009–2019 and, in many cases, have worsened. Overall, consumption of fruits and vegetables remained low in 2019. For example, four of 10 high school students had eaten fruit

or drunk 100% fruit juices <1 time/day. Similarly, four of 10 had eaten vegetables <1 time/day. Although the prevalence of having eaten fruit or drunk 100% fruit juice <1 time/day and having eaten vegetables <1 time/day is similar for male students and female students, recommended daily intakes differ by age and sex. Females and males aged 14–18 years need 1.5 cups and 2 cups, respectively, of fruits, and 2.5 cups and 3 cups, respectively, of vegetables (https://www.choosemyplate.gov/resources/MyPlatePlan). Although YRBS measures frequency of intake and not the amount consumed, children and adolescents who meet the recommended amounts typically consume fruits and vegetables multiple times throughout the day (*10*); therefore, consuming fruits or vegetables <1 time/day is likely insufficient. Strategies that encourage adolescents to

**TABLE 4. Percentage of high school students who engaged in selected physical activity behaviors, by sex, race/ethnicity, and survey year — Youth Risk Behavior Survey, United States, 2009–2019**

| Behavior | Prevalence (%) | | | | | | Linear change* | Quadratic change* | Change during 2017–2019[†] |
|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 | | | |
| **Were physically active for a total of ≥60 minutes/day on all 7 days[§]** | | | | | | | | | |
| Total | —[¶] | 28.7 | 27.1 | 27.1 | 26.1 | 23.2 | Decreased during 2011–2019 | —** | Decreased during 2017–2019 |
| Female | —[¶] | 18.5 | 17.7 | 17.7 | 17.5 | 15.4 | Decreased during 2011–2019 | —** | None |
| Male | —[¶] | 38.3 | 36.6 | 36.0 | 35.3 | 30.9 | Decreased during 2011–2019 | —** | Decreased during 2017–2019 |
| White, non-Hispanic | —[¶] | 30.4 | 28.2 | 29.0 | 27.1 | 25.6 | Decreased during 2011–2019 | —** | None |
| Black, non-Hispanic | —[¶] | 26.0 | 26.3 | 24.2 | 24.5 | 21.1 | Decreased during 2011–2019 | —** | None |
| Hispanic | —[¶] | 26.5 | 25.5 | 24.6 | 25.8 | 20.9 | Decreased during 2011–2019 | —** | Decreased during 2017–2019 |
| **Did exercises to strengthen or tone muscles on ≥3 days[††]** | | | | | | | | | |
| Total | —[¶] | 55.6 | 51.7 | 53.4 | 51.1 | 49.5 | Decreased during 2011–2019 | —** | None |
| Female | —[¶] | 43.8 | 41.6 | 42.7 | 40.8 | 39.7 | None | —** | None |
| Male | —[¶] | 66.7 | 61.8 | 63.7 | 62.1 | 59.0 | Decreased during 2011–2019 | —** | None |
| White, non-Hispanic | —[¶] | 55.7 | 52.4 | 54.5 | 50.6 | 50.8 | Decreased during 2011–2019 | —** | None |
| Black, non-Hispanic | —[¶] | 54.0 | 48.8 | 52.3 | 51.0 | 47.0 | Decreased during 2011–2019 | —** | None |
| Hispanic | —[¶] | 56.6 | 53.3 | 52.4 | 52.3 | 48.1 | Decreased during 2011–2019 | —** | None |
| **Met guidelines for aerobic and muscle-strengthening physical activity[§§]** | | | | | | | | | |
| Total | —[¶] | 21.9 | 21.6 | 20.5 | 20.0 | 16.5 | Decreased during 2011–2019 | —** | None |
| Female | —[¶] | 12.7 | 13.0 | 12.2 | 12.1 | 10.1 | Decreased during 2011–2019 | —** | None |
| Male | —[¶] | 30.7 | 30.3 | 28.6 | 28.5 | 23.1 | Decreased during 2011–2019 | —** | Decreased during 2017–2019 |
| White, non-Hispanic | —[¶] | 23.9 | 22.6 | 22.7 | 20.8 | 18.4 | Decreased during 2011–2019 | —** | None |
| Black, non-Hispanic | —[¶] | 18.4 | 20.6 | 15.7 | 17.7 | 13.4 | Decreased during 2011–2019 | —** | None |
| Hispanic | —[¶] | 18.9 | 20.5 | 18.7 | 20.0 | 16.0 | None | —** | Decreased during 2017–2019 |

See table footnotes on the next page.

increase the quantity of fruits and vegetables each time they consume them are likely needed to help them meet the daily recommendations (10). For example, schools can offer students multiple fruit and vegetable choices each day through school meal programs, including through grab-and-go salads (11).

Sugar-sweetened beverages (SSBs) are the primary source of added sugars in U.S. youths' diets (1). Frequently drinking SSBs is associated with health conditions, including obesity, type 2 diabetes, heart disease, and tooth decay (12). Alternatively, drinking enough water every day is good for overall health and is associated with higher Healthy Eating Index scores among adolescents (13). (More information about the Healthy Eating Index is available at https://www.fns.usda.gov/resource/healthy-eating-index-hei.) YRBS asks about two specific types of SSBs, soda or pop and sports drinks. This study identified substantial decreases in the percentage of students who had drunk soda or pop ≥1 time/day overall and among all sex and racial/ethnic groups. In addition, decreases occurred in the percentage of students who had drunk a sports drink ≥1 time/day overall and among female, white, and Hispanic students. Despite these improvements in soda and sports drink consumption, consumption of these beverages is common. Differences also existed by sex and race/ethnicity. Similar to this study, previous studies reported that SSB intake was higher among males than among females (14) and among black and Hispanic adolescents than among white adolescents (15). One possible explanation for the differences between racial/ethnic groups is that beverage companies disproportionately market SSBs to black and Hispanic youths (16).

TABLE 4. (*Continued*) Percentage of high school students who engaged in selected physical activity behaviors, by sex, race/ethnicity, and survey year — Youth Risk Behavior Survey, United States, 2009–2019

| Behavior | Prevalence (%) | | | | | | Linear change* | Quadratic change* | Change during 2017–2019[†] |
|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2011 | 2013 | 2015 | 2017 | 2019 | | | |
| **Went to physical education classes on all 5 days[¶¶]** | | | | | | | | | |
| **Total** | **33.3** | **31.5** | **29.4** | **29.8** | **29.9** | **25.9** | **None** | **None** | **None** |
| Female | 31.9 | 27.2 | 24.0 | 25.5 | 25.3 | 22.8 | Decreased during 2009–2019 | None | None |
| Male | 34.6 | 35.5 | 34.9 | 33.8 | 34.7 | 28.9 | None | None | None |
| White, non-Hispanic | 30.6 | 33.0 | 27.1 | 25.4 | 27.2 | 24.3 | None | None | None |
| Black, non-Hispanic | 37.0 | 27.6 | 26.6 | 35.8 | 28.5 | 23.8 | None | None | None |
| Hispanic | 40.5 | 30.0 | 37.7 | 37.7 | 37.4 | 29.9 | None | None | None |
| **Played on ≥1 sports team*** | | | | | | | | | |
| **Total** | **58.3** | **58.4** | **54.0** | **57.6** | **54.3** | **57.4** | **None** | **None** | **None** |
| Female | 52.3 | 52.6 | 48.5 | 53.0 | 49.3 | 54.6 | None | None | None |
| Male | 63.8 | 64.0 | 59.6 | 62.2 | 59.7 | 60.2 | None | None | None |
| White, non-Hispanic | 61.1 | 60.9 | 55.2 | 62.4 | 54.5 | 62.0 | None | None | None |
| Black, non-Hispanic | 57.3 | 57.0 | 55.2 | 57.6 | 59.1 | 56.1 | None | None | None |
| Hispanic | 53.2 | 54.1 | 51.2 | 48.5 | 52.2 | 51.6 | None | None | None |

 * Based on trend analyses by using a logistic regression model controlling for sex, race/ethnicity, and grade (p<0.05).
 † Based on *t*-test analysis (p<0.05).
 § Adding up time spent in any kind of physical activity that increased their heart rate and made them breathe hard some of the time during the 7 days before the survey.
 ¶ Data not available. Question not asked in that year.
 ** Insufficient years of data to assess quadratic trends.
 †† Such as push-ups, sit-ups, or weightlifting during the 7 days before the survey.
 §§ Were physically active for ≥60 minutes/day on all 7 days and did exercises to strengthen or tone muscles on ≥3 of the 7 days before the survey.
 ¶¶ In an average week when the student was in school.
 *** Counting any teams run by their school or community groups during the 12 months before the survey.

During the 2014–15 school year, the Smart Snacks in School nutrition standards were implemented, which decreased students' access to SSBs at school. (More information about the Smart Snacks in School nutrition standards is available at https://www.gpo.gov/fdsys/pkg/FR-2013-06-28/pdf/2013-15249.pdf.) Additional policy and educational approaches (e.g., health education classes or communitywide campaigns) might help further reduce SSB access in schools and other settings and help adolescents choose healthier beverage options, including plain water.

## Physical Activity Behaviors

Overall, prevalence of health-promoting physical activity behaviors was low in 2019 and either decreased or did not change during the previous 10 years. *Healthy People 2020* monitors four of the five physical activity behaviors included in this study (https://www.healthypeople.gov/), and these behaviors will continue to be monitored with *Healthy People 2030*. *Healthy People 2020* objective PA-3 aims to increase the proportion of adolescents who meet federal physical activity guidelines for aerobic physical activity to ≥31.6% (PA-3.1), muscle-strengthening activity to ≥61.2% (PA-3.2), and both aerobic physical activity and muscle-strengthening activity to ≥24.1% (PA-3.3). The proportions of students meeting the aerobic, muscle-strengthening, or both guidelines decreased during 2011–2019, and 2019 data indicate that adolescents continue to fall short of achieving these targets.

One of the *Healthy People 2020* objectives (PA-5) is to increase the proportion of adolescents who participate in daily school physical education to ≥36.6%. Given no increase in this behavior during 2009–2019 and that only 25.9% of high school students attended daily physical education class during 2019, the target for this objective is unlikely to be met in 2020. Students can accumulate approximately 40% of their daily physical activity through participation in physical education (*17*), demonstrating that physical education at school is an effective strategy for helping high school students meet the federal physical activity guidelines. During 2015–2016, although the majority of U.S. states required public high schools to provide physical education, few states mandated a time requirement for high school students, and many states permitted students to substitute other activities for their physical education requirement. (More information about the status of physical education in the United States is available at https://www.shapeamerica.org/MemberPortal/SHAPE_Sign_I.aspx?WebsiteKey=c03f2b51-3ee7-46fa-b587-de18213dcae5&LoginRedirect=true&returnurl=%2fadvocacy%2fson%2f.)

The 2019 release of the National Youth Sports Strategy highlighted youth sports participation for its physical activity, psychosocial, and academic achievement benefits. (More information about the National Youth Sports Strategy is

available at https://health.gov/our-work/physical-activity/national-youth-sports-strategy.) Despite these benefits, only 57.4% of high school students reported participating in sports. The National Survey of Children's Health also assesses participation in youth sports, with similar estimates to YRBS for youths aged 14–17 years (*3*).

Across all the physical activity behaviors, a higher percentage of males than females met aerobic, muscle-strengthening, or both guidelines, participated in daily physical education, and played on ≥1 sports team. These differences might be caused by gender stereotypes, self-efficacy, self-consciousness, or social influences (*18*). When overcoming barriers to physical activity, particularly for adolescent females, strategies that span the Social-Ecological Model by addressing individual, interpersonal, organizational, community, and societal components might need to be considered.

## Addressing Dietary and Physical Activity Behaviors

Improving dietary and physical activity behaviors among adolescents requires efforts across multiple settings. For example, schools can implement policies and practices (e.g., local school wellness policies) (https://www.fns.usda.gov/tn/local-school-wellness-policy) that support healthy eating and physical activity, including ensuring the following: 1) that foods and beverages sold during the school day meet Smart Snacks in School nutrition standards, 2) that school meals are appealing and include menu items that students enjoy, and 3) that students have access to free drinking water during the school day (*11*). Schools can also help students meet the federal physical activity guidelines by providing physical activity opportunities before, during, and after the school day. This can be achieved by developing, implementing, and evaluating a comprehensive school physical activity program, which serves as a national framework for physical education and physical activity in schools. (More guidance on comprehensive school physical activity programs is available at https://www.cdc.gov/healthyschools/physicalactivity/pdf/13_242620-A_CSPAP_SchoolPhysActivityPrograms_Final_508_12192013.pdf.)

Health education is another way that schools can help students develop the knowledge and skills needed for making health-enhancing decisions. These school efforts can be addressed and coordinated through the Whole School, Whole Community, Whole Child Model, which highlights the interconnectedness of multiple health behaviors and outcomes and promotes collaboration among diverse partners, including mental health professionals, school leaders, school nurses, physical and health educators, and parents for promoting health and well-being for all students. (More information about the Whole School, Whole Community, Whole Child approach is available at https://www.cdc.gov/healthyschools/wscc/index.htm.)

Community members and parents can reinforce the messages promoted within the school and can participate on the school wellness or school health teams that are addressing healthy eating, physical education, and physical activity. (More information about parent engagement in school health is available at https://www.cdc.gov/healthyyouth/protective/pdf/parent_engagement_strategies.pdf.) In addition, parents and community members can engage in physical activity with adolescents, provide social supports for adolescents that increase physical activity while decreasing sedentary behaviors, and make choices that support healthy eating.

Community-based interventions that address healthy eating and physical activity through policy and environmental changes can improve dietary and physical activity behaviors and weight-status outcomes among youths (*19–21*). These kinds of community-based approaches often adopt multiple strategies, including providing information (e.g., messaging campaigns and healthy recipe demonstrations), providing incentives, and improving access to opportunities for practicing healthy behaviors through policy and systems changes. Having multiple activities that target specific behaviors and using a mix of behavioral change strategies appear to be important for making health behavior changes (*19*). Community-based interventions that also include the school setting are more effective in influencing outcomes among youths than interventions that occur only in the community (*20*).

## Limitations

General limitations for the YRBS are available in the overview report of this supplement (*5*). The findings in this report are subject to at least one additional limitation. Certain questions about dietary behaviors (e.g., fruit consumption) ask about frequency rather than portion size; therefore, these data cannot directly determine whether students are meeting specific recommendations for age and sex (*22*).

## Conclusion

Because of the limited progress in increasing the prevalence of healthy dietary and physical activity behaviors among U.S. high school students, multicomponent approaches, including policy and environmental changes and opportunities for adolescents to learn about and practice making healthy choices, are needed to facilitate healthy dietary and physical activity patterns. Schools, communities, and families can work together in creating healthy environments where adolescents thrive.

## Conflicts of Interest

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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# Transportation Risk Behaviors Among High School Students — Youth Risk Behavior Survey, United States, 2019

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## Abstract

Motor-vehicle crashes are a leading cause of death and nonfatal injury among U.S. adolescents, resulting in approximately 2,500 deaths and 300,000 nonfatal injuries each year. Risk for motor-vehicle crashes and resulting injuries and deaths varies, depending on such behaviors as seat belt use or impaired or distracted driving. Improved understanding of adolescents' transportation risk behaviors can guide prevention efforts. Therefore, data from the 2019 Youth Risk Behavior Survey were analyzed to determine prevalence of transportation risk behaviors, including not always wearing a seat belt, riding with a driver who had been drinking alcohol (riding with a drinking driver), driving after drinking alcohol, and texting or e-mailing while driving. Differences by student characteristics (age, sex, race/ethnicity, academic grades in school, and sexual identity) were calculated. Multivariable analyses controlling for student characteristics examined associations between risk behaviors. Approximately 43.1% of U.S. high school students did not always wear a seat belt and 16.7% rode with a drinking driver during the 30 days before the survey. Approximately 59.9% of students had driven a car during the 30 days before the survey. Among students who drove, 5.4% had driven after drinking alcohol and 39.0% had texted or e-mailed while driving. Prevalence of not always wearing a seat belt was higher among students who were younger, black, or had lower grades. Riding with a drinking driver was higher among Hispanic students or students with lower grades. Driving after drinking alcohol was higher among students who were older, male, Hispanic, or had lower grades. Texting while driving was higher among older students or white students. Few differences existed by sexual identity. Multivariable analyses revealed that students engaging in one transportation risk behavior were more likely to engage in other transportation risk behaviors. Traffic safety and public health professionals can use these findings to reduce transportation risk behaviors by selecting, implementing, and contextualizing the most appropriate and effective strategies for specific populations and for the environment.

## Introduction

Motor-vehicle crashes are predictable and preventable. However, in the United States, they remain the second leading cause of death among adolescents and the fourth leading cause of nonfatal injury. During 2018, approximately 2,500 adolescents (persons aged 12–19 years) died in motor-vehicle crashes; of those deaths, >75% were occupants of passenger vehicles (i.e., cars, pickup trucks, vans, or sport utility vehicles) (1). Motor-vehicle crashes also resulted in approximately 297,000 nonfatal injuries among adolescents during 2018. Moreover, fatal and nonfatal motor-vehicle–crash injuries among adolescents resulted in approximately $12 billion in medical and work-loss costs during 2018 (https://www.cdc.gov/injury/wisqars).

Passenger-related transportation risk behaviors (e.g., nonuse of seat belts or riding with a driver who had been drinking

alcohol) increase the risk for injury or death in a crash or risk for a crash itself. Seat belt use among adolescents and young adults is typically lower than among adults of other age groups (1) (https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812781). For instance, the National Occupant Protection Use Survey Controlled Intersection Study uses a probability-based sample of observational surveys conducted on an annual basis to produce estimates of seat belt use nationwide at a typical daylight moment. Results during 2016–2018 indicate that seat belt use among adolescents and young adults aged 16–24 years was approximately 87% each year, whereas seat belt use among adults aged ≥25 years was 90% or higher (https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812781). Previous research also demonstrates that high school students put themselves at risk by riding with drivers who have been drinking alcohol (2).

Per mile driven, drivers aged 16–19 years have crash rates approximately four times greater than those of drivers aged ≥20 years (1); a leading contributor is driver inexperience (1,3). Because of this elevated crash risk, engagement in driver-related transportation risk behaviors (e.g., driving after

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drinking alcohol or texting or e-mailing while driving) puts adolescents at even higher risk. For example, drinking alcohol negatively affects a person's ability to drive safely regardless of age. However, even at the same blood alcohol concentration (BAC), drivers aged 16–20 years have a much higher risk for being involved in a crash than older drivers (1,4). Similarly, the negative effects of driver inexperience on driving performance are worsened by cell phone–related driver distraction (5).

For this report, 2019 data from the Youth Risk Behavior Survey (YRBS) were analyzed by student characteristics to determine the prevalence of four transportation risk behaviors among U.S. high school students. Associations between engagement in multiple transportation risk behaviors also were calculated. This study provides an update on which adolescent groups have an elevated prevalence of engaging in transportation risk behaviors and reveals the extent to which adolescents engage in multiple transportation risk behaviors. The findings can help traffic safety and public health professionals appropriately select, tailor, and implement effective strategies to have a greater impact on reducing risk behaviors, thereby preventing crashes, injuries, and deaths among adolescents.

# Methods

## Data Source

This report includes data from CDC's 2019 YRBS, a cross-sectional, school-based survey conducted biennially since 1991. Each survey year, CDC collects data from a nationally representative sample of public and private school students in grades 9–12 in the 50 U.S. states and the District of Columbia. Additional information about YRBS sampling, data collection, response rates, and processing is available in the overview report of this supplement (6). The prevalence estimates for all unintentional injury questions for the overall study population and by sex, race/ethnicity, grade, and sexual orientation are available at https://nccd.cdc.gov/youthonline/App/Default.aspx. The full YRBS questionnaire is available at https://www.cdc.gov/healthyyouth/data/yrbs/pdf/2019/2019_YRBS-National-HS-Questionnaire.pdf.

## Measures

This study examined two passenger- and two driver-related transportation risk behaviors among U.S. high school students. The overall analytic sample was used for the passenger-related risk behaviors, which included not always wearing a seat belt when riding in a car driven by someone else and riding with a driver who had been drinking alcohol (riding with a drinking driver). Not always wearing a seat belt was assessed with the

question, "How often do you wear a seat belt when riding in a car driven by someone else?" Response options included "always," "most of the time," "sometimes," "rarely," or "never," with any response other than "always" being defined as not always wearing a seat belt. Riding with a drinking driver was assessed with the question, "During the past 30 days, how many times did you ride in a car or other vehicle driven by someone who had been drinking alcohol?" Responses were dichotomized (0 times versus ≥1 time). Students who reported riding with a drinking driver at least once during the previous 30 days were classified as having engaged in the behavior.

Driver-related transportation risk behaviors included driving when they had been drinking alcohol (driving after drinking alcohol) and texting or e-mailing while driving (texting while driving). Driving after drinking alcohol was assessed with the question, "During the past 30 days, how many times did you drive a car or other vehicle when you had been drinking alcohol?" Texting while driving was assessed with the question, "During the past 30 days, on how many days did you text or e-mail while driving a car or other vehicle?" Students who indicated they had not driven a car or other vehicle during the past 30 days on each respective question were excluded from the analysis for these questions. Responses among drivers were categorized as 0 times or days versus ≥1 time or day.

An approximation of driving prevalence among students is presented to provide context for the driver-related behaviors. However, driving prevalence is not directly captured in the 2019 YRBS. For this approximation, students who chose a response other than "I did not drive a car or other vehicle during the past 30 days" for both driver-related questions (driving after drinking alcohol and texting while driving) were classified as drivers, and students who indicated that they did not drive a car or other vehicle during the past 30 days were classified as nondrivers. Driver classification was independent of students' responses to the two questions about passenger-related transportation risk behaviors because students who drove during the past 30 days could also be passengers when they were not driving during the same 30-day period.

All transportation risk behaviors were analyzed by self-reported student characteristics, including age (14, 15, 16, 17, or ≥18 years), sex (male or female), race/ethnicity (non-Hispanic white [white]; non-Hispanic black [black]; or Hispanic or Latino of any race [Hispanic]), academic grades in school (mostly As or Bs versus mostly Cs, Ds, or Fs), and sexual identity (heterosexual; lesbian, gay, or bisexual; or not sure). Although data from students in other or multiple racial/ethnic groups were collected, the numbers were too small to produce statistically stable estimates specific to other or multiple racial/ethnic groups; therefore, these data are not presented as a separate group in this report but were retained in the analytic

sample. In addition, students aged <14 years (n = 87) were not included in the analysis by age because the sample of students in this age category was too small for meaningful analysis and because these students cannot legally drive anywhere in the United States (*1*).

## Analysis

For this report, unadjusted weighted prevalence estimates and corresponding 95% confidence intervals were calculated, and posthoc *t*-tests were used to assess between-group differences. Differences between prevalence estimates were considered statistically significant if the *t*-test p value was <0.05. In the results, only statistically significant differences in prevalence estimates are reported.

Logistic regression models that controlled for age, sex, race/ethnicity, academic grades in school, and sexual identity produced adjusted prevalence ratios and examined the associations between transportation risk behaviors. For passenger-related transportation risk behaviors, students who did not engage in the risk behaviors were designated as the referent group. For driver-related transportation risk behaviors, students who drove but did not engage in the risk behaviors were designated as the referent group. Adjusted prevalence ratios were considered statistically significant if their pairwise comparison between groups (risk versus referent) was p <0.05.

## Results

In 2019, a total of 43.1% of U.S. high school students had not always worn a seat belt and 16.7% had ridden with a drinking driver during the 30 days before the survey (Table 1). Among the 59.9% of respondents who had driven a car or other vehicle during the 30 days before the survey, 5.4% had driven after drinking alcohol and 39.0% had texted while driving.

Both driving after drinking alcohol and texting while driving usually increased with age. Specifically, prevalence of driving after drinking alcohol was higher among students aged ≥18 years (8.9%) than among students aged 16 (4.0%), 15 (2.6%), or 14 (2.7%) years (Table 1). In addition, prevalence was higher among students aged 17 (5.9%) years than among those aged 15 (2.6%) years. For texting while driving, prevalence was higher among students aged ≥18 (59.5%) years than among students aged 17 (50.9%), 16 (30.5%), 15 (15.5%), or 14 (15.5%) years. Prevalence also was higher among students aged 17 years than among those aged 16, 15, or 14 years and higher among students aged 16 years than among those aged 15 or 14 years.

Conversely, not always wearing a seat belt usually decreased with age. Prevalence of not always wearing a seat belt was lower among students aged ≥18 years (39.4%) than among students aged 16 (43.5%), 15 (46.9%), or 14 (45.7%) years. Similarly, prevalence was lower among students aged 17 (38.9%) years than among all younger students. For riding with a drinking driver, no differences occurred by age.

Differences by race/ethnicity were detected for all four transportation risk behaviors but did not demonstrate a consistent pattern. Prevalence of not always wearing a seat belt was higher among black students (61.7%) than among Hispanic students (48.2%) or white students (36.6%). In addition, prevalence among Hispanic students was higher than among white students. For the alcohol-related transportation risk behaviors, Hispanic students (20.8%) had a higher prevalence of riding with a drinking driver than black students (15.9%) or white students (15.1%), and Hispanic students (6.6%) had a higher prevalence of driving after drinking alcohol than black students (4.1%). In contrast, prevalence of texting while driving was higher among white students (43.9%) than among black students (29.5%) or Hispanic students (35.2%). Students whose academic grades in school were mostly Cs, Ds, or Fs had a higher prevalence of not always wearing a seat belt (57.0%), riding with a drinking driver (20.1%), and driving after drinking alcohol (7.4%) than students whose academic grades in school were mostly As or Bs (38.8%, 15.3%, and 4.7%, respectively); however, prevalence of texting while driving did not differ by this characteristic.

Few differences were identified when examining behaviors by sex and by sexual identity. Only alcohol-related transportation risk behaviors demonstrated differences. Among students who had driven during the 30 days before the survey, male students (7.0%) had a higher prevalence of driving after drinking alcohol than female students (3.6%). By sexual identity, students who were not sure of their sexual identity (21.9%) had a higher prevalence of riding with a drinking driver than heterosexual students (15.7%); however, the prevalence was not different from lesbian, gay, or bisexual students (19.2%).

Multivariable analyses indicated that, for each transportation risk behavior, students engaging in that behavior were more likely to engage in each of the other transportation risk behaviors, after controlling for age, sex, race/ethnicity, academic grades in school, and sexual identity (Table 2). For passenger-related transportation risk behaviors, students who did not always wear a seat belt were 1.80 times as likely to have ridden with a drinking driver, 2.73 times as likely to have driven after drinking alcohol, and 1.29 times as likely to have texted while driving than students who always wore a seat belt. Students who had ridden with a drinking driver during the 30 days before the survey were 1.42 times as likely to not always wear a seat belt, 9.87 times as likely to have driven after drinking alcohol, and 1.50 times as likely to have texted while driving than students who had not

**TABLE 1. Unweighted number and unadjusted weighted prevalence estimates of high school students\* who engaged in transportation risk behaviors, by selected characteristics — Youth Risk Behavior Survey, United States, 2019**

| Characteristic | Total | | Did not always wear a seat belt¶ | | Rode with a driver who had been drinking alcohol\*\* | | Drove when they had been drinking alcohol\*\*,†† | | Texted or e-mailed while driving††,§§ | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No.† | % (95% CI) | No.§ | % (95% CI) | No.§ | % (95% CI) | No.§ | % (95% CI) | No.§ | % (95% CI) |
| **Total** | 13,677 | NA | 4,852 | 43.1 (40.2–45.9) | 2,214 | 16.7 (15.2–18.2) | 423 | 5.4 (4.5–6.5) | 2,784 | 39.0 (36.4–41.7) |
| **Age (yrs)¶¶** | | | | | | | | | | |
| 14 | 1,699 | 11.9 (10.9–13.0) | 573 | 45.7 (40.9–50.5) | 276 | 16.4 (13.9–19.1) | 14 | 2.7 (0.9–7.5) | 51 | 15.5 (11.2–21.0) |
| 15 | 3,473 | 24.8 (23.5–26.0) | 1,283 | 46.9 (42.7–51.1) | 557 | 16.7 (14.6–19.1) | 49 | 2.6 (1.7–3.9) | 211 | 15.5 (11.8–20.2) |
| 16 | 3,628 | 25.6 (24.5–26.7) | 1,318 | 43.5 (39.5–47.6) | 564 | 16.0 (13.8–18.5) | 112 | 4.0 (2.8–5.6) | 730 | 30.5 (25.8–35.5) |
| 17 | 3,102 | 23.7 (22.5–24.8) | 1,045 | 38.9 (35.6–42.4) | 481 | 16.0 (13.8–18.5) | 138 | 5.9 (4.3–7.9) | 1,072 | 50.9 (46.5–55.3) |
| ≥18 | 1,616 | 13.7 (12.6–14.9) | 574 | 39.4 (36.6–42.4) | 279 | 18.4 (15.4–21.7) | 91 | 8.9 (6.4–12.4) | 672 | 59.5 (54.9–63.9) |
| **Sex** | | | | | | | | | | |
| Male | 6,641 | 50.6 (49.1–52.1) | 2,369 | 43.3 (40.0–46.7) | 1,015 | 15.6 (14.1–17.2) | 257 | 7.0 (5.6–8.8) | 1,434 | 39.6 (36.6–42.6) |
| Female | 6,885 | 49.4 (47.9–50.9) | 2,440 | 42.7 (39.7–45.7) | 1,141 | 17.5 (15.6–19.5) | 149 | 3.6 (2.8–4.6) | 1,311 | 38.4 (35.5–41.4) |
| **Race/Ethnicity\*\*\*** | | | | | | | | | | |
| White, non-Hispanic | 6,668 | 51.2 (46.4–56.0) | 2,079 | 36.6 (33.8–39.6) | 986 | 15.1 (13.5–16.8) | 207 | 5.1 (3.9–6.5) | 1,608 | 43.9 (40.4–47.5) |
| Black, non-Hispanic | 2,040 | 12.2 (10.2–14.6) | 901 | 61.7 (56.3–66.8) | 325 | 15.9 (13.3–18.7) | 47 | 4.1 (2.6–6.4) | 312 | 29.5 (24.3–35.2) |
| Hispanic | 3,038 | 26.1 (21.8–30.9) | 1,237 | 48.2 (45.0–51.4) | 605 | 20.8 (18.7–23.1) | 107 | 6.6 (5.2–8.5) | 562 | 35.2 (30.8–39.8) |
| **Academic grades†††** | | | | | | | | | | |
| Mostly As or Bs | 9,785 | 75.1 (72.2–77.8) | 3,152 | 38.8 (36.0–41.6) | 1,449 | 15.3 (13.8–17.0) | 248 | 4.7 (3.8–5.9) | 2,070 | 40.4 (37.8–43.1) |
| Mostly Cs, Ds, or Fs | 2,677 | 20.6 (18.3–23.2) | 1,226 | 57.0 (53.4–60.5) | 547 | 20.1 (17.7–22.8) | 133 | 7.4 (5.7–9.6) | 548 | 37.1 (32.2–42.4) |
| **Sexual identity** | | | | | | | | | | |
| Heterosexual | 10,853 | 84.4 (83.4–85.3) | 3,741 | 42.1 (39.1–45.2) | 1,656 | 15.7 (14.1–17.4) | 322 | 5.2 (4.2–6.4) | 2,268 | 39.6 (36.6–42.6) |
| Lesbian, gay, or bisexual | 1,531 | 11.2 (10.4–12.0) | 564 | 44.7 (39.4–50.1) | 283 | 19.2 (16.0–22.9) | 39 | 4.7 (2.4–9.0) | 257 | 34.7 (28.4–41.7) |
| Not sure | 591 | 4.5 (3.9–5.0) | 208 | 43.3 (37.6–49.2) | 125 | 21.9 (16.8–28.1) | 24 | 9.5 (4.8–17.7) | 93 | 31.7 (22.0–43.4) |

**Abbreviations:** CI = confidence interval; NA = not applicable.

\* Unadjusted weighted prevalence estimates and corresponding 95% CIs were calculated and are presented in the table. Posthoc *t*-tests were used to assess between-group differences. Differences were considered statistically significant if the t-test p value was <0.05. Statistical significance is not indicated in the table due to the large number of different pairwise comparisons; however, all significant differences are described in the results.

† The unweighted number of students for each characteristic only includes students who selected a response on the survey question pertaining to that characteristic. Students who did not select a response were not included in the analysis for that characteristic but were retained in the analytic sample for every question on which they provided a response.

§ Students who selected any response on the survey question pertaining to a risk behavior were included in the analysis for that behavior; however, only the unweighted numbers of students who engaged in that behavior are presented in the table. Students who did not select a response were not included in the analysis for that behavior but were retained in the analytic sample for every question on which they provided a response.

¶ Most of the time, sometimes, rarely, or never wore a seat belt when riding in a car driven by someone else.

\*\* ≥1 time during the 30 days before the survey.

†† Among students who had driven a car or other vehicle during the 30 days before the survey.

§§ On ≥1 day during the 30 days before the survey.

¶¶ The total column percentages for age do not add up to 100% because students aged <14 years are not presented because they cannot drive legally in any U.S. state.

\*\*\* The total column percentages for race/ethnicity do not add up to 100% because other non-Hispanic race categories are not presented.

††† The total column percentages for academic grades do not add up to 100% because students who were not sure about their grades or who responded "none of these grades" are not presented.

ridden with a drinking driver. For driver-related transportation risk behaviors, students who had driven after drinking alcohol at least once during the 30 days before the survey were 1.65 times as likely to not always wear a seat belt, 4.91 times as likely to have ridden with a drinking driver, and 2.38 times as likely to have texted while driving than students who had not driven after drinking alcohol. Students who had texted while driving on at least one day during the 30 days before the survey were 1.32 times as likely to not always wear a seat belt, 1.96 times as likely to have ridden with a drinking driver, and 12.64\* times

as likely to have driven after drinking alcohol than students who had not texted while driving.

## Discussion

Transportation risk behaviors varied by student characteristics, with age, race/ethnicity, and academic grades demonstrating the most differences. Increased engagement in driver-related transportation risk behaviors as students become older has been reported in other studies (7–9). This finding is not surprising because adolescents engage in certain risky driver–related behaviors less often when an adult supervisor is present in the

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\* Estimate should be interpreted with caution because the 95% confidence interval is wide.

**TABLE 2. Adjusted prevalence ratios\* for high school students who engaged in multiple transportation risk behaviors — Youth Risk Behavior Survey, United States, 2019**

| Transportation risk behavior[†] | Did not always wear a seat belt[§]<br>aPR (95% CI) | Rode with a driver who had been drinking alcohol[¶]<br>aPR (95% CI) | Drove when they had been drinking alcohol[¶,**]<br>aPR (95% CI) | Texted or e-mailed while driving[**,††]<br>aPR (95% CI) |
|---|---|---|---|---|
| Did not always wear a seat belt[§] | NA | 1.80 (1.59–2.04) | 2.73 (1.81–4.11) | 1.29 (1.19–1.41) |
| Rode with a driver who had been drinking alcohol[¶] | 1.42 (1.32–1.53) | NA | 9.87 (7.14–13.64) | 1.50 (1.37–1.65) |
| Drove when they had been drinking alcohol[¶,**] | 1.65 (1.40–1.95) | 4.91 (4.17–5.77) | NA | 2.38 (2.15–2.63) |
| Texted or e-mailed while driving[**,††] | 1.32 (1.20–1.44) | 1.96 (1.69–2.27) | 12.64 (8.45–18.91)[§§] | NA |

**Abbreviations:** aPR = adjusted prevalence ratio; CI = confidence interval; NA = not applicable.

\* Multivariable logistic regression models that controlled for age, sex, race/ethnicity, academic grades, and sexual identity were used to produce the aPRs and corresponding 95% CIs presented in the table. The aPRs were considered statistically significant if the p value of their pairwise comparison between groups (risk versus referent) was <0.05. All aPRs in the table are significant.

[†] Students who engaged in protective behaviors (i.e., always wearing a seat belt) or did not engage in risk behaviors (i.e., riding with a driver who had been drinking alcohol, driving when they had been drinking alcohol among students who had driven, or texting or e-mailing while driving among students who had driven) were the referent group.

[§] Most of the time, sometimes, rarely, or never wore a seat belt when riding in a car driven by someone else.

[¶] ≥1 time during the 30 days before the survey.

[**] Among students who had driven a car or other vehicle during the 30 days before the survey.

[††] On ≥1 day during the 30 days before the survey.

[§§] Estimate should be interpreted with caution because the 95% CI is wide.

vehicle, as is required when adolescents possess a driver's permit (https://aaafoundation.org/distracted-driving-among-newly-licensed-teen-drivers). As adolescents age, begin to drive without adult supervision, and gain driving experience, driver-related risk behaviors can be more common (*9*) (https://aaafoundation.org/distracted-driving-among-newly-licensed-teen-drivers). The positive association between age and texting while driving illustrates the need to sustain attention to preventing the behavior throughout adolescence (*9*). On the other hand, the prevalence of not always wearing a seat belt decreased by age, possibly indicating that although adolescents are typically more willing to engage in risky transportation behaviors as they become older, they still maintain a sense of self-preservation and risk perception and therefore take precautions by wearing seat belts.

This study demonstrated that Hispanic students had a higher prevalence of riding with a drinking driver and driving after drinking alcohol than white students or black students. One study described similar findings about drinking and driving among Hispanics in the literature (*10*). Additional research to explore which Hispanic populations might be at higher risk found that U.S.-born Hispanic youths were more likely to initiate drinking and driving behavior compared with first-generation immigrant Hispanic youths, even after adjusting for demographic variables (*10*). Additional research is needed to determine whether different strategies to reduce alcohol-impaired driving should be selected for or tailored to specific Hispanic populations based on nativity status.

Other studies have reported that students with lower academic grades were more likely to engage in other health-related risk behaviors (e.g., risky sexual behaviors or substance use) (*11*). The 2019 YRBS illustrates that this association extends to engagement in transportation risk behaviors. Lower

academic achievement might be indicative of an underlying tendency to make riskier decisions, or risky behaviors themselves might lead to lower academic achievement. More research into a potential causal association and the temporality of that association is warranted. Of note, texting while driving was the one transportation risk behavior that did not differ by academic achievement. One potential explanation is that although adolescents understand that texting while driving is unsafe, the perceived benefits of texting while driving and the motivations for engaging in the behavior often differ from other transportation risk behaviors and can outweigh the perceived risks for adolescents at the moment when they choose to do it (*8,9*).

In this study, students engaging in any given transportation risk behavior were more likely to engage in each of the other measured transportation risk behaviors, even after controlling for student characteristics. Associations with alcohol-related behaviors were highest, particularly for driving after drinking alcohol. Students who engaged in any of the other transportation risk behaviors were approximately 3–13 times as likely to have also engaged in driving after drinking alcohol at least once during the 30 days before the survey. This might signify a general willingness to engage in risky behaviors among students who choose to drink and drive. This finding is also concerning because of the potential additive effects of these transportation risk behaviors. For example, adolescents who drive after drinking alcohol, thus increasing their risk for a crash, are also more likely to not always wear a seat belt, which increases their risk for injury or death during a crash.

Because students engaged in multiple transportation risk behaviors, interventions designed to address multiple transportation risk behaviors might concurrently help reduce

those behaviors. Existing infrastructure and resources for comprehensive school and community programs designed to address different health behaviors could be leveraged to expand the benefits of these programs to transportation risk behaviors. For example, programs that already rely on family engagement could incorporate safe driving, because parental involvement is crucial for teaching adolescents how to drive by providing varied practice opportunities, promulgating safe driver behaviors, and instilling the importance of avoiding transportation risk behaviors (https://www.cdc.gov/parentsarethekey/parents/index.html). Programs that provide counseling and social services for adolescents could incorporate brief alcohol interventions, which are promising for reducing drinking and driving among adolescents at high risk for engaging in the behavior (12,13).

Engagement in all of these transportation risk behaviors across the United States remains high. Considering that adolescent drivers (16–19 years of age) have the highest crash rates (1), the fact that only six of 10 adolescents in this study always wore seat belts is concerning. Measures that are effective for increasing seat belt use, such as primary enforcement seat belt laws that allow police to ticket drivers or passengers for being unrestrained even in the absence of other violations (13), also can be beneficial for preventing crashes or crash injuries involving other contributing factors. For example, evidence indicates that primary enforcement seat belt laws are effective for reducing fatal alcohol-related crashes among underage drivers aged 15–20 years (14).

Although this study did not find many differences in riding with a drinking driver by student characteristics, approximately one of every five students engaged in the behavior. Riding with a drinking driver is intrinsically unsafe and also is associated with adolescent drinking and driving (15). Longitudinal research has revealed that adolescent passengers who are exposed to drinking and driving at a young age are more likely to engage in drinking and driving themselves as they become older and begin to drive (16). Additional research about the drinking drivers with whom adolescents ride and their relationships with the drinking drivers (e.g., parents, other family members, or peers) might be useful for designing and implementing targeted interventions.

In every U.S. state, minimum legal drinking age (MLDA) laws stipulate that drinking alcohol is illegal for anyone aged <21 years, as is driving after drinking any amount of alcohol (zero tolerance laws) (1,13). Despite these laws, approximately one fifth of drivers aged 16–20 years killed in crashes during 2018 had BACs of ≥0.08% (1). This study found that in 2019, a total of 5.4% of students who drove did so after drinking alcohol at least once in the previous 30 days. Driving after drinking alcohol is risky and unacceptable at any age; however, the risk is even higher among adolescent drivers aged 16–20 years, even at BACs below the legal limit for adults (4). Zero tolerance laws (7,13,14), graduated driver licensing systems (7), and MLDA laws (7,13,14) are effective in helping reduce drinking and driving and alcohol-related crashes and injuries among adolescents, and they should continue to remain universally implemented. Other general population deterrent approaches that are effective for preventing alcohol-impaired driving overall also can be beneficial for specifically preventing adolescent drinking and driving. For example, publicized sobriety checkpoints are highly effective for reducing drinking and driving overall (13), and evidence indicates that they can reduce alcohol-impaired driving (17) and alcohol-related crashes among underage drivers (14).

Consistent with two recent studies, this analysis determined that texting while driving among adolescents remains high, increases with age, and is more common among white students than students of other races/ethnicities (8,9). Similar to the other studies, this analysis also determined that adolescents who engage in texting while driving are more likely to engage in other transportation risk behaviors (8,9). Awareness campaigns, education, and changes in policy related to texting while driving have had mixed effectiveness (9,13). Because of this, such technologic interventions as in-vehicle cell phone blocking technologies can serve as potential solutions; however, the effectiveness and acceptability of such solutions require more research (9,13).

Lack of parental monitoring and supervision is a common underlying contributor to many health risk behaviors, and parental involvement can be especially important for reducing transportation risk behaviors. For example, one study found that adolescents with supportive parents who monitor their behavior were less likely to engage in multiple passenger- and driver-related transportation risk behaviors, including seat belt nonuse, cell phone use while driving, and drinking and driving, than adolescents with uninvolved parents (18). Parents/guardians also can play a vital role in teaching adolescents to drive by helping ensure they gain valuable driving experience and by setting rules and expectations for adolescent drivers, including rules and expectations for not engaging in transportation risk behaviors. Parent-teen driving agreements (https://www.cdc.gov/parentsarethekey/parents/index.html) can formalize those expectations and demonstrate a commitment between parents and adolescents to adhere to safe driving practices while adolescents gain new driving privileges over time.

# Limitations

General limitations for the YRBS are available in the overview report of this supplement (6). The findings in this report are subject to at least two additional limitations. First, YRBS does not quantify driving or riding exposure in general or during the 30 days before the survey. How many trips each student takes as a driver or as a passenger and the amount of time each student spends on the road are unknown. High school students who take more frequent trips or drive for longer times or distances might have more opportunity to engage in transportation risk behaviors because of a higher exposure that is not captured by the survey. Second, for riding with a driver who had been drinking alcohol, the relationship between the student and the drinking driver (e.g., parent/guardian, other family member, a peer, or someone else) is unknown. The nature of this relationship might have implications for designing potential strategies and prevention messages for empowering adolescents so that they can intervene (15).

# Conclusion

Motor-vehicle–crash injuries remain a leading cause of death among adolescents. Despite this, passenger- and driver-related transportation risk behaviors that increase the risk for crashes, injuries, and deaths remain too common. Reducing transportation risk behaviors among adolescents by using proven strategies, especially those that can target multiple transportation risk behaviors, can help prevent crashes, reduce injuries, and save lives. Because driver-related transportation risk behaviors increased with age, continued emphasis on implementation of effective strategies for preventing these behaviors with high school juniors and seniors should be considered.

### Conflicts of Interest

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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