

Youth Risk Behavior Surveillance — United States, 2021



U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

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The *MMWR* series of publications is published by the Office of Science, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30329-4027.

Suggested citation: [Author names; first three, then et al., if more than six.] [Title]. *MMWR Suppl* 2023;72(Suppl-#):[inclusive page numbers].

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Overview and Methods for the Youth Risk Behavior Surveillance System — United States, 2021

Jonetta J. Mpofu, PhD^{1,2}; J. Michael Underwood, PhD¹; Jemekia E. Thornton, MPA^{1,2}; Nancy D. Brener, PhD¹; Adriana Rico, MPH¹; Greta Kilmer, MS¹; William A. Harris, MM¹; Michelle Leon-Nguyen, MPH¹; David Chyen, MS¹; Connie Lim, MPA¹; Cecily K. Mbaka, MPH¹; Jennifer Smith-Grant, MSPH^{1,2}; Lisa Whittle, MPH¹; Sherry Everett Jones, PhD, JD¹; Kathleen H. Krause, PhD¹; Jingjing Li, PhD, MD¹; Shari L. Shanklin, MPH¹; Izzy McKinnon, PhD¹; Loredona Arrey, MS¹; Barbara E. Queen, MS³; Alice M. Roberts, MS⁴

¹Division of Adolescent and School Health, National Center for HIV, Viral Hepatitis, STD, and TB Prevention, CDC, Atlanta, Georgia; ²U.S. Public Health Service Commissioned Corps, Rockville, Maryland; ³Westat, Rockville, Maryland; ⁴ICF International, Rockville, Maryland

Abstract

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. The system includes a nationally representative Youth Risk Behavior Survey (YRBS) and separate school-based YRBSSs conducted by states, tribes, territories, and local school districts. In 2021, these surveys were conducted during the COVID-19 pandemic. The pandemic underscored the importance of data in understanding changes in youth risk behaviors and addressing the multifaceted public health needs of youths. This overview report describes 2021 YRBSS survey methodology, including sampling, data collection procedures, response rates, data processing, weighting, and analyses. The 2021 YRBS participation map, survey response rates, and a detailed examination of student demographic characteristics are included in this report. During 2021, in addition to the national YRBS, a total of 78 surveys were administered to high school students across the United States, representing the national population, 45 states, two tribal governments, three territories, and 28 local school districts. YRBSS data from 2021 provided the first opportunity since the onset of the COVID-19 pandemic to compare youth health behaviors using long-term public health surveillance. Approximately half of all student respondents represented racial and ethnic minority groups, and approximately one in four identified as lesbian, gay, bisexual, questioning, or other (a sexual identity other than heterosexual) (LGBQ+). These findings reflect shifts in youth demographics, with increased percentages of racial and ethnic minority and LGBQ+ youths compared with previous YRBSS cycles. Educators, parents, local decision makers, and other partners use YRBSS data to monitor health behavior trends, guide school health programs, and develop local and state policy. These and future data can be used in developing health equity strategies to address long-term disparities so that all youths can thrive in safe and supportive environments. This overview and methods report is one of 11 featured in this *MMWR* supplement. Each report is based on data collected using methods presented in this overview. A full description of YRBSS results and downloadable data are available (<https://www.cdc.gov/healthyyouth/data/yrbs/index.htm>).

Introduction

The COVID-19 pandemic has affected the mental, physical, and emotional health of adolescents (1,2). Adolescents have endured the stress of the pandemic, resulting social distancing measures, and societal discord in ways unique to their young age. Trends in adolescent behavioral and emotional health that were of concern before the pandemic have worsened (3,4). The pandemic (including the loss of life, disease burden, and measures to counteract its effects) exposed structural, social, and economic conditions that accelerated certain health behaviors among students and worsened existing health disparities for racial and ethnic and sexual minority youths (2).

During January–June 2021, CDC administered the nationally representative Adolescent Behaviors and Experiences Survey (ABES) to assess student health behaviors and experiences during the pandemic (5). Results from ABES indicated that 37% of high school students experienced poor mental health during the pandemic and 44% felt persistently sad or hopeless during the previous 12 months, a period covered by the World Health Organization's pandemic declaration on March 11, 2020 (3). Approximately one in three youths have ever experienced racism at school, which was significantly associated with poor mental health (6). Students who described their sexual identity as lesbian, gay, bisexual, questioning, or other (a sexual identity other than heterosexual) (LGBQ+) had a higher prevalence of poor mental health during the pandemic than heterosexual students (3). Approximately half of students reported experiencing emotional abuse by a parent or another adult in their home (55%), with the highest

Corresponding author: Jonetta J. Mpofu, PhD, Division of Adolescent and School Health, National Center for HIV, Viral Hepatitis, STD, and TB Prevention, CDC. Telephone: 770-488-5735; Email: jmpofu@cdc.gov.

prevalence among non-Hispanic multiracial students (66%) and students identifying as questioning or other (76%) (7). In addition, although approximately one fourth of all students experienced hunger during the pandemic, White students experienced significantly less hunger (18.5%) than all other racial and ethnic groups (7).

The pandemic's effect on student health behaviors cannot be separated from the context of changing youth demographics in the United States. After years of monitoring trends in demographic data (8), White youths no longer represent the majority of students enrolled in K–12 public schools in the United States (9). Nationally representative 2017 and 2019 Youth Risk Behavior Survey (YRBS) data, and most recently ABES data, have demonstrated steady increases in the proportion of students who identify as lesbian, gay, or bisexual (10.4%, 11.2%, and 15.3%, respectively) (5,10,11). The shifting demographics of adolescents in the United States and the health disparities faced by youths from racial and ethnic and sexual minority groups make gathering information on their health behaviors and associated protective factors more important than ever.

Since 1991, the Youth Risk Behavior Surveillance System (YRBSS) has monitored health behaviors, experiences, and conditions affecting the health outcomes of high school students in the United States. The system is composed of a national school-based survey administered by CDC and multiple site-level, school-based surveys administered by states, tribal governments, territories, and local school districts. YRBSS offers a unique opportunity to monitor the prevalence of important youth health behaviors and long-term trends on certain risk behaviors, including those that have been monitored for more than 20 years. The 2021 YRBSS captured information on the following topics: student demographics (sex, sexual identity, race and ethnicity, and grade), youth health behaviors and conditions (sexual; injury and violence; bullying; diet and physical activity; obesity; and mental health, including suicide), and substance use behaviors (electronic vapor product and tobacco product use, alcohol use, and other drug use). Changes to the national questionnaire in 2021 included new questions that examined urgent and relevant student health behaviors and experiences, including protective factors (parental monitoring and school connectedness), housing instability, exposure to community violence, and mental health during the COVID-19 pandemic. Data from the 2021 survey administration offered the first direct comparison with behaviors before onset of the COVID-19 pandemic.

This report describes the 2021 YRBSS methodology, including sampling, data collection, processing, weighting, and analyses. This overview and methods report is one of 11 included in this *MMWR* supplement featuring 2021 national

YRBS data. Each of the other 10 reports uses 2021 YRBS data to assess a priority health topic for adolescents (12). This supplement does not include data from site-level surveys; however, those results can be found in YRBS Explorer (<https://yrbs-explorer.services.cdc.gov>), CDC's web-based application for YRBSS data. Topic areas of focus in this supplement include updates regarding electronic vapor product use, dietary behaviors and physical activity, and interpersonal violence and new national data on housing instability, exposure to community violence, school connectedness, and parental monitoring. Public health practitioners and researchers can use YRBSS data to examine the prevalence of youth health risk behaviors, monitor trends, and guide interventions.

National YRBS Methodology

Overview

The national YRBS is conducted biennially, typically during the spring (January–June) of odd-numbered years among students in grades 9–12 enrolled in U.S. public and private schools. However, the 2021 national YRBS administration was postponed until fall (September–December) 2021 because of the COVID-19 pandemic and the shift to virtual and hybrid school instructional models and ongoing school closures during spring 2021. Biennial administration of the YRBS allows CDC to assess temporal changes in risk behaviors among the U.S. high school population. The national YRBS provides comparable data across survey years and allows state and local entities that conduct their own YRBSSs to compare risk behaviors of their youths with those at the national level. A nationally representative sample of schools and a random sample of classes within those schools are selected to participate.

Questionnaire

In 2021, the national YRBS questionnaire consisted of 99 questions. Of those, 87 questions were included in the standard questionnaire* used by sites. Twelve questions were added to the standard questionnaire that reflected areas of interest for CDC and other partners. As in all cycles, both the previous year's standard questionnaire and additional national-only questions were revised to include measurement of emerging and prevailing risk behaviors among high school students. Subject matter experts from CDC and elsewhere proposed changes, additions, and deletions to the

* The standard YRBS questionnaire included 87 questions. YRBS coordinators (located in CDC-funded states, tribes, territories, and local school districts) voted for or against each proposed change, addition, and deletion. Final content of the standard YRBS questionnaire was decided based on the results of this voting process.

questionnaire. Further refinements to the questionnaire were made based on feedback from cognitive testing. During this process the sexual identity question was modified (Table 1). In addition, in 2021, the national YRBS questionnaire was offered for the first time in English and Spanish.

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. Most of the 2021 survey questions underwent test-retest analysis and demonstrated good reliability (13,14). The wording of each question, including recall periods, response options, and operational definitions for each variable, are available in the 2021 YRBS questionnaire and data user's guide. (YRBSS data and documentation are available at <https://www.cdc.gov/healthyyouth/data/yrbs/data.htm>.)

In accordance with guidance from subject matter experts, response options for the sexual identity question were updated for the 2021 YRBS to include the following new categories: "I am not sure about my sexual identity (questioning)," "I describe my sexual identity in some other way," and "I do not know what this question is asking." As a result, beginning in 2021, YRBS can provide data for LGBTQ+ students, as opposed to only lesbian, gay, or bisexual students.

Sampling

The 2021 YRBS sampling frame consisted of all regular public schools (including charter schools), parochial schools, and other private 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 or the Bureau of Indian Education, and vocational schools serving students who also attended another school were excluded. Schools with ≤ 40 students enrolled in grades 9–12 also were excluded. The sampling frame was constructed from data files obtained from MDR (formerly Market Data Retrieval) and the National Center for Education Statistics (NCES). NCES data sources included the Common Core of Data (<https://nces.ed.gov/ccd>) for public schools and the Private School Survey (<https://nces.ed.gov/surveys/pss>) for private schools. The YRBS sample size was increased in 2021 in anticipation of lower response rates resulting from the COVID-19 pandemic and to obtain a large enough sample size for the desired precision.

A three-stage cluster sampling design was used to produce a nationally representative sample of students in grades 9–12 who attend public and private schools. The first-stage sampling frame comprised 1,257 primary sampling units (PSUs), which consisted of entire counties, groups of smaller adjacent counties, or parts of larger counties. PSUs were categorized into 16 strata according to their metropolitan statistical area status (i.e., urban or nonurban) and the

TABLE 1. Sexual identity and sexual contact questions on the Youth Risk Behavior Survey — United States, 2021

Question	Student response	Description for analysis
Sexual identity		
Which of the following best describes you?	Heterosexual (straight) (1)	Heterosexual students (1)
1) Heterosexual (straight), 2) gay or lesbian, 3) bisexual, 4) I describe my sexual identity some other way, 5) I am not sure about my sexual identity (questioning), or 6) I do not know what this question is asking	Gay or lesbian (2) or bisexual (3)	Lesbian, gay, or bisexual students (2 or 3)
	Other (4) or questioning (5)	Other or questioning students (4 or 5)
	Did not understand (6)	Students missing sexual identity variable (6)
Sex of sexual contacts		
During your life, with whom have you had sexual contact?	I have never had sexual contact*	Students who had no sexual contact
1) I have never had sexual contact, 2) females, 3) males, or 4) females and males	Contact: Female Male	Student: Male Female
What is your sex?	Contact: Male Females and males Female Females and males	Student: Male [§] Male [§] Female ^{†,§} Female
1) Female, or 2) male		Students who had sexual contact with only the opposite sex
		Students who had sexual contact with only the same sex or with both sexes

* Excluded from analyses on sexual behaviors.

† Excluded from analyses on condom use.

§ Excluded from analyses on dual use of condoms and birth control.

percentages of Black and Hispanic or Latino (Hispanic) students in each PSU. Sixty of the 1,257 PSUs 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 60 PSUs, 180 SSUs were sampled with probability proportional to school enrollment size. To provide adequate coverage of students in small schools, an additional 20 small SSUs were selected from a subsample of 20 of the 60 PSUs. These 200 SSUs corresponded to 209 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 who could independently complete the survey were eligible to participate. Schools, classes, and students that refused to participate were not replaced.

Data Collection Procedures

Institutional review boards at CDC and ICF, the survey contractor, approved the protocol for the YRBS. Data collection was conducted consistent with applicable federal law and CDC policy.[†]

[†] See e.g., 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

Survey procedures were designed to protect students' privacy by allowing for anonymous participation. Participation was voluntary, and local parental permission procedures were followed before survey administration. During survey administration, students completed the self-administered questionnaire during one class period (approximately 45 minutes) and recorded their responses on a computer-scannable booklet.

Response Rates and Data Processing

For the 2021 YRBS, 17,508 questionnaires were completed in 152 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 17,508 completed questionnaires, 276 failed quality control and were excluded from analysis, resulting in 17,232 usable questionnaires. The school response rate was 72.7%, the student response rate was 79.1%, and the overall response rate (i.e., [student response rate] x [school response rate]) was 57.5%.

Race and ethnicity were 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 [AI/AN]," "Asian," "Black or African American [Black]," "Native Hawaiian or other Pacific Islander [NH/OPI]," or "White"). (Persons of Hispanic or Latino [Hispanic] origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.) For the second question, students could select more than one response option. For this report, students were classified as Hispanic or Latino and are referred to as Hispanic if they answered "yes" to the first question, regardless of how they answered the second question. For example, 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. Likewise, 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 and ethnicity were 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. Students who selected more than one response option to "What is your race?" were classified as multiracial. Further, to meet the needs of an increasingly diverse population, CDC implemented modified suppression criteria for the YRBSS in 2021, allowing for increased data representation from students of diverse racial and ethnic groups. Previously, estimates with a denominator of <100 were suppressed; however, many of these estimates were found to

be statistically reliable according to criteria set forth by CDC's National Center for Health Statistics (15). Guided by these criteria, and in consideration of criteria used for other national surveillance systems, YRBS estimates with a denominator of <30 were suppressed in all years.

To obtain a sufficient sample size for analyses of health-related behaviors by sexual orientation (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 dual use of condoms and birth control, and male students who had sexual contact with only males were excluded from analyses on dual use of condoms and birth control.

Weighting

A weight based on student sex, race and 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 nonpublic schools.

Analytic Methods

Findings presented in this *MMWR* supplement are derived from analytic procedures similar to what is described in this overview report. For more information regarding the detailed 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 using SAS-callable SUDAAN (version 11.0.3; RTI International) to account for the complex sampling design and weighting. In all reports, prevalence estimates and CIs were computed for variables used in those reports. Prevalence estimates where the denominator was <30 were suppressed. Pairwise differences between groups (e.g., sex, race and ethnicity, grade, sexual identity, and sex of sexual contacts) were determined using *t*-tests with Taylor series linearization. Pairwise differences were considered statistically significant if the *t*-test *p* value was <0.05. Chi-square tests were used to examine comparisons between risk behaviors and experiences by demographic and behavioral characteristics (race and ethnicity, grade, sexual identity, and sex of sexual contacts). Chi-square tests were considered statistically significant if the *p* value was <0.05.

In reports that analyzed temporal trends, logistic regression analyses were used to examine linear and quadratic changes in estimates, controlling for sex, grade, and racial and ethnic changes over time. A p value of <0.05 associated with a regression coefficient 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 (version 9.4; SAS Institute). 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. When a significant quadratic trend was identified, Joinpoint (version 4.9; National Cancer Institute) was used to automate identification of the year when the trend changed. Regression models were used to identify linear trends occurring before and after the change in trend. A quadratic trend indicates a statistically significant but nonlinear change 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. Cubic and higher-order trends were not assessed.

In reports that analyzed 2-year changes in health-related behaviors, prevalence estimates from 2019 and 2021 were compared by using t -tests for variables assessed with identically worded questions in both survey years. An exception was made for birth control use, where the wording specifically addressed sexual contact with opposite sex partners in 2021 but not in 2019. Prevalence estimates were considered statistically different if the t -test p value was <0.05 . For 2-year changes assessed with absolute measures (i.e., prevalence difference), 95% CIs that did not cross zero were considered statistically significant. For relative measures (i.e., prevalence ratio), 95% CIs that did not cross 1.0 were considered statistically significant.

Data Availability and Dissemination

National and site-level YRBS data (1991–2021) are available in a combined data set 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, and 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 also are available online via three web-based data dissemination tools: Youth Online, YRBS Analysis Tool, and YRBS Explorer. Youth Online allows point-and-click data analysis and creation of customized tables, graphs, maps, and fact sheets (<https://nccd.cdc.gov/Youthonline/App/Default.aspx>). Youth Online also performs

statistical tests by health topic and filters and sorts data by race and ethnicity, sex, grade, and sexual orientation. The YRBS Analysis Tool allows real-time data analysis of YRBS data that generates frequencies, cross-tabulations, and stratified results (<https://nccd.cdc.gov/YRBSSanalysis>). YRBS Explorer is an application featuring 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, Tribal, Territorial, and Local School District YRBS Methodology

Overview

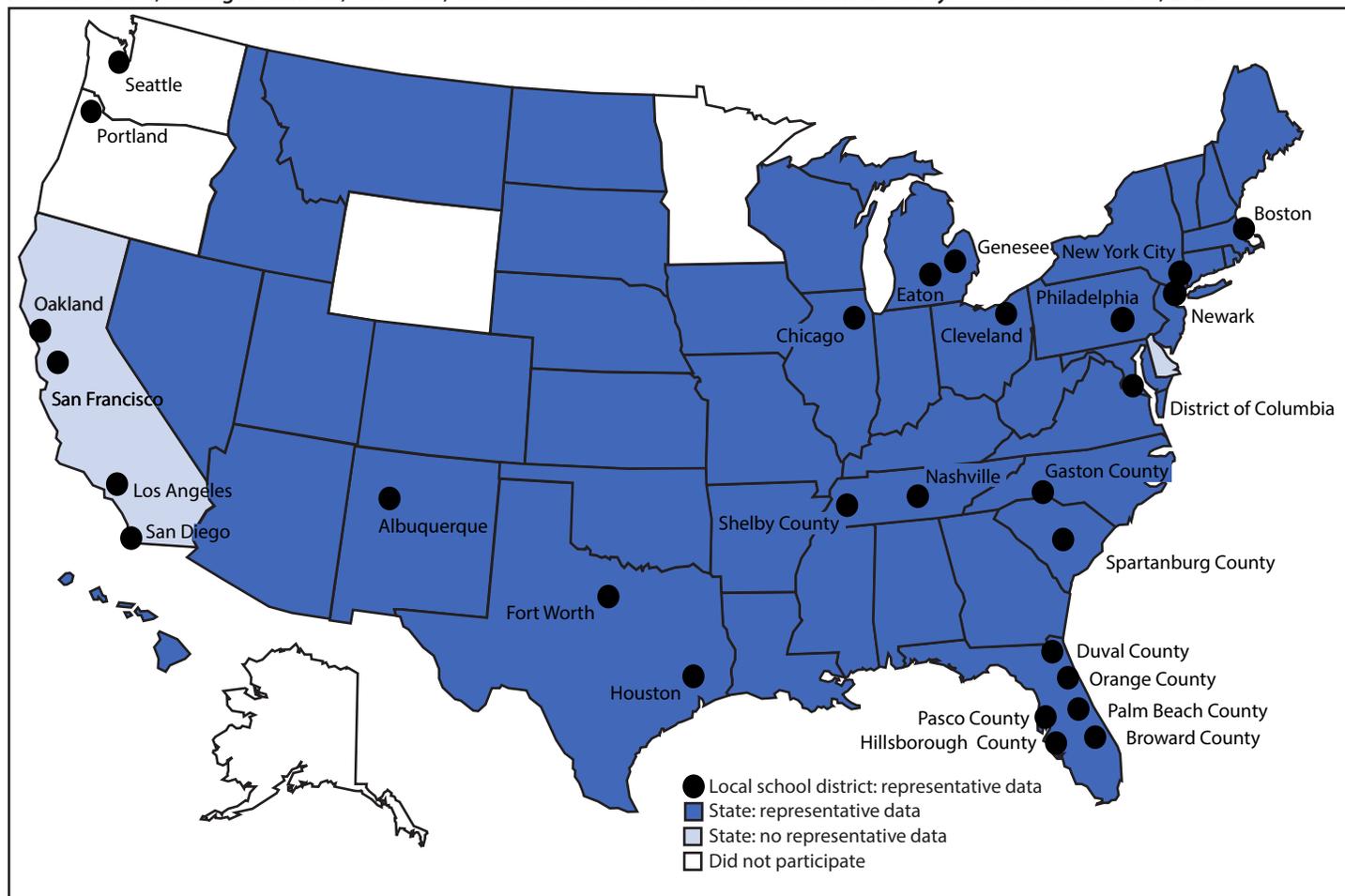
Biennial administration of site-level YRBSs allows state and local education and health agencies to assess how risk behaviors temporally change among the high school populations in their respective jurisdictions. Site-level YRBS data provide comparable data across years and allow comparisons of student behaviors across jurisdictions (e.g., national to state). Site-level surveys are conducted among students in grades 9–12 attending public schools by using samples representative of the state, tribal, territorial, or local jurisdiction where they are administered. Seventy-eight sites administered a YRBS in 2021 (45 states, two tribal governments, three territories, and 28 local school districts) (Figures 1 and 2). Sites[§] administered their surveys during spring (nine sites) or fall 2021 (69 sites). 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 YRBS; however, 29 sites collected data electronically using computers, smartphones, or tablets.

Questionnaires

The 2021 YRBS standard questionnaire contained 87 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 58 of the questions on the standard questionnaire. This flexibility allowed YRBS coordinators and

[§] CDC funds states, tribes, territories, and local school districts, referred to throughout this report as sites, to collect YRBS data. YRBS site-level surveys are conducted among students attending public schools by using samples representative of the state, tribal, territorial, or local school district where they are administered.

FIGURE 1. State, tribal government, territorial, and local school district Youth Risk Behavior Surveys — selected U.S. sites, 2021



other local partners the opportunity to pursue topics of interest by customizing their survey.

Sampling

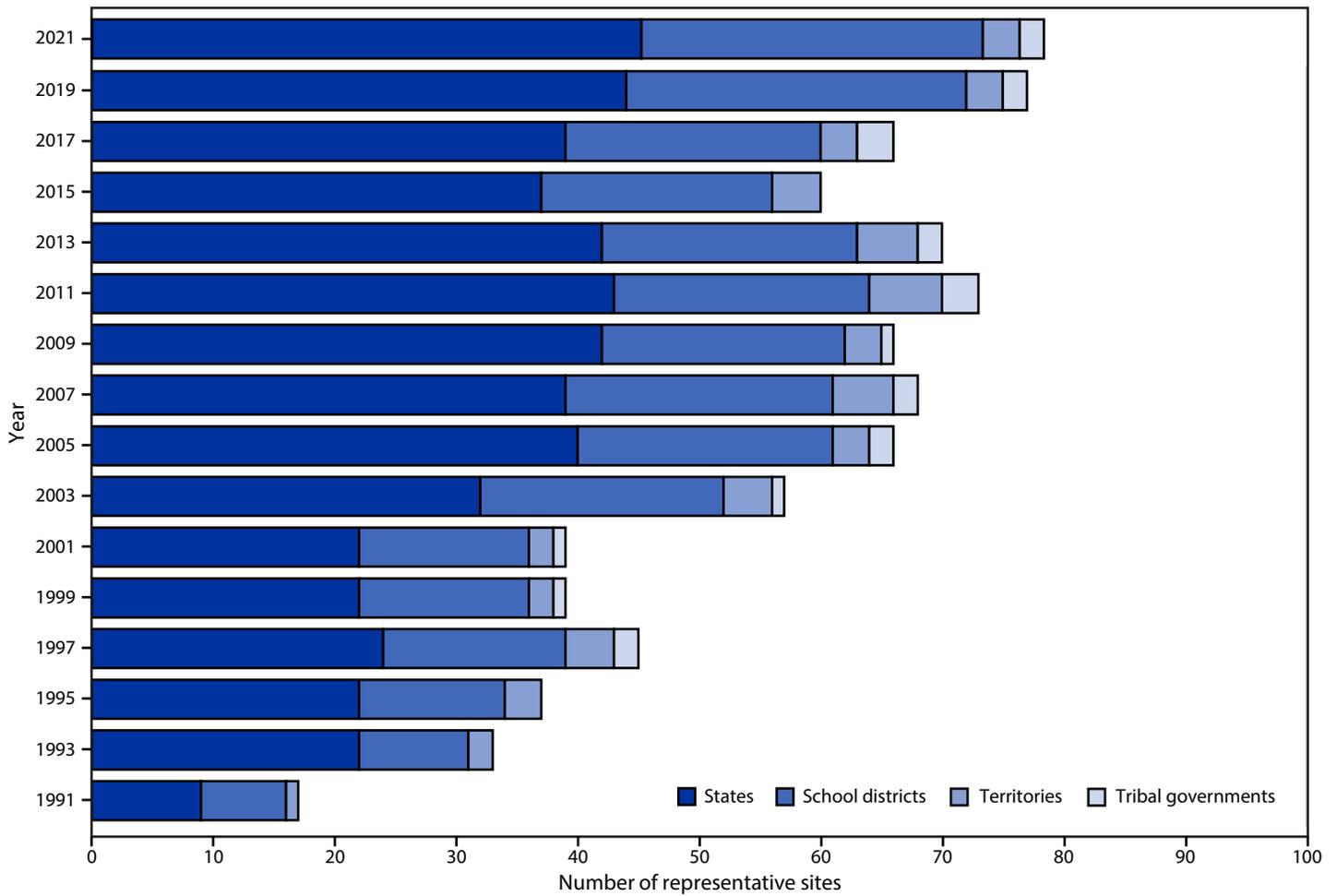
Sites used a two-stage cluster sampling design to produce a representative sample of students in grades 9–12 in their jurisdiction. In 43 states, one tribe, one territory, and four local school districts, in the first sampling stage, public schools with any of grades 9–12 were sampled with probability proportional to school enrollment size. In two states and 24 local school districts, 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 the Winnebago Tribe of Nebraska), a census of students was selected to participate. All students in selected classes who could independently complete the survey were eligible to participate.

Students in schools that were in both the national sample and a site-level sample were asked to participate in only one survey. Either the national questionnaire or the state or local school district's YRBS questionnaire was administered to the students in these schools, and data from questions included on both questionnaires were transferred to the correct data set during processing. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number of students answering each question varied.

Response Rates, Nonresponse Bias Analyses, and Weighting

Site-level data sets were 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. In 2019, CDC piloted the use of

FIGURE 2. Number of states, tribal governments, territories, and local school districts with representative Youth Risk Behavior Survey data, by year of survey — selected U.S. sites, 1991–2021



nonresponse bias analysis to determine if a site had data that could be weighted to be representative of its jurisdiction. In previous YRBS cycles, CDC weighted data for any site with an overall response rate (calculated by multiplying school and student response rates) $\geq 60\%$ (10,11). For the 2021 YRBS cycle, CDC conducted nonresponse bias analyses for all sites to determine whether data for each site could be weighted to be representative of its jurisdiction. These analyses compared responding and nonresponding schools on school enrollment size (small, medium, or large), a measure of the school’s poverty level (usually the percentage of students eligible for free or reduced-price lunch), and locale type (city, suburban, town, or rural). Analyses also compared responding and nonresponding students by grade and weighted sample and population percentages by grade, sex, and race and ethnicity. If limited statistically significant differences between comparison groups were found, data were weighted to be representative of their respective populations.

A weight calculated as the product of school base weight, student base weight, school nonresponse adjustment factor, student nonresponse adjustment factor, and poststratification adjustment factor based on student sex, grade, and race and ethnicity was attached 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. A total of 45 states, two tribal governments, three territories, and 28 local school districts, had representative (weighted) data in 2021 (Figures 1 and 2). In 16 states and 19 local school districts, weighted estimates were representative of all students in grades 9–12 attending regular public schools, and in 28 states and nine local school districts, weighted estimates were 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, tribal, territorial, and local school district YRBS data (1991–2021) 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 on 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 collected during 1991–2021 are available through Youth Online (<https://nccd.cdc.gov/Youthonline/App/Default.aspx>), the YRBS Analysis Tool (<https://nccd.cdc.gov/YRBSSanalysis>), and YRBS Explorer (<https://yrbs-explorer.services.cdc.gov>).

YRBS Response Rates and 2021 Demographic Characteristics

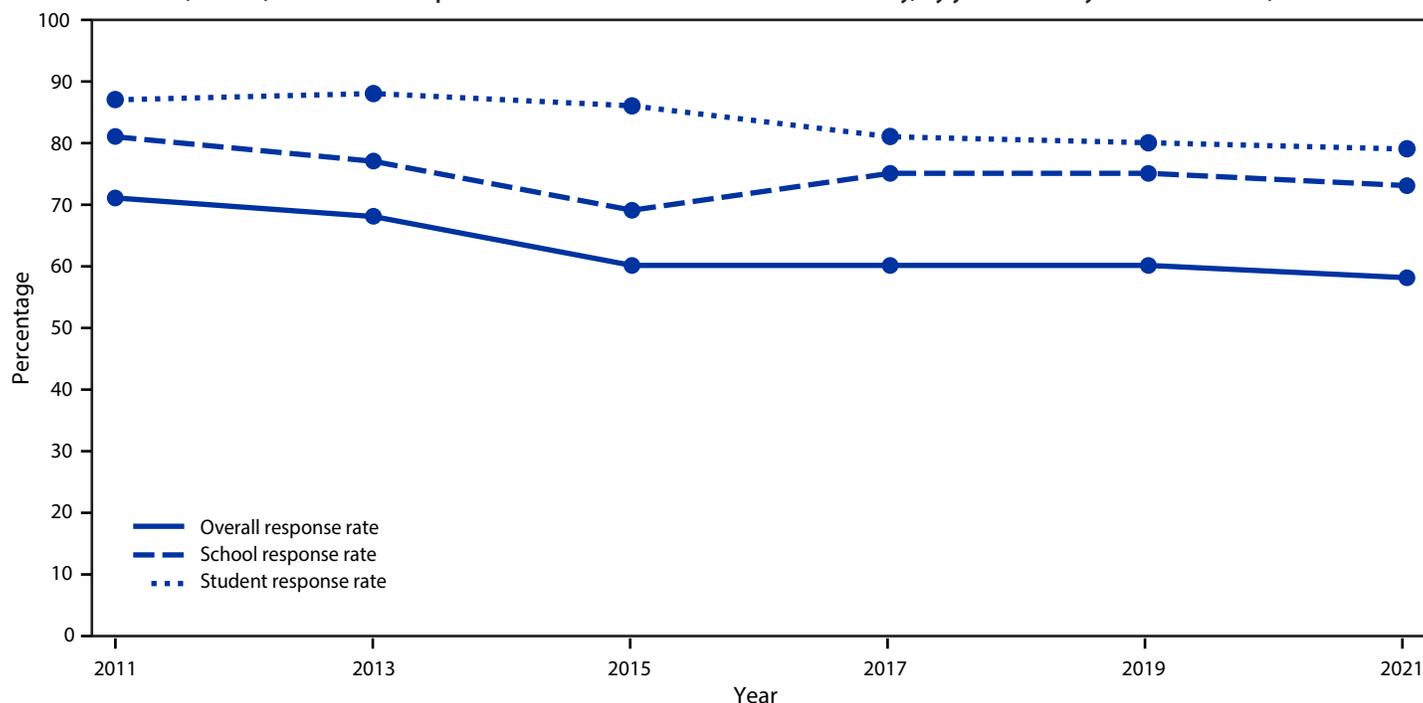
The 2021 national YRBS overall response rate was 57.5% (Figure 3). This is lower than in previous years and reflects the challenges of conducting a school-based survey during the COVID-19 pandemic. School and student response rates in 2021 (72.7% and 79.1%, respectively) were slightly lower than

in the previous two YRBS cycles. Nonresponse bias analyses of the YRBS data found evidence of bias at the school level, but little evidence that this bias significantly affected the national estimates because it was mitigated by weight adjustments based on predictors of nonresponse propensities. YRBS overall response rates have decreased steadily since 2011, with overall response rates in the low 60% range since the 2015 biennial cycle.

Data were weighted to match national population proportions. After weighting, approximately half of students were male (51.7%), and percentages of students by grade were as follows: grade 9 (26.6%), grade 10 (25.4%), grade 11 (24.3%), and grade 12 (23.5%) (Table 2). In regard to race and ethnicity, 50.7% of students were White, followed by Hispanic (25.4%), Black (12.1%), multiracial (5.7%), Asian (4.9%), AI/AN (0.7%), and NH/OPI (0.5%). The percentage of students in racial and ethnic groups other than White who participated in the national survey has increased steadily over the past 20 years, from 32% in 2001 to 49% in 2021 (Figure 4).

In 2021, a total of 75.5% of students self-identified as heterosexual, 3.2% as gay or lesbian, 12.1% as bisexual, 5.2% as questioning, and 3.9% as other (Table 2); 1.8% responded with “I do not know what this question is asking” (data not shown). The percentage of students with a sexual identity other than heterosexual has increased steadily, from 11% in 2015 to 26% in 2021 (Figure 5). Increases in the percentage of LGBQ+ students in YRBSS 2021 might be a result of changes in question wording to include students identifying as questioning, “I am not sure about

FIGURE 3. Overall, school, and student response rates for the Youth Risk Behavior Survey, by year of survey — United States, 2011–2021



my sexual identity (questioning),” or other, “I describe my sexual identity in some other way.” In 2021, a total of 57% of students reported no sexual contact during their lives. An estimated 34.6% of students had sexual contact with the opposite sex only, 6.0% with both sexes, and 2.4% with the same sex only.

Discussion

YRBSS is the largest public health surveillance system in the United States, monitoring multiple health-related behaviors among high school students. The results of the 2021 YRBSS surveys provide the first comparison of youth health behaviors since the onset of the COVID-19 pandemic, using long-term

public health surveillance data. Although multiple surveys assessing youth health behaviors have been conducted since March 2020 (5,16), including ABES, each was limited by small sample sizes, lack of representativeness, or inability to compare findings with those from previous years. YRBS findings can be compared with data from previous YRBS cycles and used in combination with other surveys to provide a robust assessment of youth health needs as communities continue to rebound from the consequences of the pandemic.

Nationally representative data from youths are crucial for identifying health needs and creating evidence-based interventions. The findings of the 2021 YRBS revealed increasing diversity among U.S. high school students. Approximately half of all students identified as being from a racial and ethnic group other than White (49.3%), compared with 48.9% in 2019 and 46.5% in 2017. This shift in youth demographics aligns with U.S. Census projections (8) that racial and ethnic populations other than White will account for the majority of all Americans by 2045. In addition, approximately one in four students identified as LGBTQ+. Improvements to existing questions and methodology and the introduction of new YRBS questions provide an opportunity to identify needs for an increasingly diverse population of students and address emerging adolescent health issues.

In 2021, YRBS response rates were below 60%, continuing a previously reported decline in YRBS response rates (11). Whereas a part of the drop in YRBS participation was attributable to school-level COVID-19 safety precautions, disinformation campaigns targeting YRBSs across the country also contribute to declining YRBS response rates (17). Such campaigns misrepresent survey content, data collection procedures, and data utility. Although YRBS data use is at an all-time high, increasing parent refusals for student participation might ultimately prevent a state or locality from obtaining representative data.

New questions featured in the 2021 YRBS on housing instability, exposure to community violence, mental health, and protective factors (parental monitoring and school connectedness) expand the reach of youth health data and address important issues affecting youths. For example, results from the report on school connectedness found approximately 62% of students felt connected to others at school. Although there was variation by race and ethnicity and sexual identity, overall, students who felt connected to others at school had a lower prevalence of all examined risk factors, including poor mental health, prescription opioid misuse, and missing school because of feeling unsafe (18). Findings from the report on housing instability indicate that approximately 3% of students experienced housing instability. Students who experienced housing instability were more likely to be LGBTQ+ than heterosexual; more likely to be AI/AN, Black,

TABLE 2. Student demographic characteristics and response rates — Youth Risk Behavior Survey, United States, 2021

Characteristic	No. (%)
Student sample size*	17,232 (100)
Response rate	
Schools	(72.7)
Students	(79.1)
Overall	(57.5)
Sex†	
Female	8,152 (48.3)
Male	8,816 (51.7)
Race and ethnicity^{§,¶}	
American Indian or Alaska Native	145 (0.7)
Asian	850 (4.9)
Black or African American	2,322 (12.1)
Native Hawaiian or other Pacific Islander	88 (0.5)
White	9,151 (50.7)
Hispanic or Latino	3,244 (25.4)
Multiracial	1,000 (5.7)
Grade**	
9	4,646 (26.6)
10	4,466 (25.4)
11	4,118 (24.3)
12	3,843 (23.5)
Sexual identity††	
Heterosexual	12,421 (75.5)
Gay or lesbian	520 (3.2)
Bisexual	1,848 (12.1)
Questioning	823 (5.2)
Other	659 (3.9)
Sexual contact^{¶¶}	
Opposite sex only	4,762 (34.6)
Same sex only	314 (2.4)
Both sexes	744 (6.0)
No sexual contact	7,597 (57.0)

* Among the 17,508 completed questionnaires, 276 failed quality control and were excluded from analysis, resulting in 17,232 usable questionnaires.

† Does not include 264 students who did not indicate sex.

§ Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

¶ Does not include 432 students who did not indicate race, ethnicity, or both.

** Does not include 23 students who responded, “ungraded other grade” and 136 students who did not indicate a grade.

†† Does not include 330 students who responded, “I do not know what this question is asking” and 631 students who did not indicate sexual identity.

¶¶ Does not include 3,815 students who did not indicate sex, sex of sexual contacts, or both.

FIGURE 4. Percentage of students identifying as White or other race and ethnicity,* by year of survey — Youth Risk Behavior Survey, 1991–2021

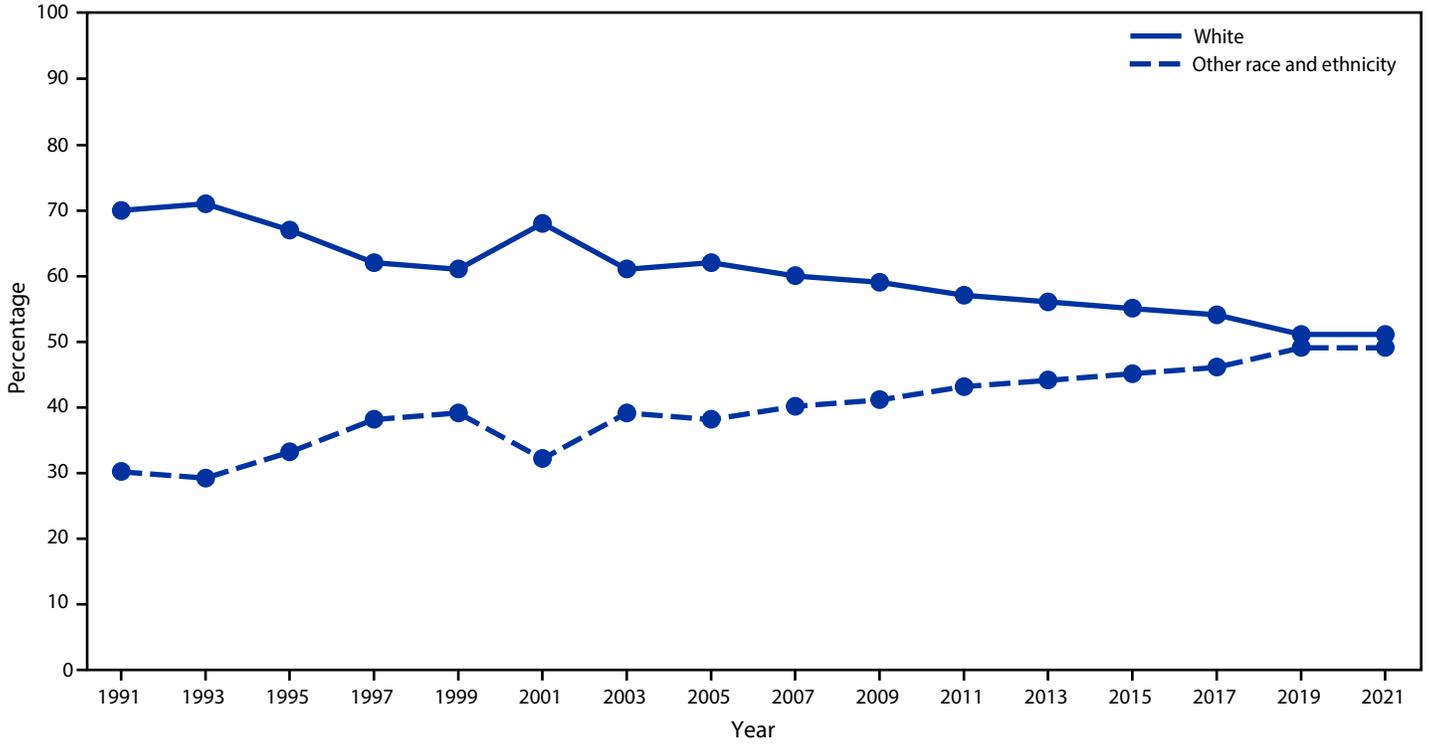
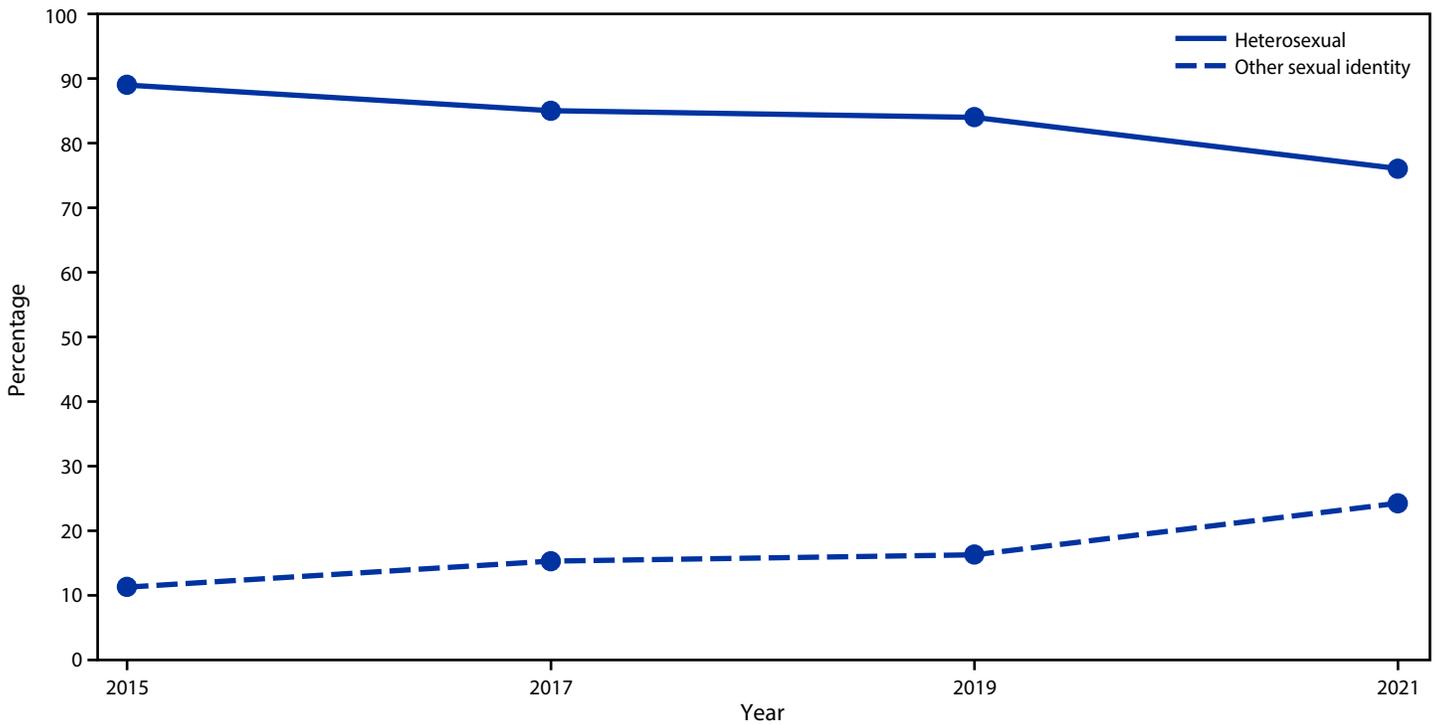


FIGURE 5. Percentage of students identifying as heterosexual or other sexual identities, by year of survey — Youth Risk Behavior Survey, 2015–2021



or NH/OPI than White; and more likely to experience sexual or physical violence, persistent feelings of sadness or hopelessness, and suicidal ideation compared with their peers who were stably housed (19). Finally, findings from the report on community violence demonstrate that overall, 20% of students witnessed community violence and 3.5% carried a gun. AI/AN, Black, and Hispanic students witnessed more community violence and were more likely to carry a gun compared with their White peers (20).

In addition to new questions, prevalence and patterns in health behaviors identified in other reports on longstanding YRBS topics also reinforced the need for specific, tailored public health interventions and resources to improve student health. The report on suicidal thoughts and behaviors indicated an approximately 6 percentage point increase (24% to 30%) from 2019 to 2021 in the prevalence of female students overall who reported seriously considering attempting suicide (21). From 2019 to 2021, Black, White, and Hispanic female students experienced increases in prevalence of reporting seriously considering attempting suicide (21). Other findings indicated a 3.7 percentage point decrease from 2019 to 2021 in the prevalence of HIV testing and a 5 percentage point decrease in the prevalence of testing for sexually transmitted infections among sexually active students (22).

Limitations

Each report in this supplement includes a limitations section pertaining to that report. In general, YRBSS findings are subject to at least six limitations. First, these data apply only to students in grades 9–12 who attend public and private schools in the United States. Homeschooled students are not included nor are persons who do not attend school; therefore, data are not representative of all persons in this age group. In 2019, approximately 5% of youths aged 14–17 years were not enrolled in school (https://nces.ed.gov/programs/digest/d20/tables/dt20_103.20.asp?current). Second, the extent of underreporting or overreporting of health-related behaviors cannot be determined, although the 2021 survey questions examined demonstrated strong test-retest reliability (13,14). Third, not all states and local school districts administer the YRBS, and those that did administer it might not have included all standard questions on their YRBS questionnaire; therefore, data from certain questions are not available from all sites. For schools in both the national sample and a state or local sample, the total number of students answering each question varied. Fourth, YRBS data analyses are based on cross-sectional surveys and can only indicate association between variables, not causality. Moreover, the survey is descriptive and not designed to explain the reasons behind any observed trends. Fifth, whereas the national survey historically has been administered

during the spring semester, in 2021 it was administered during the fall semester, which might affect comparisons with previous YRBS cycles. Finally, COVID-19 precautions might have reduced school and student participation, although more schools were sampled than in previous cycles to obtain sufficient numbers of students for the desired analyses.

Conclusion

As students and schools emerge from the COVID-19 pandemic, youth health data are vital to understanding and improving the health of adolescents in the United States. YRBSS remains the best source for quality data at the national, state, tribal, territorial, 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. Since its inception in 1991, the YRBSS has collected data from approximately 5 million high school students in approximately 2,200 separate surveys. In 2021, in addition to the national data, 45 states, two tribal governments, three territories, and 28 local school districts received data representative of their high school student populations (Figure 1).

Shifts in student demographics can be met with school health programs to help diverse youth populations. To meet the needs of a changing student population, school health programs and policies must also shift to prioritize health equity and the unique needs of racial and ethnic and sexual minority students and consider structural and community-level factors that influence health behaviors and resulting health outcomes.

This overview report describes YRBSS methods for guiding the analyses presented in this *MMWR* supplement. A full description of 2021 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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School Connectedness and Risk Behaviors and Experiences Among High School Students — Youth Risk Behavior Survey, United States, 2021

Natalie J. Wilkins, PhD¹; Kathleen H. Krause, PhD¹; Jorge V. Verlenden, PhD¹; Leigh E. Szucs, PhD¹; Emily N. Ussery, PhD²; Christopher T. Allen, PhD³; Joi Stinson, MPH¹; Shannon L. Michael, PhD⁴; Kathleen A. Ethier, PhD¹

¹*Division of Adolescent and School Health, National Center for HIV, Viral Hepatitis, STD, and TB Prevention, CDC;* ²*Division of Overdose Prevention, National Center for Injury Prevention and Control, CDC;* ³*Division of Violence Prevention, National Center for Injury Prevention and Control, CDC;* ⁴*Division of Population Health, National Center for Chronic Disease Prevention and Health Promotion, CDC*

Abstract

School connectedness, defined as students' belief that adults and peers in their school care about their learning as well as about them as persons, has been linked to positive educational, behavioral, and health outcomes in adolescence and into adulthood. Data from the 2021 nationally representative Youth Risk Behavior Survey, conducted during the COVID-19 pandemic, were used to estimate prevalence of students' perception of school connectedness and examine associations between school connectedness and seven risk behaviors and experiences: poor mental health, marijuana use, prescription opioid misuse, sexual intercourse, unprotected sex, experiencing forced sex, and missing school because of feeling unsafe. Prevalence estimates were generated and pairwise *t*-tests were used to detect differences among student subpopulations by sex, grade, race and ethnicity, and sexual identity; Wald chi-square tests were used to detect differences in risk behaviors by level of connectedness within a subpopulation. Logistic regression models were used to estimate prevalence ratios comparing the prevalence of risk behaviors and experiences of students with high connectedness with students with low connectedness, stratified by demographics. During 2021, 61.5% of U.S. high school students reported feeling connected to others at school. In addition, school connectedness was associated with lower prevalence of every risk behavior and experience examined in this study, although certain associations differed by race and ethnicity and sexual identity (e.g., school connectedness was associated with better mental health outcomes for youths with heterosexual, bisexual, and questioning or other sexual identities, but not for youths who identified as lesbian or gay). These findings can guide public health interventions that promote youth well-being by creating school environments where all youths have a sense of belonging and feel they are cared for and supported.

Introduction

School connectedness is the sense of being cared for, supported, and belonging, which is fostered by a caring and supportive educational environment and is commonly defined as the “belief by students that adults and peers in the school care about their learning as well as about them as persons (1).” School connectedness during adolescence has been linked to positive health outcomes, including reductions in emotional distress, symptoms of poor mental health, and suicidal ideation (2,3); health risk behaviors (e.g., marijuana and prescription drug misuse) (3); and negative experiences (e.g., sexual violence victimization) (3), and multiple of these protective effects have been found to last into adulthood (3). In addition, school connectedness has been identified as a protective factor for adolescents who might be facing stress, adversity, or

marginalization. For example, higher school connectedness has been associated with lower levels of peer victimization, experiences of school violence, and poor mental health among adolescents identifying as lesbian, gay, and bisexual and has been associated with both an increased likelihood of bystander intervention during bullying and an increased likelihood of seeking assistance after being bullied (4,5). Studies have also found protective associations between school connectedness and adolescent sexual behaviors, including lower prevalence of early sexual debut and lower frequency of sex (3).

Understanding the association between adolescents' perceptions of school connectedness and their behaviors and experiences is important for identifying ways that schools might promote healthy behaviors, protect against risk, and facilitate healthy trajectories. Furthermore, investigating the role of school connectedness as a protective factor for youths across and among racial, ethnic, sexual orientation, and gender identities is necessary for understanding the potential of school connectedness as an intervention (6,7).

In 2021, for the first time, the Youth Risk Behavior Survey (YRBS) included a single-item measure of school

Corresponding author: Natalie J. Wilkins, PhD, Division of Adolescent and School Health, National Center for HIV, Viral Hepatitis, STD, and TB Prevention, CDC. Telephone: 770-488-1392; Email: nwilkins@cdc.gov.

connectedness, providing the opportunity to examine perspectives of connectedness among a nationally representative sample of U.S. high school students. Using YRBS data, this report explores the association between perceptions of school connectedness and adolescent behaviors and experiences. The findings in this report can support the development of interventions and guide decision-making among educational and public health leaders about ways to best promote and protect the health of adolescents.

Methods

Data Source

This report includes data from the 2021 YRBS (N = 17,232), 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 (8). The prevalence estimates for school connectedness for the overall study population and by sex, race and ethnicity, grade, and sexual identity are available at <https://nccd.cdc.gov/youthonline/App/Default.aspx>. The full YRBS questionnaire, data sets, and documentation are available at <https://www.cdc.gov/healthyyouth/data/yrbs/index.htm>. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.*

Measures

This study examined school connectedness and its association with risk behaviors and experiences and demographics. School connectedness was measured as, “Do you agree or disagree that you feel close to people at your school?” with responses coded as high (strongly agree and agree) versus low (not sure, disagree, and strongly disagree) connectedness. Seven risk behaviors and experiences examined were poor mental health, marijuana use, prescription opioid misuse, sexual intercourse, unprotected sex, experiencing forced sex, and missing school because of feeling unsafe (Table 1). Demographic variables included sex (female or male); race and ethnicity (American Indian or Alaska Native [AI/AN], Asian, Black or African American [Black], Hispanic or Latino [Hispanic], Native Hawaiian or other Pacific

Islander [NH/OPI], White, or multiracial [selected >1 racial category]; grade (9 and 10 or 11 and 12); and sexual identity (heterosexual, lesbian, gay, bisexual, questioning [I am not sure about my sexual identity/questioning], or other [I describe my identity in some other way] [LGBQ+]). (Persons of Hispanic origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.)

Analysis

Prevalence estimates of high connectedness among all students and stratified by demographic category were calculated, and pairwise *t*-tests with Taylor series linearization were conducted to detect differences within categories. The prevalence of seven risk behaviors and experiences (Table 1) were estimated among students overall and stratified by demographic category, with estimates for students with high and low connectedness. Pairwise *t*-tests were used to detect prevalence differences in connectedness (high and low), stratified by demographic characteristic; Wald chi-square tests were used to detect prevalence differences in risk behaviors by level of connectedness within a demographic stratum. Finally, unadjusted logistic regression models with a statement for predicted marginal proportions were used to estimate prevalence ratios (PRs) of each risk behavior among students with high connectedness compared with students with low connectedness. Analyses were conducted in SAS-callable SUDAAN (version 11.0.3; RTI International) by using sample weights to account for complex survey design and nonresponse. Estimates were considered statistically significant if the 95% CI did not include 1.0 or $p < 0.05$. Prevalence estimates with a denominator < 30 were considered statistically unreliable and therefore were suppressed (8).

Results

School Connectedness Overall and by Population Characteristics

During 2021, 61.5% of U.S. high school students reported that they felt connected to others at school (Table 2). Prevalence of feeling connected to others at school was highest among male (65.5%), Asian (66.7%), 9th- and 10th-grade (63.3%), and heterosexual (65.1%) students. The lowest prevalence of feeling connected to others at school was reported among students who were female (57.6%), AI/AN (53.9%) or Black (53.9%), in 11th and 12th grade (59.8%) and had questioning or other sexual identities (48.3%).

* 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

TABLE 1. Question and analytic coding for risk behaviors and experiences, by variable assessed — Youth Risk Behavior Survey, United States, 2021

Variable	Question	Response options	Analytic coding
Poor mental health	During the past 30 days, how often was your mental health not good?	Never, rarely, sometimes, most of the time, always	Yes (most of the time, always) versus no (never, rarely, sometimes)
Lifetime marijuana use	During your life, how many times have you used marijuana?	0 times, 1–2 times, 3–9 times, 10–19 times, 20–39 times, 40–99 times, ≥100 times	Yes (1–2 times, 3–9 times, 10–19 times, 20–39 times, 40–99 times, ≥100 times) versus 0 times
Lifetime 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?*	0 times, 1–2 times, 3–9 times, 10–19 times, 20–39 times, ≥40 times	Yes (1–2 times, 3–9 times, 10–19 times, 20–39 times, ≥40 times) versus 0 times
Ever sexual intercourse	Have you ever had sexual intercourse?	Yes, no	Yes versus no
No protection at last sexual intercourse	Combination of: (a) The last time you had sexual intercourse, did you or your partner use a condom? (b) The last time you had sexual intercourse with an opposite-sex partner, what one method did you or your partner use to prevent pregnancy? (c) Have you ever had sexual intercourse?	(a) I have never had sexual intercourse, yes, no (b) I have never had sexual intercourse with an opposite-sex partner, no method was used to prevent pregnancy, birth control pills (do not count emergency contraception such as Plan B or the "morning after" pill), condoms, an IUD (such as Mirena or ParaGard) or implant (such as Implanon or Nexplanon), shot (such as Depo-Provera), patch (such as OrthoEvra), or birth control ring (such as NuvaRing), withdrawal or some other method, not sure (c) Yes, no	Yes (Either (a) no, (b) no birth control was used to prevent pregnancy, withdrawal or some other method, not sure, or (c) yes with missing responses to (a) and (b)) versus no (Either (a) I have never had sexual intercourse, yes (b) I have never had sexual intercourse with an opposite-sex partner, birth control pills (do not count emergency contraception such as Plan B or the "morning after" pill), condoms, an IUD (such as Mirena or ParaGard) or implant (such as Implanon or Nexplanon), shot (such as Depo-Provera), patch (such as OrthoEvra), or birth control ring (such as NuvaRing), or (c) No
Ever experienced forced sex	Have you ever been physically forced to have sexual intercourse when you did not want to?	Yes, no	Yes versus no
Missed school because of feeling unsafe	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?	0 days, 1 day, 2–3 days, 4–5 days, ≥6 days	Yes (1 day, 2–3 days, 4–5 days, ≥6 days) versus 0 days

Abbreviation: IUD = intrauterine device.

* Instructions for this question specified opioid drugs "For these questions, count drugs such as codeine, Vicodin, OxyContin, Hydrocodone, and Percocet." However, if students considered nonopioid prescription pain medications when answering this question, an overestimation of prescription opioid misuse prevalence might have occurred.

School Connectedness and Risk Behaviors and Experiences

Students who reported feeling connected to others at school had lower prevalence of all risk behaviors and experiences compared with students who reported not feeling connected to others at school (Table 3). These observations included lower prevalence of poor mental health (22.0% versus 40.1%), lifetime marijuana use (25.8% versus 32.6%), lifetime prescription opioid misuse (9.6% versus 16.8%), sexual intercourse (27.6% versus 34.9%), unprotected sex (7.9% versus 12.7%), experiencing forced sex (6.6% versus 12.1%), and missing school because of feeling unsafe (5.9% versus 11.0%). The association between high connectedness and lower risk behaviors and experiences was consistent for both male and female students and across all grades except for sexual intercourse, which was not different among 11th- and 12th-grade students reporting high versus low connectedness.

School Connectedness and Risk Behaviors and Experiences by Racial and Ethnic Identity

Across all racial and ethnic identities, students who reported high levels of school connectedness also reported lower prevalence of poor mental health compared with students who reported low school connectedness (AI/AN: 19.7% versus 44.6%; Asian: 16.9% versus 33.7%; Black: 20.1% versus 32.9%; Hispanic: 23.4% versus 38.9%; White: 21.9% versus 43.8%; and multiracial: 27.4% versus 43.0%) (Table 3). Among Asian (PR = 0.26) and Black (PR = 0.51) students, school connectedness had the strongest association with lower prevalence of ever experiencing forced sex (Table 4). Among Hispanic students, school connectedness was most strongly associated with lower prevalence of poor mental health (PR = 0.60). Among multiracial students, school connectedness was associated only with lower prevalence of poor mental health

TABLE 2. Prevalence of school connectedness by demographic characteristics — Youth Risk Behavior Survey, United States, 2021*

Characteristic	Felt connected to others at school† % (95%CI)
Sex†,§	
Female	57.6 (54.3–60.9)
Male	65.5 (63.4–67.6)
Race and ethnicity§,¶	
American Indian or Alaska Native	53.9 (43.4–64.1)
Asian	66.7 (56.6–75.5)
Black or African American	53.9 (50.2–57.6)
Native Hawaiian or other Pacific Islander	60.3 (51.3–68.6)
White	65.2 (62.5–67.8)
Hispanic or Latino	57.5 (55.1–59.9)
Multiracial	59.8 (55.7–63.7)
Grade	
9 and 10	63.3 (60.6–65.9)
11 and 12	59.8 (56.1–63.4)
Sexual identity§	
Heterosexual	65.1 (62.3–67.8)
Lesbian or gay	55.0 (46.3–63.5)
Bisexual	54.2 (49.1–59.2)
Questioning or other	48.3 (43.8–52.9)
Total	61.5 (59.0–63.9)

* N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

† On the basis of the answer (“strongly agree” or “agree” [not sure, disagree, strongly disagree]) to the survey question, “Do you agree or disagree that you feel close to people at your school?”

§ On the basis of *t*-tests with Taylor series linearization ($p < 0.05$), statistically significant differences were observed between the following subgroups of students: female versus male; American Indian or Alaska Native versus White; Asian versus Black or African American (Black); Black versus multiracial; Black versus White; Hispanic or Latino (Hispanic) versus White; multiracial versus White; lesbian or gay versus heterosexual; bisexual versus heterosexual; questioning or other versus heterosexual; bisexual versus questioning or other.

¶ Persons of Hispanic origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

(PR = 0.64); among White students, school connectedness was most strongly associated with lower prevalence of missing school because of feeling unsafe (PR = 0.46).

School Connectedness and Risk Behaviors and Experiences by Sexual Identity

School connectedness was associated with lower prevalence of poor mental health among students who identified as heterosexual (16.4% versus 31.3%), bisexual (45.8% versus 63.8%), or questioning or other (43.2% versus 60.1%), but not among students who identified as lesbian or gay (Table 3). Among heterosexual students and students with questioning or other sexual identities, school connectedness was most strongly associated with lower prevalence of poor mental health (PR = 0.52) and (PR = 0.72), respectively (Table 4). Among lesbian or gay students, school connectedness was most strongly associated with lower prevalence of lifetime

prescription opioid misuse (PR = 0.38). Among bisexual students, school connectedness was most strongly associated with lower prevalence of missing school because of feeling unsafe (PR = 0.58).

Discussion

This report provides the first national prevalence estimates of school connectedness among U.S. high school students stratified by sex, race and ethnicity, grade, and sexual identity and examines the associations between school connectedness and a range of youth risk behaviors and experiences. Previous research links school connectedness with fewer risk behaviors and adverse experiences among adolescents and indicates that this protective effect might improve the health trajectories of adolescents into adulthood (3,9). Findings from the current study illustrate that during 2021, approximately one half of all U.S. high school students (61.5%) reported feeling connected to others at school. This pattern held for all student subpopulations stratified by demographics, except for students with questioning or other sexual identities (48.3%). However, prevalence of school connectedness was found to vary by race and ethnicity and sexual identity. School connectedness was highest among Asian students and lower among AI/AN, Black, Hispanic, and multiracial students compared with their White peers. School connectedness was also lower among students who identify as lesbian or gay, bisexual, and questioning or other compared with their peers who identify as heterosexual. These data were collected during the COVID-19 pandemic, and while the effect of the pandemic is unknown, findings are consistent with previous research indicating that prevalence of connectedness is lowest among youths who have experienced racism at school (10); identify as LGBTQ+ (11); and are multiply marginalized and underrepresented (i.e., youths who hold minority racial and ethnic and sexual identities) (7). Creating school environments that intentionally focus on students with marginalized identities by proactively addressing discrimination and fostering inclusivity supports positive health and development for all students and might be an important mechanism by which to eliminate inequities in school connectedness (12).

Overall, school connectedness was associated with lower prevalence of every risk behavior and experience examined in this study. School connectedness was associated with better mental health during the past 30 days among high school students overall and among all student subpopulations, except among students who identify as lesbian or gay. Robust evidence has demonstrated that school communities can positively influence student mental health, including fostering emotional

TABLE 3. Prevalence of risk behavior by level of school connectedness and demographic characteristics — Youth Risk Behavior Survey, United States, 2021*

Characteristic	Level of school connectedness [†]	Mental health not good in past 30 days % (95% CI)	Lifetime marijuana use % (95% CI)	Lifetime prescription opioid misuse % (95% CI)	Ever sexual intercourse % (95% CI)	Unprotected sex % (95% CI)	Ever experienced forced sex % (95% CI)	Skipped school in past 30 days because felt unsafe % (95% CI)
Total	High	22.0 (20.5–23.6) [§]	25.8 (23.4–28.3) [§]	9.6 (8.6–10.7) [§]	27.6 (25.1–30.1) [§]	7.9 (6.8–9.1) [§]	6.6 (5.4–7.9) [§]	5.9 (4.9–7.1) [§]
	Low	40.1 (38.0–42.3)	32.6 (29.0–36.4)	16.8 (14.9–18.8)	34.9 (32.1–37.8)	12.7 (11.0–14.7)	12.1 (11.2–13.0)	11.0 (9.3–13.0)
Sex								
Female	High	32.7 (29.6–35.9) [§]	28.3 (25.5–31.2) [§]	12.2 (10.6–13.9) [§]	27.3 (24.3–30.6) [§]	9.3 (8.0–10.7) [§]	11.2 (9.4–13.3) [§]	7.1 (5.61–8.9) [§]
	Low	51.2 (49.1–53.2)	35.0 (30.4–39.9)	19.3 (16.8–22.1)	35.8 (32.4–39.4)	12.5 (10.1–15.5)	17.8 (16.1–19.5)	13.5 (11.5–15.9)
Male	High	13.1 (11.4–15.1) [§]	23.6 (21.2–26.3) [§]	7.2 (6.28–8.3) [§]	27.8 (25.0–30.8) [§]	6.8 (5.5–8.3) [§]	2.8 (1.9–4.1) [§]	4.8 (3.9–6.1) [§]
	Low	26.9 (23.9–30.1)	29.5 (26.3–32.9)	13.3 (11.5–15.4)	33.5 (30.2–37.0)	12.7 (10.8–14.9)	4.9 (4.0–5.9)	8.0 (6.2–10.3)
Race and ethnicity[¶]								
American Indian or Alaska Native	High	19.7 (10.1–35.0) [§]	16.5 (7.3–33.0)	11.8 (3.4–34.0)	27.7 (12.0–51.9)	4.8 (1.6–13.7)	13.8 (4.9–33.0)	7.6 (2.9–18.4) [§]
	Low	44.6 (31.0–59.0)	39.9 (22.6–60.2)	19.4 (10.5–33.2)	43.2 (27.8–60.1)	—**	22.5 (10.9–40.7)	22.7 (11.0–41.1)
Asian	High	16.9 (12.5–22.6) [§]	8.9 (5.6–13.8)	8.6 (5.8–12.5) [§]	9.4 (6.9–12.6)	2.5 (0.9–6.6)	2.2 (1.0–4.6) [§]	2.3 (1.2–4.1) [§]
	Low	33.7 (28.9–38.8)	12.8 (9.9–16.3)	16.1 (11.0–22.9)	13.8 (10.9–17.3)	6.0 (3.6–9.9)	8.3 (6.0–11.5)	7.8 (5.0–12.0)
Black or African American	High	20.1 (17.1–23.4) [§]	34.2 (26.1–43.5)	10.7 (7.8–14.6) [§]	36.7 (30.8–43.1)	12.1 (9.0–15.9)	5.3 (3.6–7.6) [§]	9.1 (6.3–12.9) [§]
	Low	32.9 (28.0–38.2)	33.7 (26.4–41.9)	17.8 (13.9–22.5)	35.6 (28.0–44.0)	15.1 (11.2–20.0)	10.3 (7.4–14.1)	14.3 (10.1–19.9)
Native Hawaiian or other Pacific Islander	High	—	—	—	—	—	—	—
	Low	—	—	—	—	—	—	—
White	High	21.9 (19.5–24.5) [§]	24.1 (22.2–26.1) [§]	8.8 (7.1–10.0) [§]	27.5 (24.9–30.4) [§]	6.4 (5.1–8.0) [§]	6.4 (5.2–7.9) [§]	4.4 (3.1–6.2) [§]
	Low	43.8 (41.0–46.6)	31.4 (28.3–34.6)	15.9 (13.3–19.0)	36.1 (33.3–39.0)	12.1 (10.1–14.4)	12.5 (10.9–14.2)	9.6 (7.6–12.0)
Hispanic or Latino	High	23.4 (21.8–25.2) [§]	29.3 (27.1–31.6)	11.3 (9.2–13.8) [§]	28.2 (25.7–30.9) [§]	11.2 (9.3–13.3) [§]	8.1 (6.8–9.6) [§]	8.8 (6.2–12.4) [§]
	Low	38.9 (35.0–43.1)	35.7 (28.0–44.3)	18.3 (15.0–22.1)	36.6 (32.0–41.5)	14.2 (11.9–16.8)	12.7 (10.3–15.6)	11.9 (9.4–14.8)
Multiracial	High	27.4 (22.4–33.1) [§]	34.5 (24.0–46.9)	10.4 (6.9–15.4)	31.7 (24.5–39.9)	8.1 (5.1–12.5)	10.4 (7.3–14.7)	5.1 (2.6–10.0) [§]
	Low	43.0 (35.1–51.3)	41.7 (32.2–51.8)	15.1 (10.0–22.1)	37.9 (31.5–44.7)	13.4 (8.9–19.6)	13.4 (9.3–19.0)	11.2 (8.1–15.3)
Grade								
9 and 10	High	21.4 (19.0–24.0) [§]	18.1 (15.2–21.4) [§]	10.2 (8.9–11.8) [§]	16.9 (14.3–19.8) [§]	5.5 (4.3–7.0) [§]	6.2 (5.0–7.7) [§]	6.7 (5.1–8.7) [§]
	Low	39 (35.6–42.4)	23.7 (20.6–27.2)	17.1 (15.1–19.4)	24.1 (21.2–27.3)	9.4 (7.8–11.2)	11.0 (9.6–12.6)	11.4 (9.5–13.7)
11 and 12	High	22.5 (20.9–24.2) [§]	34.1 (31.4–36.9) [§]	8.9 (7.8–10.2) [§]	39.1 (35.9–42.4)	11.0 (9.2–13.2) [§]	7.0 (5.6–8.7) [§]	4.8 (3.9–5.8) [§]
	Low	41.4 (38.8–44.0)	40.5 (36.2–45.0)	16.1 (13.8–18.8)	44.6 (39.3–49.9)	16.2 (13.5–19.3)	12.8 (11.2–14.5)	10.2 (8.1–12.9)
Sexual identity								
Heterosexual	High	16.4 (15.3–17.6) [§]	24.2 (22.4–26.1) [§]	7.3 (6.4–8.3) [§]	27.0 (24.5–29.6)	7.0 (5.9–8.2) [§]	3.8 (2.8–5.1) [§]	4.6 (3.6–5.9) [§]
	Low	31.3 (28.4–34.4)	31.1 (27.7–34.7)	13.0 (10.8–15.6)	34.7 (31.4–38.2)	12.5 (10.7–14.5)	7.1 (6.1–8.2)	8.5 (7.0–10.4)
Lesbian or gay	High	35.2 (27.5–43.8)	28.5 (17.4–43.1)	11.5 (7.2–17.8) [§]	29.2 (19.5–41.1)	6.2 (2.6–14.2)	12.7 (7.4–20.8) [§]	12.7 (6.1–24.6)
	Low	50.2 (37.1–63.3)	33.3 (26.8–40.6)	30.1 (22.1–39.6)	35.3 (23.9–48.7)	13.4 (6.6–25.2)	21.9 (16.4–28.6)	15.0 (9.4–23.3)
Bisexual	High	45.8 (40.1–51.5) [§]	41.3 (31.1–52.2)	19.9 (16.9–23.2) [§]	36.9 (32.3–41.8)	16.6 (12.6–21.5)	20.0 (16.2–24.5) [§]	9.7 (6.8–13.5) [§]
	Low	63.8 (59.3–68.1)	46.4 (39.4–53.6)	27.5 (23.1–32.3)	44.7 (40.0–49.4)	16.4 (12.5–21.2)	28.1 (24.4–32.1)	16.7 (12.5–22.0)
Questioning or other	High	43.2 (35.9–50.9) [§]	24 (18.6–30.4)	17.4 (13.0–23.0)	22.6 (16.2–30.6)	6.3 (3.7–10.6)	13.6 (8.6–20.9)	8.5 (4.7–15.1) [§]
	Low	60.1 (55.9–64.2)	29.6 (24.8–34.9)	21.5 (17.9–25.5)	25.7 (22.5–29.3)	11.6 (8.5–15.7)	19.6 (16.6–22.9)	16.1 (12.6–20.4)

* N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] In answer to the question, "Do you agree or disagree that you feel close to people at your school," "High" = Strongly agree, agree; "Low" = Not sure, disagree, strongly disagree.

[§] Wald chi-square test indicates statistically significant difference (p<0.05) for students who reported high versus low level of school connectedness.

[¶] Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

** Prevalence estimates with a denominator <30 were considered statistically unreliable and therefore were suppressed.

resilience and lessening emotional distress, anxiety, and depression (2,3). Longitudinal studies have also found causal associations between school connectedness in adolescence and emotional well-being in adulthood (3). Similar to findings in this report, previous studies have indicated that sexual and gender minority youths describe school climate as less positive and report less connection with adults at school, which might contribute to lower connectedness overall and compromise the potential for connectedness to serve a protective role (6).

For substance use outcomes, school connectedness was associated with a lower prevalence of lifetime prescription opioid misuse overall and across a majority of subpopulations by sex, grade, race and ethnicity, and sexual identity with three exceptions: there was no association among AI/AN students, multiracial students, or students with questioning or other sexual identities. School connectedness was also associated with a lower prevalence of lifetime marijuana use overall, across sex and grade levels, and among White and heterosexual students. These

TABLE 4. Prevalence ratios comparing risk behaviors among students with low and high school connectedness — Youth Risk Behavior Survey, United States, 2021*

Characteristic	Mental health not good in past 30 days PR (95% CI)	Lifetime marijuana use PR (95% CI)	Lifetime prescription opioid misuse PR (95% CI)	Ever sexual intercourse PR (95% CI)	Unprotected sex PR (95% CI)	Ever experienced forced sex PR (95% CI)	Skipped school in past 30 days because felt unsafe PR (95% CI)
Total	0.55 (0.51–0.59) [†]	0.79 (0.72–0.87) [†]	0.57 (0.49–0.67) [†]	0.79 (0.71–0.88) [†]	0.62 (0.53–0.73) [†]	0.54 (0.45–0.65) [†]	0.54 (0.44–0.66) [†]
Sex							
Female	0.64 (0.59–0.70) [†]	0.81 (0.71–0.92) [†]	0.63 (0.53–0.75) [†]	0.76 (0.66–0.88) [†]	0.74 (0.58–0.94) [†]	0.63 (0.52–0.77) [†]	0.52 (0.41–0.67) [†]
Male	0.49 (0.39–0.61) [†]	0.80 (0.72–0.89) [†]	0.54 (0.45–0.66) [†]	0.83 (0.73–0.94) [†]	0.53 (0.41–0.69) [†]	0.57 (0.38–0.86) [†]	0.60 (0.42–0.85) [†]
Race and ethnicity[§]							
American Indian or Alaska Native	0.44 (0.23–0.84) [†]	0.41 (0.17–1.01)	0.61 (0.17–2.21)	0.64 (0.25–1.66)	— [¶]	0.61 (0.16–2.37)	0.33 (0.11–1.05)
Asian	0.50 (0.39–0.65) [†]	0.69 (0.41–1.17)	0.54 (0.31–0.93) [†]	0.68 (0.46–1.01)	0.41 (0.11–1.50)	0.26 (0.11–0.61) [†]	0.29 (0.12–0.69) [†]
Black or African American	0.61 (0.5–0.73) [†]	1.02 (0.75–1.39)	0.60 (0.41–0.89) [†]	1.03 (0.83–1.28)	0.80 (0.52–1.22)	0.51 (0.31–0.83) [†]	0.64 (0.48–0.85) [†]
Native Hawaiian or other Pacific Islander	—	—	—	—	—	—	—
White	0.50 (0.46–0.54) [†]	0.77 (0.69–0.85) [†]	0.55 (0.41–0.76) [†]	0.76 (0.67–0.86) [†]	0.53 (0.40–0.68) [†]	0.51 (0.41–0.65) [†]	0.46 (0.33–0.65) [†]
Hispanic or Latino	0.60 (0.54–0.67) [†]	0.82 (0.66–1.02)	0.62 (0.49–0.77) [†]	0.77 (0.69–0.86) [†]	0.79 (0.66–0.93) [†]	0.64 (0.51–0.80) [†]	0.75 (0.53–1.04)
Multiracial	0.64 (0.47–0.87) [†]	0.83 (0.61–1.12)	0.69 (0.39–1.21)	0.84 (0.63–1.11)	0.60 (0.34–1.07)	0.78 (0.44–1.38)	0.46 (0.20–1.06)
Grade							
9 and 10	0.55 (0.49–0.62) [†]	0.76 (0.65–0.88) [†]	0.60 (0.50–0.71) [†]	0.70 (0.55–0.88) [†]	0.58 (0.44–0.77) [†]	0.56 (0.47–0.68) [†]	0.59 (0.43–0.79) [†]
11 and 12	0.54 (0.49–0.60) [†]	0.84 (0.75–0.94) [†]	0.55 (0.46–0.66) [†]	0.88 (0.76–1.01)	0.68 (0.53–0.89) [†]	0.55 (0.43–0.70) [†]	0.47 (0.37–0.59) [†]
Sexual identity							
Heterosexual	0.52 (0.47–0.59) [†]	0.78 (0.70–0.86) [†]	0.56 (0.45–0.70) [†]	0.78 (0.69–0.88) [†]	0.56 (0.46–0.68) [†]	0.53 (0.38–0.75) [†]	0.54 (0.40–0.73) [†]
Lesbian or gay	0.70 (0.46–1.07)	0.86 (0.56–1.31)	0.38 (0.23–0.62) [†]	0.83 (0.52–1.31)	0.46 (0.11–1.97)	0.58 (0.34–0.99) [†]	0.85 (0.35–2.04)
Bisexual	0.72 (0.64–0.81) [†]	0.89 (0.72–1.1)	0.72 (0.59–0.88) [†]	0.83 (0.68–1.00)	1.01 (0.74–1.39)	0.71 (0.57–0.89) [†]	0.58 (0.34–0.97) [†]
Questioning or other	0.72 (0.61–0.85) [†]	0.81 (0.64–1.04)	0.81 (0.62–1.06)	0.88 (0.63–1.23)	0.54 (0.28–1.05)	0.69 (0.45–1.08)	0.53 (0.26–1.08)

Abbreviation: PR = prevalence ratio.

* N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] 95% CI did not cross null value (1.0).

[§] Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

[¶] Prevalence estimates with a denominator <30 were considered statistically unreliable and therefore were suppressed.

overall findings align with previous research demonstrating a protective association between school connectedness and substance use (9). However, findings from the subgroup analyses indicate the association with lifetime marijuana use might not exist among all subpopulations, including youths from racial and ethnic or sexual minority groups. Among sexual minority youths, one previous study found no association between school connectedness and lifetime marijuana use (13), whereas another observed a significant negative association with current (e.g., past 30 days) marijuana use (14). Thus, the lack of associations in the current study might partially be a result of the lifetime marijuana use measure, which includes youths who do not currently use marijuana, or it might demonstrate that school connectedness is not a strong correlate of marijuana use among certain subpopulations.

For violence outcomes, school connectedness was associated with lower prevalence of ever experiencing forced sex among all youth subpopulations, except among AI/AN or multiracial youths and those with questioning or other sexual identities; limited sample sizes and wide CIs might explain findings that were not statistically significant among these groups. Youths

who have experienced sexual violence trauma often report feelings of isolation and distrust, which could impede their sense of connection and belonging in school (15). School connectedness was also associated with lower prevalence of skipping school because of feeling unsafe among students across sex and grade; among Asian, Black, White students; and among heterosexual or bisexual students. School safety reflects an aspect of school community and climate that facilitates connectedness. Perceptions of safety might indicate supportive school environments where students are less likely to experience violence, victimization, and punitive discipline and thus influence students' feelings of connectedness to school, including among students with identities that are often marginalized, such as LGBTQ+, Black, and Hispanic youths (11).

For sexual risk outcomes, school connectedness among Hispanic, White, and heterosexual students was associated with lower prevalence of both ever having sex and having unprotected sex at last sexual intercourse. School connectedness was associated with lower prevalence of unprotected sex across sex and grade and lower prevalence of ever having

sex among males and 9th and 10th grade students. Previous research has highlighted the potential of school connectedness as a protective factor for adolescent sexual health. A recent systematic review demonstrated protective associations between school connectedness and ever having sex, early sexual debut, frequency of sex, and condom and contraceptive use among adolescents (16). In this study, protective effects of school connectedness on sexual activity were only observed among younger students. Prevalence of sexual behaviors increases as students age (<https://yrbs-explorer.services.cdc.gov/#/>), which provides important context when interpreting null associations between school connectedness and ever having sex among 11th and 12th grade students. Future studies should investigate how social connectedness with peers and romantic partners could affect sexual behaviors over time (16).

The COVID-19 pandemic caused widespread disruptions to school operations during the time when these data were collected and increased stress and trauma for certain youths and their families (17). Although findings indicate consistent associations between students feeling connected to others at school and lower levels of risk behaviors and experiences, data from this study are cross-sectional, and causal direction cannot be inferred. These findings indicate that school connectedness might have a protective or buffering effect, reducing students' risk behaviors and experiences in the context of a pandemic and increased adversity. In addition, engaging in risk behaviors or experiencing risk might inhibit students' ability to feel connected to others in their school.

Schools can play a critical role in promoting students' health and development by creating environments where all students feel that they are cared for, supported, and belong (6). Establishing safe and supportive schools for adolescents involves creating an antidiscriminatory environment, which includes layers of protection for students by building caring relationships between students and teachers, managing classrooms effectively, encouraging family engagement, and offering staff wellness and professional development (6). School connectedness initiatives that foster inclusion and apply culturally informed practices might more effectively foster positive student health outcomes for all students by engaging students who are more likely to experience poor mental health and risk behaviors (6,18). School partnerships with community-based health services providers might enhance the ability of schools to meet the needs of student populations at high risk for negative health outcomes. Finally, encouraging students to participate in efforts to enhance school climate and offering positive youth engagement opportunities with community partners has the potential to increase student engagement and foster connectedness (6).

Limitations

General limitations for the YRBS are available in the overview report of this supplement (8). The findings in this report are subject to at least four additional limitations. First, the data used in these analyses are cross-sectional and provide a single point-in-time estimate for all variables; therefore, causality and direction of associations between school connectedness and student behaviors and experiences cannot be inferred. Second, the multidimensional characteristics of connectedness, including perceptions of relationships among adults, peers, and the broader school environment, might not be captured by the single item used to measure school connectedness in this study. Third, the limited cell sizes in certain stratified analyses resulted in data suppression for certain racial and ethnic groups. Other racial and ethnic groups have imprecise CIs and might be subject to type II error of failing to reject a false null hypothesis with the Wald chi-square tests. Finally, student responses might only reflect connectedness at a particular point of time; therefore, prevalence of connectedness could vary over time.

Future Directions

This study aligns with previous research signaling the potential of school connectedness to serve as a protective factor for certain students. However, more research is needed to understand intersecting factors that might contribute to students' sense of connectedness to the school environment. A variety of strategies exist that schools can use to improve school connectedness; CDC currently recommends strategies such as classroom management, youth development programs that engage students in community settings and bring mentors into schools, and improving LGBQ+ inclusivity (https://www.cdc.gov/healthyyouth/protective/school-connectedness/connectedness_schools.htm). CDC's Technical Package on Youth Violence Prevention (<https://www.cdc.gov/violenceprevention/pdf/yv-technicalpackage.pdf>) also highlights the best available evidence for programs and policies to reduce violence, including school-based programs. Schools likely vary in their ability and inclination to put in place these strategies and others like them (e.g., social-emotional learning approaches that teach skills to support students' social and emotional development). Additional research to understand the interplay of school strategies and students' beliefs about school connectedness can help set direction for school implementation.

Because of differences in the experience of school connectedness by race and ethnicity and sexual identity, deficits in this important protective factor have long-term implications for students' health and well-being into adulthood (3).

More research is needed to identify and dismantle social and structural barriers to improving school connectedness among young persons from racial and ethnic minority groups and LGBTQ+ students. Data from CDC's Adolescent Behaviors and Experiences Survey found that Asian, Black, and multiracial students were most likely to experience racism in school; even among those who reported feeling connected to others at school, the majority had experienced racism (10). Implementing policies and practices that prevent and address racism at school might improve the school environment and students' feelings of connectedness (18). Strategies that improve school environments for LGBTQ+ students are well established and include school policies and practices such as having student-led clubs (e.g., Gender and Sexualities Alliances [GSAs]), enforced antiharassment policies, identified safe spaces for students, and professional development for school staff on the importance of inclusivity. These strategies create school environments that benefit all students and have been linked to improved health and development outcomes for both LGBTQ+ students and their heterosexual peers (12). Recent data from CDC's School Health Profiles survey indicate that, although approximately all schools prohibit harassment of LGBTQ+ students and 80% identify safe spaces, only 44% of secondary schools have GSAs and 30% provide training to teachers and school staff on supporting LGBTQ+ students (<https://www.cdc.gov/healthyyouth/data/profiles/pdf/2020/CDC-Profiles-2020.pdf>).

Because of the broad and robust association between school connectedness and the behaviors and experiences of U.S. high school students, it is critical to identify individual, social, structural, and environmental factors that serve as barriers to connectedness and continue to investigate what is needed to effectively create safe and supportive school environments that foster connection.

Conclusion

During 2021, approximately one half of U.S. high school students overall and across sex, race and ethnicity, grade, and a majority of sexual identities reported a high level of connectedness to school; racial and ethnic and sexual minority students reported lower levels of school connectedness than their White and heterosexual peers. Moreover, this study found that school connectedness was associated with a lower prevalence of all health risk behaviors and experiences, and the association between school connectedness and certain health risk behaviors and experiences varied across racial and ethnic groups and sexual identities. These findings align with previous cross-sectional and longitudinal research linking

school connectedness to better health outcomes for youths (9) and highlight the importance of school-based strategies that strengthen school connectedness and protect against multiple adolescent health risks. School programs and practices that promote safe and supportive environments and foster inclusion (e.g., GSAs, multicultural groups, and inclusivity training for staff members) might play an important role in improving school connectedness among all youths, including racial and ethnic and sexual identity minority adolescents (6,18).

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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Witnessing Community Violence, Gun Carrying, and Associations with Substance Use and Suicide Risk Among High School Students — Youth Risk Behavior Survey, United States, 2021

Christopher R. Harper, PhD¹; Jingjing Li, PhD, MD²; Kameron Sheats, PhD¹; Marci F. Hertz, MS³; Molly Merrill-Francis, PhD¹; Norah W. Friar, MPH¹; Carmen L. Ashley, MPH²; Shari Shanklin, MPH²; Colleen Barbero, PhD¹; Elizabeth M. Gaylor, MPH⁴; Brooke E. Hoots, PhD³

¹Division of Violence Prevention, National Center for Injury Prevention and Control, CDC; ²Division of Adolescent and School Health, National Center for HIV, Viral Hepatitis, STD, and TB Prevention, CDC; ³Division of Overdose Prevention, National Center for Injury Prevention and Control, CDC; ⁴Division of Injury Prevention, National Center for Injury Prevention and Control, CDC

Abstract

Community violence, including homicides involving firearms, is a significant public health concern. From 2019 to 2020, firearm-related homicides increased by 39% for youths and young adults aged 10–24 years, and rates of suicide by firearm increased by approximately 15% among the same age group. Findings from the nationally representative 2021 Youth Risk Behavior Survey were used to analyze disparities and correlates of witnessing community violence and gun carrying among a nationally representative sample of high school students. Chi-square tests and logistic regression accounting for the complex sampling of the survey were used to assess demographic differences by student sex, race and ethnicity, age, and sexual identity in ever witnessing community violence, gun carrying in the past 12 months, and their associations with substance use and suicide risk. Measures of substance use included current binge drinking and marijuana use and lifetime prescription opioid misuse and illicit drug use. Suicide risk included seriously considered attempting suicide and attempted suicide in the past 12 months. Overall, approximately 20% of students witnessed community violence and 3.5% of students carried a gun. American Indian or Alaska Native, Black, and Hispanic students were more likely to witness community violence and to report carrying a gun than their White peers. Males were more likely to witness community violence and carry a gun than females. Lesbian, gay, or bisexual students were more likely to witness community violence than their heterosexual peers. Also, witnessing community violence consistently was associated with increased odds of gun carrying, substance use, and suicide risk for both males and females and when comparing Black, White, and Hispanic students. These findings highlight the importance of comprehensive violence prevention strategies that incorporate health equity to mitigate the effects of violence exposure on substance use and suicide risk among youths.

Introduction

Community violence is defined as violence between unrelated persons who might or might not know each other, generally outside the home (<https://www.cdc.gov/violenceprevention/communityviolence/index.html>). From 2019 to 2020, firearm-related homicides, including community violence, increased by 39% for youths and young adults aged 10–24 years, with rates of suicide by firearm increasing by 15% in the same age group (1). In 2020, firearm-related injuries caused more deaths of persons aged 1–19 years than any other injury or other cause of death (2). Exposure to violence has serious health consequences across a person's lifespan. Witnessing community violence and firearm carrying have both been linked to increased substance use and suicide risk among youths (3–5). The longitudinal Project on Human Development in Chicago Neighborhoods

found that among children and adolescents aged 9–15 years, witnessing community violence was associated with alcohol use, smoking, and marijuana use, in addition to suicide risk (3). Exposure to community violence also might increase risk for violence perpetration. Youths who either commit or experience different forms of violence are at higher risk for perpetrating violence later in adolescence and in adulthood, and exposure to community violence is a risk factor for gun carrying (3,4).

Different communities, populations, and racial and ethnic groups face disproportionate exposure to community violence related to structural racism and inequities that might have increased during the COVID-19 pandemic (1). For example, the rate of homicides by firearm among Black or African American (Black) males aged 10–24 years was 20.6 times as high as that among White males of the same age in 2019, and this ratio increased to 21.6 in 2020 (1). Data from the 2021 Youth Risk Behavior Survey (YRBS) were analyzed to better understand disparities and correlates of witnessing community violence and gun carrying, including differences in the prevalence of witnessing community violence and gun

Corresponding author: Christopher R. Harper, PhD, Division of Violence Prevention, National Center for Injury Prevention and Control, CDC. Telephone: 404-718-8330; Email: chris.harper@cdc.gov.

carrying by sex, race and ethnicity, age, and sexual identity and associations among witnessing community violence, gun carrying, suicide risk, and substance use by sex and race and ethnicity. This is the first report using nationally representative YRBS data to examine the associations between witnessing community violence and gun carrying. Findings might be used to develop community- and school-based strategies to prevent violence and mitigate the effects of violence exposure and gun carrying on youths at disproportionate risk for violence victimization and perpetration.

Methods

Data Source

This report includes data from the 2021 YRBS (N = 17,232), 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 witnessing community violence and gun carrying for the overall study population and by sex, race and ethnicity, grade, and sexual identity are available at <https://nccd.cdc.gov/youthonline/App/Default.aspx>. The full YRBS questionnaire, data sets, and documentation are available at <https://www.cdc.gov/healthyyouth/data/yrbs/index.htm>. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.*

Measures

The primary health risk behaviors examined were ever witnessing community violence and past-year gun carrying. The analysis included two measures of suicide risk (seriously considered attempting suicide and attempted suicide in the past 12 months) and four measures of substance use (current binge drinking, current marijuana use, lifetime prescription opioid misuse, and lifetime illicit substance use). All variables were binary and coded with the absence of the behavior or exposure as the reference category (Table 1). Demographic variables included sex (female and male), sexual identity (heterosexual, lesbian, gay, bisexual, questioning, or other), and race and ethnicity (American Indian or Alaska Native [AI/AN], Asian, Black, Native Hawaiian or other Pacific Islander, White, Hispanic or Latino [Hispanic], and multiracial). (Persons of Hispanic origin

might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.) Age was categorized into three groups for ease of comparison (≤ 15 years, 16–17 years, and ≥ 18 years).

Analysis

Descriptive analyses were conducted to determine the point prevalence estimates and corresponding 95% CIs for ever witnessing community violence and gun carrying in the past 12 months in overall samples and by sex (male versus female) and by the three largest racial and ethnic groups (Black, White, and Hispanic) because of sample size constraints. Chi-square tests and *t*-tests with Taylor series linearization were used to compare demographic group differences. Associations between witnessing community violence and independent variables (gun carrying, suicide risk, and substance use) were assessed in separate sex- or race and ethnicity–stratified adjusted logistic regression models, which generated adjusted prevalence ratios and corresponding 95% CIs for each independent variable. Associations between gun carrying and independent variables (suicide risk and substance use) were assessed in nonstratified adjusted models. All regression models were controlled for sex, age, race and ethnicity, and sexual identity. Estimates were considered statistically significant if the 95% CI did not include 1.0, *p* value was < 0.05 , or both. All analyses were conducted in SAS-callable SUDAAN (version 11.0.3; RTI International) using sample weights to account for complex survey design and nonresponse (6).

Results

Overall, 19.9% of high school students reported ever witnessing community violence, and 3.5% reported carrying a gun during the previous 12 months. Ever witnessing community violence and gun carrying were more prevalent among males than females and for AI/AN, Black, Hispanic, and multiracial students than for Asian or White students (Table 2). Gun carrying during the past 12 months was significantly more prevalent among students aged ≥ 18 years compared with students aged ≤ 15 years. However, no statistically significant differences existed in witnessing community violence by age. Lesbian, gay, or bisexual students were more likely to witness community violence than their heterosexual peers; however, differences in gun carrying by sexual identity were not statistically significant.

Witnessing community violence was more prevalent among students who carried a gun, and suicide risk and substance use also were associated with witnessing community violence (Tables 3 and 4). Suicide risk and substance use were associated with gun carrying (Table 5).

* See e.g., 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

TABLE 1. Health risk behavior measures — Youth Risk Behavior Survey, United States, 2021

Behavior	Question	Response option	Analytic coding
Violence-related outcomes			
Witnessed community violence	Have you ever seen someone get physically attacked, beaten, stabbed, or shot in your neighborhood?	Yes or no	Yes versus no
Gun carrying	During the past 12 months, on how many days did you carry a gun?	0 days; 1 day; 2 or 3 days; 4 or 5 days; or ≥6 days	≥1 day versus 0 days
Suicide risk			
Seriously considered attempting suicide	During the past 12 months, did you ever seriously consider attempting suicide?	Yes or no	Yes versus no
Attempted suicide	During the past 12 months, how many times did you actually attempt suicide?	0 times; 1 time; 2 or 3 times; 4 or 5 times; or ≥6 times	≥1 time versus 0 times
Substance use			
Current 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 female) or 5 or more drinks of alcohol in a row, that is, within a couple of hours (if you are male)?	0 days; 1 day; 2 days; 3–5 days; 6–9 days; 10–19 days; or ≥20 days	≥1 day versus 0 days
Current marijuana use	During the past 30 days, how many times did you use marijuana?	0 times; 1 or 2 times; 3–9 times; 10–19 times; 20–39 times; or ≥40 times	≥1 time versus 0 times
Lifetime prescription opioid misuse	The next 2 questions ask about the use of prescription pain medicine without a doctor's prescription or differently than how a doctor told you to use it. For these questions, count drugs such as codeine, Vicodin, OxyContin, Hydrocodone, and Percocet. 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?	0 times; 1 or 2 times; 3–9 times; 10–19 times; 20–39 times; or ≥40 times	≥1 time versus 0 times
Lifetime illicit drug use	Calculated variable based upon responses to the following questions: heroin, cocaine, methamphetamines, synthetic marijuana, ecstasy, hallucinogenic drugs, and inhalants. <ul style="list-style-type: none"> • During your life, how many times have you sniffed glue, breathed the contents of aerosol spray cans, or inhaled any paints or sprays to get high? • During your life, how many times have you used synthetic marijuana? • During your life, how many times have you used any form of cocaine, including powder, crack, or freebase? • During your life, how many times have you used heroin (also called smack, junk, or China white)? • During your life, how many times have you used methamphetamines (also called speed, crystal meth, crank, ice, or meth)? • During your life, how many times have you used ecstasy (also called MDMA or Molly)? • During your life, how many times have you used hallucinogenic drugs, such as LSD, acid, PCP, angel dust, mescaline, or mushrooms? 	0 times; 1 or 2 times; 3–9 times; 10–19 times; 20–39 times; or ≥40 times	≥1 time for at least 1 of the included questions versus 0 times for all included questions

Discussion

Approximately one in five high school students ever witnessed community violence, and 3.5% of high school students carried a gun during the previous 12 months. Witnessing community violence and gun carrying were associated with student substance use and suicide risk. These findings were consistent with other studies indicating associations between witnessing community violence and gun carrying and increased risk for suicide, substance use, and other adverse health outcomes (3,4).

Community violence has been described as an adverse childhood experience (ACE), and both ACE exposure and witnessing community violence have been associated with weapon carrying (5). Previous research has demonstrated that young persons might carry weapons for self-defense to protect against future violence,

particularly when they have been directly victimized or perceive high levels of community violence (5). The overall prevalence of witnessing community violence and gun carrying, as well as the statistically significant differences by race and ethnicity and sex highlight the need to implement comprehensive evidence-based prevention strategies in locations that are disproportionately affected by violence.

Findings from the 2021 YRBS indicate that students from most racial and ethnic minority groups were more likely to witness community violence and to report gun carrying than their White peers. The differential exposure by race and ethnicity might increase disparities in other types of morbidity and mortality from substance use or other health outcomes (e.g., chronic disease) because of stress and adversity. Racial and ethnic minorities experience higher rates of violence, which have been

TABLE 2. Witnessing community violence and gun carrying, by student characteristics — Youth Risk Behavior Survey, United States, 2021*

Characteristic	Witnessing community violence			Gun carrying		
	Yes % (95%CI)	No % (95%CI)	Chi-square test p value [†]	Yes % (95% CI)	No % (95% CI)	Chi-square test p value [†]
Overall	19.9 (17.3–22.7)	80.1 (77.3–82.7)	NA	3.5 (2.8–4.4)	96.5 (95.6–97.2)	NA
Sex	NA	NA	0.024	NA	NA	0.000
Female	19.2 (16.6–22.1)	80.8 (77.9–83.4)	NA	1.8 (1.5–2.3)	98.2 (97.7–98.5)	NA
Male	20.4 (17.8–23.2)	79.6 (76.8–82.2)	NA	5.0 (3.9–6.3)	95.0 (93.7–96.1)	NA
Race and ethnicity[§]	NA	NA	0.000	NA	NA	0.000
American Indian or Alaska Native	26.0 (18.6–35.1) ^{¶,**,††,§§,¶¶,***}	74.0 (64.9–81.4)	NA	5.3 (2.5–11.1) ^{**}	94.7 (88.9–97.5)	NA
Asian	9.3 (6.7–12.8) ^{¶,††,§§,¶¶,***}	90.7 (87.2–93.3)	NA	1.0 (0.5–1.8) ^{¶,††,§§,¶¶,***}	99.0 (98.2–99.5)	NA
Black or African American	29.3 (25.8–33.2) [¶]	70.7 (66.8–74.2)	NA	5.1 (4.2–6.3) ^{¶,¶¶,***}	94.9 (93.7–95.8)	NA
Native Hawaiian or other Pacific Islander	26.2 (22.0–30.9)	73.8 (69.1–78.0)	NA	3.9 (2.9–5.3)	96.1 (94.7–97.1)	NA
White	24.5 (19.1–30.8) ^{¶¶,***}	75.5 (69.2–80.9)	NA	3.0 (1.6–5.5)	97.0 (94.5–98.4)	NA
Hispanic or Latino	21.3 (11.8–35.4)	78.7 (64.6–88.2)	NA	5.1 (0.7–29.6)	94.9 (70.4–99.3)	NA
Multiracial	14.8 (12.9–17.0)	85.2 (83.0–87.1)	NA	3.0 (2.4–3.8)	97.0 (96.2–97.6)	NA
Age group, yrs	NA	NA	0.281	NA	NA	0.046
≤15	18.8 (16.8–21.0)	81.2 (79.0–83.2)	NA	3.2 (2.5–4.1)	96.8 (95.9–97.5)	NA
16–17	20.5 (17.0–24.5)	79.5 (75.6–83.0)	NA	3.5 (2.6–4.6)	96.5 (95.4–97.4)	NA
≥18	22.5 (17.4–28.6)	77.5 (71.4–82.6)	NA	6.5 (4.2–9.9) ^{†††}	93.5 (90.1–95.8)	NA
Sexual identity						
Lesbian, gay, or bisexual	27.0 (23.9–30.3) ^{§§§,¶¶¶}	73.0 (69.7–76.1)	0.000	2.9 (1.9–4.3)	97.1 (95.7–98.1)	0.287
Heterosexual	18.2 (15.7–20.9)	81.8 (79.1–84.3)	NA	3.3 (2.7–4.1)	96.7 (95.9–97.3)	NA
Questioning or other	20.4 (17.7–23.4)	79.6 (76.6–82.3)	NA	4.6 (2.9–7.2)	95.4 (92.8–97.1)	NA

Abbreviation: NA = not applicable.

* N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

† Chi-square tests were applied to examine the bivariate relationships between demographic characteristics and witnessing community violence or gun carrying. Statistical significance is defined as $p < 0.05$ for the chi-square test.

§ Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

¶ Significantly different from White students, on the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$).

** Significantly different from Asian students, on the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$).

†† Significant difference from Black or African American students, on the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$).

§§ Significantly different from American Indian or Alaska Native students, on the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$).

¶¶ Significantly different from multiracial students, on the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$).

*** Significantly different from Hispanic students, on the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$).

††† Significantly different from students aged ≤15 years, on the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$).

§§§ Significantly different from heterosexual students, on the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$).

¶¶¶ Significantly different from questioning or other students, on the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$).

explained by discrimination and racism, concentrated poverty, high crime rates, and economic or residential instability (7).

Furthermore, findings revealed a substantially higher prevalence of community violence exposure among students who carried a gun compared with those who did not. Gun carrying might be associated with experiences of racism, discrimination, feeling the need to protect oneself because of increased exposure to community violence, mistrust in the criminal justice and other government systems, and poor or inadequate community-level protective factors (5). Results also showed differences in exposure to community violence for youths who identified as lesbian, gay, or bisexual. These youths were more likely to witness community violence than those identifying as heterosexual. Sexual minority youths have been found to be at greater risk for substance use, suicide risk, and victimization (8). These factors might create an environment where sexual minority students are more likely to witness interpersonal violence because they often are the victim (9).

This report also found important associations between witnessing community violence, substance use, and suicide risk. Youths who witnessed community violence were more likely to report carrying a gun, considering or attempting suicide, and engaging in current and lifetime substance use behavior compared with youths who had not witnessed it. Witnessing community violence, particularly repeatedly, has been associated with poor mental health, including posttraumatic stress disorder (PTSD) and major depression, with greater exposures to traumatic events increasing the likelihood of PTSD (10,11). Exposure to ACEs, which includes polyvictimization (i.e., exposure to multiple types of violence) is associated with increased risk for short- and long-term mental and physical health problems, including suicide risk, risky sexual behaviors, and substance use disorders, and increased risk for early death (12).

TABLE 3. Prevalence of witnessing community violence among high school students, by gun carrying, suicide risk, and substance use behaviors and experiences and sex — Youth Risk Behavior Survey, United States, 2021*

Behavior/Experience	Witnessed community violence					
	Male			Female		
	Did not experience the risk behavior % (95% CI)	Experienced the risk behavior % (95% CI)	aPR ^{†,§} (95% CI)	Did not experience the risk behavior % (95% CI)	Experienced the risk behavior % (95% CI)	aPR ^{†,§} (95% CI)
Gun carrying[¶]	18.9 (16.5–21.4)	56.7 (49.2–63.8)	3.1 (2.7–3.5)	18.7 (16.1–21.7)	61.2 (50.9–70.6)	3.0 (2.4–3.8)
Suicide risk						
Seriously considered attempting suicide [¶]	17.5 (15.2–20.2)	37.1 (31.4–43.3)	2.1 (1.8–2.5)	13.8 (10.4–17.9)	32.1 (27.6–36.9)	2.2 (1.6–3.0)
Attempted suicide [¶]	18.1 (15.7–20.9)	44.5 (38.0–51.3)	2.3 (1.9–2.7)	15.3 (13.1–18.0)	42.9 (38.7–47.2)	2.5 (2.2–2.9)
Substance use						
Current binge drinking ^{**}	18.3 (15.8–21.1)	34.2 (27.0–42.2)	1.9 (1.5–2.4)	17.0 (14.5–19.8)	32.0 (25.4–39.4)	1.9 (1.6–2.3)
Current marijuana use ^{††}	16.9 (14.7–19.4)	41.0 (35.1–47.1)	2.3 (2.0–2.7)	14.7 (12.3–17.4)	39.1 (35.3–43.1)	2.4 (2.0–2.9)
Lifetime prescription opioid misuse	18.4 (16.2–20.9)	38.1 (30.6–46.1)	2.0 (1.7–2.4)	15.7 (13.4–18.3)	39.0 (33.5–44.9)	2.3 (1.9–2.8)
Lifetime illicit drug use ^{§§}	18.0 (15.5–20.9)	39.8 (31.9–48.4)	2.2 (1.9–2.5)	15.8 (13.3–18.7)	41.1 (36.1–46.3)	2.5 (2.1–2.9)

Abbreviation: aPR = adjusted prevalence ratio.

* N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

† aPRs were estimated with gun carrying, suicide risk, and substance use variables as the outcome.

§ Logistic models adjusted for age, race and ethnicity, and sexual identity. Estimates were considered statistically significant if the 95% CIs did not include 1.0.

¶ During the 12 months before the survey

** Had four or more drinks of alcohol in a row (if they were female) or five or more drinks of alcohol in a row (if they were male) within a couple of hours on ≥1 day during the 30 days before the survey.

†† One or more times during the 30 days before the survey.

§§ Lifetime use of at least one of the following: cocaine, ecstasy, hallucinogenic drugs, heroin, inhalants, methamphetamines, or synthetic marijuana.

TABLE 4. Prevalence of witnessing community violence among high school students, by gun carrying, suicide risk, and substance use behaviors and experiences and race and ethnicity* — Youth Risk Behavior Survey, United States, 2021[†]

Behavior/Experience	Witnessed community violence								
	Black or African American			White			Hispanic or Latino		
	Did not experience the risk behavior % (95% CI)	Experienced the risk behavior % (95% CI)	aPR ^{§,¶} (95% CI)	Did not experience the risk behavior % (95% CI)	Experienced the risk behavior % (95% CI)	aPR ^{§,¶} (95% CI)	Did not experience the risk behavior % (95% CI)	Experienced the risk behavior % (95% CI)	aPR ^{§,¶} (95% CI)
Gun carrying^{**}	26.9 (23.5–30.7)	70.8 (54.8–83.0)	2.6 (2.1–3.2)	14.2 (12.4–16.3)	45.6 (33.6–58.2)	3.6 (2.9–4.3)	24.6 (20.5–29.2)	64.4 (55.0–72.8)	2.7 (2.3–3.3)
Suicide risk									
Seriously considered attempting suicide	26.1 (22.1–30.4)	41.6 (34.2–49.5)	1.7 (1.2–2.3)	10.6 (8.9–12.5)	29.4 (26.2–32.8)	2.8 (2.5–3.2)	22.3 (16.8–28.9)	40.5 (32.6–48.8)	1.8 (1.3–2.6)
Attempted suicide ^{**}	28.0 (23.9–32.7)	45.3 (38.7–52.1)	1.6 (1.3–2.0)	12.3 (10.5–14.3)	40.7 (34.3–46.7)	3.1 (2.7–3.6)	23.4 (19.5–27.8)	45.5 (36.0–55.4)	2.0 (1.7–2.3)
Substance use									
Current binge drinking ^{††}	27.1 (23.4–31.1)	58.8 (39.1–76.1)	2.1 (1.5–2.9)	12.8 (11.1–14.8)	26.1 (19.5–34.0)	2.0 (1.6–2.5)	22.8 (18.7–27.5)	43.5 (36.8–50.4)	1.9 (1.5–2.5)
Current marijuana use ^{§§}	24.2 (20.5–28.4)	47.0 (39.2–55.1)	1.9 (1.5–2.4)	11.7 (9.9–13.7)	32.3 (27.9–37.0)	2.8 (2.2–3.4)	22.0 (18.9–25.6)	46.8 (39.8–53.8)	2.1 (1.8–2.3)
Lifetime prescription opioid misuse	26.7 (22.8–31.0)	45.3 (35.3–55.7)	1.7 (1.4–2.2)	12.2 (10.8–13.8)	35.1 (27.5–43.6)	2.8 (2.2–3.6)	23.1 (19.5–27.1)	44.3 (37.9–50.8)	1.9 (1.7–2.2)
Lifetime illicit drug use ^{¶¶}	29.2 (25.0–33.9)	51.7 (36.5–66.6)	1.7 (1.1–2.6)	11.9 (10.0–14.0)	35.1 (29.5–41.1)	2.9 (2.4–3.4)	23.2 (19.5–27.3)	46.9 (38.0–55.9)	2.0 (1.7–2.3)

Abbreviation: aPR = adjusted prevalence ratio.

* Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

† N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

§ aPRs were estimated with gun carrying, suicide risk, and substance use variables as the outcome. All aPRs were statistically significant if p<0.05.

¶ Logistic models adjusted for age, sex, and sexual identity. Estimates were considered statistically significant if the 95% CIs did not include 1.0.

** During the 12 months before the survey

†† Had four or more drinks of alcohol in a row (if they were female) or five or more drinks of alcohol in a row (if they were male) within a couple of hours on ≥1 day during the 30 days before the survey.

§§ One or more times during the 30 days before the survey.

¶¶ Lifetime use of at least one of the following: cocaine, ecstasy, hallucinogenic drugs, heroin, inhalants, methamphetamines, or synthetic marijuana.

TABLE 5. Adjusted prevalence ratios for suicide risk and substance use behavior, by gun carrying — Youth Risk Behavior Survey, United States, 2021*

Risk/Behavior	No, gun carrying % (95% CI)	Yes, gun carrying % (95% CI)	aPR [†] (95% CI)
Suicide risk			
Seriously considered attempting suicide [§]	21.7 (20.7–22.9)	40.2 (35.2–45.5)	2.0 (1.8–2.3)
Attempted suicide [§]	9.3 (8.5–10.1)	36.4 (30.1–43.2)	3.7 (3.1–4.5)
Substance use			
Current binge drinking [¶]	9.7 (8.7–10.9)	38.2 (30.5–46.7)	3.9 (3.1–4.8)
Current marijuana use ^{**}	14.8 (13.3–16.4)	51.2 (42.8–59.5)	3.3 (2.8–3.9)
Lifetime prescription drug misuse	11.2 (10.4–12.1)	43.5 (36.5–50.9)	4.0 (3.2–5.0)
Lifetime illicit drug use ^{††}	12.1 (11.1–13.2)	46.9 (41.6–52.2)	3.8 (3.2–4.5)

Abbreviation: aPR = adjusted prevalence ratio.

* N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] Logistic models adjusted for sex, race and ethnicity, age, and sexual identity. Estimates were considered statistically significant if the 95% CI did not include 1.0.

[§] During the 12 months before the survey.

[¶] Had four or more drinks of alcohol in a row (if they were female) or five or more drinks of alcohol in a row (if they were male) within a couple of hours on ≥1 day during the 30 days before the survey.

^{**} One or more times during the 30 days before the survey.

^{††} Lifetime use of at least one of the following: cocaine, ecstasy, hallucinogenic drugs, heroin, inhalants, methamphetamines, or synthetic marijuana.

Addressing risk and protective factors common to multiple forms of violence and substance use might be an effective and efficient way to prevent violence. Family-based strategies include promoting home environments that support healthy development through parenting skill and relationship programs (<https://www.cdc.gov/violenceprevention/communicationresources/pub/technical-packages.html#technicalPackages>). Multiple community-level, evidence-based strategies for preventing youth violence include modifying physical environments (e.g., mitigating abandoned housing), engaging youths through street outreach, mentoring programs, and changing community norms (<https://www.cdc.gov/violenceprevention/communicationresources/pub/technical-packages.html#technicalPackages>).

Schools offer a unique opportunity to help reduce youth violence. Schools have direct contact with approximately 50 million students for at least 6 hours a day over a 13-year period and have a role in promoting social, physical, and intellectual development (https://nces.ed.gov/programs/digest/d20/tables/dt20_103.20.asp?current). School-based violence prevention programs typically focus on skill-building to solve problems nonviolently, conflict resolution, and emotional

control. Environmental school strategies include those that increase youths' feelings of connectedness to the school environment and to school staff and prosocial peers. Youths who report feeling connected to school are less likely to engage in violent behaviors and substance use and are more likely to report positive mental health or well-being (13,14). CDC's What Works in Schools approach includes a safe and supportive environments strategy (<https://www.cdc.gov/healthyyouth/whatworks/what-works-safe-and-supportive-environments.htm>) to help students feel more connected to trusted adults at school and at home. Connectedness is a protective factor that might help prevent or reduce substance use, poor mental health, violence, and suicide.

The community and social context is important for the implementation of violence prevention efforts. For example, across communities and other settings, protective factors include youths' feeling connected to persons in these settings, and having safe spaces where they can talk with trusted adults might promote healthy development and buffer the potentially negative influence of other risks (5). However, building connectedness might be challenging when structural inequities such as racism and discrimination are pervasive, and disadvantaged youths are most at risk for experiencing violence. Knowledge gaps remain about how to best address structural inequities (i.e., discrimination and economic adversity) that drive disparities in violence. Strategies such as tax credits for families with children, safe and affordable housing, paid parental leave, livable wages, and economic support for developmentally appropriate child care might help mitigate certain inequities (<https://www.cdc.gov/violenceprevention/communicationresources/pub/technical-packages.html#technicalPackages>).

Another important approach to reducing the number of suicides and other types of violent deaths is mitigating access to lethal means among those at risk for harming themselves or others. For example, recent reviews suggest that counseling paired with the provision of a safety device can increase secure storage of firearms and that child access prevention laws have been associated with lower rates of youth firearm self-injury, including suicide (14,15). Additional research could strengthen and guide programs, policies, and practices for the primary prevention of violence, suicide, and substance use.

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 three additional limitations. First, the question assessing lifetime prescription opioid misuse refers to

prescription pain medicine (e.g., the question provides examples of opioid-containing prescription medications only). However, if students considered nonopioid prescription pain medications when answering, an overestimation of prescription opioid misuse prevalence might have occurred. Second, the YRBS is a cross-sectional, comprehensive youth health survey. More prospective research on witnessing community violence and gun carrying could explore causal mechanisms, strengthening the evidence for prevention efforts. Finally, the question on witnessing community violence was written as a lifetime question. The item does not indicate when the violent act was witnessed, the relationship to the victim, or the number of times the youth might have witnessed the violence. Other behavior questions examined had differing time frames; for example, marijuana use was asked for the past 30 days, whereas opioid use was lifetime. These differences lend credence to the idea that time-specific data on community violence could help improve data-to-action efforts at state and local levels.

Conclusion

Community violence and gun carrying are significant concerns for youths in the United States. More efforts are needed to develop, adapt, and implement evidence-based interventions for communities that are disproportionately affected by violence and to strengthen the use of violence-related data for prevention efforts, including raising awareness of the burden of community violence and gun carrying. Strategies that address shared risk and protective factors, including family, school, community, and society, are more likely to prevent not only community violence and firearm-related homicides, but also other forms of violence. Ultimately, creating safer schools and communities is essential for all youths to have the same opportunity for health and well-being.

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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Experiences of Unstable Housing Among High School Students — Youth Risk Behavior Survey, United States, 2021

Izraelle I. McKinnon, PhD^{1,2}; Kathleen H. Krause, PhD¹; Leah Robin, PhD¹; Adriane King, MPH¹; Michelle Leon-Nguyen, MPH¹; Evelyn Zavala, MPH¹; Nicolas A. Suarez, MPH¹; Connie Lim, MPA¹; Jennifer Smith-Grant, MSPH^{1,3}; J. Michael Underwood, PhD¹

¹Division of Adolescent and School Health, National Center for HIV, Viral Hepatitis, STD, and TB Prevention, CDC; ²Epidemic Intelligence Service, CDC; ³U.S. Public Health Service

Abstract

Youths experiencing unstable housing face higher risks for poor physical, mental, and sexual health outcomes and increased risk for suicide compared with their peers experiencing stable housing. In addition, youths of color and sexual minority youths are disproportionately more likely to experience homelessness. For the first time, in 2021, the nationally representative Youth Risk Behavior Survey included an item assessing housing stability, or nighttime residence among students in grades 9–12 in the United States. During 2021, 2.7% of U.S. high school students experienced unstable housing. Among racial and ethnic subgroups, Native Hawaiian or other Pacific Islander youths were most likely to experience unstable housing, followed by American Indian or Alaska Native and Black youths. Sexual minority (lesbian, gay, bisexual, and questioning or other) youths were more likely to experience unstable housing compared with their heterosexual peers. Compared with students who were stably housed, students who were unstably housed were more likely to engage in risky sexual behaviors, substance use, and suicide ideation and attempts, and to experience violence. These findings highlight which adverse health risks and behaviors are elevated among youths experiencing housing insecurity. Focused public health interventions are required to address the disproportionate burden of health risks prevalent among youths who are unstably housed.

Introduction

According to the National Center for Homeless Education, during the 2020–2021 school year, approximately 1.1 million youths in prekindergarten through 12th grade, or 2.2% of all students, experienced unstable housing (i.e., lacked a fixed, regular, and adequate nighttime residence) in the United States (1). Studies have documented the burden of adverse health risks and behaviors among youths who are unstably housed, including more high-risk sexual behaviors and experiences of violence (including partner abuse), when compared with youths who are stably housed (2). Youths experiencing unstable housing report higher levels of psychiatric disorders, suicide ideation and attempts, and substance use when compared with their peers (2,3). Among students experiencing unstable housing, students of color are overrepresented, with the exception of Asian students (<https://nche.ed.gov/wp-content/uploads/2021/12/Student-Homelessness-in-America-2021.pdf>). In addition, because sexual minority youths (lesbian, gay, bisexual, and questioning or other [LGBQ+]) might face family rejection and mistreatment because of their sexual identity, studies often document higher rates of housing instability among this population

compared with heterosexual youths (<https://www.thetrevorproject.org/wp-content/uploads/2022/02/Trevor-Project-Homelessness-Report.pdf>). Disparities in housing stability place students of color and sexual minority youths at higher risk for behaviors and health outcomes associated with experiences of unstable housing.

A 2019 report using state and local Youth Risk Behavior Survey (YRBS) data demonstrated a higher prevalence of risk behaviors among youths who were unstably housed (4). Students experiencing unstable housing were more likely to be male, non-Hispanic Black, and identify as lesbian, gay, or bisexual. Students who were unstably housed were more likely to report substance use, be currently sexually active, not use a condom during last sexual intercourse, experience violence victimization, and report suicide ideation and attempts compared with students who were stably housed (4). Although that study illustrates a disproportionate burden of adverse health risk behaviors and outcomes among youths experiencing unstable housing compared with youths with stable housing, the data are representative of only 23 states and 11 local school districts. This report provides 2021 YRBS results on housing instability among high school students, the first report using nationally representative data. Public health professionals, advocates, and policy makers can use these data to assess demographic characteristics, risk behaviors, and public health needs among youths experiencing unstable housing. These findings can be used to guide evidence-based interventions for the vulnerable populations of youths that experience unstable housing.

Corresponding author: Izraelle I. McKinnon, PhD, Division of Adolescent and School Health, National Center for HIV, Viral Hepatitis, STD, and TB Prevention, Telephone: 404-718-3733, Email: yul3@cdc.gov.

Methods

Data Source

This report includes data from the 2021 YRBS (N = 17,232), 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 students experiencing unstable housing for the overall study population and by sex, race and ethnicity, grade, and sexual identity are available at <https://nccd.cdc.gov/youthonline/App/Default.aspx>. The full YRBS questionnaire is available at <https://www.cdc.gov/healthyouth/data/yrbs/pdf/2021/2021-YRBS-National-HS-Questionnaire.pdf>. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.*

Measures

To obtain information on housing stability, students were asked, “During the past 30 days, where did you usually sleep?” Responses were coded into a binary variable of experiencing unstable housing (“in the home of a friend, family member, or other person because I had to leave my home or my parent or guardian cannot afford housing,” “in a shelter or emergency housing,” “in a motel or hotel,” “in a car, park, campground, or other public place,” or “I do not have a usual place to sleep”) versus stable housing (“in my parent’s or guardian’s home,” or “somewhere else”). The response option “somewhere else” is included in the definition of “experiencing stable housing” because it provides students a response option to the question if they do not fully understand the question or response options, or do not fit squarely into any of the response option categories (e.g., students living in dormitories and students with recently deceased or incarcerated parents living with a relative) or within the definition of experiencing unstable housing. Student demographic characteristics included sex (female or male), grade (9, 10, 11, or 12), race (American Indian or Alaska Native [AI/AN], Asian, Black, Native Hawaiian or other Pacific Islander [NH/OPI], Hispanic, White, and persons of multiple races [multiracial]), and sexual identity (heterosexual or LGBTQ+). (Persons of Hispanic origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.) Health risk behaviors used in this

report, including those related to substance use, sexual health, violence victimization, and mental health and suicide risk, are provided (Table 1).

Analysis

Prevalence estimates were calculated for all responses regarding where a student usually slept in the past 30 days; the dichotomized behavior of being unstably versus stably housed; and for experiencing unstable housing versus being stably housed stratified by sex, grade, race and ethnicity, and sexual identity. Logistic regression models with specifications for predicted marginal proportions provided unadjusted and adjusted (for demographic characteristics not being examined in that model [i.e., sex, grade, race and ethnicity, and sexual identity]) prevalence ratios to detect disparities within a demographic category compared with a common reference group (e.g., all grades compared with grade 9). Prevalence estimates of each risk behavior were stratified by housing status. Unadjusted and adjusted (for all demographic characteristics) prevalence ratios were calculated to compare the risk for a health risk behavior among students who were unstably housed with those who were stably housed. Statistical significance was determined if the 95% CI did not cross the null value of 1.0. Analyses were conducted using SUDAAN (version 11.0.3; RTI International) to account for complex survey design and nonresponse.

Results

In 2021, 2.7% of high school students in the United States were unstably housed in the 30 days before participating in YRBS: 1.7% of high school students slept in the home of a friend, family member, or other person because they had to leave their home or their parent or guardian could not afford housing; 0.3% slept in a shelter or emergency housing; 0.2% slept in a motel or hotel; 0.2% slept in a car, park, campground, or other public place; and 0.3% did not have a usual place to sleep. Approximately 97% of high school students were stably housed, with 96.1% of students sleeping in their parent’s or guardian’s home and 1.3% sleeping somewhere else (Table 2).

Female and male students were similarly likely to have experienced unstable housing in the past 30 days (2.4% of female and 2.7% of male students) (Table 3). The prevalence of unstable housing increased with increasing grade level; 2.0% of 9th graders, 2.1% of 10th graders, 2.8% of 11th graders, and 3.4% of 12th graders were unstably housed. Adjusted for other demographic variables, the prevalence of unstable housing was 1.7 times higher among 12th-grade compared with 9th-grade students. The racial and ethnic groups that experienced the highest prevalence of unstable housing were NH/OPI (10.0%), AI/AN (7.9%), and

* See e.g., 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

TABLE 1. Measures for selected health risk behaviors among high school students — Youth Risk Behavior Survey, United States, 2021

Variable	Question	Response options	Analytic coding
Substance Use			
Ever misused prescription opioids	During the past 30 days, how many times did you take prescription pain medicine without a doctor's prescription or differently than how a doctor told you to use it?	0 times, 1 or 2 times, 3–9 times, 10–19 times, 20–39 times, ≥40 times	Yes (1 or 2 times, 3–9 times, 10–19 times, 20–39 times, ≥40 times) versus no (0 times)
Ever used illicit drugs	During your life, how many times have you A) used any form of cocaine, including powder, crack, or freebase? B) sniffed glue, breathed the contents of aerosol spray cans, or inhaled any paints or sprays to get high? C) used heroin (also called smack, junk, or China White)? D) used methamphetamines (also called speed, crystal meth, crank, ice, or meth)? E) used ecstasy (also called MDMA or Molly)? F) used hallucinogenic drugs, such as LSD, acid, PCP, angel dust, mescaline, or mushrooms?	0 times, 1 or 2 times, 3–9 times, 10–19 times, 20–39 times, ≥40 times	Yes (1 or 2 times, 3–9 times, 10–19 times, 20–39 times, ≥40 times [for any included drug]) versus no (0 times [for all included drugs])
Ever injected any illegal drug	During your life, how many times have you used a needle to inject any illegal drug into your body?	0 times, 1 time, ≥2 times	Yes (1 time, ≥2 times) versus no (0 times)
Sexual health			
Currently sexually active	During the past 3 months, with how many people did you have sexual intercourse?	I have not had sexual intercourse, I have had sexual intercourse, but not during the past 3 months, 1 person, 2 persons, 3 persons, 4 persons, 5 persons, ≥6 persons	Yes (1 person, 2 persons, 3 persons, 4 persons, 5 persons, ≥6 persons) versus no (I have not had sexual intercourse, I have had sexual intercourse, but not during the past 3 months)
Used alcohol or drugs at last sexual intercourse	Did you drink alcohol or use drugs before you had sexual intercourse the last time?	I have never had sexual intercourse, yes, no	Yes versus no (no, I have never had sexual intercourse)
Did not use a condom during last sexual intercourse	The last time you had sexual intercourse, did you or your partner use a condom?	I have never had sexual intercourse, yes, no	Yes versus no (no, I have never had sexual intercourse)
Not tested for any STD (other than HIV) in the past 12 months	During the past 12 months, have you been tested for a sexually transmitted disease (STD) other than HIV, such as chlamydia or gonorrhea?	Yes, no, not sure	No (no, not sure) versus yes
Not ever tested for HIV	Have you ever been tested for HIV, the virus that causes AIDS? (Do not count tests done if you donated blood.)	Yes, no, not sure	No (no, not sure) versus yes
Violence victimization			
Experienced sexual dating violence in the past 12 months	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.)	I did not date or go out with anyone during the past 12 months, 0 times, 1 time, 2–3 times, 4–5 times, ≥6 times	Yes (1 time, 2–3 times, 4–5 times, ≥6 times) versus no (0 times, I did not date or go out with anyone during the past 12 months)
Experienced physical dating violence in the past 12 months	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.)	I did not date or go out with anyone during the past 12 months, 0 times, 1 time, 2–3 times, 4–5 times, ≥6 times	Yes (1 time, 2–3 times, 4–5 times, ≥6 times) versus no (0 times, I did not date or go out with anyone during the past 12 months)
Experienced sexual violence by anyone in the past 12 months	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.)	0 times, 1 time, 2–3 times, 4–5 times, ≥6 times	Yes (1 time, 2–3 times, 4–5 times, ≥6 times) versus no (0 times)

Black (5.1%) students; after adjusting for other demographic variables, these groups experienced 5.9, 4.7, and 2.6 times higher prevalence of unstable housing compared with White students, respectively. The prevalence of unstable housing was lowest among Asian students (0.8%); after adjusting for other demographic variables, Asian students experienced 0.3 times lower prevalence

of unstable housing compared with White students. Among sexual identity groups, the prevalence of unstable housing was 2.0% among heterosexual students, 4.7% among lesbian or gay students, 4.2% among bisexual students, 4.0% among questioning students, and 2.6% among students who describe their sexual identity in some other way. Overall, the prevalence of unstable housing was

TABLE 1. (Continued) Measures for selected health risk behaviors among high school students — Youth Risk Behavior Survey, United States, 2021

Variable	Question	Response options	Analytic coding
Mental health and suicide risk			
Poor mental health in the past 30 days	During the past 30 days, how often was your mental health not good? (Poor mental health includes stress, anxiety, and depression.)	Never, rarely, sometimes, most of the time, always	Yes (rarely; sometimes; most of the time; always) versus no (never)
Experienced persistent feelings of sadness or hopelessness	During the past 12 months, did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing some usual activities?	Yes, no	Yes versus no
Seriously considered suicide in the past 12 months	During the past 12 months, did you ever seriously consider attempting suicide?	Yes, no	Yes versus no
Made a suicide plan in the past 12 months	During the past 12 months, did you make a plan about how you would attempt suicide?	Yes, no	Yes versus no
Attempted suicide	During the past 12 months, how many times did you actually attempt suicide?	0 times, 1 time, 2–3 times, 4–5 times, ≥6 times	Yes (1 time, 2–3 times, 4–5 times, ≥6 times) versus no (0 times)

TABLE 2. Prevalence of unstable and stable housing among high school students — Youth Risk Behavior Survey, United States, 2021

Nighttime residence	% (95% CI)*
Housing options[†]	
In the home of a friend, family member, or other person because I had to leave my home or my parent or guardian cannot afford housing	1.7 (1.3–2.1)
In a shelter or emergency housing	0.3 (0.2–0.4)
In a motel or hotel	0.2 (0.1–0.3)
In a car, park, campground, or other public space	0.2 (0.1–0.4)
I do not have a usual place to sleep	0.3 (0.2–0.4)
In my parent's or guardian's home	96.1 (95.2–96.7)
Somewhere else	1.3 (0.7–2.3)
Housing stability status[§]	
Unstable housing	2.7 (2.2–3.3)
Stable housing	97.3 (96.8–97.8)

* N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] Student response to, "During the past 30 days, where did you usually sleep?"

[§] Housing items were dichotomized as unstable housing for responses "in the home of a friend, family member, or other person because I had to leave my home or my parent or guardian cannot afford housing," "in a shelter or emergency housing," "in a motel or hotel," "in a car, park, campground, or other public space," or "I do not have a usual space to sleep" and stable housing for responses "in my parent's or guardian's home" or "somewhere else."

approximately two times higher among students who identify as LGBTQ+ compared with heterosexual students.

Students who were unstably versus stably housed were more likely to have ever misused prescription opioids (36.4% versus 11.7%, respectively), used illicit drugs (41.7% versus 12.7%, respectively), and injected any illegal drug (22.5% versus 0.9%, respectively) (Table 4). After adjusting for demographics, the prevalence of prescription opioid misuse and illicit drug use was nearly three times higher among students who were unstably versus stably housed and 19 times higher for injection drug use. The prevalence of current sexual activity and use of alcohol or drugs

at last sexual intercourse was two times higher among students who were unstably versus stably housed. The prevalence of not using a condom at last sexual intercourse was higher among students who were unstably housed; however, after adjusting for demographic variables, the prevalence ratio comparing students who were unstably with stably housed was no longer significant. The prevalence of students who did not get tested for sexually transmitted diseases (STDs) in the past year or who had never been tested for HIV among students experiencing unstable housing was lower (81.2% and 81.4%, respectively) compared with those experiencing stable housing (95.2% and 94.7%, respectively). There were also differences in the prevalence of sexual and physical dating violence and sexual violence by anyone in the past year by housing stability status; 28.5% of students who were unstably housed experienced sexual dating violence, 31.9% experienced physical dating violence, and 27.6% experienced sexual violence by anyone, compared with 9.3%, 7.7%, and 10.6% among those who experienced stable housing, respectively. The prevalence of these forms of violence victimization was two to nearly four times higher among students who were unstably versus stably housed.

The prevalence of poor mental health in the past 30 days was approximately the same among students who were unstably (35.5%) and stably (29.0%) housed in the past 30 days, although the prevalence of persistent feelings of sadness or hopelessness in the past year was significantly higher among students who experienced unstable housing (56.8%) compared with their peers who were stably housed (42.6%) (Table 4). Adjusting for other demographic variables, students who experienced unstable housing were nearly twice as likely to have seriously considered suicide or made a suicide plan during the past year, and more than three times as likely to have attempted suicide during the past year.

Discussion

This report provides the first nationally representative estimates of housing instability among high school students and provides evidence that they were at higher risk for a broad range of health risk behaviors and adverse experiences compared with their peers who were stably housed. During 2021, 2.7% of all high school students experienced unstable housing in the 30 days before participating in YRBS. Furthermore, when compared with their peers who experienced stable housing, these students were more likely to engage in substance use, risky sexual health behaviors, and suicide ideation and attempts, and to experience violence. Youths experiencing unstable housing had a disproportionate burden of adverse health risks and behaviors that should be addressed with interventions that prevent experiencing unstable housing or ameliorate the adverse consequences of experiencing unstable housing.

TABLE 3. Prevalence of unstable housing among high school students, by select student characteristics — Youth Risk Behavior Survey, United States, 2021

Characteristic	% (95% CI)*	PR (95% CI)	aPR (95% CI)†
Sex			
Female	2.4 (1.9–3.2)	Ref	Ref
Male	2.7 (2.2–3.4)	1.1 (0.8–1.5)	1.2 (0.8–1.7)
Grade			
9	2.0 (1.4–2.9)	Ref	Ref
10	2.1 (1.5–2.8)	1.0 (0.7–1.5)	0.9 (0.6–1.5)
11	2.8 (2.0–4.0)	1.4 (0.9–2.3)	1.4 (0.9–2.2)
12	3.4 (2.7–4.3)	1.7 (1.1–2.8) [§]	1.7 (1.1–2.8) [§]
Race and ethnicity[¶]			
American Indian or Alaska Native	7.9 (4.1–14.4)	3.9 (1.9–7.7) [§]	4.7 (2.3–9.8) [§]
Asian	0.8 (0.4–1.5)	0.4 (0.2–0.8) [§]	0.3 (0.1–0.8) [§]
Black	5.1 (3.8–6.8)	2.5 (1.8–3.4) [§]	2.6 (1.9–3.7) [§]
Native Hawaiian or other Pacific Islander	10.0 (4.3–21.7)	4.9 (2.1–11.7) [§]	5.9 (2.6–13.2) [§]
White	2.0 (1.6–2.5)	Ref	Ref
Hispanic	2.5 (1.6–3.9)	1.2 (0.7–2.2)	1.1 (0.7–1.9)
Multiracial	3.1 (2.0–5.0)	1.5 (0.9–2.6)	1.5 (0.9–2.8)
Sexual identity			
Heterosexual	2.0 (1.6–2.5)	Ref	Ref
Gay or lesbian	4.7 (2.9–7.3)	2.4 (1.5–3.7) [§]	1.9 (1.0–3.3) [§]
Bisexual	4.2 (2.6–6.6)	2.1 (1.4–3.3) [§]	2.3 (1.4–3.7) [§]
Questioning	4.0 (2.2–7.1)	2.0 (1.2–3.5) [§]	1.8 (1.1–3.1) [§]
Other sexual identity	2.6 (1.6–4.2)	1.3 (0.8–2.2)	1.5 (0.9–2.6)

Abbreviations: aPR = adjusted prevalence ratio; PR = prevalence ratio; Ref = referent group.

* N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

† PR for sex adjusted for grade, race/ethnicity, and sexual identity; PR for grade adjusted for sex, race and ethnicity, and sexual identity; PR for race and ethnicity adjusted for sex, grade, and sexual identity; PR for sexual identity adjusted for sex, grade, and race/ethnicity.

§ A significant difference in the prevalence of unstable housing across levels of the demographic characteristics was observed. Differences were considered significant if the 95% CI did not cross the null value of 1.0.

¶ Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

The 2.7% prevalence of youths experiencing unstable housing estimated using YRBS data is consistent with other studies. A national estimate of all school-aged youths found that 2.2% of students were homeless (1), and a national study of households with youths aged 13–17 years found that 3.0% reported experiences of unstable housing (6). These estimates might differ slightly because of differences in groups of youths across studies, methods of identification, and data collection methods. YRBS specifically asks about unstable housing in the past 30 days and therefore might underestimate the prevalence of unstable housing among high school students over the course of the entire year of 2021. In addition, as evidenced in this report, NH/PI, AI/AN, Black, and LGBTQ+ students were more likely to experience unstable housing than their white and heterosexual peers, and the prevalence of unstable housing increased with increasing grade level. The overrepresentation of racial and ethnic and sexual minority groups among youths experiencing housing instability also was consistent with other studies (6–8). However, unlike other studies, this study did not find an elevated risk for experiencing unstable housing among Hispanic students relative to their White peers (6). Furthermore, the higher prevalence of certain risk behaviors and experiences among youths who were unstably versus stably housed documented in the 2021 YRBS data were consistent with previous reports (2–4,9). Although youths who were unstably housed were more likely to be currently sexually active and use alcohol or other substances before last sex, they were also more likely to have ever been tested for HIV or any other STD in the past year. Among youths experiencing unstable housing, the prevalence of testing was higher among those who were currently sexually active and experiencing physical or sexual dating violence (10), risk behaviors which were prevalent among one fourth to nearly one half of the youths who were unstably housed in this sample.

Underlying certain experiences of youth homelessness are experiences of family instability, engagement in foster care, and situations of abuse and neglect. Youths who are unstably housed might have marginal support systems and be more likely to experience adverse childhood events (11), family rejection, and family instability (12) than their peers who are stably housed. Such adverse experiences and behaviors are associated with poorer health status among youths who are unstably versus stably housed (11). Intersecting identities might heighten these risks; for example, lesbian, gay, and bisexual homeless youths experience significantly more sexual victimization, depression, and anxiety than their heterosexual peers experiencing homelessness (13). Some experiences of homelessness among youths might be facilitated by service gaps or referrals to services that require relocation to access them, particularly in rural communities (7). Such residential

TABLE 4. Prevalence of select health risk behaviors, by housing stability status among high school students — Youth Risk Behavior Survey, United States, 2021

Behavior	Unstable	Stable	PR (95% CI) [†]	aPR (95% CI) ^{†,§}
	% (95% CI)*	% (95% CI)*		
Substance use				
Ever misused prescription opioids	36.4 (30.3–43.0)	11.7 (10.8–12.6)	3.1 (2.6–3.7) [¶]	2.9 (2.4–3.4) [¶]
Ever used illicit drugs	41.7 (35.9–47.7)	12.7 (11.5–13.9)	3.3 (2.7–4.0) [¶]	3.0 (2.4–3.7) [¶]
Ever injected any illegal drug	22.5 (16.6–29.7)	0.9 (0.6–1.3)	25.9 (14.7–45.8) [¶]	19.0 (9.9–36.5) [¶]
Sexual health				
Currently sexually active	48.2 (41.7–54.8)	20.0 (18.7–21.3)	2.4 (2.1–2.8) [¶]	2.0 (1.6–2.6) [¶]
Used alcohol or drugs at last sexual intercourse	41.0 (28.2–55.2)	19.7 (17.5–22.2)	2.1 (1.5–3.0) [¶]	2.1 (1.5–3.1) [¶]
Did not use a condom during last sexual intercourse	60.2 (49.8–69.7)	47.6 (44.9–50.3)	1.3 (1.1–1.5) [¶]	1.2 (1.0–1.4)
Not tested for any STD (other than HIV) in the past 12 months	81.2 (76.7–85.0)	95.2 (94.5–95.9)	0.9 (0.8–0.9) [¶]	0.9 (0.8–1.0) [¶]
Not ever tested for HIV	81.4 (78.1–84.3)	94.7 (94.0–95.3)	0.9 (0.8–0.9) [¶]	0.9 (0.9–0.9) [¶]
Violence victimization				
Experienced sexual dating violence in the past 12 months	28.5 (18.6–41.0)	9.3 (8.2–10.5)	3.1 (2.2–4.3) [¶]	3.0 (2.1–4.5) [¶]
Experienced physical dating violence in the past 12 months	31.9 (25.6–39.0)	7.7 (6.6–8.8)	4.2 (3.2–5.4) [¶]	3.7 (2.9–4.8) [¶]
Experienced sexual violence by anyone in the past 12 months	27.6 (23.0–32.6)	10.6 (9.6–11.6)	2.6 (2.1–3.2) [¶]	2.6 (2.0–3.4) [¶]
Mental health and suicide				
Poor mental health in the past 30 days	35.5 (29.3–42.3)	29.0 (27.4–30.7)	1.2 (1.0–1.5)	1.1 (0.8–1.5)
Experienced persistent feelings of sadness or hopelessness in the past 12 months	56.8 (50.4–63.0)	42.6 (41.3–44.0)	1.3 (1.2–1.5) [¶]	1.3 (1.1–1.5) [¶]
Seriously considered suicide in the past 12 months	44.9 (40.1–49.9)	21.8 (20.7–22.9)	2.1 (1.8–2.4) [¶]	1.9 (1.6–2.3) [¶]
Made a suicide plan in the past 12 months	38.0 (30.9–45.6)	17.3 (16.0–18.7)	2.2 (1.7–2.8) [¶]	2.0 (1.5–2.6) [¶]
Attempted suicide in the past 12 months	38.2 (31.7–45.2)	9.4 (8.6–10.2)	4.1 (3.3–5.0) [¶]	3.3 (2.5–4.2) [¶]

Abbreviations: aPR = adjusted prevalence ratio; PR = prevalence ratio; STD = sexually transmitted disease.

* N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] Comparing the health behavior prevalence among students experiencing unstable housing versus stable housing.

[§] Adjusted for sex, grade, race and ethnicity, and sexual identity.

[¶] A significant difference in prevalence of a health behavior by housing stability status was observed. Differences were considered significant if the 95% CI did not cross the null value of 1.0.

instability is associated with a heightened likelihood of violence victimization (12). Despite increased exposure to adverse events and associated adverse physical, mental, and sexual health outcomes, episodes of unstable housing might serve as barriers to accessing consistent and comprehensive health and mental health care. Because of the intersection of housing instability trauma, lack of support, and fragmented and complicated access to health and mental health care, further research is needed to identify programs and policies to meet the health and mental health needs and complex life circumstances of youths experiencing homelessness.

Schools play a pivotal role in providing care and services to youths who are unstably housed. The McKinney-Vento Homeless Assistance Act (MVA) authorizes direct services that enable youths experiencing unstable housing to enroll, attend, and achieve success in school (<http://uscode.house.gov/view.xhtml?path=/prelim@title42/chapter119/subchapter6/partB&edition=prelim>). MVA-appointed liaisons serve as one of the primary contacts between families experiencing unstable housing and school support services and ensure that youths who are unstably housed can succeed academically. Certain MVA programs provide training and support that foster connections with families and youths through various comprehensive services for youths with complex needs,

including referrals to school- and community-based programs for family counseling, adolescent health care, mental health, and LGBTQ+ programs supported by student-led groups like Gender and Sexuality Alliances (GSAs). For example, Boston Public Schools established the Homeless Education Resource Network to refer students and families to housing service organizations (14). In New York City Public Schools, an annual MVA training is provided to 1,600 liaisons supporting students in temporary housing. Statewide efforts in Florida demonstrate how MVA funding is allocated to local education agencies (15), including Hillsboro County's Help Students in Transition Program and the Broward County Homeless Education Assistance Resource Team.

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 four additional limitations. First, causality cannot be inferred between housing instability and health risk behaviors because data are cross-sectional. Second, all variables did not share a common time reference point. Exposure to unstable housing was measured during the

past 30 days, but the risk behaviors in this report included behaviors in which a student had ever engaged, behaviors that occurred during the past 12 months, and behaviors that occurred at time of last sexual intercourse. Third, this analysis is limited to students who attend school and were present on the day(s) of data collection; adolescents experiencing unstable housing are more likely to disengage from school (16). Finally, students who slept “somewhere else” in the past 30 days were categorized as experiencing stable housing, although students who experienced unstable housing might have also selected this option. Therefore, the prevalence of unstable housing might be underestimated, and prevalence ratios are conservative and reflect robust associations.

Future Directions

School-based programmatic supports are important, and YRBS data can be used to inform these programs and resources and to enhance connections between MVA programs and other school-based resources, such as school-based health centers, mental health services, and GSAs. Resources for supporting youths who experience housing instability also should include guidance for reducing health risks and increasing access to clinical and mental health support. Policy efforts also should be made to prevent unstable housing among youths and address health risks among this population. For example, Chicago Public School’s 2022 Comprehensive Mental Health and Suicide Prevention Policy requires that a behavioral health team be established in every K–12 school to reduce stigma and increase staff ability to recognize students who are at risk for suicidality and mental health issues such as depression, noting housing instability as a root cause of such health risks (17). Additional research is needed to further explore the determinants that place unstably housed youths at risk for adverse health behaviors and experiences, as well as factors that might promote resilience among youths experiencing unstable housing. Schools could also consider interventions focusing on AI/AN, Black, NH/PI, and LGBTQ+ students, who face a disproportionate burden of unstable housing.

Conclusion

Students who are unstably housed are more likely to engage in health risk behaviors and encounter adverse experiences and are at greater risk for adverse outcomes when compared with their peers who are stably housed. This analysis underscores an ongoing need to assess the prevalence, characteristics, health risks, and adverse experiences of students experiencing unstable

housing. To that end, YRBS will continue to collect data on youths experiences of unstable housing and track trends over time through national, state, and local surveys. Furthermore, some students might be more likely to experience unstable housing based on characteristics that reflect systems of power, such as race and ethnicity or sexual identity. MVA provides an example of guidance and programs to meet short- and long-term needs of unstably housed students and their families. Furthermore, school staff might consider implementing policies and practices for housing, insurance, legal needs, and health and mental health services for students experiencing unstable housing.

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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Parental Monitoring and Risk Behaviors and Experiences Among High School Students — Youth Risk Behavior Survey, United States, 2021

Patricia J. Dittus, PhD¹; Jingjing Li, PhD, MD¹; Jorge V. Verlenden, PhD¹; Natalie J. Wilkins, PhD¹; Michelle N. Carman-McClanahan, MPH¹; Yolanda Cavalier, DrPH¹; Melissa C. Mercado, PhD²; Laura E. Welder, DrPh³; Douglas R. Roehler, PhD⁴; Kathleen A. Ethier, PhD¹

¹Division of Adolescent and School Health, National Center for HIV, Viral Hepatitis, STD, and TB Prevention, CDC; ²Division of Violence Prevention, National Center for Injury Prevention and Control, CDC; ³Division of Injury Prevention, National Center for Injury Prevention and Control, CDC; ⁴Division of Overdose Prevention, National Center for Injury Prevention and Control, CDC

Abstract

Parents have an important role in the promotion of healthy adolescent behaviors that can influence positive developmental trajectories and health outcomes. Parental monitoring is a central component of the parent-child relationship with the potential to reduce adolescent risk behaviors. Data from CDC's 2021 nationally representative Youth Risk Behavior Survey were used to describe the prevalence of parental monitoring reported by U.S. high school students and examine associations between parental monitoring and adolescent behaviors and experiences. Behaviors and experiences included sexual behaviors, substance use, violence, and indicators of poor mental health. This report marks the first national assessment of parental monitoring among U.S. high school students. Point prevalence estimates and corresponding 95% CIs were generated in the bivariate analyses between parental monitoring and the outcomes, stratified by demographic characteristics (sex, race and ethnicity, sexual identity, and grade). Multivariable logistic regression analyses were conducted to estimate the main effects of parental monitoring (categorized as high = always or most of the time and low = never, rarely, or sometimes) for each outcome, controlling for all demographics. Overall, 86.4% of students reported that their parents or other adults in their family know where they are going or with whom they will be all or most of the time. Reports of high parental monitoring were protective for all risk behaviors and experiences, with models controlling for sex, race and ethnicity, sexual identity, and grade. Results highlight the need for public health professionals who develop public health interventions and programs to conduct further research on the relation between parental monitoring and student health outcomes.

Introduction

Parents have an important role in the promotion of healthy adolescent behaviors that can influence developmental trajectories and health outcomes. Parental monitoring is an active, multidimensional process that includes setting boundaries and establishing an open exchange of information or knowledge related to a child's whereabouts, companions, and activities (1). Parental monitoring has been identified as a central component of the parent-child relationship, with the potential to reduce risk behaviors, reduce involvement in situations that might involve high risk or negative behavior, and promote environmental contexts that support positive behavior and decision-making (1–3).

Previous studies have found protective associations between parental monitoring and multiple adolescent behaviors and experiences across race, ethnicity, and gender. For example, associations have been found between increased parental

monitoring and adolescents' decreased prevalence of ever having engaged in sexual intercourse as well as increased use of contraception or condoms if they do (4,5). Parental monitoring also has been associated with reduced intention to engage in risk behaviors such as drinking alcohol, using marijuana, and misusing prescription drugs (3,6). In addition, parental monitoring has been inversely associated with multiple violence-related outcomes, including reductions in bullying perpetration and victimization (e.g., school-based bullying, electronic or cyber-bullying), dating violence, and sexual violence (7,8). Less is known about the relations between parental monitoring and indicators of poor mental health. However, less parental monitoring has been associated with a greater likelihood of self-injury attempts, including suicide attempts (9,10). In addition, the role of parental monitoring in supporting adolescent health behaviors, reducing risk, and encouraging positive, healthy decision-making has not been studied comprehensively across adolescent subgroups. For example, additional research is needed to understand the protective role of parental monitoring for sexual minority adolescents.

One question assessing adolescents' perceptions of parental knowledge of whereabouts and companions was included

Corresponding author: Patricia J. Dittus, PhD, Division of Adolescent and School Health, National Center for HIV, Viral Hepatitis, STD, and TB Prevention, CDC. Telephone: 404-639-8299; Email: pdd6@cdc.gov.

on the 2021 Youth Risk Behavior Survey (YRBS). This inclusion marks the first national, school-based assessment of student-reported parental monitoring and its association with adolescent behaviors and experiences. YRBS data from 2021 were used to both describe the prevalence of parental monitoring reported by youths and examine associations between high and low levels of parental monitoring and youth behaviors and experiences, including sexual behaviors, substance use, violence, and indicators of poor mental health. Findings from this report can be used to better understand the potential influence of parental monitoring and shape public health initiatives designed to improve adolescent health and well-being.

Methods

Data Source

This report includes data from the 2021 YRBS (N = 17,232), 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 parental monitoring for the overall study population and by sex, race and ethnicity, grade, and sexual identity are available at <https://nccd.cdc.gov/youthonline/App/Default.aspx>. The full YRBS questionnaire, data sets, and documentation are available at <https://www.cdc.gov/healthyyouth/data/yrbs/index.htm>. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.*

Measures

The main exposure of interest, parental monitoring, is derived from the question, “How often do your parents or other adults in your family know where you are going or with whom you will be?” Responses were combined to create two categories: high parental monitoring (always or most of the time) and low parental monitoring (never, rarely, or sometimes). The nine student health behaviors and experiences included sexual behaviors, substance use, violence, and mental health and suicide-related behaviors. Outcome variables were dichotomized (Table 1). Demographic variables included race and ethnicity (American Indian or Alaska Native [AI/AN],

Asian, Black or African American [Black], Native Hawaiian or other Pacific Islander, White, Hispanic or Latino [Hispanic], and multiracial), sex (female or male), sexual identity (heterosexual, lesbian, gay, bisexual, questioning, or other), and grade (9 and 10 or 11 and 12). (Persons of Hispanic origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.)

Analysis

Point prevalence estimates and corresponding 95% CIs were generated in the bivariate analyses between parental monitoring and the outcomes, stratified by demographic characteristics. Multivariable logistic regression analyses were conducted to estimate the main effects of parental monitoring for each outcome, controlling for all demographic characteristics. Estimates were considered statistically significant if the 95% CIs did not include 1.0 or if *p* was <0.05. Prevalence estimates with a denominator <30 were considered statistically unreliable and therefore were suppressed (11). All analyses were conducted in SAS-callable SUDAAN (version 11.0.3; RTI International) using sample weights to account for complex survey design and nonresponse.

Results

Overall, 86.4% of students reported that their parents or other adults in their family know where they are going or with whom they will be all or most of the time (Table 2). High parental monitoring was more prevalent among females compared with males (89.3% versus 84.1%), more prevalent among Asian students compared with Black students (91.3% versus 79.8%), and less prevalent among students who self-identify as lesbian, gay, or bisexual compared with heterosexual or questioning or other students (84.2% versus 87.6% and 88.9%, respectively). By grade, no differences occurred in reports of parental monitoring.

The prevalences of nine health risk behaviors and experiences, stratified by level of parental monitoring and demographic characteristics, were calculated (Tables 3 and 4). Differences occurred in the prevalence of each outcome by sex, race and ethnicity, sexual identity, and grade. Compared with students who reported low levels of parental monitoring, students who reported high parental monitoring experienced more positive health outcomes (e.g., fewer sexual risk behaviors, less substance use, fewer experiences of violence, fewer mental health challenges, and fewer suicide attempts) and engaged in more protective behaviors (e.g., condom use). This pattern was particularly pronounced for lesbian, gay, or bisexual students with high parental monitoring.

* See e.g., 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

TABLE 1. Questions, response options, and denominators for health behaviors and experiences, by variable assessed — Youth Risk Behavior Survey, United States, 2021*

Variable	Question	Response options (analytic coding)	Denominator [†]
Parental monitoring	How often do your parents or other adults in your family know where you are going or with whom you will be?	Never, rarely, sometimes, most of the time, always (high = most of the time, always versus low = never, rarely, sometimes)	9,092
Ever had sex	Have you ever had sexual intercourse?	Yes, no (yes versus no)	12,157
Condom use [§]	The last time you had sexual intercourse, did you or your partner use a condom?	Yes, no (yes versus no)	3,314
Multiple partners	During your life, with how many persons have you had sexual intercourse?	I have never had sexual intercourse, 1 person, 2 persons, 3 persons, 4 persons, 5 persons, ≥6 persons (yes = ≥4 versus no = <4)	15,456
Current prescription opioid misuse	During the past 30 days, how many times did you take prescription pain medicine without a doctor's prescription or differently than how a doctor told you to use it? (The lead-in for this question indicates "drugs such as codeine, Vicodin, OxyContin, Hydrocodone, and Percocet".)	0 times, 1 or 2 times, 3–9 times, 10–19 times, 20–39 times, ≥40 times (yes = ≥1 versus no = 0)	9,866
Current marijuana use	During the past 30 days, how many times did you use marijuana?	0 times, 1 or 2 times, 3–9 times, 10–19 times, 20–39 times, ≥40 times (yes = ≥1 versus no = 0)	16,897
Forced sex	Have you ever been physically forced to have sexual intercourse when you did not want to?	Yes, no (yes versus no)	14,158
Electronic bullying	During the past 12 months, have you ever been electronically bullied?	Yes, no (yes versus no)	17,032
Persistent feelings of sadness or 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?	Yes, no (yes versus no)	16,961
Attempted suicide	During the past 12 months, how many times did you actually attempt suicide?	0 times, 1 time, 2 or 3 times, 4 or 5 times, ≥6 times (yes = ≥1 versus no = 0)	15,573

* N = 17,232 respondents.

[†] The denominators are analytic sample sizes (unweighted).

[§] Among sexually active youths.

In the multivariable logistic regression analyses, reports of high parental monitoring were protective for all risk behaviors and experiences, with models controlling for sex, race and ethnicity, sexual identity, and grade (Table 5). For instance, prevalence of ever having had sex among high school students who reported high levels of parental monitoring was 54% lower compared with those who reported low levels of parental monitoring. Compared with low levels of parental monitoring, high levels of parental monitoring were associated with higher prevalence of using a condom at last sex and lower prevalence of reporting multiple lifetime sex partners. Similarly, high levels of parental monitoring were associated with lower prevalence of both current prescription opioid misuse and current marijuana use. In regard to experiences of violence, students who reported high levels of parental monitoring were less likely to have experienced forced sex in their lifetime and electronic bullying during the past 12 months than students who reported low levels of parental monitoring. Finally, high school students who reported high levels of parental monitoring were less likely to report persistent feelings of sadness and hopelessness and to have attempted suicide in the past 12 months than students who reported low levels of monitoring.

Discussion

This report provides the first national prevalence estimates of adolescents' experience of parental monitoring among U.S. high school students. Analyses of data collected in fall 2021 estimated that most students reported high levels of parental monitoring, defined in this report as parent knowledge of where a student was going and with whom. Although differences occurred in experience of parental monitoring by sex, race and ethnicity, sexual identity, and grade, overall 86% of students across all groups said their parents knew where they were and with whom they would be.

Associations between levels of students' experience of parental monitoring and behaviors and experiences that affect the health and well-being of adolescents, including sexual behaviors, substance use, violence, mental health, and suicide-related behaviors, also were examined. For all behaviors and experiences included in this report, high parental monitoring was associated with lower risk for negative outcomes. Of note, the measure of parental monitoring used in this report reflects students' perceptions of whether their parents know where they are and with whom. This measure might indicate various interrelated factors, including parental behaviors (e.g., positive

TABLE 2. Prevalence of high school students who reported high levels of parental monitoring, by demographic characteristics — Youth Risk Behavior Survey, United States, 2021*

Characteristic	High parental monitoring [†]	p value [§]
	% (95% CI)	
Overall	86.4 (84.9–87.8)	NA
Sex		<0.001
Female	89.3 (87.9–90.6)	
Male	84.1 (81.9–86.0)	
Race and ethnicity[¶]		<0.001
American Indian or Alaska Native	84.4 (72.5–91.8)	
Asian ^{**} , ^{††}	91.3 (88.3–93.6)	
Black or African American ^{§§}	79.8 (75.5–83.5)	
Native Hawaiian or other Pacific Islander ^{**} , ^{††} , ^{§§} , ^{¶¶} , ^{***} , ^{†††}	— ^{§§§}	
White	88.5 (87.0–89.9)	
Hispanic or Latino ^{**} , ^{§§}	84.3 (81.9–86.4)	
Multiracial ^{**}	86.8 (81.9–90.6)	
Sexual identity		0.013
Heterosexual	87.8 (86.3–89.1)	
Lesbian, gay, or bisexual	84.2 (82.4–85.8)	
Questioning or other	88.9 (86.0–91.3)	
Grade		0.057
9 and 10	87.8 (85.4–89.8)	
11 and 12	85.2 (83.4–86.9)	

* N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] High parental monitoring is defined by a response of “most of the time, always” to the question, “How often do your parents or other adults in your family know where you are going or with whom you will be?”

[§] p value is based on chi-square tests (p<0.05).

[¶] Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

^{**} Significantly different from Black or African American students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

^{††} Significantly different from Hispanic students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

^{§§} Significantly different from White students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

^{¶¶} Significantly different from Asian students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

^{***} Significantly different from American Indian or Alaska Native students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

^{†††} Significantly different from multiracial students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

^{§§§} Dash indicates cell data are suppressed because the denominator is <30 and therefore considered to be statistically unreliable.

communication and inquiry) and adolescent disclosure, and might reflect positive parent-child relationships and family connectedness. Previous research has found that adolescents' perceptions of parents' knowledge of their whereabouts and companions are influenced by both solicitation of information by parents and relationship satisfaction reported by adolescents (5). The multidimensional nature of the construct indicates that it is related to a broad set of behaviors (i.e., activities in which adolescents engage, such as sex and substance use) and experiences (i.e., things that happen to adolescents). The multiple factors likely influencing whether students disclose

their whereabouts and companions to their parents might be related in different ways to the outcomes of interest and might lead to different promotion strategies.

For instance, parental knowledge of students' whereabouts can prevent opportunities for engaging in risk behaviors or for spending time with peers who might promote such behaviors (1,3,6). In this report, high parental monitoring was inversely related to student reports of ever having sex, multiple sex partners, and for male students, increased prevalence of condom use. These findings support previous research demonstrating that parental monitoring positively affects decisions about sexual activity among young persons (4–7). Similarly, observed relations between parental monitoring and decreased substance use in this report are congruent with analyses from the National Survey on Drug Use and Health, other longitudinal studies (12), and parenting interventions targeting adolescent substance use (3).

High parental monitoring also was related to lower prevalence of electronic bullying victimization and forced sex. Previous studies have found that collaborative parental monitoring strategies (e.g., those focused on communication) are associated with lower cyber-bullying victimization and perpetration, and family connectedness is associated with decreased experience of violence victimization and perpetration (2,7,8). Building strong relationships with parents and other prosocial adults might be an especially important protection for students at increased risk for violence (7,8). CDC's youth violence and adverse childhood experiences (ACEs) technical packages provide examples of the best available evidence for the prevention of youth violence and ACEs, including parenting skills and family relationship programs that support caregivers and teach communication, problem-solving, and behavior monitoring and management skills (13,14).

In this report, a strong relation was found between students' perceptions of parental monitoring and improved mental health and decreased suicidality. High parental monitoring was associated with lower likelihood of reporting symptoms of poor mental health, including feeling sad and hopeless and having attempted suicide. This finding adds to studies that have found a weak negative association between parental monitoring and depression (9). In another study, parental monitoring also was negatively correlated with suicidality, self-injury, and depression, such that increased monitoring was associated with decreased poor outcomes (10). The link between parental knowledge of companions and whereabouts and students' mental health and suicidality is less direct. This link aligns, however, with other research on family relationships and connectedness (15), suggesting that monitoring knowledge expressed by students is likely the result of positive relationships rather than parental control of activities. In fact, parental

TABLE 3. Prevalence of sexual behaviors and substance use behaviors among high school students, by demographic characteristics and levels of parental monitoring — Youth Risk Behavior Survey, United States, 2021*

Characteristic	Ever had sex [†]		Used condom [†]		Multiple partners [†]		Current prescription opioid misuse [†]		Current marijuana use [†]	
	High parental monitoring % (95% CI)	Low parental monitoring % (95% CI)	High parental monitoring % (95% CI)	Low parental monitoring % (95% CI)	High parental monitoring % (95% CI)	Low parental monitoring % (95% CI)	High parental monitoring % (95% CI)	Low parental monitoring % (95% CI)	High parental monitoring % (95% CI)	Low parental monitoring % (95% CI)
Sex										
Female	28.7 (25.7–32.0)	54.5 (49.9–59.1)	48.4 (44.4–52.5)	37.7 (27.2–49.6)	4.3 (3.4–5.5)	12.8 (10.1–16.1)	6.8 (5.8–7.9)	18.7 (14.2–24.2)	15.7 (13.6–18.0)	39.6 (32.2–47.5)
Male	26.5 (24.2–28.9)	52.7 (47.5–57.7)	60.9 (55.1–66.3)	43.6 (35.1–52.5)	4.9 (4.1–5.9)	20.0 (16.0–24.7)	3.0 (2.4–3.8)	9.6 (6.5–13.3)	11.2 (9.5–13.1)	32.3 (27.4–37.5)
Race and ethnicity[§]										
American Indian or Alaska Native	27.2 (15.8–42.6)	— [¶]	—	—	7.8 (2.9–19.4)	—	4.5 (1.1–16.3)	—	13.8 (7.1–25.0)	—
Asian	10.4 (7.8–13.6)	25.1 (17.5–34.5)	—	—	2.0 (1.2–3.2)	3.0 (0.5–15.7)	3.3 (2.3–4.6)	12.7 (5.1–28.1)	4.4 (2.9–6.5)	16.9 (8.2–31.6)
Black or African American	34.5 (28.1–41.4)	56.5 (47.3–65.4)	50.6 (43.6–57.6)	44.0 (30.2–58.9)	7.0 (4.1–11.9)	23.5 (17.3–31.0)	7.3 (4.6–11.2)	14.2 (9.9–20.1)	18.7 (15.5–22.5)	35.7 (27.8–44.4)
Hispanic or Latino	29.1 (26.9–31.5)	53.6 (44.5–62.4)	50.0 (43.5–56.5)	45.8 (35.5–56.5)	5.4 (4.8–6.1)	14.0 (9.6–20.1)	6.9 (5.4–8.8)	16.8 (11.6–23.7)	14.8 (12.4–17.5)	34.7 (28.8–41.0)
Multiple races	32.8 (26.6–39.6)	44.8 (31.2–59.2)	—	—	5.3 (3.0–8.9)	13.9 (7.2–24.9)	4.6 (2.5–8.1)	12.4 (5.7–25.1)	18.6 (12.9–26.1)	40.6 (26.7–56.2)
White	27.5 (25.4–29.8)	55.5 (50.6–60.4)	57.4 (54.5–60.3)	38.0 (30.0–46.8)	4.1 (3.1–5.5)	18.3 (14.4–23.0)	3.8 (3.1–4.6)	10.1 (6.5–15.4)	12.5 (10.6–14.6)	36.7 (30.8–42.9)
Sexual identity										
Heterosexual	27.2 (24.8–29.6)	52.4 (48.2–56.7)	56.6 (53.4–59.9)	44.6 (37.8–51.6)	4.5 (3.9–5.3)	15.9 (13.3–18.9)	3.5 (3.0–4.1)	10.0 (7.0–14.0)	11.8 (10.3–13.4)	34.1 (31.0–37.3)
Lesbian, gay, or bisexual	35.9 (32.9–39.0)	60.7 (52.7–68.1)	39.4 (33.3–45.7)	38.7 (23.0–57.2)	5.7 (4.5–7.3)	19.5 (12.7–28.8)	9.5 (7.4–12.2)	21.7 (14.0–31.9)	23.3 (19.6–27.3)	43.9 (34.0–54.4)
Questioning or other	20.7 (17.0–24.9)	54.3 (43.9–64.4)	53.9 (43.1–64.4)	15.9 (6.8–32.6)	4.1 (2.3–7.3)	23.6 (14.7–35.7)	9.1 (6.9–11.9)	24.0 (14.3–37.6)	14.1 (10.5–18.6)	43.7 (29.7–58.8)
Grade										
9 and 10	17.2 (15.3–19.3)	41.8 (37.2–46.5)	58.6 (51.8–65.1)	49.9 (41.0–58.9)	2.3 (1.8–3.0)	10.1 (7.5–13.4)	5.2 (4.4–6.2)	12.2 (8.5–17.1)	9.5 (8.0–11.3)	26.3 (21.3–32.0)
11 and 12	38.5 (35.2–41.8)	62.1 (57.9–66.1)	52.3 (48.4–56.1)	37.5 (31.6–43.9)	7.2 (5.9–9.7)	22.4 (19.1–26.0)	4.6 (3.7–5.6)	13.3 (10.8–16.2)	17.5 (15.3–19.9)	41.6 (38.0–45.4)

* N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] Refer to Table 1 for variable definitions.

[§] Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

[¶] Dashes indicate cell data are suppressed because the denominator is <30 and therefore considered to be statistically unreliable.

monitoring strategies that facilitate involvement, information sharing, and parental warmth and support have demonstrated potential for reducing risks for poor mental health outcomes (<https://www.cdc.gov/suicide/pdf/preventionresource.pdf>).

Overall, parental monitoring had universal positive effects across all domains of risk behavior and experiences investigated in this report. Systematic reviews of parental monitoring literature have found similar protective associations between parental monitoring and youth risk behaviors, including substance use and risky sexual activity (2–4,6). However, among students with a history of social isolation and societal marginalization, including those who identify as lesbian, gay, bisexual, questioning, or other, effectiveness of parental monitoring has been tied to strategies that focus on the establishment of positive home environments and family relationships where students are comfortable disclosing

information and feel accepted, rather than just focus on limiting opportunities for sexual activity (16). The findings discussed in this report warrant further exploration and research on specific aspects of parental monitoring and engagement that are most strongly tied to positive youth health behaviors and outcomes.

Future Directions

Parental monitoring is a broad construct that encompasses a range of interrelated actions that include information exchange between parents and students. Measurements of parental monitoring vary, with certain measures attending more to parental actions and parental sense of control and others incorporating adolescents' willingness to disclose information to parents (1). The student perspective of parental monitoring represented by

TABLE 4. Prevalence of violence experiences, feeling sad and hopeless, and suicide attempts among high school students, by demographic characteristics and levels of parental monitoring — Youth Risk Behavior Survey, United States, 2021*

Characteristic	Forced sex [†]		Electronic bullying [†]		Sad and hopeless [†]		Suicide attempts [†]	
	High parental monitoring % (95% CI)	Low parental monitoring % (95% CI)	High parental monitoring % (95% CI)	Low parental monitoring % (95% CI)	High parental monitoring % (95% CI)	Low parental monitoring % (95% CI)	High parental monitoring % (95% CI)	Low parental monitoring % (95% CI)
Sex								
Female	11.9 (10.3–13.7)	31.2 (26.5–36.4)	18.7 (17.1–20.5)	34.5 (30.8–38.3)	56.0 (53.2–58.8)	73.6 (68.8–77.9)	11.2 (9.7–12.9)	29.9 (25.2–34.9)
Male	2.6 (2.0–3.3)	8.1 (5.4–11.8)	10.5 (9.3–12.0)	16.8 (14.4–19.5)	26.9 (25.1–28.8)	45.1 (41.2–49.0)	4.5 (3.6–5.8)	13.7 (10.8–17.4)
Race and ethnicity[§]								
American Indian or Alaska Native	20.2 (11.8–32.2)	— [¶]	29.7 (18.4–44.2)	—	43.3 (31.3–56.2)	—	11.8 (6.1–21.6)	—
Asian	3.6 (2.4–5.4)	12.4 (6.2–23.1)	12.1 (9.1–15.9)	19.0 (11.9–28.8)	33.0 (28.6–37.7)	50.1 (24.7–75.4)	5.1 (2.9–8.6)	18.3 (3.5–32.4)
Black or African American	5.8 (4.3–7.8)	10.7 (7.7–14.8)	9.1 (7.5–11.0)	12.8 (9.0–17.8)	41.0 (36.7–45.5)	42.1 (35.3–49.2)	11.2 (8.4–14.9)	21.7 (14.6–31.1)
Native Hawaiian or other Pacific Islander	—	—	—	—	—	—	—	—
White	7.2 (6.3–8.4)	18.6 (13.9–24.4)	17.0 (14.8–19.4)	31.0 (26.2–36.3)	39.4 (37.0–41.9)	59.4 (54.0–64.5)	7.1 (5.9–8.5)	19.0 (13.8–25.5)
Hispanic or Latino	8.3 (6.9–10.0)	18.4 (12.8–25.6)	12.5 (9.2–16.7)	17.1 (13.0–22.2)	46.4 (43.7–49.2)	58.7 (51.3–65.6)	9.5 (7.9–11.3)	20.7 (16.3–25.8)
Multiracial	10.6 (7.9–14.0)	24.0 (15.6–35.2)	14.3 (9.2–21.4)	40.9 (28.0–55.0)	51.4 (46.3–56.4)	66.1 (51.4–78.1)	10.0 (7.4–13.4)	27.1 (14.8–44.4)
Sexual identity								
Heterosexual	4.3 (3.5–5.2)	9.9 (7.6–12.8)	12.1 (10.9–13.3)	17.9 (15.9–20.0)	33.5 (31.3–35.7)	51.6 (46.9–56.4)	4.8 (3.9–5.7)	13.6 (11.2–16.3)
Lesbian, gay, or bisexual	18.9 (16.4–21.7)	38.4 (30.1–47.4)	25.0 (21.4–29.0)	36.1 (28.8–44.1)	70.2 (66.2–73.8)	75.3 (67.1–81.9)	21.2 (17.7–25.1)	38.6 (28.9–49.3)
Questioning or other	13.9 (10.5–18.1)	38.9 (28.7–50.1)	22.4 (18.2–27.2)	54.2 (44.0–64.1)	66.4 (61.5–71.0)	79.8 (67.0–88.4)	13.1 (10.3–16.5)	46.8 (32.1–62.1)
Grade								
9 and 10	6.8 (5.7–8.2)	15.5 (11.5–20.5)	15.9 (14.4–17.5)	24.7 (20.4–29.7)	39.7 (37.4–42.1)	57.7 (51.9–63.3)	9.5 (8.3–10.8)	21.7 (16.8–27.6)
11 and 12	7.7 (6.5–9.2)	18.3 (15.5–21.6)	13.5 (12.1–15.0)	22.9 (19.2–27.1)	43.5 (41.5–45.5)	54.6 (51.2–58.0)	6.6 (5.7–7.6)	18.7 (14.4–23.9)

* N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] Refer to Table 1 for variable definitions.

[§] Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

[¶] Dashes indicate cell data suppressed because the denominator is <30 and therefore considered to be statistically unreliable.

the YRBS measure considers adolescent information sharing, representing student perceptions of parental knowledge. Further research is needed to assess measurement quality and explore the relation between other dimensions of parental monitoring and student health outcomes. Additional research also is needed to explore factors that might affect parental monitoring practices (e.g., neighborhood social cohesion, parent-adolescent relational quality, and cultural values) that might support increased parental monitoring and engagement. Such research is needed for the design of public health interventions and programming. Future work could explore protective qualities of parental monitoring across intersecting student and parent identities (e.g., race and ethnicity and sexual identity) and attributes of interventions to improve parental monitoring and adolescent outcomes.

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, causality between parental monitoring and student behaviors and experiences cannot be inferred by these cross-sectional data. Second, the single-item measure of perceived parental monitoring might not capture the complexity of this construct because parental monitoring knowledge might be gained through a combination of voluntary youth disclosure of information, parental solicitation of information, and parental control strategies such as rule enforcement (17). Finally, although the examples provided are only of opioid-containing prescription medications, the assessment of prescription opioid misuse might be overestimated because the questions refer to prescription pain medication more generally.

TABLE 5. Associations between parental monitoring and selected risk behaviors and experiences among high school students, by demographic characteristics — Youth Risk Behavior Survey, United States, 2021*

Characteristic	Ever had sex [†]	Condom use [†]	Multiple partners [†]	Current prescription opioid misuse [†]	Current marijuana use [†]	Forced sex [†]	Electronic bullying [†]	Sad and hopeless [†]	Suicide attempts [†]
	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)
Sex									
Female	1.04 (0.95–1.15)	0.86 (0.74–1.00) ^{§,¶}	0.73 (0.60–0.90) [§]	1.72 (1.38–2.16) [§]	1.15 (1.05–1.25) [§]	3.26 (2.83–3.76) [§]	1.52 (1.32–1.76) [§]	1.69 (1.54–1.87) [§]	1.58 (1.27–1.97) [§]
Male	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Race and ethnicity**									
American Indian or Alaska Native	0.92 (0.63–1.34)	0.76 (0.39–1.51)	1.75 (0.87–3.50)	1.03 (0.28–3.79)	0.96 (0.56–1.64)	2.34 (1.50–3.65) [§]	1.53 (1.00–2.35) [§]	1.13 (0.89–1.45)	2.22 (1.43–3.44) [§]
Asian	0.41 (0.33–0.50) [§]	1.12 (0.85–1.46)	0.34 (0.21–0.56) [§]	0.86 (0.55–1.33)	0.37 (0.24–0.58) [§]	0.53 (0.41–0.69) [§]	0.66 (0.48–0.93) [§]	0.81 (0.73–0.90) [§]	0.76 (0.46–1.24)
Black or African American	1.22 (1.04–1.43) [§]	0.90 (0.80–1.02)	1.61 (0.99–2.62)	1.66 (1.07–2.58) [§]	1.29 (1.07–1.54) [§]	0.72 (0.56–0.93) [§]	0.48 (0.33–0.58) [§]	0.97 (0.87–1.07)	1.42 (1.05–1.91) [§]
Native Hawaiian or other Pacific Islander	0.69 (0.42–1.14)	0.86 (0.16–4.63)	8.81 (6.60–11.76) [§]	1.88 (0.65–5.49)	0.78 (0.17–8.61)	1.21 (0.49–2.99)	0.48 (0.10–2.33)	0.97 (0.71–1.32)	1.04 (0.39–2.79)
White	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Hispanic or Latino	1.06 (0.93–1.21)	0.89 (0.76–1.05)	1.15 (0.92–1.43)	1.64 (1.24–2.18) [§]	1.10 (0.92–1.30)	1.14 (0.97–1.34)	0.65 (0.49–0.87) [§]	1.13 (1.06–1.21) [§]	1.21 (0.99–1.47)
Multiracial	1.10 (0.91–1.32)	0.78 (0.62–0.97) [§]	1.05 (0.63–1.72)	1.00 (0.64–1.54)	1.29 (0.93–1.78)	1.20 (0.86–1.66)	0.81 (0.57–1.15)	1.17 (1.07–1.29) [§]	1.22 (0.91–1.62)
Sexual identity									
Heterosexual	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Lesbian, gay, or bisexual	1.28 (1.17–1.40) [§]	0.76 (0.64–0.90) [§]	1.47 (1.14–1.90) [§]	2.07 (1.69–2.53) [§]	1.67 (1.45–1.93) [§]	2.82 (2.27–3.49) [§]	1.75 (1.46–2.10) [§]	1.70 (1.56–1.85) [§]	3.22 (2.52–4.12) [§]
Questioning or other	0.82 (0.72–0.94) [§]	0.87 (0.71–1.06)	1.18 (0.78–1.81)	2.17 (1.56–3.02) [§]	1.17 (1.01–1.34) [§]	2.31 (1.79–2.99) [§]	1.71 (1.43–2.05) [§]	1.60 (1.46–1.75) [§]	2.34 (1.94–2.94) [§]
Grade									
9 and 10	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
11 and 12	2.05 (1.88–2.23) [§]	0.83 (0.72–0.96) [§]	2.73 (2.23–3.33) [§]	0.95 (0.74–1.21)	1.73 (1.54–1.94) [§]	1.20 (1.04–1.38) [§]	0.86 (0.78–0.95) [§]	1.07 (1.02–1.13) [§]	0.74 (0.62–0.89) [§]
Parental monitoring									
High	0.54 (0.50–0.57) [§]	1.32 (1.15–1.52) [§]	0.31 (0.27–0.35) [§]	0.37 (0.31–0.45) [§]	0.39 (0.34–0.45) [§]	0.40 (0.31–0.51) [§]	0.58 (0.52–0.64) [§]	0.70 (0.66–0.74) [§]	0.39 (0.32–0.47) [§]
Low	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref

Abbreviations: aPR = adjusted prevalence ratio; Ref = referent group.

* N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] Refer to Table 1 for variable definitions.

[§] Estimates were considered statistically significant if the 95% CIs did not include 1.0.

[¶] The unrounded value of the upper CI is 0.99; p = 0.047.

** Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

Conclusion

Adolescents need support and guidance to promote healthy behavioral decisions and development. The nationally representative findings from the 2021 YRBS provide evidence of the potential effectiveness of parental monitoring in reducing adolescent risk behaviors, negative experiences, and subsequent outcomes. Understanding factors that influence effective parental monitoring and parenting practices that foster supportive relationships and home environments represent important next steps in this area of research.

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 Thoughts and Behaviors Among High School Students — Youth Risk Behavior Survey, United States, 2021

Elizabeth M. Gaylor, MPH¹; Kathleen H. Krause, PhD²; Laura E. Welder, DrPH¹; Adina C. Cooper, PhD²; Carmen Ashley, MPH²; Karin A. Mack, PhD¹; Alexander E. Crosby, MD³; Eva Trinh, PhD¹; Asha Z. Ivey-Stephenson, PhD¹; Lisa Whittle, MPH²

¹Division of Injury Prevention, National Center for Injury Prevention and Control, CDC; ²Division of Adolescent and School Health, National Center for HIV, Viral Hepatitis, STD, and TB Prevention, CDC; ³Department of Community Health & Preventive Medicine, Morehouse School of Medicine, Atlanta, Georgia

Abstract

Suicide is the third leading cause of death among high school-aged youths aged 14–18 years. The 2021 suicide rate for this age group was 9.0 per 100,000 population. Updating a previous analysis of the Youth Risk Behavior Survey during 2009–2019, this report uses 2019 and 2021 data to examine high school students' reports of suicidal thoughts and behaviors. Prevalence estimates are reported by grade, race and ethnicity, sexual identity, and sex of sexual contacts. Unadjusted logistic regression models were used to calculate prevalence differences comparing 2019 to 2021 and prevalence ratios comparing suicidal behavior between subgroups across demographic characteristics to a referent group. From 2019 to 2021, female students had an increased prevalence of seriously considered attempting suicide (from 24.1% to 30%), an increase in making a suicide plan (from 19.9% to 23.6%), and an increase in suicide attempts (from 11.0% to 13.3%). In addition, from 2019 to 2021, Black or African American (Black), Hispanic or Latino (Hispanic), and White female students had an increased prevalence of seriously considered attempting suicide. In 2021, Black female students had an increased prevalence of suicide attempts and Hispanic female students had an increased prevalence of suicide attempts that required medical treatment compared with White female students. Prevalence of suicidal thoughts and behaviors remained stable overall for male students from 2019 to 2021. A comprehensive approach to suicide prevention with a focus on health equity is needed to address these disparities and reduce prevalence of suicidal thoughts and behaviors for all youths. School and community-based strategies include creating safe and supportive environments, promoting connectedness, teaching coping and problem solving, and gatekeeper training.

Introduction

Suicide presents a major challenge to public health in the United States and globally (1). In 2021, a total of 48,183 persons (all ages) died from suicide; suicide was the 11th leading cause of death overall in the United States, accounting for approximately 1.4% of all deaths (2). Although suicide and suicidal behaviors are a public health concern across the life span, youths aged 14–18 years present unique prevention challenges. Among high school-age youths aged 14–18 years, 1,952 suicides occurred in 2021, making suicide the third leading cause of death for this age group (2021 rate = 9.0 per 100,000 population). Suicide accounted for approximately one fifth of deaths (18.6%) among this age group (2). Deaths are only a portion of the burden of suicidal behavior; suicide attempts and suicidal thoughts among youths exceed deaths among this group. In 2020, according to data from a nationally representative sample of emergency departments (EDs), approximately 105,000 youths aged 14–18 years visited EDs for self-harm injuries (3).

One of the main objectives of *Healthy People 2030* Mental Health and Mental Disorders is to reduce suicide attempts by youths (4). The Youth Risk Behavior Survey (YRBS) monitors six categories of priority health behaviors and experiences among high school students with four questions related to suicide (5). This report summarizes 2021 YRBS data regarding suicidal thoughts and behaviors among high school students and compares results with 2019; this report also updates a previous analysis of the YRBS examining 2009–2019 data (6). The findings of this report indicate the need for a comprehensive public health approach to youth suicide prevention with attention to disproportionately affected populations.

Methods

Data Source

This report includes data from the 2019 (N=13,667) and 2021 (N = 17,232) 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

Corresponding author: Karin A. Mack, PhD, Division of Injury Prevention, National Center for Injury Prevention and Control, CDC. Telephone: 770-488-4389; Email: kmack@cdc.gov.

information about YRBS sampling, data collection, response rates, and processing is available in the overview report of this supplement (5). The prevalence estimates for suicidal thoughts and behaviors for the overall study population and by sex, race and ethnicity, grade, and sexual identity are available at <https://nccd.cdc.gov/youthonline/App/Default.aspx>. The full YRBS questionnaire, data sets, and documentation are available at <https://www.cdc.gov/healthyyouth/data/yrbs/index.htm>. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.*

Measures

Four questions about suicidal thoughts and behavior are the focus of this report. The first asked, “During the past 12 months, did you ever seriously consider attempting suicide?”; the second, “During the past 12 months, did you make a plan about how you would attempt suicide?”; the third, “During the past 12 months, how many times did you actually attempt suicide?”; and the fourth, “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 questions had response options of yes or no except for the question about how many times a student attempted suicide, which was recoded to reflect whether a student had attempted suicide: yes (1 time, 2 or 3 times, 4 or 5 times, or 6 or more times) versus no (0 times). The question about needing medical treatment for a suicide attempt had an additional response option of “I did not attempt suicide during the past 12 months,” which was recoded to no.

Demographic variables included sex, measured as female or male and grade, measured as 9, 10, 11, or 12. Race and ethnicity was coded as a composite of two questions. First, students were asked, “Are you Hispanic or Latino?” This question measured as yes versus no; regardless of how students responded to the race question, those who answered yes were coded as Hispanic or Latino (Hispanic). Second, students were asked, “What is your race? Check all that apply” and coded as American Indian or Alaska Native (AI/AN), Asian, Black or African American (Black), Hispanic, Native Hawaiian or other Pacific Islander (NH/OPI), and White. Students who selected more than one race were coded as multiracial. (Persons of Hispanic origin might be of any race but were categorized as Hispanic; all racial groups were non-Hispanic.) Sexual orientation was measured by sexual identity and sex of sexual contacts. Sexual identity, measured as heterosexual; lesbian, gay, bisexual, questioning, or other (LGBQ+), had new response options in 2021 and was not comparable to the sexual identity

measure from 2019. Sex of sexual contacts (“During your life, with whom have you had sexual contact?”) was measured as: “I have never had sexual contact,” “females,” “males,” or “females and males.” Responses were compared with the student’s sex to create the following categories: no sexual contact, opposite sex only (e.g., female students who have only ever had sexual contact with males), same sex only, or both sexes (e.g., female students who reported contact with females only or females and males).

Analysis

Prevalence estimates and 95% CIs were calculated for each of the four suicidal measures, stratified by sex (historically, female youths are more likely to have suicidal thoughts and attempts, whereas male youths are more likely to die by suicide) (6), for the years 2019 and 2021. Sex-stratified prevalence estimates were further stratified by race and ethnicity, grade, sexual identity, and sex of sexual contacts. Using unadjusted logistic regression models with a statement to generate predicted marginal proportions, prevalence difference (PD) and prevalence ratios (PRs) were calculated to detect a difference in prevalence of a suicidal behavior for 2019 as compared with 2021 within a stratum (e.g., AI/AN female students). Using 2021 data only, PR were calculated to detect a difference in the prevalence of a suicidal behavior between subgroups across a demographic characteristic as compared with a referent group. A p value of <0.05 and 95% CI that did not cross the null value of 1.0 were used to determine statistical significance. The absolute value of the prevalence difference is presented. Prevalence estimates with a denominator <30 were considered statistically unreliable and therefore were suppressed (5). All analyses were conducted using SUDAAN (version 11.0.3; RTI International).

Results

Seriously Considered Attempting Suicide

Approximately one third (30.0%) of female students in 2021 reported that they had seriously considered attempting suicide during the 12 months before the survey, a substantial increase compared with 2019 (24.1%) (Table 1). The percentage of male students reporting that they had seriously considered attempting suicide were similar during the study period (2019 = 13.3%; 2021 = 14.3%). Increases in seriously considered attempting suicide differed by race, grade, and sex of sexual contacts among female students. For example, the prevalence significantly increased among Black (PD = 6.8%; PR = 1.29), Hispanic (PD = 6.0%; PR = 1.27), and White

*45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

TABLE 1. Prevalence of seriously considered attempting suicide, prevalence difference, prevalence ratio comparing 2019 with 2021, and 2021 prevalence ratio by demographic characteristics — Youth Risk Behavior Survey, United States, 2019 and 2021

Characteristic	2019* % (95% CI)	2021* % (95% CI)	From 2019 to 2021 PD†	From 2019 to 2021 PR (95% CI)	2021 PR (95% CI)
Female					
Total	24.1 (22.3–26.0)	30.0 (28.5–31.4)	5.9[§]	1.24 (1.14–1.36)[¶]	N/A
Race and ethnicity**					
American Indian or Alaska Native	36.6 (20.7–56.1)	36.8 (25.3–50.0)	0.2	1.01 (0.55–1.83)	1.17 (0.81–1.70)
Asian	22.0 (16.9–28.1)	24.2 (19.8–29.1)	2.2	1.10 (0.80–1.51)	0.77 (0.63–0.94) [¶]
Black or African American	23.7 (20.7–27.1)	30.5 (25.6–36.0)	6.8 [§]	1.29 (1.04–1.59) [¶]	0.97 (0.79–1.20)
Native Hawaiian or other Pacific Islander	— ^{††}	25.3 (7.6–58.3)	—	—	0.80 (0.28–2.31)
White	24.3 (21.9–26.9)	31.4 (29.2–33.7)	7.1 [§]	1.29 (1.14–1.46) [¶]	Ref
Hispanic or Latino	22.7 (19.3–26.5)	28.7 (26.8–30.8)	6.0 [§]	1.27 (1.07–1.50) [¶]	0.92 (0.83–1.01)
Multiracial	33.1 (27.8–38.7)	28.5 (22.7–35.2)	4.6	0.86 (0.66–1.13)	0.91 (0.71–1.16)
Grade					
9	23.7 (20.7–27.0)	30.7 (27.4–34.3)	7.0 [§]	1.30 (1.09–1.54) [¶]	1.20 (1.05–1.37) [¶]
10	23.6 (20.3–27.3)	33.6 (30.7–36.7)	10.0 [§]	1.42 (1.20–1.69) [¶]	1.31 (1.16–1.48) [¶]
11	24.9 (22.5–27.6)	29.7 (26.8–32.8)	4.8 [§]	1.19 (1.04–1.37) [¶]	1.16 (1.04–1.30) [¶]
12	24.0 (20.7–27.6)	25.6 (23.8–27.4)	1.6	1.07 (0.91–1.25)	Ref
Sexual identity					
Heterosexual	N/A	19.9 (18.5–21.5)	N/A	N/A	Ref
Lesbian or gay	N/A	41.0 (31.8–50.9)	N/A	N/A	2.06 (1.59–2.66) [¶]
Bisexual	N/A	51.9 (47.6–56.1)	N/A	N/A	2.60 (2.32–2.91) [¶]
Questioning	N/A	36.0 (30.4–41.9)	N/A	N/A	1.80 (1.51–2.15) [¶]
Other	N/A	47.9 (43.6–52.1)	N/A	N/A	2.40 (2.18–2.64) [¶]
Sex of sexual contacts					
Opposite sex only	25.3 (22.8–28.0)	35.3 (32.4–38.3)	10.0 [§]	1.40 (1.23–1.59) [¶]	1.68 (1.52–1.85) [¶]
Same sex only or both sexes	59.2 (52.5–65.6)	58.4 (53.0–63.7)	0.8	0.99 (0.86–1.14)	2.78 (2.51–3.08) [¶]
No sexual contact	16.1 (14.2–18.3)	21.0 (19.8–22.4)	4.9 [§]	1.30 (1.13–1.50) [¶]	Ref
Male					
Total	13.3 (12.2–14.5)	14.3 (13.3–15.4)	1.0	1.08 (0.96–1.20)	N/A
Race and ethnicity**					
American Indian or Alaska Native	32.8 (17.9–52.2)	19.1 (9.7–34.0)	13.7	0.58 (0.26–1.32)	1.32 (0.71–2.44)
Asian	17.3 (12.6–23.3)	11.8 (8.9–15.4)	5.5	0.68 (0.46–1.02)	0.81 (0.61–1.09)
Black or African American	10.7 (8.2–13.7)	13.0 (10.4–16.0)	2.3	1.22 (0.88–1.69)	0.89 (0.71–1.12)
Native Hawaiian or other Pacific Islander	7.7 (1.8–28.1)	18.7 (8.3–36.9)	11.0	2.42 (0.50–11.77)	1.29 (0.60–2.78)
White	13.8 (12.3–15.3)	14.5 (13.1–16.0)	0.8	1.05 (0.91–1.22)	Ref
Hispanic or Latino	11.4 (9.8–13.3)	14.2 (12.1–16.6)	2.8 [§]	1.24 (1.00–1.54) [¶]	0.98 (0.82–1.17)
Multiracial	17.5 (12.4–24.1)	18.1 (14.5–22.4)	0.6	1.04 (0.70–1.53)	1.25 (0.99–1.58)
Grade					
9	11.9 (9.9–14.2)	11.9 (9.8–14.5)	0.0	1.00 (0.77–1.30)	0.72 (0.58–0.90) [¶]
10	13.2 (11.1–15.8)	12.7 (11.2–14.4)	0.5	0.96 (0.77–1.19)	0.77 (0.64–0.93) [¶]
11	13.6 (11.5–16.0)	16.8 (15.0–18.7)	3.2 [§]	1.23 (1.02–1.50) [¶]	1.02 (0.84–1.24)
12	14.9 (12.4–17.7)	16.5 (14.2–19.0)	1.6	1.11 (0.88–1.39)	Ref
Sexual identity					
Heterosexual	N/A	11.6 (10.6–12.8)	N/A	N/A	Ref
Lesbian or gay	N/A	35.5 (27.7–44.1)	N/A	N/A	3.05 (2.44–3.82) [¶]
Bisexual	N/A	40.2 (31.9–49.1)	N/A	N/A	3.45 (2.81–4.25) [¶]
Questioning	N/A	28.0 (21.1–36.1)	N/A	N/A	2.40 (1.79–3.24) [¶]
Other	N/A	45.8 (29.1–63.5)	N/A	N/A	3.93 (2.58–5.99) [¶]
Sex of sexual contacts					
Opposite sex only	14.6 (12.9–16.5)	18.6 (16.7–20.5)	4.0 [§]	1.27 (1.08–1.49) [¶]	2.13 (1.79–2.54) [¶]
Same sex only or both sexes	39.1 (29.3–49.9)	57.3 (49.5–64.8)	18.2 [§]	1.47 (1.09–1.97) [¶]	6.58 (5.46–7.94) [¶]
No sexual contact	9.7 (8.1–11.7)	8.7 (7.6–10.0)	1.0	0.89 (0.71–1.12)	Ref

Abbreviations: N/A = not applicable; PD = prevalence difference; PR = prevalence ratio; Ref = referent group.

* 2019: N = 13,677 respondents; 2021: N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

† Absolute value presented.

§ On the basis of *t*-test with Taylor series linearization ($p < 0.05$).

¶ 95% CI did not cross the null value of 1.0.

** Persons of Hispanic origin might be of any race but were categorized as Hispanic; all racial groups were non-Hispanic.

†† Prevalence estimates with a denominator < 30 were considered statistically unreliable and therefore were suppressed.

(PD = 7.1%; PR = 1.29) female students. Among male students, although the overall prevalence were similar, increases were observed among Hispanic (PD = 2.8%; PR = 1.24), 11th-grade (PD = 3.2%; PR = 1.23), opposite sex only sexual contacts (PD = 4.0%; PR = 1.27), and same sex or both sex sexual contacts (PD = 18.2%; PR = 1.47).

In 2021, Asian female students had a lower prevalence of seriously considered attempting suicide compared with White female students (PR = 0.77). The prevalence of female students in 9th-, 10th-, and 11th-grade who seriously considered attempting suicide was significantly greater (PR = 1.20, 1.31, and 1.16, respectively) than female students in 12th-grade. In addition, prevalence was significantly higher among LGBTQ+ female students (PR = 2.06 lesbian or gay; 2.60 bisexual; 1.80 questioning; 2.40 other) compared with heterosexual students. Among males in 2021, students in 9th- and 10th-grade were less likely (PR = 0.72 and 0.77, respectively) than students in 12th-grade to report seriously considered attempting suicide. Similar to female students, prevalence was significantly higher among LGBTQ+ male students (PR = 3.05 gay; 3.45 bisexual; 2.40 questioning; 3.93 other) compared with heterosexual students.

Made a Suicide Plan

Approximately one fourth (23.6%) of female students in 2021 reported making a suicide plan during the 12 months before the survey, a significant increase over 2019 (19.9%) (Table 2). The percentage of male students reporting making a suicide plan was stable during the study period (2019 = 11.3%; 2021 = 11.6%). Significant increases in prevalence between 2019 and 2021 of reporting having made a suicide plan were observed among Hispanic (PD = 5.2%; PR = 1.26), White (PD = 3.7%; PR = 1.19), in 9th-grade (PD = 4.7%; PR = 1.23), and 10th-grade (PD = 6.6%; PR = 1.33) female students as well as female students who had sex only with opposite sex partners (PD = 7.2%; PR = 1.35). NH/OPI male students (PD = 12.8%), male students who had sexual contact with opposite sex partners only (PD = 3.2%; PR = 1.25), and those who had sexual contact with same sex or both sex partners (PD = 15.5%; PR = 1.50) reported significant increases in the prevalence of having made a suicide plan from 2019 to 2021.

In 2021, female students in 9th and 10th grade were significantly more likely (PR = 1.28 and 1.37, respectively) than 12th-grade students to report having made a suicide plan. Female students reporting opposite sex only sexual contacts (PR = 1.81) and those with same sex or both sex partners were more likely (PR = 3.33) than those with no sexual contact to report having made a suicide plan. In 2021, NH/OPI male students (PR = 1.62) were significantly more likely than White male students to have made a suicide plan.

Additionally, male students reporting opposite sex only sexual contacts (PR = 2.38) and those with same sex or both sex partners were more likely (PR = 6.89) than those with no sexual contact to report having made a suicide plan. Prevalence of having made a suicide plan was significantly higher among LGBTQ+ students (females: PR = 2.06 lesbian or gay; 2.87 bisexual; 1.91 questioning; 2.44 other; males: PR = 3.59 gay; 3.23 bisexual; 2.58 questioning; 4.00 other) compared with heterosexual students.

Attempted Suicide

Reports of suicide attempts during the 12 months before the survey significantly increased among female students (PD = 2.3%; PR = 1.21) and was unchanged among male students from 2019 to 2021 (Table 3). The prevalence of reported attempted suicide was 13.3% among females in 2021 and 6.6% among males. Increases in reports of suicide attempts occurred among White (PD = 3.0%; PR = 1.32), 10th-grade (PD = 4.6%; PR = 1.41) female students, as well as among female students with opposite sex only sexual contacts (PD = 4.7%; PR = 1.41). In 2021, Black female students were more likely (PR = 1.43) than White female students to report having attempted suicide, as well as 9th- and 10th-grade (PR = 1.54 and 1.52 respectively) female students compared with 12th-grade and LGBTQ+ students (PR = 1.86 lesbian or gay; 3.26 bisexual; 1.53 questioning; 2.47 other) compared with heterosexual students. Also in 2021, female students reporting opposite sex only sexual contacts (PR = 2.50) and those with same sex only or both sex partners (PR = 5.19) were more likely than those with no sexual contact to report having attempted suicide. In 2021, AI/AN and Black male students reports of attempted suicide were significantly higher (PR = 2.37, 2.05 respectively) than White male students. Among males in 2021, LGBTQ+ students (PR = 3.93 gay; 3.44, bisexual; 2.81 questioning; 6.60 other) were more likely to have reported attempting suicide compared with heterosexual students, and male students reporting opposite sex only sexual contacts (PR = 2.96) and those with same sex only or both sex partners were more likely (PR = 10.72) than those with no sexual contact to report having attempted suicide.

Attempted Suicide that Required Medical Treatment

The prevalence of attempted suicide that required medical treatment was relatively stable between 2019 and 2021 for female (2019 = 3.3%; 2021 = 3.9%) and male (2019 = 1.7%; 2021 = 1.7%) students overall and by student characteristics (Table 4). In 2021, female Hispanic students were more likely

TABLE 2. Prevalence of made a suicide plan, prevalence difference and prevalence ratio comparing 2019 with 2021, and 2021 prevalence ratio by demographic characteristics — Youth Risk Behavior Survey, United States, 2019 and 2021

Characteristic	2019* % (95% CI)	2021* % (95% CI)	From 2019 to 2021 PD [†]	From 2019 to 2021 PR (95% CI)	2021 PR (95% CI)
Female					
Total	19.9 (18.4–21.6)	23.6 (22.1–25.1)	3.7[§]	1.18 (1.07–1.31)[¶]	N/A
Race and ethnicity**					
American Indian or Alaska Native	29.8 (17.4–46.1)	27.0 (16.4–41.1)	2.7	0.91 (0.47–1.77)	1.18 (0.72–1.94)
Asian	19.2 (15.2–24.0)	22.9 (19.5–26.6)	3.6	1.19 (0.91–1.56)	1.00 (0.82–1.21)
Black or African American	20.4 (17.6–23.5)	24.3 (20.7–28.2)	3.9	1.19 (0.97–1.47)	1.06 (0.88–1.28)
Native Hawaiian or other Pacific Islander	— ^{††}	23.3 (8.9–48.5)	—	—	1.02 (0.42–2.43)
White	19.2 (16.9–21.8)	22.9 (20.7–25.3)	3.7 [§]	1.19 (1.02–1.40) [¶]	Ref
Hispanic or Latino	19.6 (16.9–22.6)	24.8(22.6–27.0)	5.2 [§]	1.26 (1.07–1.49) [¶]	1.08 (0.95–1.23)
Multiracial	28.2 (23.4–33.6)	24.4 (19.3–30.5)	3.8	0.87 (0.65–1.15)	1.07 (0.82–1.38)
Grade					
9	20.4 (17.9–23.2)	25.1 (22.3–28.3)	4.7 [§]	1.23 (1.03–1.46) [¶]	1.28 (1.11–1.48) [¶]
10	20.3 (17.2–23.7)	26.9 (24.8–29.1)	6.6 [§]	1.33 (1.11–1.58) [¶]	1.37 (1.24–1.52) [¶]
11	20.4 (17.6–23.5)	22.4 (19.2–26.0)	2.0	1.10 (0.89–1.35)	1.14 (0.94–1.38)
12	18.5 (15.7–21.6)	19.6 (17.9–21.4)	1.1	1.06 (0.89–1.27)	Ref
Sexual identity					
Heterosexual	N/A	15.1 (13.7–16.6)	N/A	N/A	Ref
Lesbian or gay	N/A	31.1 (22.1–41.8)	N/A	N/A	2.06 (1.47–2.88) [¶]
Bisexual	N/A	43.2 (39.1–47.5)	N/A	N/A	2.87 (2.53–3.24) [¶]
Questioning	N/A	28.8 (23.9–34.3)	N/A	N/A	1.91 (1.57–2.32) [¶]
Other	N/A	36.8 (32.3–41.4)	N/A	N/A	2.44 (2.13–2.79) [¶]
Sex of sexual contacts					
Opposite sex only	20.7 (18.4–23.3)	27.9 (25.4–30.7)	7.2 [§]	1.35 (1.16–1.57) [¶]	1.81 (1.54–2.13) [¶]
Same sex only or both sexes	48.2 (42.8–53.6)	51.3 (46.3–56.2)	3.1	1.06 (0.92–1.23)	3.33 (2.84–3.90) [¶]
No sexual contact	13.8 (12.3–15.6)	15.4 (13.8–17.2)	1.6	1.11 (0.95–1.31)	Ref
Male					
Total	11.3 (10.3–12.4)	11.6 (10.5–12.8)	0.3	1.03 (0.90–1.17)	N/A
Race and ethnicity**					
American Indian or Alaska Native	19.4 (7.6–41.4)	17.1 (8.0–32.8)	2.3	0.88 (0.29–2.66)	1.53 (0.78–2.99)
Asian	13.0 (8.7–19.2)	10.3 (6.5–15.8)	2.8	0.79 (0.44–1.41)	0.91 (0.56–1.50)
Black or African American	10.1 (7.3–13.9)	11.3 (8.7–14.5)	1.2	1.12 (0.75–1.68)	1.01 (0.75–1.35)
Native Hawaiian or other Pacific Islander	5.3 (1.1–22.5)	18.1 (11.8–26.8)	12.8 [§]	3.41 (0.70–16.58)	1.62 (1.04–2.50) [¶]
White	12.0 (10.6–13.5)	11.2 (9.8–12.8)	0.8	0.94 (0.78–1.12)	Ref
Hispanic or Latino	9.6 (8.0–11.4)	11.9 (9.9–14.3)	2.3	1.25 (0.97–1.60)	1.06 (0.86–1.30)
Multiracial	15.8 (11.5–21.1)	15.0 (10.9–20.4)	0.7	0.95 (0.62–1.47)	1.34 (0.93–1.93)
Grade					
9	9.5 (7.9–11.4)	11.4 (9.3–14.0)	1.9	1.20 (0.91–1.58)	0.98 (0.81–1.18)
10	10.4 (8.6–12.4)	9.8 (8.0–12.0)	0.5	0.95 (0.73–1.24)	0.84 (0.63–1.13)
11	12.1 (10.3–14.2)	13.7 (12.1–15.5)	1.6	1.13 (0.93–1.38)	1.17 (0.95–1.45)
12	13.6 (11.4–16.1)	11.7 (9.9–13.8)	1.9	0.86 (0.68–1.09)	Ref
Sexual identity					
Heterosexual	N/A	9.5 (8.5–10.6)	N/A	N/A	Ref
Lesbian or gay	N/A	34.1 (24.9–44.6)	N/A	N/A	3.59 (2.69–4.80) [¶]
Bisexual	N/A	30.6 (23.7–38.6)	N/A	N/A	3.23 (2.50–4.16) [¶]
Questioning	N/A	24.5 (17.4–33.4)	N/A	N/A	2.58 (1.84–3.63) [¶]
Other	N/A	37.9 (23.8–54.3)	N/A	N/A	4.00 (2.60–6.15) [¶]
Sex of sexual contacts					
Opposite sex only	12.9 (11.5–14.6)	16.2 (14.4–18.1)	3.2 [§]	1.25 (1.06–1.47) [¶]	2.38 (1.81–3.13) [¶]
Same sex only or both sexes	31.2 (23.8–39.7)	46.7 (37.6–56.1)	15.5 [§]	1.50 (1.09–2.07) [¶]	6.89 (5.04–9.43) [¶]
No sexual contact	7.9 (6.7–9.4)	6.8 (5.4–8.5)	1.1	0.86 (0.64–1.14)	Ref

Abbreviations: N/A = not applicable; PD = prevalence difference; PR = prevalence ratio; Ref = referent group.

* 2019: N = 13,677 respondents; 2021: N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] Absolute value presented.

[§] On the basis of *t*-test with Taylor series linearization (*p*<0.05).

[¶] 95% CI did not cross the null value of 1.0.

** Persons of Hispanic origin might be of any race but were categorized as Hispanic; all racial groups were non-Hispanic.

^{††} Prevalence estimates with a denominator <30 were considered statistically unreliable and therefore were suppressed.

TABLE 3. Prevalence of attempted suicide, prevalence difference and prevalence ratio comparing 2019 with 2021, and prevalence ratio by demographic characteristics in 2021 — Youth Risk Behavior Survey, United States, 2019 and 2021

Characteristic	2019* % (95% CI)	2021* % (95% CI)	From 2019 to 2021 PD [†]	From 2019 to 2021 PR (95% CI)	2021 PR (95% CI)
Female					
Total	11.0 (9.7–12.5)	13.3 (12.0–14.7)	2.3[§]	1.21 (1.03–1.41)[¶]	N/A
Race and ethnicity**					
American Indian or Alaska Native	13.4 (5.3–30.1)	19.4 (11.3–31.3)	6.0	1.44 (0.53–3.94)	1.56 (0.87–2.79)
Asian	8.4 (4.8–14.2)	8.3 (4.9–13.8)	0.1	0.99 (0.47–2.07)	0.67 (0.37–1.19)
Black or African American	15.2 (10.8–20.9)	17.8 (14.1–22.3)	2.7	1.17 (0.79–1.74)	1.43 (1.10–1.86) [¶]
Native Hawaiian or other Pacific Islander	— ^{††}	14.4 (6.4–29.3)	—	—	1.16 (0.54–2.50)
White	9.4 (7.8–11.3)	12.4 (10.7–14.5)	3.0 [§]	1.32 (1.04–1.67) [¶]	Ref
Hispanic or Latino	11.9 (9.0–15.6)	13.8 (12.0–15.9)	1.9	1.16 (0.85–1.57)	1.11 (0.90–1.37)
Multiracial	17.8 (13.1–23.7)	13.9 (10.6–18.0)	3.9	0.78 (0.53–1.16)	1.12 (0.80–1.56)
Grade					
9	12.8 (10.7–15.3)	15.8 (13.8–18.0)	3.0	1.23 (0.99–1.54)	1.54 (1.27–1.87) [¶]
10	11.0 (9.1–13.3)	15.6 (13.3–18.2)	4.6 [§]	1.41 (1.11–1.81) [¶]	1.52 (1.21–1.91) [¶]
11	10.4 (8.1–13.3)	11.2 (8.8–14.1)	0.7	1.07 (0.76–1.50)	1.09 (0.86–1.38)
12	9.4 (6.9–12.6)	10.3 (8.7–12.1)	0.9	1.09 (0.78–1.53)	Ref
Sexual identity					
Heterosexual	N/A	8.1 (7.3–9.1)	N/A	N/A	Ref
Lesbian or gay	N/A	15.2 (10.2–21.9)	N/A	N/A	1.86 (1.27–2.73) [¶]
Bisexual	N/A	26.5 (23.2–30.2)	N/A	N/A	3.26 (2.73–3.89) [¶]
Questioning	N/A	12.5 (9.6–16.0)	N/A	N/A	1.53 (1.22–1.92) [¶]
Other	N/A	20.1 (15.9–25.1)	N/A	N/A	2.47 (1.95–3.12) [¶]
Sex of sexual contacts					
Opposite sex only	11.4 (9.5–13.5)	16.1 (14.1–18.4)	4.7 [§]	1.41 (1.14–1.76) [¶]	2.50 (2.02–3.09) [¶]
Same sex only or both sexes	31.4 (27.0–36.1)	33.5 (29.3–38.0)	2.1	1.07 (0.88–1.29)	5.19 (4.16–6.48) [¶]
No sexual contact	6.1 (4.8–7.8)	6.4 (5.4–7.6)	0.3	1.06 (0.79–1.42)	Ref
Male					
Total	6.6 (5.5–8.1)	6.6 (5.8–7.5)	0.0	1.00 (0.79–1.25)	N/A
Race and ethnicity**					
American Indian or Alaska Native	34.3 (16.5–57.9)	13.0 (6.6–23.8)	21.3	0.38 (0.16–0.92) [¶]	2.37 (1.22–4.61) [¶]
Asian	7.1 (3.6–13.7)	4.7 (2.3–9.4)	2.4	0.66 (0.25–1.73)	0.86 (0.45–1.64)
Black or African American	8.5 (5.6–12.9)	11.2 (8.4–14.7)	2.7	1.31 (0.80–2.16)	2.05 (1.43–2.95) [¶]
Native Hawaiian or other Pacific Islander	—	6.1 (1.2–26.5)	—	—	1.11 (0.24–5.21)
White	6.4 (5.1–7.8)	5.5 (4.5–6.7)	0.9	0.86 (0.64–1.15)	Ref
Hispanic or Latino	5.5 (3.9–7.6)	6.5 (4.3–9.8)	1.1	1.20 (0.71–2.01)	1.20 (0.74–1.93)
Multiracial	7.3 (3.4–15.1)	8.1 (5.4–12.0)	0.8	1.11 (0.48–2.57)	1.48 (0.92–2.38)
Grade					
9	6.0 (4.5–7.9)	6.9 (5.4–8.8)	1.0	1.17 (0.81–1.68)	1.01 (0.79–1.31)
10	6.5 (4.7–9.0)	6.2 (5.0–7.6)	0.3	0.95 (0.64–1.39)	0.90 (0.76–1.08)
11	6.7 (5.2–8.8)	6.2 (4.6–8.3)	0.5	0.92 (0.62–1.36)	0.91 (0.64–1.28)
12	7.3 (5.2–10.0)	6.9 (5.8–8.0)	0.4	0.94 (0.66–1.35)	Ref
Sexual identity					
Heterosexual	N/A	5.0 (4.1–6.0)	N/A	N/A	Ref
Lesbian or gay	N/A	19.6 (12.5–29.3)	N/A	N/A	3.93 (2.58–5.99) [¶]
Bisexual	N/A	17.2 (12.2–23.6)	N/A	N/A	3.44 (2.32–5.11) [¶]
Questioning	N/A	14.0 (7.8–23.8)	N/A	N/A	2.81 (1.48–5.35) [¶]
Other	N/A	32.9 (20.7–47.9)	N/A	N/A	6.60 (3.94–11.05) [§]
Sex of sexual contacts					
Opposite sex only	7.5 (5.8–9.6)	8.5 (7.2–10.0)	1.0	1.14 (0.84–1.53)	2.96 (2.27–3.86) [¶]
Same sex only or both sexes	26.5 (17.5–38.0)	30.8 (21.0–42.7)	4.3	1.16 (0.69–1.95)	10.72 (6.88–16.71) [¶]
No sexual contact	3.5 (2.6–4.8)	2.9 (2.2–3.7)	0.7	0.81 (0.55–1.19)	Ref

Abbreviations: N/A = not applicable; PD = prevalence difference; PR = prevalence ratio; Ref = referent group.

* 2019: N = 13,677 respondents; 2021: N=17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

† Absolute value presented.

§ On the basis of t-test with Taylor series linearization ($p < 0.05$).

¶ 95% CI did not cross the null value of 1.0.

** Persons of Hispanic origin might be of any race but were categorized as Hispanic; all racial groups were non-Hispanic.

†† Prevalence estimates with a denominator < 30 were considered statistically unreliable and therefore were suppressed.

TABLE 4. Prevalence of attempted suicide that required medical treatment, prevalence difference and prevalence ratio comparing 2019 with 2021, and prevalence ratio by demographic characteristics in 2021 — Youth Risk Behavior Survey, United States, 2019 and 2021

Characteristic	2019* % (95% CI)	2021* % (95% CI)	From 2019 to 2021 PD [†]	From 2019 to 2021 PR (95% CI)	2021 PR (95% CI)
Female					
Total	3.3 (2.6–4.2)	3.9 (3.1–4.8)	0.5	1.16 (0.84–1.60)	N/A
Race and ethnicity[§]					
American Indian or Alaska Native	— [¶]	1.0 (0.1–7.2)	—	—	—
Asian	1.9 (0.6–5.8)	2.2 (0.9–5.2)	0.3	1.13 (0.28–4.64)	0.61 (0.22–1.72)
Black or African American	3.8 (2.3–6.2)	5.5 (3.5–8.7)	1.7	1.46 (0.75–2.82)	1.56 (1.00–2.42)
Native Hawaiian or other Pacific Islander	—	1.3 (0.2–6.7)	—	—	—
White	2.9 (1.9–4.4)	3.5 (2.8–4.5)	0.6	1.22 (0.76–1.96)	Ref
Hispanic or Latino	3.6 (2.6–4.9)	4.7 (3.6–6.0)	1.1	1.30 (0.87–1.95)	1.31 (1.01–1.72)**
Multiracial	6.7 (3.2–13.2)	3.0 (1.5–5.9)	3.7	0.45 (0.17–1.19)	0.84 (0.48–1.48)
Grade					
9	3.3 (2.3–4.8)	4.8 (3.8–6.0)	1.5	1.44 (0.93–2.23)	1.51 (1.01–2.27)**
10	3.6 (2.3–5.5)	4.1 (2.9–5.8)	0.5	1.14 (0.66–1.96)	1.29 (0.88–1.90)
11	2.7 (1.7–4.3)	3.3 (2.4–4.6)	0.6	1.24 (0.70–2.17)	1.05 (0.67–1.64)
12	3.4 (2.2–5.3)	3.2 (2.1–4.8)	0.2	0.94 (0.51–1.72)	Ref
Sexual identity					
Heterosexual	N/A	2.1 (1.5–2.9)	N/A	N/A	Ref
Lesbian or gay	N/A	3.0 (1.4–6.3)	N/A	N/A	1.45 (0.63–3.31)
Bisexual	N/A	8.8 (6.3–12.1)	N/A	N/A	4.23 (2.89–6.17)**
Questioning	N/A	3.4 (1.9–6.0)	N/A	N/A	1.63 (0.88–3.02)
Other	N/A	6.3 (3.7–10.5)	N/A	N/A	3.04 (1.51–6.09)**
Sex of sexual contacts					
Opposite sex only	3.4 (2.4–4.8)	4.9 (3.7–6.4)	1.5	1.43 (0.92–2.23)	5.08 (2.99–8.63)**
Same sex only or both sexes	10.4 (7.5–14.2)	13.7 (10.8–17.3)	3.4	1.32 (0.89–1.96)	14.36 (9.00–22.91)**
No sexual contact	1.4 (0.8–2.4)	1.0 (0.6–1.6)	0.4	0.68 (0.33–1.41)	Ref
Male					
Total	1.7 (1.3–2.3)	1.7 (1.4–2.0)	0.1	0.97 (0.70–1.34)	N/A
Race and ethnicity[§]					
American Indian or Alaska Native	16.0 (4.7–42.4)	—	—	—	—
Asian	1.4 (0.2–10.2)	1.1 (0.3–3.4)	0.3	0.76 (0.08–7.71)	0.87 (0.21–3.59)
Black or African American	2.9 (1.5–5.5)	3.3 (1.9–5.6)	0.4	1.14 (0.49–2.66)	2.64 (1.37–5.10)**
Native Hawaiian or other Pacific Islander	—	5.5 (0.9–27.8)	—	—	—
White	1.2 (0.8–1.9)	1.2 (0.9–1.8)	0.0	1.01 (0.57–1.77)	Ref
Hispanic or Latino	2.3 (1.4–3.9)	2.0 (1.5–2.7)	0.3	0.86 (0.48–1.54)	1.61 (1.02–2.55)**
Multiracial	0.9 (0.2–3.8)	3.1 (1.3–7.0)	2.2	3.32 (0.66–16.65)	2.50 (0.91–6.83)
Grade					
9	1.3 (0.7–2.3)	1.1 (0.6–2.4)	0.1	0.91 (0.36–2.30)	0.78 (0.35–1.71)
10	1.7 (0.9–3.3)	1.8 (0.9–3.4)	0.1	1.06 (0.43–2.61)	1.22 (0.47–3.20)
11	2.0 (1.2–3.2)	2.3 (1.4–3.7)	0.3	1.16 (0.60–2.26)	1.55 (0.77–3.12)
12	1.9 (1.0–3.9)	1.5 (0.9–2.3)	0.5	0.77 (0.34–1.74)	Ref
Sexual identity					
Heterosexual	N/A	0.9 (0.7–1.2)	N/A	N/A	Ref
Lesbian or gay	N/A	7.4 (3.2–16.1)	N/A	N/A	7.93 (3.75–16.77)**
Bisexual	N/A	6.8 (2.8–15.3)	N/A	N/A	7.23 (2.94–17.76)**
Questioning	N/A	6.6 (2.1–18.7)	N/A	N/A	7.06 (2.06–24.22)**
Other	N/A	13.4 (4.9–31.9)	N/A	N/A	14.31 (4.94–41.51)**
Sex of sexual contacts					
Opposite sex only	1.9 (1.3–2.9)	2.1 (1.6–2.8)	0.2	1.12 (0.69–1.81)	4.09 (2.23–7.48)**
Same sex only or both sexes	9.4 (4.9–17.6)	15.8 (10.4–23.2)	6.3	1.67 (0.79–3.54)	30.15 (14.99–60.64)**
No sexual contact	0.5 (0.3–1.1)	0.5 (0.3–0.9)	0.0	0.99 (0.42–2.33)	Ref

Abbreviations: N/A = not applicable; PD = prevalence difference; PR = prevalence ratio; Ref = referent group.

* 2019: N = 13,677 respondents; 2021: N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] Absolute value presented.

[§] Persons of Hispanic origin might be of any race but were categorized as Hispanic; all racial groups were non-Hispanic.

[¶] Prevalence estimates with a denominator <30 were considered statistically unreliable and therefore were suppressed.

** 95% CI did not cross the null value of 1.0.

(PR = 1.31) than female White students, and 9th-grade female students (PR = 1.51) were more likely than 12th-grade students, to report an attempted suicide that required medical treatment. Bisexual and other identifying female students were more likely (PR = 4.23 and 3.04, respectively) than heterosexual female students to report an attempted suicide that required medical treatment. Black (PR = 2.64) and Hispanic (PR = 1.61) male students were more likely than White male students to report an attempted suicide that required medical treatment. Among males in 2021, LGBTQ+ students (PR = 7.93 gay; 7.23 bisexual; 7.06 questioning; 14.31 other) were more likely to report an attempted suicide that required medical treatment compared with heterosexual students. Students with opposite sex only sexual contacts (PR = 5.08 female; 4.09 male) and those with same sex or both sexes sexual contacts were more likely (PR = 14.36 female; 30.15 male) than students with no sexual contact to report an attempted suicide that required medical treatment.

Discussion

Overall results from the 2019 and 2021 YRBSSs highlight stable prevalence of suicidal thoughts and behaviors among male students across all outcomes, with increases observed among certain subgroups of male students and significant increases among female students in three of four outcomes (i.e., suicidal thoughts, plans, and attempts). This is similar to trends observed before the COVID-19 pandemic (7). These findings are consistent with the trends of rising rates of suicide risk among females (8) and highlight the potential effect of the COVID-19 pandemic mitigation measures that might have increased students' social isolation and anxiety, leading to the onset or exacerbation of adolescent mental health concerns and suicidal thoughts and behaviors (9).

The COVID-19 pandemic had a differential effect on suicide risk among male and female youths (10). Consistent with a study that cited a 50.6% increase in mean weekly emergency department visits during February and March 2021 for suspected suicide attempts among females aged 12–17 years versus 3.7% among males of the same age (10), the current study found significant increases in female students who reported seriously considered attempting suicide, making a suicide plan, and attempting suicide. In 2021, approximately one third of female students reported that they had seriously considered attempting suicide, approximately one fourth reported making a suicide plan, and 13.3% reported attempting suicide.

In 2021, 9th- and 10th-grade female students were significantly more likely than 12th-grade students to seriously consider attempting suicide, make a suicide plan and report

a suicide attempt; 9th-grade female students compared with 12th-grade female students were more likely to have made a suicide attempt that required medical treatment. These findings concur with previous research indicating that both females and those in younger grade levels (7th- and 9th-grade) are more likely than males and those in older grade levels (11th- and 12th-grade) to report both nonfatal self-harm and suicide attempts (11). Because of the increased prevalence of suicidal thoughts and behaviors among female students, particularly for those in 9th- and 10th-grade, the importance of early prevention and intervention to prevent suicide is evident. Given multiple developmental needs, determining how to best implement developmentally appropriate, evidence-based strategies to reach elementary and middle school-age youths might be a critical step in disrupting the upward trend of suicidal behaviors and might require further research on programs that are effective for young children and youths and their implementation.

In 2021, among both female and male students who reported having had same sex sexual contact or opposite sex sexual contact, the prevalence of all outcomes was significantly higher than students with no sexual contact. In addition, in 2021, prevalence of all four outcomes was found to be significantly higher among male LGBTQ+ students compared with male heterosexual students. The prevalence of three outcomes (seriously consider suicide, plan and attempt) was higher among female LGBTQ+ students compared with female heterosexual students. These findings are consistent with previous research that indicate that LGBTQ+ youths are at increased risk for suicidal thoughts and behaviors (6) (<https://www.cdc.gov/suicide/facts/disparities-in-suicide.html>). Creating a safe and supportive school environment for LGBTQ+ students by implementing gay and straight alliances, training teachers on LGBTQ+ inclusivity, and using an LGBTQ+ curriculum, has been associated with lower odds for suicide-related thoughts and behaviors among LGBTQ+ students (<https://www.liebertpub.com/doi/10.1089/lgbt.2021.0133>). Creating affirming environments in both home and online spaces has also been determined to reduce suicide attempts among LGBTQ+ youths (<https://www.thetrevorproject.org/resources/article/facts-about-lgbtq-youth-suicide>).

Significant prevalence increases among those who seriously considered attempting suicide, made a suicide plan, and reported making a suicide attempt were observed from 2019 to 2021 by race and ethnicity. For example, increases were noted between 2019 and 2021 among Black, Hispanic, and White female students who seriously considered attempting suicide, among White, and Hispanic female students who made a suicide plan, and among White female students who reported attempting suicide. A substantial number of students rely on

school-based mental health care, especially youths in racial and ethnic minority groups from under-resourced families (12); the increased prevalence of suicidal behaviors among these students might reflect a lack of access to mental health care as schools closed to offset transmission of COVID-19.

Although lack of access to mental health services might have contributed to increased suicide risk, certain other factors, including substance misuse, family or relationship problems, community violence, and discrimination, might have also contributed to the increased risk (13). These factors highlight the need for a comprehensive approach to suicide prevention that is aimed at preventing suicide risk, supporting those at increased risk for suicide, preventing reattempts, and supporting survivors of suicide loss (13).

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 two additional limitations. First, the 2021 national YRBS expanded its options to the sexual identity question to be more inclusive of how students self-identify; thus, the results from this question should not be compared to results from previous surveys. Second, this analysis was conducted among all students and did not stratify based on whether students had considered suicide; suicidal behaviors might differ between those who experienced suicidal thoughts and those who did not.

Future Directions

There were marked differences in suicidal thoughts and behaviors by sexual orientation. Future research examining how intersectional identities and social norms regarding gender, race and ethnicity, and sexual orientation contribute to risk for suicidal behaviors can guide the development of effective interventions. Expanding the research evidence on the factors contributing to racial and ethnic differences in suicidal thoughts and behaviors can guide the development of inclusive intervention approaches. Increasing access to culturally and linguistically relevant mental health services can improve suicide prevention for racial and ethnic minority youths by connecting them to services that address their lived experiences (14). Better understanding how the pandemic exacerbated suicide risk could be important in developing school and community-based interventions for implementation during times of infrastructure disruption. These interventions should address common risk and protective factors considering student sex, grade, sexual identity, and race and ethnicity.

The CDC Suicide Prevention Resource for Action identifies strategies for a comprehensive approach to suicide prevention (13) that addresses the multiple factors associated with suicide risk. The implementation of school-based strategies, in addition to other community-based supports, has the potential for great reach and importance for youth suicide prevention. For example, creating safe and supportive environments for students by promoting school connectedness, teaching coping and problem solving, gatekeeper training, and implementing mental health services and programs can support youths in school (13,15).

Conclusion

From 2019 to 2021, the prevalence of suicidal thoughts and behaviors increased among certain demographic groups but was stable among other groups. The increased prevalence of suicidal thoughts and behaviors among females, particularly among 9th- and 10th-grade females and Black, Hispanic, and White female students, as well as youths identifying as LGBTQ+ and youths with same sex sexual contact, point to notable disparities warranting further consideration. Understanding the stable prevalence of suicidal thoughts and behaviors among males overall during a major infrastructure disruption (e.g., during the COVID-19 pandemic) could yield insights into protective factors. A combination of risk and protective factors at the individual, relationship, community, and societal levels likely contributes to the differences in suicidal thoughts and behaviors among sexual minority youths, different racial and ethnic groups and the differences observed by sex and grade. A comprehensive approach to suicide prevention, which reduces risk and supports youths at increased risk, provides support to those at risk and can ultimately save lives (13).

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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Role of the COVID-19 Pandemic on Sexual Behaviors and Receipt of Sexual and Reproductive Health Services Among U.S. High School Students — Youth Risk Behavior Survey, United States, 2019–2021

Leigh E. Szucs, PhD¹; Sanjana Pampati, MPH¹; Jingjing Li, PhD, MD¹; Casey E. Copen, PhD²; Emily Young, MPH^{1,3}; Sandra Leonard, DNP¹; Michelle N. Carman-McClanahan, MPH¹

¹Division of Adolescent and School Health, National Center for HIV, Viral Hepatitis, STD, and TB Prevention, CDC; ²Division of STD Prevention, National Center for HIV, Viral Hepatitis, STD, and TB Prevention, CDC; ³Oak Ridge Institute for Science and Education, Oak Ridge, Tennessee

Abstract

Disproportionate rates of sexually transmitted diseases (STDs), including HIV, and unintended pregnancy among adolescents persist and might have been affected by the COVID-19 pandemic. This study uses 2019 and 2021 data from the nationally representative Youth Risk Behavior Surveys to characterize changes in sexual behaviors and receipt of sexual and reproductive health services among U.S. high school students before and during the pandemic. Outcomes included HIV testing (lifetime), STD testing (past 12 months), condom use (last sexual intercourse), and primary contraceptive method used to prevent pregnancy (last sexual intercourse). Except for HIV testing, all analyses were limited to currently sexually active students. Weighted prevalence and 95% CIs of outcomes for 2019 and 2021 were calculated for each year by demographics (sex [female or male], age, and race and ethnicity) and sex of sexual contacts (opposite sex only, both sexes, same sex only). For each year, pairwise *t*-tests with Taylor series linearization were used to identify demographic differences among outcomes. Across years, change in prevalence of outcomes was assessed by using absolute and relative measures of association overall and by demographics. During 2019–2021, the prevalence of HIV testing decreased by 3.68 percentage points, from 9.4% to 5.8%. Among sexually active students, prevalence of STD testing decreased by 5.07 percentage points, from 20.4% to 15.3%. Among sexually active students reporting opposite sex or both sexes sexual contact, intrauterine device or implant use at last sexual intercourse increased by 4.11 percentage points, from 4.8% to 8.9%, and no contraceptive method use increased by 2.74 percentage points, from 10.7% to 13.4%. Because of disruptions throughout the pandemic, results underscore the importance of improving access to a range of health services for adolescents and improving STD/HIV and unintended pregnancy prevention.

Introduction

Disproportionate rates of sexually transmitted diseases (STDs), including HIV and unintended pregnancy, have long affected adolescents and young adults across the United States. High rates of annual chlamydia cases among females aged 15–19 years (<https://www.cdc.gov/std/statistics/2021/default.htm>), new HIV infections among adolescent sexual minority males (<https://www.cdc.gov/hiv/library/reports/hiv-surveillance.html>), and higher rates of adolescent pregnancy and birth in the United States compared with other high-income countries are of concern (1). Despite declines in pregnancy and birth rates and improvements in contraceptive use among adolescents (2), racial and ethnic, geographic, and socioeconomic disparities persist (3). Studies highlight increases in condomless sex among Black or African American

(Black) and White youths (3), decreases in contraceptive method use during sexual intercourse (2,4), and suboptimal adherence to STD testing among adolescent females (5). Such data on the sexual and reproductive health (SRH) behaviors and experiences were collected before the 2020 onset of the COVID-19 pandemic and do not reflect the stressors and disruptions experienced by adolescents during the pandemic.

Beginning in early 2020, nationwide stay-at-home orders, physical distancing, quarantine and isolation guidance, and disruptions in access to SRH services had substantial effects on adolescent and adult sexual health (6). During the pandemic, decreases or total elimination of in-person health care visits, including facility closures, discontinuation of prevention and treatment methods (e.g., pre-exposure prophylaxis and birth control), and physical and economic barriers to preventative services (e.g., transportation and insurance coverage) were reported by older adolescents and adults (7). Income or health insurance coverage loss by adolescents or their parents might have created economic barriers to accessing and paying for health services (e.g., contraceptives) (6). To date, limited studies

Corresponding author: Leigh E. Szucs, PhD, Division of Adolescent and School Health, National Center for HIV, Viral Hepatitis, STD, and TB Prevention, CDC; Telephone: 404-718-6785; Email: lszucs@cdc.gov.

have explicitly examined adolescents' SRH behaviors and experiences before and during the pandemic (6,8). To address this gap, this study uses 2019 and 2021 Youth Risk Behavior Survey (YRBS) data to describe prevalence estimates of sexual behaviors and receipt of SRH services among U.S. high school students during the pandemic. Because of disruptions in access to health services caused by the pandemic, this study primarily focused on adolescents' reported receipt of SRH services that were primarily accessible through health care providers (i.e., testing and hormonal contraception) and sexual behaviors, examining differences by demographic characteristics and absolute and relative changes over time. Results can support public health goals for reducing or preventing STD/HIV and unintended pregnancy and addressing disparities in access to and quality of adolescent SRH preventative care.

Methods

Data Source

This report includes data from the 2019 (N = 13,677) and 2021 (N = 17,232) 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 (9). The prevalence estimates for sexual behaviors and receipt of SRH services for the overall study population and by sex, race and ethnicity, grade, and sexual identity are available at <https://nccd.cdc.gov/youthonline/App/Default.aspx>. The full YRBS questionnaire, data sets, and documentation are available at <https://www.cdc.gov/healthyyouth/data/yrbs/index.htm>. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.*

Measures

Students' self-reported sexual behaviors and receipt of SRH services, were examined as outcomes (Table 1). Lifetime HIV testing and STD testing during the past 12 months were both dichotomized as yes or no/don't know. Any condom use at last sexual intercourse was dichotomized as yes or no. Four measures were constructed to capture use and nonuse of primary contraceptive method to prevent pregnancy at last sexual intercourse: 1) use of intrauterine device (IUD) or implant; 2) use of shot, patch, or birth control ring; 3) use

of birth control pills; and 4) no contraceptive method used. These contraceptive methods were examined because of the study's objective to explore changes in adolescents' receipt of SRH services commonly accessible through a health care provider before and during the pandemic. Other primary contraceptive methods used to prevent pregnancy are also measured in YRBS but are not examined in this study (e.g., condoms as primary contraceptive method used to prevent pregnancy; 2021 = 45.3%).

Demographic characteristics examined included sex (female or male), age (aged ≤ 15 years, 16–17 years, or ≥ 18 years), and race and ethnicity. Race and ethnicity was categorized as Black, Hispanic or Latino (Hispanic), and White. (Persons of Hispanic origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.) The number of students from other race or multiracial groups was too small for separate analyses. Sex of lifetime sexual contacts was categorized as opposite sex only, same sex only, or both sexes.

Analysis

For lifetime HIV testing, the analytic sample was not restricted. For STD testing during the past 12 months and any condom use at last sexual intercourse, the analytic sample was restricted to those who are currently sexually active (i.e., those who reported having had sexual intercourse with one or more persons during the 3 months before survey administration). The overall YRBS sample included 27.0% and 21.6% of students reporting being currently sexually active in 2019 and 2021, respectively. For analyses examining primary contraceptive method use to prevent pregnancy at last sexual intercourse, the analytic sample was restricted to currently sexually active students reporting opposite sex or both sexes sexual contacts during their lifetime.

Weighted prevalence and 95% CIs of sexual behaviors and receipt of SRH services are presented for each year (2019 and 2021) and by demographic characteristics. Within the same year, demographic differences in prevalence of sexual behaviors and receipt of SRH services were examined by using pairwise *t*-tests with Taylor series linearization. Across years, changes in sexual behaviors and receipt of SRH services from 2019 to 2021 were assessed by using absolute (prevalence difference [PD]) and relative (prevalence ratio [PR]) measures among the total sample, as well as by demographic characteristics. Models used to obtain PD and PR estimates did not control for any demographic variables or other covariates. P-values < 0.05 and 95% CIs that did not cross zero (for PD) or 1.0 (for PR) were considered statistically significant. Prevalence estimates with a denominator < 30 were considered statistically unreliable and therefore were suppressed (9). Analyses were conducted using

*See e.g., 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

TABLE 1. Measures for select sexual and reproductive health services and sexual behaviors among high school students — Youth Risk Behavior Survey, United States, 2019–2021*

Construct	Measure	Response option
Receipt of SRH services		
HIV testing, lifetime	Have you ever been tested for HIV, the virus that causes AIDS? (Do not count tests done if you donated blood.)	Yes, no, not sure
STD testing, past 12 months	During the past 12 months, have you been tested for an STD other than HIV, such as chlamydia or gonorrhea?	Yes, no, not sure
Sexual behaviors		
Condom use at last sexual intercourse	The last time you had sexual intercourse, did you or your partner use a condom?	I have never had sexual intercourse, yes, no
Primary contraceptive method to prevent pregnancy: [†]	2019: The last time you had sexual intercourse, what one method did you or your partner use to prevent pregnancy? (Select only one response.)	An IUD (such as Mirena or ParaGard) or implant (such as Implanon or Nexplanon) before last sexual intercourse with an opposite-sex partner (to prevent pregnancy among students who were currently sexually active); shot (such as Depo-Provera), patch (such as Ortho Evra), or birth control ring (such as NuvaRing); birth control pills (2019), birth control pills (Do not count emergency contraception such as Plan B or the “morning after” pill.) (2021); no method to prevent pregnancy
Use of IUD or implant at last sexual intercourse	2021: The last time you had sexual intercourse with an opposite-sex partner, what one method did you or your partner use to prevent pregnancy? (Select only one response.)	
Use of shot, patch, or birth control ring at last sexual intercourse		
Use of birth control pills at last sexual intercourse		
Use of no contraceptive method at last sexual intercourse		

Abbreviations: IUD = intrauterine device; SRH = sexual and reproductive health; STD = sexually transmitted disease.

* 2019: N = 13,677 respondents; 2021: N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] YRBS question wording and response options for primary contraceptive method used to prevent pregnancy at last sexual intercourse changed between the 2019 and 2021 surveys. Question wording and response options are reported for both years when there were differences. Full survey instruments can be found at <https://www.cdc.gov/healthyyouth/data/yrbs/questionnaires.htm>.

SAS-callable SUDAAN (version 11.0.3; RTI International) to account for the complex sampling design, and weights were applied to account for school and student nonresponse and to represent the U.S. high school student population.

Results

From 2019 to 2021, the prevalence of lifetime HIV testing decreased significantly by 3.68 percentage points, from 9.4% to 5.8% (Table 2). Among currently sexually active students, the prevalence of STD testing during the past 12 months decreased significantly by 5.07 percentage points, from 20.4% to 15.3%; condom use at last sexual intercourse did not significantly change. Among currently sexually active students reporting opposite sex or both sexes sexual contacts during their lifetime, the prevalence of IUD or implant use at last sexual intercourse increased significantly by 4.11 percentage points, from 4.8% to 8.9%, and no contraceptive method use increased significantly by 2.74 percentage points, from 10.7% to 13.4%. Among currently sexually active students reporting opposite sex or both sexes' sexual contacts during their lifetime, shot, patch, or birth control ring use and use of birth control pills (all at last sexual intercourse) did not significantly change over time.

Among female students, STD testing and HIV testing significantly decreased by 8.58 percentage points and

4.24 percentage points, respectively: IUD or implant use significantly increased by 4.76 percentage points (Table 2). Among male students, HIV testing significantly decreased by 3.10 percentage points. In 2021, male students were less likely to report STD testing than female students (12.7% versus 17.6%). In 2021, male students were more likely to report condom use than female students (57.7% versus 47.3%). In 2021, compared with female students' report of contraceptive method used (self or partner), male students were less likely to report they or their partner used no contraceptive method (15.2% versus 11.3%) and shot, patch, or birth control ring (4.6% versus 2.3%) at last sexual intercourse.

Lifetime HIV testing significantly decreased by 2.96 and 3.05 percentage points for students aged ≤15 and 16–17 years, respectively, but did not significantly change for students aged ≥18 years (Table 3). STD testing during the past 12 months decreased significantly by 12.22 percentage points, from 25.4% to 13.2% for students aged ≥18 years but did not significantly change for students aged ≤15 or 16–17 years. Among students aged 16–17 years, IUD or implant use at last sexual intercourse increased significantly by 6.29 percentage points, from 4.7% to 11.0% but did not significantly change for students aged ≤15 or ≥18 years. Among high school students aged ≤15 years, no contraceptive method used at last sexual intercourse increased significantly by 8.01 percentage points, from 12.4% to 20.5%,

TABLE 2. Changes in prevalence of sexual and reproductive health services and sexual behaviors among high school students, overall and by sex — Youth Risk Behavior Survey, United States, 2019–2021

Sexual and reproductive health service and sexual behavior (n)*	Total				Female				Male			
	2019 % (95% CI)	2021 % (95% CI)	PD % (95% CI) [†]	PR % (95% CI) [†]	2019 % (95% CI)	2021 % (95% CI)	PD % (95% CI) [†]	PR % (95% CI) [†]	2019 % (95% CI)	2021 % (95% CI)	PD % (95% CI) [†]	PR % (95% CI) [†]
HIV testing, lifetime (n = 25,033)	9.4 (8.5 to 10.4)	5.8 (5.1 to 6.5)	-3.68 (-4.84 to -2.52) [†]	0.61 (0.52 to 0.71) [†]	10.0 (9.0 to 11.1)	5.8 (5.0 to 6.7)	-4.24 (-5.63 to -2.85) [§]	0.58 (0.48 to 0.69) [¶]	8.8 (7.7 to 10.0)**	5.7 (5.0 to 6.5)	-3.10 (-4.48 to -1.71) ^{††}	0.65 (0.54 to 0.78) ^{§§}
STD testing, past 12 months (n = 4,559)	20.4 (17.5 to 23.6)	15.3 (13.4 to 17.5)	-5.07 (-8.71 to -1.44) [†]	0.75 (0.62 to 0.92) [†]	26.1 (22.5 to 30.2)	17.6 (14.6 to 20.9)	-8.58 (-13.56 to -3.59) [§]	0.67 (0.53 to 0.85) [¶]	13.7 (11.1 to 16.9)**	12.7 (10.3 to 15.6) ^{¶¶}	1.04 (-4.97 to 2.88)	0.92 (0.69 to 1.24)
Condom use at last sexual intercourse (n = 6,455)***	54.3 (52.0 to 56.6)	51.8 (49.4 to 54.3)	-2.45 (-5.81 to 0.90)	0.95 (1.02)	49.6 (45.6 to 53.6)	47.3 (43.2 to 51.4)	-2.30 (-8.01 to 3.40)	0.95 (0.85 to 1.07)	60.0 (57.0 to 62.9)**	57.7 (52.8 to 62.5) ^{¶¶}	-2.31 (-7.99 to 3.38)	0.96 (0.87 to 1.06)
Use of IUD or implant to prevent pregnancy at last sexual intercourse (n = 5,171)	4.8 (3.3 to 6.9)	8.9 (6.1 to 12.8)	4.11 (0.39 to 7.94) [†]	1.86 (1.10 to 3.12) [†]	5.6 (4.0 to 7.6)	10.3 (6.9 to 15.1)	4.76 (0.35 to 9.17) [§]	1.86 (1.12 to 3.07) [¶]	4.0 (2.1 to 7.4)	7.3 (4.5 to 11.5)	3.27 (-0.97 to 7.51)	1.82 (0.83 to 3.98)
Use of shot, patch, or birth control ring to prevent pregnancy at last sexual intercourse (n = 4,796)	3.5 (2.5 to 4.9)	3.5 (2.7 to 4.6)	0.04 (-1.46 to 1.54)	1.01 (0.66 to 1.55)	4.7 (3.1 to 7.1)	4.6 (3.4 to 6.2)	-0.12 (-2.51 to 2.26)	0.97 (0.59 to 1.62)	2.2 (1.3 to 3.7)**	2.3 (1.3 to 4.0) ^{¶¶}	0.13 (-1.59 to 1.85)	1.06 (0.49 to 2.28)
Use of birth control pills to prevent pregnancy at last sexual intercourse (n = 5,171)	23.3 (19.9 to 27.1)	20.8 (18.6 to 23.2)	-2.52 (-6.82 to 1.79)	0.89 (0.74 to 1.08)	26.1 (22.2 to 30.4)	22.8 (19.2 to 26.8)	-3.29 (-8.92 to 2.33)	0.87 (0.69 to 1.10)	20.2 (16.5 to 24.6)**	18.4 (15.7 to 21.4)	-1.87 (-6.85 to 3.11)	0.91 (0.70 to 1.17)
Use of no contraceptive method to prevent pregnancy at last sexual intercourse (n = 5,171)	10.7 (8.8 to 12.8)	13.4 (11.8 to 15.2)	2.74 (0.15 to 5.34) [†]	1.26 (1.01 to 1.57) [†]	11.9 (9.2 to 15.2)	15.2 (12.8 to 18.0)	3.33 (0.63 to 7.30)	1.28 (0.94 to 1.74)	9.3 (7.2 to 12.1)	11.3 (9.6 to 13.1) ^{¶¶}	1.92 (-1.09 to 4.93)	1.21 (0.89 to 1.64)

Abbreviations: IUD = intrauterine device; PD= prevalence difference; PR = prevalence ratio; STD = sexually transmitted disease.

* 2019: N = 13,677 respondents; 2021: N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data. Unweighted counts indicating denominators. For HIV testing (lifetime), all students were included in the sample. For any condom use at last sexual intercourse and STD testing (past 12 months), sample was restricted to currently sexually active (i.e., having had sexual intercourse with at least one person during the 3 months before the survey). For use of IUD or implant, shot, patch, or birth control ring, birth control pills, and no contraceptive method, sample was restricted to currently sexually active and those reporting opposite sex or both sex sexual contacts (lifetime).

[†] PD and PR compare 2019 versus 2021. 95% CIs that did not cross zero (for PD) or 1.0 (for PR) were considered statistically significant (p<0.05).

[§] PD comparing 2019 versus 2021 among females indicated a significant difference (p<0.05).

[¶] PR comparing 2019 versus 2021 among females indicated a significant difference (p<0.05).

** Male students significantly differed from female students in 2019, based on t-test with Taylor series linearization (p<0.05).

^{††} PD comparing 2019 versus 2021 among males indicated a significant difference (p<0.05).

^{§§} PR comparing 2019 versus 2021 among males indicated a significant difference (p<0.05).

^{¶¶} Male students significantly differed from female students in 2021, based on t-test with Taylor series linearization (p<0.05).

*** Condom use at last sexual intercourse was measured by a separate item from the item for primary contraceptive method used for preventing pregnancy.

but did not significantly change for students aged 16–17 or ≥18 years.

In 2021, students aged 16–17 years, compared with students aged ≤15 years, were more likely to report HIV testing (7.2% versus 3.5%), STD testing (18.2% versus 8.4%), IUD or implant use (11.0% versus 1.9%), and use of birth control pills (23.1% versus 11.7%), and less likely to report no contraceptive method use (11.1% versus 20.5%). In 2021, compared with students aged ≤15 years, students aged ≥18 years were more likely to report HIV testing (10.3% versus 3.5%), IUD or

implant use (10.5% versus 1.9%), and use of birth control pills (25.3% versus 11.7%), and less likely to report condom use at last sexual intercourse (46.4% versus 55.1%) and no contraceptive method use (13.1% versus 20.5%).

Lifetime HIV testing decreased significantly for Black (PD = -6.47), Hispanic (PD = -3.15), and White students (PD = -3.17) (Table 4). Among sexually active White students, STD testing decreased significantly by 6.86 percentage points and did not significantly change for Black and Hispanic students. IUD or implant use increased significantly by

TABLE 3. Changes in prevalence of sexual and reproductive health services and sexual behaviors and among high school students, by age — Youth Risk Behavior Survey, United States, 2019–2021

Sexual and reproductive health services and sexual behavior (n)*	≤15 years				16–17 years				≥18 years			
	2019 % (95% CI)	2021 % (95% CI)	PD % (95% CI) [†]	PR % (95% CI) [†]	2019 % (95% CI)	2021 % (95% CI)	PD % (95% CI) [†]	PR % (95% CI) [†]	2019 % (95% CI)	2021 % (95% CI)	PD % (95% CI) [†]	PR % (95% CI) [†]
HIV testing, lifetime (n = 25,033)	6.5 (5.2 to 8.1)	3.5 (2.7 to 4.5)	-2.96 (-4.68 to -1.24) [§]	0.54 (0.39 to 0.76) [¶]	10.3 (9.2 to 11.4)**	7.2 (6.2 to 8.4) ^{††}	-3.05 (-4.58 to -1.52) ^{§§}	0.70 (0.59 to 0.84) ^{¶¶}	13.8 (11.9 to 16.1)**,*†††	10.3 (7.6 to 13.7) ^{§§§}	-3.58 (-7.25 to 0.09)	0.74 (0.53 to 1.08)
STD testing, past 12 months (n = 4,559)	13.0 (9.2 to 17.9)	8.4 (5.3 to 13.1)	-4.53 (-10.27 to 1.20)	0.65 (0.37 to 1.14)	20.6 (16.9 to 24.8)**	18.2 (16.0 to 20.6) ^{††}	-2.41 (-6.99 to 2.18)	0.88 (0.70 to 1.11)	25.4 (21.8 to 29.4) ^{***}	13.2 (8.4 to 20.1)	-12.22 (-19.12 to -5.31) ^{¶¶¶}	0.52 (0.33 to 0.82) ^{****}
Condom use at last sexual intercourse (n = 6,455) ^{††††}	59.7 (54.6 to 64.6)	55.1 (49.9 to 60.1)	-4.65 (-11.82 to 2.53)	0.92 (0.81 to 1.05)	54.2 (51.0 to 57.5)**	51.8 (48.3 to 55.3)	-2.42 (-7.23 to 2.39)	0.96 (0.87 to 1.05)	50.7 (45.8 to 55.6) ^{***}	46.4 (39.7 to 53.2) ^{§§§}	-4.31 (-12.71 to 4.09)	0.91 (0.77 to 1.09)
Use of IUD or implant to prevent pregnancy at last sexual intercourse (n = 5,171)	1.7 (0.8 to 3.6)	1.9 (0.9 to 4.1)	0.22 (-1.73 to 2.18)	1.13 (0.39 to 3.29)	4.7 (3.4 to 6.5)**	11.0 (7.3 to 16.2) ^{††}	6.29 (1.62 to 10.96) ^{§§}	2.34 (1.40 to 3.91) ^{¶¶}	7.4 (4.0 to 13.3) ^{***}	10.5 (6.2 to 17.4) ^{§§§}	3.12 (-3.97 to 10.21)	1.42 (0.64 to 3.15)
Use of shot, patch, or birth control ring to prevent pregnancy at last sexual intercourse (n = 4,796)	2.4 (1.1 to 5.3)	2.7 (1.4 to 5.3)	0.34 (-2.33 to 3.00)	1.14 (0.40 to 3.29)	3.3 (2.1 to 5.2)	3.7 (2.7 to 5.1)	0.45 (-1.49 to 2.39)	1.14 (0.65 to 2.00)	5.0 (2.9 to 8.3)	3.8 (1.8 to 7.9)	-1.18 (-5.01 to 2.65)	0.76 (0.31 to 1.90)
Use of birth control pills to prevent pregnancy at last sexual intercourse (n = 5,171)	14.8 (10.8 to 20.0)	11.7 (8.6 to 15.8)	-3.13 (-8.95 to 2.69)	0.79 (0.51 to 1.22)	24.2 (20.5 to 28.3)**	23.1 (20.4 to 26.0) ^{††}	-1.09 (-5.92 to 3.74)	0.96 (0.78 to 1.17)	27.5 (21.7 to 34.2) ^{***}	25.3 (19.6 to 32.1) ^{§§§}	-2.18 (-11.05 to 6.70)	0.92 (0.66 to 1.29)
Use of no contraceptive method to prevent pregnancy at last sexual intercourse (n = 5,171)	12.4 (8.6 to 17.6)	20.5 (16.9 to 24.6)	8.01 (2.11 to 13.92) [§]	1.64 (1.10 to 2.47) [¶]	10.5 (8.4 to 13.0)	11.1 (9.3 to 13.2) ^{††}	0.63 (-2.40 to 3.65)	1.06 (0.80 to 1.41)	9.7 (6.6 to 14.1)	13.1 (8.6 to 19.4) ^{§§§}	3.35 (-3.17 to 9.87)	1.34 (0.77 to 2.35)

Abbreviations: IUD = intrauterine device; PD= prevalence difference; PR = prevalence ratio; STD = sexually transmitted disease.

* 2019: N = 13,677 respondents; 2021: N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data. Unweighted counts indicating denominators. For HIV testing (lifetime), all students were included in the sample. For any condom use at last sexual intercourse and STD testing (past 12 months), sample was restricted to currently sexually active (i.e., having had sexual intercourse with at least one person during the 3 months before the survey). For use of IUD or implant, shot, patch, or birth control ring, birth control pills, and no contraceptive method to prevent pregnancy, sample was restricted to currently sexually active and those reporting opposite sex or both sex sexual contacts (lifetime).

[†] PD and PR compare 2019 versus 2021. 95% CIs that did not cross zero (for PD) or 1.0 (for PR) were considered statistically significant (p<0.05).

[§] PD comparing 2019 versus 2021 among students aged ≤15 years indicated a significant difference (p<0.05).

[¶] PR comparing 2019 versus 2021 among students aged ≤15 years indicated a significant difference (p<0.05).

^{**} Students aged 16–17 years significantly differed from students aged ≤15 years in 2019, based on t-test with Taylor series linearization (p<0.05).

^{††} Students aged 16–17 years significantly differed from students aged ≤15 years in 2021, based on t-test with Taylor series linearization (p<0.05).

^{§§} PD comparing 2019 versus 2021 among students aged 16–17 years indicated a significant difference (p<0.05).

^{¶¶} PR comparing 2019 versus 2021 among students aged 16–17 years indicated a significant difference (p<0.05).

^{***} Students aged ≥18 years significantly differed from students aged ≤15 years in 2019, based on t-test with Taylor series linearization (p<0.05).

^{†††} Students aged ≥18 years significantly differed from students aged 16–17 years in 2019, based on t-test with Taylor series linearization (p<0.05).

^{§§§} Students aged ≥18 years significantly differed from students aged ≤15 years in 2021, based on t-test with Taylor series linearization (p<0.05).

^{¶¶¶} PD comparing 2019 versus 2021 among students aged ≥18 indicated a significant difference (p<0.05).

^{****} PR comparing 2019 versus 2021 among students aged ≥18 indicated a significant difference (p<0.05).

^{††††} Condom use at last sexual intercourse was measured by a separate item from the item for primary contraceptive method used for preventing pregnancy.

TABLE 4. Changes in prevalence of sexual and reproductive health services and sexual behaviors among high school students, by race and ethnicity — Youth Risk Behavior Survey, United States, 2019–2021

Sexual and reproductive health services and sexual behavior (n) [†]	Black or African American*				Hispanic or Latino*				White*			
	2019 % (95% CI)	2021 % (95% CI)	PD % (95% CI) [§]	PR % (95% CI) [§]	2019 % (95% CI)	2021 % (95% CI)	PD % (95% CI) [§]	PR % (95% CI) [§]	2019 % (95% CI)	2021 % (95% CI)	PD % (95% CI) [§]	PR % (95% CI) [§]
HIV testing, lifetime (n = 25,033)	14.0 (11.3 to 17.1)	7.5 (5.7 to 9.7)	-6.47 (-9.98 to -2.95) [¶]	0.54 (0.38 to 0.75) ^{**}	9.7 (7.3 to 12.9) ^{††}	6.6 (5.5 to 7.8) ^{¶¶}	-3.15 (-6.16 to -0.13) ^{***}	0.68 (0.48 to 0.95) ^{†††}	8.0 (7.1 to 8.9) ^{§§§}	4.8 (3.8 to 6.0)	-3.17 (-4.57 to -1.78) ^{¶¶¶}	0.60 (0.47 to 0.77) ^{****}
STD testing, past 12 months (n = 4,559)	23.8 (16.8 to 32.5)	18.6 (11.6 to 28.6)	-5.12 (-16.67 to 6.44)	0.78 (0.45 to 1.38)	19.7 (13.8 to 27.2)	19.5 (15.5 to 24.2) ^{¶¶}	-0.18 (-8.15 to 7.78)	0.99 (0.66 to 1.49)	19.3 (22.9)	12.5 (10.1 to 15.3)	-6.86 (-11.06 to -2.66) ^{¶¶¶}	0.65 (0.49 to 0.84) ^{****}
Condom use at last sexual intercourse (n = 6,455) ^{††††}	48.2 (43.3 to 53.2)	48.8 (41.8 to 55.8)	0.59 (-8.03 to 9.22)	1.01 (0.85 to 1.21)	56.2 (52.1 to 60.2) ^{††}	49.7 (43.8 to 55.6)	-6.50 (-13.72 to 0.72)	0.88 (0.77 to 1.02)	55.8 (53.0 to 58.6) ^{§§§}	54.6 (51.4 to 57.6)	-1.25 (-5.44 to 2.94)	0.98 (0.91 to 1.05)
Use of IUD or implant to prevent pregnancy at last sexual intercourse (n = 5,171)	2.0 (1.0 to 3.9)	6.2 (3.2 to 11.6)	4.20 (-0.02 to 8.41)	3.11 (1.22 to 7.93) ^{**}	1.6 (0.7 to 3.4) ^{§§}	7.3 (4.4 to 11.9)	5.75 (1.90 to 9.61) ^{***}	4.69 (1.85 to 11.89) ^{†††}	6.7 (5.0 to 8.9) ^{§§§}	10.0 (6.5 to 15.1)	3.31 (-1.32 to 7.94)	1.49 (0.90 to 2.48)
Use of shot, patch, or birth control ring to prevent pregnancy at last sexual intercourse (n = 4,796)	5.5 (3.0 to 10.0)	3.7 (2.4 to 5.8)	-1.81 (-5.54 to 1.92)	0.67 (0.32 to 1.43)	1.4 (0.6 to 3.2) ^{††,§§}	2.2 (1.5 to 3.3) ^{¶¶}	0.79 (-0.67 to 2.26)	1.56 (0.62 to 3.94)	4.3 (2.7 to 6.9)	3.9 (2.8 to 5.5)	-0.38 (-2.82 to 2.05)	0.91 (0.51 to 1.63)
Use of birth control pills to prevent pregnancy at last sexual intercourse (n = 5,171)	12.1 (8.8 to 16.4)	11.0 (7.5 to 15.9)	-1.03 (-6.66 to 4.59)	0.91 (0.56 to 1.49)	15.5 (11.6 to 20.4) ^{§§}	15.7 (13.0 to 18.8) ^{¶¶}	0.18 (-5.08 to 5.43)	1.01 (0.72 to 1.42)	29.7 (25.8 to 33.9) ^{§§§}	24.9 (21.4 to 28.7) ^{§§§§}	-4.79 (-10.29 to 0.70)	0.84 (0.69 to 1.03)
Use of no contraceptive method to prevent pregnancy at last sexual intercourse (n = 5,171)	23.2 (19.3 to 27.6)	21.4 (15.2 to 29.2)	-1.76 (-9.92 to 6.40)	0.92 (0.64 to 1.34)	12.8 (9.1 to 17.7) ^{††,§§}	19.0 (14.6 to 24.4) ^{¶¶}	6.19 (-0.29 to 12.67)	1.48 (0.98 to 2.26)	6.8 (5.3 to 8.5) ^{§§§}	9.5 (7.7 to 11.5) ^{§§§§}	2.71 (0.24 to 5.17) ^{¶¶¶}	1.40 (1.03 to 1.91) ^{****}

Abbreviations: IUD = intrauterine device; PD= prevalence difference; PR = prevalence ratio; STD = sexually transmitted disease.

* Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.
[†] 2019: N = 13,677 respondents; 2021: N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data. Unweighted counts indicating denominators. For HIV testing (lifetime), all students were included in the sample. For any condom use at last sexual intercourse and STD testing (past 12 months), sample was restricted to currently sexually active (i.e., having had sexual intercourse with at least one person during the 3 months before the survey). For use of IUD or implant, shot, patch, or birth control ring, birth control pills, and no contraceptive method to prevent pregnancy, sample was restricted to currently sexually active and those reporting opposite sex or both sex sexual contacts (lifetime).
[§] PD and PR comparing 2019 versus 2021. 95% CIs that did not cross zero (for PD) or 1.0 (for PR) were considered statistically significant (p<0.05).
[¶] PD comparing 2019 versus 2021 among Black or African American (Black) students indicated a significant difference (p<0.05).
^{**} PR comparing 2019 versus 2021 among Black students indicated a significant difference (p<0.05).
^{††} Hispanic students significantly differed from Black students in 2019, based on t-test with Taylor series linearization (p<0.05).
^{§§} Hispanic students significantly differed from White students in 2019, based on t-test with Taylor series linearization (p<0.05).
^{¶¶} Hispanic students significantly differed from White students in 2021, based on t-test with Taylor series linearization (p<0.05).
^{***} PD comparing 2019 versus 2021 among Hispanic students indicated a significant difference (p<0.05).
^{†††} PR comparing 2019 versus 2021 among Hispanic students indicated a significant difference (p<0.05).
^{§§§} White students significantly differed from Black students in 2019 based on t-test with Taylor series linearization (p<0.05).
^{¶¶¶} PD comparing 2019 versus 2021 among White students indicated a significant difference (p<0.05).
^{****} PR comparing 2019 versus 2021 among White students indicated a significant difference (p<0.05).
^{††††} Condom use at last sexual intercourse was measured by a separate item from the item for primary contraceptive method used for preventing pregnancy.
^{§§§§} White students significantly differed from Black students in 2021, based on t-test with Taylor series linearization (p<0.05).

TABLE 5. Changes in prevalence of sexual and reproductive health services and sexual behaviors among high school students, by sex of sexual contacts — Youth Risk Behavior Survey, United States, 2019–2021

Sexual and reproductive health services and sexual behavior (n)*	Opposite sex only				Same sex only				Both sexes			
	2019 % (95% CI)	2021 % (95% CI)	PD % (95% CI)†	PR % (95% CI)†	2019 % (95% CI)	2021 % (95% CI)	PD % (95% CI)†	PR % (95% CI)†	2019 % (95% CI)	2021 % (95% CI)	PD % (95% CI)†	PR % (95% CI)†
HIV testing, lifetime (n = 25,033)	12.6 (11.1 to 14.3)	9.7 (8.3 to 11.2)	-2.96 (-5.14 to -0.78) [§]	0.77 (0.63 to 0.93) [¶]	18.5 (12.5 to 26.7)	10.1 (7.1 to 14.2)	-8.49 (-16.40 to -0.57) ^{**}	0.54 (0.32 to 0.91) ^{††}	20.7 (16.9 to 25.2) ^{§§}	14.7 (11.5 to 18.7) ^{¶¶}	-5.97 (-11.47 to 0.46) ^{***}	0.71 (0.52 to 0.98) ^{†††}
STD testing, past 12 months (n = 4,559)	19.0 (16.3 to 21.9)	14.4 (12.1 to 17.0)	-4.57 (-8.27 to -0.88) [§]	0.76 (0.61 to 0.95) [¶]	27.7 (15.6 to 44.1)	9.7 (4.9 to 18.3)	-18.00 (-33.87 to -2.14) ^{**}	0.35 (0.15 to 0.82) ^{††}	29.7 (23.1 to 37.3) ^{§§}	23.4 (17.2 to 30.9) ^{¶¶,§§§}	-6.37 (-16.26 to 3.52)	0.79 (0.54 to 1.15)
Condom use at last sexual intercourse (n = 6,455) ^{¶¶¶}	56.3 (53.7 to 58.8)	55.5 (52.8 to 58.3)	-0.73 (-4.48 to 3.02)	0.99 (0.92 to 1.06)	29.0 (17.7 to 43.6) ^{****}	18.3 (8.0 to 36.6) ^{††††}	-10.66 (-29.98 to 8.65)	0.63 (0.26 to 1.55)	45.3 (37.1 to 53.7) ^{§§}	40.3 (32.0 to 49.1) ^{¶¶,§§§}	-4.99 (-17.02 to 7.03)	0.89 (0.67 to 1.18)
Use of IUD or implant to prevent pregnancy at last sexual intercourse (n = 5,171)	4.8 (3.3 to 7.0)	8.3 (5.4 to 12.5)	3.50 (-0.44 to 7.45)	1.73 (0.98 to 3.04)	— ^{§§§§}	—	—	—	4.8 (2.5 to 8.9)	12.9 (8.9 to 18.3)	8.14 (2.59 to 13.68) ^{***}	2.70 (1.31 to 5.56) ^{†††}
Use of shot, patch, or birth control ring to prevent pregnancy at last sexual intercourse (n = 4,796)	3.6 (2.5 to 5.1)	3.6 (2.8 to 4.6)	0.04 (-1.51 to 1.60)	1.01 (0.66 to 1.56)	—	—	—	—	2.7 (1.0 to 6.9)	3.0 (1.5 to 5.8)	0.24 (-3.04 to 3.52)	1.09 (0.34 to 3.49)
Use of birth control pills to prevent pregnancy at last sexual intercourse (n = 5,171)	23.5 (19.9 to 27.6)	21.4 (18.8 to 24.3)	-2.14 (-6.87 to 2.60)	0.91 (0.74 to 1.12)	—	—	—	—	21.0 (14.6 to 29.1)	16.7 (11.3 to 23.8)	-4.30 (-13.86 to 5.26)	0.79 (0.48 to 1.32)
Use of no contraceptive method to prevent pregnancy at last sexual intercourse (n = 5,171)	9.4 (7.7 to 11.5)	11.8 (10.3 to 13.6)	2.39 (-0.12 to 4.90)	1.25 (0.98 to 1.60)	—	—	—	—	22.4 (15.7 to 30.9) ^{§§}	23.7 (19.8 to 28.2) ^{¶¶}	1.36 (-7.31 to 10.02)	1.06 (0.72 to 1.55)

Abbreviations: IUD = intrauterine device; PD= prevalence difference; PR = prevalence ratio; STD = sexually transmitted disease.

* 2019: N = 13,677 respondents; 2021: N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data. Unweighted counts indicating denominators. For HIV testing (lifetime), all students were included in the sample. For any condom use at last sexual intercourse and STD testing (past 12 months), sample was restricted to currently sexually active (i.e., having had sexual intercourse with at least one person during the 3 months before the survey). For use of IUD or implant, shot, patch, or birth control ring, birth control pills, and no contraceptive method to prevent pregnancy, sample was restricted to currently sexually active and those reporting opposite sex or both sex sexual contacts (lifetime).

† PD and PR comparing 2019 versus 2021. 95% CIs that did not cross the null value of 0 (for PD) or 1.0 (for PR) were considered statistically significant (p<0.05).

§ PD comparing 2019 versus 2021 among students having opposite sex only sexual contacts indicated a significant difference (p<0.05).

¶ PR comparing 2019 versus 2021 among students having opposite sex only sexual contacts indicated a significant difference (p<0.05).

** PD comparing 2019 versus 2021 among students having same sex only sexual contacts indicated a significant difference (p<0.05).

†† PR comparing 2019 versus 2021 among students having same sex only sexual contacts indicated a significant difference (p<0.05).

§§ Students having both sex sexual contacts significantly different from students having opposite sex only sexual contacts in 2019, based on t-test with Taylor series linearization (p<0.05).

¶¶ Students having both sex sexual contacts significantly different from students having opposite sex only sexual contacts in 2021, based t-test with Taylor series linearization (p<0.05).

*** PD comparing 2019 versus 2021 among students having both sex sexual contacts indicated a significant difference (p<0.05).

††† PR comparing 2019 versus 2021 among students having both sex sexual contacts indicated a significant difference (p<0.05).

§§§ Students having both sex sexual contacts significantly different from students having same sex only sexual contacts in 2021, based on t-test with Taylor series linearization (p<0.05).

¶¶¶ Condom use at last sexual intercourse was measured by a separate item from the primary method used for preventing pregnancy item.

**** Students having same sex only sexual contacts significantly different from students having opposite sex only sexual contacts in 2019, based on t-test with Taylor series linearization (p<0.05).

†††† Students having same sex only sexual contacts significantly different from students having opposite sex only sexual contacts in 2021, based on t-test with Taylor series linearization (p<0.05).

§§§§ Prevalence estimates with a denominator <30 were considered statistically unreliable and therefore were suppressed.

5.75 percentage points for Hispanic students. Among White students, no contraceptive method use increased significantly by 2.71 percentage points and did not significantly change for Black and Hispanic students. In 2021, compared with White students, Hispanic and Black students were less likely to use birth control pills (24.9%, 15.7%, 11.0%, respectively) and more likely to report no contraceptive method use (9.5%, 19.0%, 21.4%, respectively). In 2021, compared with Hispanic students, White students were less likely to report shot, patch, or birth control ring use (3.9% versus 2.2%) and more likely to report HIV testing (4.8% versus 6.6%) and STD testing (12.5% versus 19.5%).

HIV testing significantly decreased for students reporting opposite sex only (PD = -2.96), same sex only (PD = -8.49), and both sexes sexual contacts (PD = -5.97) (Table 5). STD testing decreased significantly by 4.57 and 18.00 percentage points among students reporting opposite sex only and same sex only sexual contacts, respectively. IUD or implant use significantly increased by 8.14 percentage points among students reporting sexual contacts of both sexes and did not significantly change for students reporting opposite sex only contacts. In 2021, compared with students reporting opposite sex sexual contacts, students reporting both sexes sexual contacts were more likely to report HIV testing (9.7% versus 14.7%), STD testing (14.4% versus 23.4%), and no contraceptive method use (11.8% versus 23.7%), and less likely to report condom use at last sexual intercourse (55.5% versus 40.3%). In 2021, compared with students reporting same sex only contacts, students reporting both sexes sexual contacts were more likely to report STD testing (9.7% versus 23.4%) and condom use (18.3% versus 40.3%). In 2021, students reporting same sex only sexual contacts were less likely to report condom use than students reporting opposite sex only sexual contacts (18.3% versus 55.5%).

Discussion

This study provides the first nationally representative estimates of sexual behaviors and receipt of SRH services before and during the COVID-19 pandemic among U.S. high school students. Since the pandemic, considerable decreases in HIV and STD testing were identified, and the magnitude and presence of the decline in receipt of SRH services primarily accessible through health care providers varied by demographic characteristics, including sex, age, race and ethnicity, and sex of sexual contacts.

Declines in overall HIV testing among all adolescents and STD testing among those sexually active mirror similar reductions in STD/HIV testing, particularly among adolescent

males who have sex with men in the United States during the pandemic period (10). Changes in sexual activity patterns and medical office closures or limited-service offerings might have affected testing during the pandemic (10). Overall, fewer than 10% of high school students reported HIV testing, and differences by age, race and ethnicity, and sex of sexual contacts illustrate gaps in meeting recommendations for universal and routine HIV screening for all youths aged ≥ 13 years at least once (<https://www.cdc.gov/hiv/guidelines/testing.html>). Students who reported same sex only and both sexes sexual contacts had the greatest decreases in HIV testing. This finding is concerning because of disproportionate rates of HIV infection among adolescent sexual minority males (11). Addressing structural barriers to HIV services for adolescents (e.g., access to culturally responsive and inclusive testing services) remains a priority.

From 2019 to 2021, sexually active younger students (aged ≤ 15 years) and male students were less likely to have received STD testing than older and female students; however, female and older students had larger declines in STD testing than these groups. Higher prevalence of STD screening among sexually active female students compared with male students might be explained by greater rates of chlamydia and gonorrhea among females and aligns with recommendations for annual chlamydia and gonorrhea screening for sexually active women aged ≥ 25 years (<https://www.cdc.gov/std/treatment-guidelines/default.htm>). White students reported the largest decrease in STD testing (6%) and were less likely to have received STD testing than Hispanic students in 2021. Similar patterns are observed in sex-stratified data from the National Survey of Family Growth (NSFG) (2013–2019), wherein Black and Hispanic males received STD tests at larger proportions than White males (12). Students with same sex only sexual contacts experienced the largest decrease in STD testing, mirroring other estimates of declines in STD/HIV testing among adolescent males who have sex with males and other sexual minority groups (10).

Improving access to STD testing is important because of persistent and disproportionate increases in rates of infection (<https://www.cdc.gov/std/statistics/2021/default.htm>) and suboptimal adherence to current CDC recommendation for a certain level of STD screening among adolescents. Delays or elimination of clinical care services, shortages, supply issues regarding testing materials (e.g., self-testing kits), and hesitancy in seeking health services have affected testing during the pandemic (7). Continuing to identify STD testing needs and providing routine screening and testing throughout adolescence, while considering confidentiality concerns (13), annual screening guidelines, and pandemic disruptions, is needed. The updated CDC STD Strategic Plan

2022–2026 (<https://www.cdc.gov/std/dstdp/dstdp-strategic-plan-2022-2026.htm>) and National HIV/AIDS Strategy (<https://www.whitehouse.gov/wp-content/uploads/2021/11/National-HIV-AIDS-Strategy.pdf>) provide guidance for addressing disparities among persons with varying racial and ethnicity and sexual identities, including strategies for screening, testing, and treatment in a variety of clinical and community settings.

Among the contraceptive methods used to prevent pregnancy at last sexual intercourse examined in this study, certain changes over time were identified among specific subgroups. The use of no contraceptive method significantly increased from 10.7% to 13.4% and was greatest among students aged ≤ 15 years and White students. Younger students reporting higher use of no contraceptive method mirrors prepandemic trends (2015–2019) among sexually active adolescents, illustrating persistent patterns of higher contraceptive method nonuse among those aged 15–17 versus 18–19 years (2). However, there was a significant increase (4.8% to 8.9%) in IUD or implant use. The increase in prevalence of these long-acting reversible contraceptive (LARC) methods is noteworthy and parallels other nationwide prepandemic trends in increased use (2). Older adolescents were more likely to report LARC use, which aligns with prepandemic findings from the Title X National Family Planning Program (14). Improving awareness and counseling on all available contraceptives, including LARC methods, as sexually active adolescents age remains important (13). Hispanic and Black students reported increases in IUD or implant use from 2019 to 2021, illustrating progress toward addressing racial and ethnic disparities and improving use of highly effective methods of contraception in 2021. As access to SRH services improves as part of pandemic recovery, return of fully available clinic and school-based services; use of same-day initiation of LARC methods and counseling on the importance of STD/HIV testing; and contraceptive method choice, including using both condoms and hormonal contraceptive methods; might help reduce disparities (4). In addition, because of high prevalence of condom use for pregnancy prevention among sexually active students (2), future research examining trends and differences in use of condoms as the primary contraceptive method used at last sexual intercourse are warranted.

Limitations

General limitations for 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, limited sample size prevented stratifying by multiple characteristics

concurrently (e.g., by sex and sex of sexual contacts) and examining race and ethnicity subgroups with smaller samples (e.g., Asians). Second, male students might not be aware of their female partner's contraceptive use at last sexual intercourse (15). Third, separating condom use for pregnancy prevention versus STD/HIV prevention is not feasible. Although YRBS assesses condom use as a primary method for pregnancy prevention (not included), condom use for STD/HIV prevention is not explicitly measured. Fourth, differences in question wording (Table 1) might have affected comparability in questions and responses between 2019 and 2021; however, the study team used analytic strategies to address question comparability where possible (e.g., limited the analytic sample to exclude students with only same sex sexual contacts). Finally, in 2021, the response option for use of birth control pills explicitly said to exclude emergency contraception; however, in 2019, the response option did not. Students might have differentially classified emergency contraception in 2019 versus 2021. Data from the NSFG indicate steady increases in emergency contraception use among sexually active adolescents in the United States between 2008 and 2015 (14% and 21%, respectively) (16), highlighting an important contraceptive method to monitor through ongoing surveillance.

Future Directions

The findings in this report highlight opportunities to promote adolescent sexual health by addressing pandemic-driven disruptions and historically declining trends in adolescent protective sexual behaviors (e.g., condom use) (2,3). Continuing to provide adolescent friendly SRH services delivered by culturally competent and trained providers is critical. Before and during the pandemic, innovative models of telehealth proved viable for ensuring the delivery of essential health services, including SRH services (17). For example, health care providers report using telehealth for contraception initiation or continuation and STD testing services during the pandemic (18), possibly affecting changes in select contraceptive methods used to prevent pregnancy among the sexually active high school students in this study. Continued work to address documented challenges in telehealth (e.g., confidentiality) for SRH service delivery (13,18), including maintaining availability of in-person services, remains important.

Schools are positioned to help support adolescent SRH by offering onsite or community-based preventive health services and comprehensive education (<https://www.cdc.gov/healthyyouth/whatworks/what-works-overview.htm>). Studies indicate increases in STD/HIV testing and hormonal contraceptive use among adolescents who attend schools

with established health service referral systems (19). Tools and resources to help develop and implement referral systems that link adolescents to school- or community-based SRH services are available at <https://www.ncsddc.org/resource/developing-a-referral-system-for-sexual-health-services-2/>. One study also illustrates positive effects of STD/HIV and pregnancy prevention education on adolescent sexual risk and protective behaviors (20). Because of the study's findings regarding high contraceptive method nonuse among students aged ≤ 15 years, explicit attention to building SRH knowledge and skills for using preventative clinical services among this cohort of adolescents is needed. CDC's Health Education Curriculum Analysis Tool (HECAT) (https://www.cdc.gov/healthyyouth/hecat/pdf/2021/hecat_module_sh.pdf) can be used to address concerns about adolescent sexual behaviors observed during the pandemic by guiding school-based delivery of comprehensive, developmentally appropriate, inclusive, and culturally responsive education.

Finally, youth- and community-driven initiatives that work to dismantle existing or new barriers to accessing and using SRH services are important. Implementation research suggests youths should be engaged as decision-makers in SRH program design and implementation (21). Working directly with adolescents and community members who experience disparate access to SRH services can help ensure needs are being met through culturally responsive and inclusive care.

Conclusion

Access to quality, affordable, and confidential SRH services remains critical for reducing STD/HIV and unintended pregnancy among adolescents. Social and economic changes during the COVID-19 pandemic, including social distancing, stay-at-home orders, and health care facility and school closures, might have affected the sexual behaviors and use of a range of SRH services and resources for adolescents across the United States. Decreases in STD/HIV testing and increases in nonuse of contraception signal the continuing need for comprehensive, inclusive, and culturally responsive education and health services. Findings can be bolstered by future work on the long-term effects of COVID-19 on adolescent's sexual behaviors, romantic relationships, and sexual health care.

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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Dating Violence, Sexual Violence, and Bullying Victimization Among High School Students — Youth Risk Behavior Survey, United States, 2021

Heather B. Clayton, PhD¹; Greta Kilmer, MS²; Sarah DeGue, PhD¹; Lianne F. Estefan, PhD¹; Vi D. Le, PhD¹; Nicolas A. Suarez, MPH²; Bridget H. Lyons, MPH¹; Jemekia E. Thornton, MPA²

¹*Division of Violence Prevention, National Center for Injury Prevention and Control, CDC;*

²*Division of Adolescent and School Health, National Center for HIV, Viral Hepatitis, STD, and TB Prevention, CDC*

Abstract

Experiences of teen dating violence (TDV), sexual violence, and bullying during adolescence are all forms of interpersonal violence victimization (IVV) and are associated with health and behavioral issues during adulthood. Data from the nationally representative 2011–2021 Youth Risk Behavior Surveys were used to estimate the 2021 prevalence of IVV reported by U.S. high school students. IVV included past-year sexual TDV, physical TDV, sexual violence by anyone, electronic bullying, being bullied on school property, and lifetime forced sex and was analyzed by demographic characteristics and sex of sexual contacts. This report also explored trends in IVV over this 10-year period among U.S. high school students. In 2021, a total of 8.5% of students reported physical TDV, 9.7% reported sexual TDV, 11.0% reported sexual violence by anyone (with 59.5% of those also reporting sexual TDV), 15.0% reported bullying on school property, and 15.9% reported electronic bullying victimization during the past 12 months; 8.5% also reported experiencing forced sex in their lifetime. Disparities were observed for each form of IVV assessed for females and for most forms of IVV among racial and ethnic minority students; students who identified as lesbian, gay, bisexual, questioning, or other (LGBQ+); and students who reported their sexual contacts as same sex only or both sexes. Trend analyses indicated that physical TDV, sexual TDV, any physical or sexual TDV, and both physical and sexual TDV victimization decreased from 2013 to 2021 (although sexual TDV increased from 2019 to 2021). Any bullying victimization decreased from 2011 to 2021. Lifetime forced sexual intercourse decreased from 2011 to 2015, then increased from 2015 to 2021. Being bullied on school property was unchanged from 2011 to 2017, then decreased from 2017 to 2021. Sexual violence by anyone increased from 2017 to 2021. This report highlights disparities in IVV and provides the first national estimates among Native Hawaiian or other Pacific Islander youths. Findings, including trend analyses indicating recent increases in certain forms of IVV, point to the continued urgency of violence prevention efforts for all U.S. youths and especially those who are disproportionately affected by IVV.

Introduction

Teen dating violence (TDV), sexual violence, and bullying during adolescence, all forms of interpersonal violence victimization (IVV), are associated with later revictimization, substance use, physical and mental health issues, and suicidal ideation (1). The most recent available data from the 2021 nationally representative Adolescent Behaviors and Experiences Study (ABES), designed to capture adolescent experiences during the COVID-19 pandemic, found that 9.6% of high school students reported experiencing any sexual violence, 7.7% experienced sexual TDV, 6.4% experienced physical TDV, 13.8% experienced electronic bullying, and 12.5% were bullied at school during the year before the survey (<https://www.cdc.gov/healthyyouth/data/abes/tables/summary.htm#UIV>). In addition, 6.7% of students from the 2021

ABES reported lifetime experience of forced sexual intercourse. Substantial disparities exist in the prevalence of IVV. Females, racial and ethnic minority populations, and sexual minority youths experienced disproportionately greater prevalence of these forms of IVV (1,2). Understanding the pattern of disparities in IVV is important for developing prevention and intervention efforts.

Using data from the national Youth Risk Behavior Survey (YRBS), this report presents 2021 prevalence estimates for TDV, sexual violence, and bullying victimization of U.S. high school students by sex, race and ethnicity, sexual identity, and sex of sexual contacts. In addition, this report presents 2011–2021 trends for TDV, sexual violence, and bullying victimization among U.S. high school students and compares 2019 with 2021 data to explore potential differences in past-year estimates before (fall 2019) and during (fall 2021) the COVID-19 pandemic. These findings can be used when developing prevention and intervention efforts to address health inequities and improve long-term behavioral and health outcomes of U.S. youths.

Corresponding author: Heather B. Clayton, PhD, Division of Violence Prevention, National Center for Injury Prevention and Control. Telephone: 404-834-2021; Email: hclayton@cdc.gov.

Methods

Data Source

This report includes data from the 2021 YRBS (N = 17,232), 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 (3). The prevalence estimates for types of IVV for the overall study population and by sex, race and ethnicity, grade, and sexual identity are available at <https://nccd.cdc.gov/youthonline/App/Default.aspx>. The full YRBS questionnaire, data sets, and documentation are available at <https://www.cdc.gov/healthyyouth/data/yrbs/index.htm>. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.*

Measures

This analysis included six standard measures of IVV and three composite variables created from those measures (Table 1). The standard measures were physical TDV, sexual TDV, sexual violence by anyone (partner or nonpartner), bullied on school property, electronically bullied during the 12 months before the survey, and lifetime forced sexual intercourse. For each measure, dichotomous categories were created to indicate experiencing no victimization versus any victimization. The denominators for TDV victimization measures were students who reported dating during the 12 months before the survey; the denominators for sexual violence by anyone, lifetime forced sex, and bullying victimization measures were the full sample of students.

The two standard TDV victimization measures were combined into the following two composite measures: 1) experienced any TDV victimization (physical, sexual, or both) and 2) experienced both physical and sexual TDV victimization. Similarly, a bullying victimization “any” measure was created. The following student demographic characteristics were also included in analyses: sex (female and male); race and ethnicity (American Indian or Alaska Native [AI/AN], Asian, Black or African American [Black], Native Hawaiian or other Pacific Islander [NH/OPI], White, Hispanic or Latino [Hispanic], and multiracial); sexual identity (heterosexual, lesbian, gay, bisexual, questioning, or other); and sex of sexual contacts (opposite only, same only, or both sexes). (Persons of Hispanic origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.)

* See e.g., 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

Analysis

Prevalence for each form of IVV was estimated for all years with available data. To identify temporal trends, logistic regression analyses were used to model linear and quadratic time effects while controlling for sex, grade, and race and ethnicity changes over time. Time variables were treated as continuous and were coded by using orthogonal coefficients calculated with PROC IML in SAS (version 9.4; SAS Institute). Separate regression models were used to assess linear and quadratic trends for each variable; 3 years of survey data were required to calculate linear trends, and 6 survey years were required to calculate quadratic trends. Time effects with p values of <0.05 were considered statistically significant. When a statistically significant quadratic trend was identified, Joinpoint (version 4.9; National Cancer Institute) was used to identify the specific year where the change in trend occurred, and regression models were then used to identify linear trends occurring in each time segment. Significant differences in the 2-year prevalence of all the IVV measures (standard and composite) also were examined, using *t*-tests with Taylor series linearization to compare 2019 with 2021 (p<0.05).

Weighted prevalence estimates and corresponding 95% CIs were provided for all IVV measures. Comparisons by demographic characteristics and sex of sexual contacts were conducted using chi-square tests (p<0.05). When differences among subgroups were demonstrated, additional *t*-tests were performed to test pairwise differences between subpopulations. Differences between prevalence estimates were considered statistically significant if the *t*-test p-value was <0.05 for main effects (sex, race and ethnicity, sexual identity, and sex of sexual contacts). Analyses were completed using SAS (version 9.4; SAS Institute) and SUDAAN (version 11.0.3; RTI International) to account for the complex survey design and weighting.

Results

Findings from the 2021 survey indicate that 8.5% of students who had dated in the past year experienced physical TDV and 9.7% experienced sexual TDV. Overall, 13.6% of students experienced any TDV (physical, sexual, or both), and 3.6% experienced both types of TDV (Table 2). In the full sample, 11.0% of students reported sexual violence victimization by anyone in the previous year. Of those students who reported sexual violence by anyone, 59.5% also reported sexual TDV. Lifetime forced sexual intercourse was reported by 8.5% of all students. Finally, 15.0% of students reported being bullied on school property, 15.9% reported electronic bullying, and 22.0% reported any bullying during the 12 months before the survey (Table 3).

TABLE 1. Interpersonal violence victimization measures — Youth Risk Behavior Survey, United States, 2021

Health risk behavior	Questionnaire item	Analytic coding
Violence victimization		
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.) [Excludes students who did not date or go out with anyone during the past 12 months] A. I did not date or go out with anyone during the past 12 months B. 0 times C. 1 time D. 2 or 3 times E. 4 or 5 times F. ≥6 times	>1 time versus 0 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.) [Excludes students who did not date or go out with anyone during the past 12 months] A. I did not date or go out with anyone during the past 12 months B. 0 times C. 1 time D. 2 or 3 times E. 4 or 5 times F. ≥6 times	>1 time versus 0 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.) A. 0 times B. 1 time C. 2 or 3 times D. 4 or 5 times E. ≥6 times	>1 time versus 0 times
Bullied on school property	During the past 12 months, have you ever been bullied on school property? A. Yes B. No	Yes versus no
Electronically bullied	During the past 12 months, have you ever been electronically bullied? A. Yes B. No	Yes versus no
Forced sex	Have you ever been physically forced to have sexual intercourse when you did not want to? A. Yes B. No	Yes versus no

In 2021, differences for demographic characteristics and sex of sexual contacts were observed for the majority of IVV measures (Tables 2 and 3). Female students had greater prevalence of all types of IVV compared with male students. Variation in prevalence among racial and ethnic minority students was also observed for all types of IVV, although patterns were not consistent. AI/AN students reported the highest levels of TDV (including 18.5% prevalence of any TDV) and Asian, Black, and NH/OPI students reported the lowest levels. Differences were found in the prevalence of physical TDV for students who were multiracial (10.4%) or White (9.1%) compared with Asian students (5.3%), and Hispanic students (7.4%) had lower prevalence of physical TDV compared with White students (9.1%). Prevalence of sexual TDV was greater for students who were multiracial (11.6%), White (10.7%), or Hispanic (10.0%) compared with Black students (5.3%). The prevalence of sexual violence by anyone was greater for students who were AI/AN (15.8%), multiracial (14.7%), White (11.9%), or Hispanic (11.3%) compared with students

who were Black (7.4%), Asian (5.7%), or NH/OPI (5.4%). Variation in the prevalence of lifetime forced sexual intercourse was observed for all racial and ethnic groups; however, the most consistent pattern was observed among AI/AN students, who had the greatest prevalence (18.3%) of forced sexual intercourse compared with students within all other racial and ethnic groups (range = 4.5%–9.8%) except multiracial students (11.6%). The patterns for being bullied on school property and electronic bullying were similar, with higher prevalence of bullying among AI/AN and White students and lower prevalence among Asian, Black, and NH/OPI students. Multiracial students had higher rates than Asian, Black, and NH/OPI students. AI/AN and White students tended to report any bullying at higher rates than Asian, Black, or Hispanic students.

The 2021 prevalence estimates for all forms of IVV also tended to be higher among students with a sexual identity other than heterosexual. Bisexual students had greater prevalence of sexual violence by anyone (25.3%) compared with those who identified as heterosexual (7.6%), lesbian or gay (17.0%), or

TABLE 2. Prevalence of interpersonal violence victimization among high school students, by demographic characteristics and type of violence — Youth Risk Behavior Survey, United States, 2021*

Characteristic	Any TDV ^{†,§}		Physical TDV ^{†,¶}		Sexual TDV ^{†,***}	
	% (95% CI)	p value ^{††}	% (95% CI)	p value ^{††}	% (95% CI)	p value ^{††}
Overall	13.6 (12.3–15.1)	NA	8.5 (7.6–9.6)	NA	9.7 (8.6–11.0)	NA
Sex						
Female	19.0 (17.1–21.0)	<0.001	10.2 (8.9–11.6)	<0.001	15.3 (13.6–17.2)	<0.001
Male	8.2 ^{§§} (6.8–10.0)		6.7 ^{§§} (5.8–7.7)		4.0 ^{§§} (3.0–5.5)	
Race and ethnicity^{§§}						
American Indian or Alaska Native	18.5 (8.6–35.4)	<0.001	14.6 (6.7–29.0)	0.003	11.0 (5.5–20.9)	<0.001
Asian	7.2 ^{***,†††,§§§,¶¶¶} (3.4–14.9)		5.3 ^{***,¶¶¶} (3.1–8.7)		5.5 ^{†††} (2.6–11.4)	
Black or African American	9.7 ^{***,†††,¶¶¶} (7.5–12.5)		8.1 (6.6–9.9)		5.3 ^{***,¶¶¶} (4.1–6.9)	
Native Hawaiian or other Pacific Islander	9.4 ^{¶¶¶} (4.0–20.4)		13.8 (5.6–30.4)		5.5 (1.1–23.9)	
White	14.9 (12.9–17.2)		9.1 ^{***} (7.9–10.5)		10.7 (8.8–13.0)	
Hispanic or Latino	13.2 (11.4–15.3)		7.4 ^{¶¶¶} (6.2–8.9)		10.0 (8.4–11.8)	
Multiracial	16.1 (11.9–21.5)		10.4 (7.5–14.1)		11.6 (8.3–16.1)	
Sexual identity						
Heterosexual (straight)	10.0 ^{****,††††} (8.9–11.2)	<0.001	6.2 ^{††††} (5.4–7.1)	<0.001	6.6 ^{††††} (5.6–7.7)	<0.001
Lesbian or gay	17.0 ^{§§§§} (11.5–24.3)		14.1 ^{§§§§} (9.5–20.4)		12.0 (7.5–18.7)	
Bisexual	26.0 ^{§§§§} (21.7–30.7)		16.1 ^{§§§§} (12.8–20.2)		20.8 ^{****,§§§§} (17.2–24.9)	
Questioning	21.1 ^{§§§§} (15.4–28.1)		12.8 ^{§§§§} (8.7–18.5)		16.0 ^{§§§§} (11.7–21.6)	
Other	27.9 ^{§§§§} (21.4–35.5)		16.5 ^{§§§§} (10.7–24.6)		23.8 ^{****,§§§§} (17.7–31.3)	
Sex of sexual contacts						
Opposite sex only	15.4 (13.6–17.4)	<0.001	9.3 (8.1–10.6)	<0.001	10.8 (9.2–12.6)	<0.001
Same sex only	16.4 (9.2–27.6)		12.6 (7.8–19.6)		11.2 (5.8–20.5)	
Both sexes	40.1 ^{¶¶¶¶,****} (34.6–45.9)		25.7 ^{¶¶¶¶,****} (19.5–33.2)		32.0 ^{¶¶¶¶,****} (26.8–37.7)	
Total	Both physical and sexual TDV^{†,††††}	NA	Sexual violence by anyone^{§§§§§}	NA	Forced sex (lifetime)	NA
	3.6 (2.9–4.5)		11.0 (10.1–12.0)		8.5 (7.6–9.4)	
Sex						
Female	5.2 (4.2–6.5)	<0.001	17.9 (16.3–19.5)	<0.001	13.5 (12.3–14.8)	<0.001
Male	1.9 ^{§§} (1.3–2.7)		4.6 ^{††} (3.8–5.5)		3.6 ^{††} (2.8–4.4)	
Race and ethnicity						
American Indian or Alaska Native	5.9 (1.8–17.4)	0.779	15.8 (9.7–24.6)	<0.001	18.3 (12.1–26.6)	<0.001
Asian	3.1 (1.6–5.9)		5.7 ^{¶¶¶,***,†††,§§§} (3.4–9.4)		4.5 ^{¶¶¶,***,†††,§§§} (3.2–6.2)	
Black or African American	2.5 (1.4–4.5)		7.4 ^{¶¶¶,***,†††,§§§} (6.4–8.7)		7.1 ^{†††,§§§} (5.0–10.0)	
Native Hawaiian or other Pacific Islander	5.7 (1.0–27.2)		5.4 ^{¶¶¶,***,†††,§§§} (2.2–12.7)		9.8 ^{†††} (4.7–19.4)	
White	4.0 (2.8–5.5)		11.9 (10.7–13.3)		8.4 ^{†††,§§§} (7.4–9.5)	
Hispanic or Latino	3.7 (2.8–4.9)		11.3 (9.7–13.1)		9.5 ^{†††} (8.2–10.9)	
Multiracial	3.2 (2.0–5.1)		14.7 (11.3–18.7)		11.6 (9.1–14.5)	

See table footnotes on the next page.

questioning (17.5%). Students who identified as bisexual or other identity had greater prevalence of experiencing both types of TDV and any bullying than students who identified as questioning. Students who identified as lesbian or gay also reported any bullying at a greater prevalence than questioning students. All forms of TDV and sexual violence were reported at higher rates among students who reported sexual contact with both sexes than those who reported sexual contact with opposite sex only or same sex only. Students who reported sexual contact with both sexes or same sex only had a greater prevalence of being bullied on school property or electronically, and experiencing any bullying, than those with sexual contacts of the opposite sex only.

Trend analyses indicated that physical TDV, sexual TDV, experience of any TDV, and experiences with both physical and

sexual TDV all decreased from 2013 to 2021 (Table 4). Being bullied on school property and any bullying victimization both decreased from 2011 to 2021. Lifetime forced sexual intercourse decreased during 2011–2015, then increased during 2015–2021. Sexual violence victimization by anyone increased during the period 2017–2021. Being bullied electronically did not change during the period 2011–2021; however, being bullied on school property decreased during 2017–2021 after being stable from 2011 to 2017. Few differences in types of IVV were observed from 2019 (pre-COVID-19 pandemic) to 2021 (during the COVID-19 pandemic). Being bullied on school property decreased from 19.5% to 15.0%, and the related composite measure (any bullying victimization) also decreased during this period from 24.8% to 22.0%. Sexual TDV increased from 8.2% in 2019 to 9.7% in 2021.

TABLE 2. (Continued) Prevalence of interpersonal violence victimization among high school students, by demographic characteristics and type of violence — Youth Risk Behavior Survey, United States, 2021*

Characteristic	Any TDV ^{†,§}		Physical TDV ^{†,¶}		Sexual TDV ^{†,***}	
	% (95% CI)	p value ^{††}	% (95% CI)	p value ^{††}	% (95% CI)	p value ^{††}
Sexual identity						
Heterosexual (straight)	2.0 (1.5–2.5)	<0.001	7.6 ^{††††} (6.9–8.4)	<0.001	5.0 ^{††††} (4.3–5.8)	<0.001
Lesbian or gay	8.9 ^{§§§§} (5.1–15.1)		17.0 ^{§§§§} (12.7–22.5)		16.9 ^{§§§§} (12.7–22.2)	
Bisexual	9.6 ^{††††,§§§§} (6.6–13.7)		25.3 ^{****,††††,§§§§} (21.0–30.2)		23.3 ^{****,††††,§§§§} (20.5–26.3)	
Questioning	3.9 (1.8–8.2)		17.5 ^{§§§§} (14.6–20.8)		13.6 ^{§§§§} (10.9–16.9)	
Other	11.7 ^{††††,§§§§} (6.6–19.8)		20.9 ^{§§§§} (16.8–25.8)		19.0 ^{††††,§§§§} (14.6–24.4)	
Sex of sexual contacts						
Opposite sex only	3.6 (2.9–4.4)	<0.001	16.6 (15.0–18.4)	<0.001	12.7 ^{*****} (11.1–14.5)	<0.001
Same sex only	4.3 (1.7–10.2)		25.5 (17.5–35.6)		22.7 ^{¶¶¶¶} (15.7–31.6)	
Both sexes	16.3 ^{¶¶¶¶,*****} (11.1–23.4)		44.0 ^{¶¶¶¶,*****} (39.2–49.0)		43.1 ^{¶¶¶¶,*****} (38.7–47.6)	

Abbreviations: NA = not applicable; TDV = teen dating violence.

* N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

† During the 12 months before the survey, among students who dated or went out with someone during the 12 months before the survey.

§ Combined any “yes” responses to physical TDV and sexual TDV.

¶ 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, one or more times, among the 58.2% 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, one or more times, among the 58.0% of students nationwide who dated or went out with someone during the 12 months before the survey.

†† p value is based on chi-square tests (p<0.05).

§§ Significantly different from female students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

¶¶ Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

*** Significantly different from White students, based on t-test analysis with Taylor series linearization (p<0.05).

††† Significantly different from Hispanic students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

§§§ Significantly different from American Indian or Alaska Native students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

¶¶¶ Significantly different from multiracial students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

**** Significantly different from gay or lesbian students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

†††† Significantly different from questioning students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

§§§§ Significantly different from heterosexual students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

¶¶¶¶ Significantly different from opposite sex only, on the basis of t-test analysis with Taylor series linearization (p<0.05).

***** Significantly different from same sex only, on the basis of t-test analysis with Taylor series linearization (p<0.05).

††††† Combined where responses to both physical TDV and sexual TDV were “yes.”

§§§§§ 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, one or more times during the 12 months before the survey.

Discussion

This report describes 2021 prevalence estimates and trends in prevalence during 2011–2021 for different forms of IVV experienced by U.S. high school students. Findings indicate that multiple forms of TDV, sexual violence, and bullying victimization are common experiences for U.S. youths. Disparities in exposure also are evident, with female, racial and ethnic minority, and sexual minority youths disproportionately affected by these forms of violence in adolescence. Although other studies have demonstrated greater rates of violence among certain racial and ethnic and sexual minority groups (1,2), the number of subgroups examined with nationally representative data has been limited. This report presents data for additional population characteristics and behavior including AI/AN, Asian, NH/OPI, and multiracial youths; bisexual and questioning youths; and sex of sexual contacts, providing a nuanced context of prevalence and disparities among racial and ethnic and sexual minority youths.

Consistent with other studies, prevalence of both physical and sexual TDV was higher for females than males (1). Although males also report TDV victimization, factors including community norms that support gender inequity might increase the likelihood that females experience and report TDV (4). In addition, rates of both physical and sexual TDV were higher for AI/AN, NH/OPI, and multiracial youths than for White youths, and the prevalence of experiencing any TDV was highest for AI/AN youths. Trends indicate that sexual TDV increased from 2019 to 2021. Research has linked increases in stress and isolation to poor mental health in youths, which is associated with TDV (5). Although not yet examined, these effects might help explain this increase in sexual TDV during the pandemic period. The reasons why sexual TDV increased whereas physical TDV remained stable are unclear; additional research could examine whether factors such as technology-facilitated sexual violence (e.g., posting or sharing sexual pictures of someone without their consent, or nonconsensual sexting) and sexual harassment contribute to

TABLE 3. Prevalence of bullying victimization among high school students, by demographic characteristics and type of bullying — Youth Risk Behavior Survey, United States, 2021*

Characteristic	Any bullying ^{†,§}		Bullied on school property		Electronically bullied [†]	
	% (95% CI)	p value [¶]	% (95% CI)	p value [¶]	% (95% CI)	p value [¶]
Overall	22.0 (21.0–23.0)	NA	15.0 (14.1–15.8)	NA	15.9 (15.0–16.8)	NA
Sex						
Female	26.2 (24.9–27.6)	<0.001	17.0 (15.8–18.3)	<0.001	20.5 (19.3–21.7)	<0.001
Male	17.7 ^{**} (16.0–19.5)		12.8 ^{**} (11.3–14.5)		11.2 ^{**} (10.3–12.2)	
Race and ethnicity^{††}						
American Indian or Alaska Native	29.7 (21.9–39.0)	<0.001	17.8 (12.1–25.3)	<0.001	20.9 (14.3–29.4)	<0.001
Asian	17.3 ^{§§,***,†††} (13.3–22.3)		10.8 ^{§§,†††} (8.5–13.6)		13.3 ^{§§} (9.9–17.6)	
Black or African American	13.4 ^{§§,¶¶,†††} (11.7–15.2)		8.5 ^{§§,¶¶,†††} (7.2–10.1)		9.5 ^{§§,¶¶,†††} (8.4–10.9)	
Native Hawaiian or other Pacific Islander	14.0 ^{§§,***} (6.4–27.7)		8.9 (2.5–27.3)		9.7 ^{§§,¶¶,***} (5.9–15.5)	
White	26.3 ^{††} (24.6–28.1)		17.9 ^{¶¶} (16.6–19.3)		18.8 ^{¶¶} (17.2–20.4)	
Hispanic or Latino	17.9 ^{§§,***} (14.9–21.3)		12.4 ^{§§} (10.2–15.0)		13.2 ^{§§,***} (10.6–16.3)	
Multiracial	23.7 (19.1–28.9)		17.5 (13.3–22.8)		16.9 (12.8–22.0)	
Sexual identity						
Heterosexual (straight)	17.9 ^{§§§} (16.9–19.0)	<0.001	12.0 (11.1–12.9)	<0.001	12.7 ^{¶¶¶} (11.8–13.6)	<0.001
Lesbian or gay	35.2 ^{¶¶¶,****} (29.2–41.7)		26.4 ^{****} (21.4–32.2)		24.8 ^{****} (19.8–30.5)	
Bisexual	35.6 ^{¶¶¶,****} (32.5–38.9)		24.4 ^{****} (20.9–28.4)		28.4 ^{¶¶¶,****} (25.1–31.9)	
Questioning	26.4 ^{§§§} (23.3–29.7)		15.0 (12.0–18.5)		19.6 ^{****} (16.0–23.8)	
Other	41.0 ^{¶¶¶,****} (34.9–47.4)		29.3 ^{****} (23.9–35.4)		31.7 ^{¶¶¶,****} (26.4–37.5)	
Sex of sexual contacts						
Opposite sex only	24.8 ^{††††} (23.4–26.3)	<0.001	16.1 ^{††††} (14.8–17.4)	<0.001	19.5 ^{††††} (18.2–20.9)	<0.001
Same sex only	38.9 ^{§§§§} (32.1–46.1)		29.3 ^{§§§§} (21.9–38.1)		31.8 ^{§§§§} (25.2–39.3)	
Both sexes	47.2 ^{††††,§§§§} (41.1–53.3)		33.1 ^{§§§§} (27.3–39.4)		39.1 ^{§§§§} (33.2–45.2)	

Abbreviation: NA = not applicable.

* N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] During the 12 months before the survey.

[§] Combined any "yes" responses to bullied on school property and electronic bullying.

[¶] p value is based on chi-square tests (p<0.05).

^{**} Significantly different from female students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

^{††} Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

^{§§} Significantly different from White students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

^{¶¶} Significantly different from Hispanic students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

^{***} Significantly different from American Indian or Alaska Native students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

^{†††} Significantly different from multiracial students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

^{§§§} Significantly different from gay or lesbian students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

^{¶¶¶} Significantly different from questioning students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

^{****} Significantly different from heterosexual students, on the basis of t-test analysis with Taylor series linearization (p<0.05).

^{††††} Significantly different from same sex only, on the basis of t-test analysis with Taylor series linearization (p<0.05).

^{§§§§} Significantly different from opposite sex only, on the basis of t-test analysis with Taylor series linearization (p<0.05).

this finding. These trends and evidence of disparities in TDV experiences, with particularly vulnerable youths experiencing higher rates, highlight the need for comprehensive violence prevention efforts that are grounded in equity principles and address the unique needs of adolescents disproportionately affected by TDV.

Prevalence of lifetime forced sex and sexual violence victimization by anyone was higher for females than males, consistent with other studies (1). Rates of forced sex were also two to four times higher for AI/AN youths compared with other single-race groups, consistent with recent findings that nearly one in four AI/AN women experienced sexual abuse as a child, the highest rate among racial and ethnic groups (6). Of those students who reported sexual violence by anyone, 59.9% also reported sexual TDV, which indicates that a substantial portion

of sexual violence victimization experiences were by someone other than a dating partner. Sexual violence in adolescence often is perpetrated by peers outside a dating context (7) and also can be perpetrated by family members, other known adults, and strangers, among others. Because of recent increases in lifetime forced sex (from 2015 to 2021) and past-year sexual violence victimization by anyone (from 2017 to 2021), prevention efforts that address sexual violence in both dating and nondating contexts are critical (<https://www.cdc.gov/violenceprevention/pdf/2012FindingsonSVinYouth-508.pdf>).

All forms of bullying victimization were more common among females, White youths, and sexual minority youths, consistent with previous research (1). In addition to White youths, AI/AN and multiracial youths had higher bullying rates than other racial and ethnic groups. Research on IVV

TABLE 4. Trends in prevalence of interpersonal violence victimization among high school students — Youth Risk Behavior Survey, United States, 2011–2021*

Interpersonal violence experience	Prevalence						Linear change [†]	Quadratic change [†]	Change during 2019–2021 [§]
	2011	2013	2015	2017	2019	2021			
Any TDV ^{¶,**}	— ^{††}	15.7	15.6	11.7	12.2	13.6	Decreased	NA ^{§§}	No change
Physical TDV [¶]	—	10.3	9.6	8.0	8.2	8.5	Decreased	NA ^{§§}	No change
Sexual TDV [¶]	—	10.4	10.6	6.9	8.2	9.7	Decreased	NA ^{§§}	Increased
Both physical and sexual TDV ^{¶,¶¶}	—	4.9	4.6	2.5	3.0	3.6	Decreased	NA ^{§§}	No change
Sexual violence by anyone ^{***}	—	—	—	9.7	10.8	11.0	Increased	NA ^{§§}	No change
Forced sex (lifetime)	8.0	7.3	6.7	7.4	7.3	8.5	No linear change	Decreased 2011–2015 Increased 2015–2021	No change
Bullying									
Any bullying ^{***,†††}	27.0	25.2	25.7	24.0	24.8	22.0	Decreased	No quadratic change	Decreased
Bullied on school property ^{***}	20.1	19.6	20.2	19.0	19.5	15.0	Decreased	No linear change 2011–2017 Decreased 2017–2021	Decreased
Electronically bullied ^{***}	16.2	14.8	15.5	14.9	15.7	15.9	No linear change	No quadratic change	No change

Abbreviations: NA = not available; TDV = teen dating violence.

* N = 90,306 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] On the basis of trend analyses using a logistic regression model controlling for sex, race and ethnicity, and grade ($p < 0.05$).

[§] On the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$).

[¶] During the 12 months before the survey, among students who dated or went out with someone during the 12 months before the survey.

^{**} Combined any “yes” responses to physical TDV and sexual TDV.

^{††} Dashes indicate that no data are available.

^{§§} Insufficient years of data to assess quadratic trend.

^{¶¶} Combined where responses to both physical TDV and sexual TDV were “yes.”

^{***} During the 12 months before the survey.

^{†††} Combined any “yes” responses to bullied at school and electronically bullied.

experiences among AI/AN youths typically is limited to comparisons with White youths; therefore, these findings comparing AI/AN youths with other racial and ethnic minority youths provide needed data for the field (8,9). Tailoring prevention strategies to the cultural beliefs and norms of racial and ethnic minority subgroups that are disproportionately at risk for IVV might help address these disparities (10). Overall, rates of bullying victimization decreased from 2011 to 2021; however, the decrease in bullying on school property from 19.5% pre-pandemic (2019) to 15.0% during the COVID-19 pandemic (2021) was likely driven by reduced time spent on school property during 2020–2021. Electronic bullying rates remained stable, which is not a surprising finding because virtual learning and overall online interactions increased during the pandemic (5).

Sexual minority youths were at an increased risk for all forms of IVV included in this report compared with heterosexual youths. Although other studies indicate how sexual minority youths experience higher rates of bullying and sexual and physical violence compared with their peers who are not sexual minority youths, others excluded questioning youths and did not examine differences with bisexual youths or sex of sexual contacts (2,11). By disaggregating sexual minority youths and including identity and sex of sexual contacts (i.e., youths who identify as lesbian, gay, bisexual, questioning, or other and

youths who have sexual contact with same-sex partners only and partners of both sexes), this report adds further context to national prevalence estimates of violence victimization against sexual minority youths; for example, students who identify as bisexual and students who have sexual contact with both sexes experience violence victimization at higher rates. School-based strategies to support LGBTQ+ youths have been found to be associated with decreases in IVV among both LGBTQ+ youths and heterosexual youths, contributing to safer school environments for all students (12). The consistent disparities in violence by sexual orientation found in this analysis highlight the important role of LGBTQ+ supportive practices in reducing experiences of violence.

Effective, evidence-based primary prevention is critical to reducing the substantial risk for violence victimization during high school, and research points to the importance of starting these prevention efforts early, before violence begins. Prevention strategies work best when they operate across levels of the social ecological model, addressing risk and protective factors of persons, their peers and families, and their physical and social environments (<https://www.cdc.gov/violenceprevention/about/connectingthedots.html>). CDC developed a series of guides that outline prevention resources to help communities identify effective approaches and implement comprehensive, multicomponent prevention

efforts based on the best available research evidence to address sexual violence, youth violence, and intimate partner violence (<https://www.cdc.gov/violenceprevention/communicationresources/pub/technical-packages.html#technicalPackages>). For example, one prevention approach involves teaching youths how to act as engaged, proactive bystanders when they encounter sexist, homophobic, racist, or violence-supportive attitudes. Youth Voices in Prevention, a youth-led sexual violence prevention program, was found to increase bystander behaviors and decrease violence-related attitudes, with stronger effects for sexual minority and AI/AN youths (13). In addition, CDC developed Dating Matters: Strategies to Promote Healthy Teen Relationships, which includes prevention strategies focused on healthy relationship skills for youths and their families, schools, and neighborhoods.

Findings in this report highlight the importance of tailoring prevention strategies to create safe, nonjudgmental environments that promote protective factors to reduce disparities and increase safety among youths (6). Prevention efforts must also address disparities in risk for adolescent victimization by sex, race and ethnicity, and sexual minority status. Approaches should be designed or adapted to address the unique social and structural risk and protective factors affecting these groups, including social determinants of health (e.g., racism, discrimination, and socioeconomic disadvantage) that perpetuate and reinforce health disparities (14,15). For example, approaches that strengthen household financial security, create safer and healthier communities through physical environment enhancements, or connect youths to caring adults through mentoring or job training programs can help build protective environments for youths at higher risk for violence exposure (<https://www.cdc.gov/violenceprevention/pdf/yv-technicalpackage.pdf>) (14).

Limitations

General limitations for the YRBS are available in the overview report of this supplement (3). The findings in this report are subject to at least four additional limitations. First, because of the breadth of topics included in the YRBS, the violence subtype measures included in the YRBS, and in this report, were assessed by single items, which might not capture all the dimensions of a construct. Second, 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. Third, the forms of violence assessed in this report do not encompass the full range of violence experiences in adolescence, and patterns of victimization across groups (e.g., by sex or race and ethnicity) for other types of violence might be different from those identified for TDV, sexual violence, and bullying in this report. Finally, the sexual violence measures had higher levels of missingness than other outcomes in this report (17.8%, forced sex; 22.6% sexual violence by anyone; and 24.5%, sexual TDV among the 17,232 respondents) attributed, at least in part, to the use of different versions of the YRBS questionnaire in specific states and localities that did not include sexual violence questions. More information on missingness of YRBS data is available in the overview report of this supplement (3). Although the proportion of missing data for sexual violence questions is consistent with previous YRBS cycles, prevalence estimates for sexual violence measures might be over- or underestimated.

Future Directions

Identifying the differential burden of adolescent IVV among the demographic groups included in this report is important. Although this IVV report disaggregated racial and ethnic groups as much as was feasible with these 2021 YRBS data, each group presented is not homogenous. Victimization studies that further disaggregate the categories of racial and ethnic groups and also explore the intersection of race and ethnicity, sex, and sexual identity, might add additional information that can be used to tailor prevention and intervention efforts for those populations. Future research on IVV that includes transgender youths would advance our ability to understand the needs of transgender youths; the 2023 YRBS will measure transgender identity (https://www.cdc.gov/healthyyouth/data/yrbs/pdf/2023/2023_yrbs_national_hs_questionnaire.pdf). In addition, national estimates of other forms of violence victimization in adolescence, such as physical assault and homicide, are needed to provide a broader picture of violence risks for youths, including violence that might disproportionately affect males (<https://www.cdc.gov/violenceprevention/communityviolence/index.html>).

Conclusion

Violence victimization among youths is a public health concern because experiences of IVV during childhood have been associated with increased risk for adverse experiences and poor health outcomes during adulthood (1). This report used nationally representative data from the 2021 YRBS to estimate the prevalence of TDV, sexual violence, and bullying

victimization among U.S. high school students by demographic characteristics and sex of sexual contacts. Understanding disparities in IVV can be useful in prevention efforts for youths who are disproportionately affected by violence. Prevention approaches that focus not just on the personal, family, or school level but also incorporate an understanding of the social determinants of health (15) might be more effective for reducing violence experienced by youths among disproportionately affected populations.

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 in 2021 and Changes from 2019 to 2021 Among High School Students — Youth Risk Behavior Survey, United States, 2021

Shannon L. Michael, PhD¹; Sherry Everett Jones, PhD, JD²; Caitlin L. Merlo, MPH¹; Sarah A. Sliwa, PhD¹; Sarah M. Lee, PhD¹; Kelly Cornett, MS¹; Nancy D. Brener, PhD²; Tiffany J. Chen, MSPH^{3,4}; Carmen L. Ashley, MPH²; Sohyun Park, PhD³

¹Division of Population Health, National Center for Chronic Disease Prevention and Health Promotion, CDC; ²Division of Adolescent and School Health, National Center for HIV, Viral Hepatitis, STD, and TB Prevention, CDC; ³Division of Nutrition, Physical Activity, and Obesity, National Center for Chronic Disease Prevention and Health Promotion, CDC; ⁴McKing Consulting Corporation, Atlanta, Georgia

Abstract

The fall of 2021 was the first school semester to begin with widespread in-person learning since the COVID-19 pandemic began. Understanding dietary and physical activity behaviors of adolescents during this time can provide insight into potential health equity gaps and programmatic needs in schools and communities. This report uses data from the 2021 national Youth Risk Behavior Survey conducted among a nationally representative sample of U.S. public and private school students in grades 9–12 to update estimates of dietary and physical activity behaviors among U.S. high school students overall and by sex and race and ethnicity. In addition, 2-year comparisons (2019 versus 2021) of these behaviors were examined. In 2021, daily consumption of fruits, vegetables, and breakfast during the past 7 days remained low and decreased overall with specific disparities by sex and race and ethnicity from 2019 to 2021. The overall prevalence of students attending physical education classes daily, exercising to strengthen muscles on ≥ 3 days/week (i.e., met the guideline for muscle-strengthening activity), and playing on at least one sports team decreased from 2019 to 2021; whereas being physically active for ≥ 60 minutes/day on all 7 days (i.e., met the guideline for aerobic activity) and meeting both aerobic and muscle-strengthening guidelines remained low but did not change. These findings underscore the need for strategies to increase healthy dietary and physical activity behaviors both in the recovery phase of COVID-19 and longer term.

Introduction

Healthy dietary and physical activity behaviors provide adolescents with various benefits and are important public health strategies for chronic disease prevention (1,2). These benefits include supporting healthy growth and development, maintaining a healthy body weight, reducing anxiety, and reducing the risk for developing health conditions (e.g., heart disease or type 2 diabetes) (1,2). Not having consistent opportunities to practice these health behaviors could negatively affect students' physical and mental health, which have long-term health implications (1–3).

From the start of the COVID-19 pandemic in 2020, school and community practices changed to comply with COVID-19 guidance. Such changes included modified meal services and sport schedules, which likely affected opportunities for students to consistently engage in healthy dietary and physical activity behaviors (4,5). For example, recent studies illustrated that breakfast regularity declined during the pandemic, whereas

afternoon and evening snack consumption increased among adolescents (6), and homes had more high-calorie snack foods, unhealthy foods (e.g., desserts or sweets), and nonperishable processed foods during the pandemic (7). Likewise, adolescent physical activity levels decreased at the beginning of the pandemic because of changes in school- and sports-based programs (4,8). These pandemic-related effects are concerning because students might not meet key recommendations in the Dietary Guidelines for Americans 2020–2025 for following a healthy eating pattern (1) and not reach the duration and frequency of physical activity recommended by the Physical Activity Guidelines for Americans, second edition (2).

Despite studies examining dietary and physical activity behaviors of students between March 2020 and July 2021 (4–8), little is known about these behaviors among U.S. high school students during the fall of 2021 when most of them returned to school in person. This report provides 2021 national estimates of dietary and physical activity behaviors among U.S. high school students overall and by sex and race and ethnicity. This report also compares 2019 with 2021 data overall and by sex and race and ethnicity to identify health disparities magnified during the pandemic. Health professionals, state and local health officials, policymakers, and

Corresponding author: Shannon L. Michael, PhD, Division of Population Health, National Center for Chronic Disease Prevention and Health Promotion, CDC. Telephone: 770-488-6125; Email: sot2@cdc.gov.

school leaders can use the findings in this report to highlight the need for school health policies, practices, and programs that promote students' healthy dietary and physical activity behaviors and their overall physical and mental health during immediate and longer-term pandemic recovery efforts.

Methods

Data Source

This report includes data from the 2019 (N = 13,677) and 2021 (N = 17,232) 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 (9). The prevalence estimates for dietary and physical activity behaviors for the overall study population and by sex, race and ethnicity, grade, and sexual identity are available at <https://nccd.cdc.gov/youthonline/App/Default.aspx>. The full YRBS questionnaire, data sets, and documentation are available at <https://www.cdc.gov/healthyyouth/data/yrbs/index.htm>. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.*

Measures

Six dietary variables and five physical activity variables were examined for this report (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 (i.e., did not eat breakfast daily), 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 (i.e., met the federal guideline for aerobic activity) (2), had exercised to strengthen or tone muscles on ≥3 days (i.e., met the federal guideline for muscle-strengthening activity), had met both aerobic and muscle-strengthening guidelines, had attended physical education classes on all 5 days during an average school week, and had played on ≥1 sports team during the 12 months before the survey.

*45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

Student demographic characteristics examined included sex (female or male) and race and ethnicity. Students were classified into seven racial and ethnic categories including American Indian or Alaska Native (AI/AN), Asian, Black or African American (Black), Hispanic or Latino (Hispanic), Native Hawaiian or other Pacific Islander (NH/OPI), White, and students who were two or more races (multiracial). (Persons of Hispanic origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.) Grade was also included in the regression model.

Analysis

For each behavior, the 2021 prevalence and 95% CIs were calculated overall and for each sex and race and ethnicity group. Statistically significant pairwise differences by sex and race and ethnicity were determined by *t*-tests with Taylor series linearization, as were comparisons between 2019 and 2021. Differences between prevalence estimates were considered statistically significant if the *t*-test *p* value was <0.05. Only statistically significant findings are described.

Using national YRBS data from 2021, four logistic regression models examined the association between: 1) having played on ≥1 sports team and being physically active for ≥60 minutes/day on all 7 days, 2) having played on ≥1 sports team and having met both aerobic and muscle-strengthening guidelines, 3) having attended physical education classes on all 5 days and being physically active for ≥60 minutes/day on all 7 days, and 4) having attended physical education classes on all 5 days and having met both aerobic and muscle-strengthening guidelines. These models controlled for sex, race and ethnicity, and grade. Results from the analyses are reported as adjusted prevalence ratios (APRs) with 95% CIs. APRs were considered statistically significant if the 95% CI did not include 1.0. Prevalence estimates with a denominator <30 were considered statistically unreliable and therefore were suppressed (9).

Results

Dietary Behaviors

In 2021, 47.1% of students had eaten fruit or drunk 100% fruit juices <1 time/day, 45.3% had eaten vegetables <1 time/day, 75.0% had not eaten breakfast daily, 14.7% had drunk sugar-sweetened soda or pop ≥1 time/day, 11.2% had drunk a sports drink ≥1 time/day, and 44.2% had drunk <3 glasses/day of plain water (Table 2).

Dietary behaviors varied by demographic characteristics. A higher percentage of female than male students had eaten fruit or drunk 100% fruit juices <1 time/day (50.5% versus 43.6%),

TABLE 1. Question wording and analytic coding for included dietary and physical activity behavior variables — Youth Risk Behavior Survey, United States, 2021

Variable	Question	Response options	Analytic coding
Poor dietary behaviors			
Ate fruit or drank 100% fruit juices <1 time/day*	During the past 7 days, how many times did you... • 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.) • 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	<1 time/day versus ≥1 time/day
Ate vegetables <1 time/day*	During the past 7 days, how many times did you eat... • green salad? • potatoes? (Do not count French fries, fried potatoes, or potato chips.) • carrots? • 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	<1 time/day versus ≥1 time/day
Did not eat breakfast daily	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	≤6 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	≥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	≥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/day, 2 times/day, 3 times/day, or ≥4 times/day	<3 times/day versus ≥3 times/day
Physical activity behaviors			
Were physically active for a total of ≥60 minutes/day on all 7 days (i.e., met the guideline for aerobic activity)	During the past 7 days, on how many days were you physically active for 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	7 days versus <7 days
Did exercises to strengthen or tone muscles on ≥3 days (i.e., met the guideline for muscle-strengthening activity)	During the past 7 days, on how many days did you do exercises to strengthen or tone your muscles (e.g., push-ups, sit-ups, or weightlifting)?	0 days, 1 day, 2 days, 3 days, 4 days, 5 days, 6 days, or 7 days	≥3 days versus <3 days
Met both aerobic and muscle-strengthening 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.”]	NA	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 classes?	0 days, 1 day, 2 days, 3 days, 4 days, or 5 days	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	≥1 team versus <1 team

Abbreviation: NA = not applicable.

* This variable comprised more than one question. The responses of the questions were summed and then dichotomized to reflect <1 time/day versus ≥1 time/day.

TABLE 2. Percentage of high school students* with poor dietary behaviors,† by sex and race and ethnicity — Youth Risk Behavior Survey, United States, 2021

Characteristic	Ate fruit or drank 100% fruit juices <1 time/day [§] % (95% CI)	Ate vegetables <1 time/day [¶] % (95% CI)	Did not eat breakfast daily ^{**} % (95% CI)	Drank sugar-sweetened soda or pop ≥1 time/day ^{††} % (95% CI)	Drank a sports drink ≥1 time/day ^{§§} % (95% CI)	Drank <3 glasses/day of plain water ^{¶¶} % (95% CI)
Overall	47.1 (45.6–48.5)	45.3 (42.7–47.9)	75.0 (73.1–76.7)	14.7 (13.4–16.2)	11.2 (9.6–12.9)	44.2 (41.9–46.6)
Sex						
Female	50.5 (48.3–52.8)	45.0 (42.8–47.3)	80.1 (77.8–82.2)	12.7 (10.7–14.9)	8.4 (6.6–10.6)	46.1 (43.3–49.0)
Male	43.6 (41.9–45.4)	45.2 (41.9–48.6)	69.9 (67.9–71.9)	16.5 (15.3–17.7)	13.6 (11.8–15.6)	42.2 (39.8–44.7)
Race and ethnicity***						
American Indian or Alaska Native	49.1 (36.2–62.2)	37.4 (23.6–53.6)	77.9 (68.7–85.0)	22.8 (12.7–37.5)	21.0 (13.5–31.4)	37.6 (24.7–52.6)
Asian	40.6 (31.0–51.0)	30.4 (21.4–41.2)	61.9 (55.9–67.5)	5.4 (4.1–6.9)	3.9 (2.3–6.5)	28.1 (21.9–35.3)
Black or African American	47.0 (44.1–50.0)	55.7 (52.5–59.0)	83.8 (81.0–86.2)	15.1 (12.5–18.2)	18.7 (14.9–23.2)	48.1 (44.6–51.7)
Native Hawaiian or other Pacific Islander	48.8 (35.8–62.0)	59.0 (40.6–75.1)	80.0 (66.6–88.9)	18.2 (8.3–35.4)	— ^{†††}	41.3 (28.6–55.4)
White	46.9 (44.3–49.6)	41.7 (38.8–44.7)	72.4 (69.7–75.0)	15.8 (13.8–18.2)	10.2 (8.6–12.1)	46.0 (43.5–48.6)
Hispanic or Latino	48.2 (46.5–49.9)	50.7 (47.8–53.5)	77.7 (75.1–80.2)	14.0 (12.4–15.9)	11.5 (10.5–12.5)	43.1 (38.8–47.4)
Multiracial	48.0 (43.7–52.3)	41.1 (36.4–46.1)	78.1 (70.8–83.9)	12.5 (9.8–15.9)	9.6 (7.6–12.1)	40.8 (35.9–45.9)

* N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

† Refer to Table 1 for variable definitions.

§ On the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$). Female students significantly different from male students. No significant differences by race and ethnicity.

¶ On the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$). No significant differences by sex. American Indian or Alaska Native (AI/AN) students significantly different from Black or African American (Black) students; Asian students significantly different from Black, Hispanic or Latino (Hispanic), Native Hawaiian and other Pacific Islander (NH/OPI), White, and multiracial students; Black students significantly different from Hispanic, White, and multiracial students; Hispanic students significantly different from White and multiracial students; and NH/OPI significantly different from White students.

** On the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$). Female students significantly different from male students. Asian students significantly different from AI/AN, Black, Hispanic, NH/OPI, White, and multiracial students; Black students significantly different from Hispanic, White, and multiracial students; and Hispanic students significantly different from White students.

†† On the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$). Female students significantly different from male students. AI/AN significantly different from Asian students; Asian students significantly different from Black, Hispanic, White, and multiracial students; and White students significantly different from multiracial students.

§§ On the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$). Female students significantly different from male students. AI/AN students significantly different from Asian, Hispanic, White, and multiracial students; Asian students significantly different from Black, Hispanic, White, and multiracial students; and Black students significantly different from Hispanic, White, and multiracial students.

¶¶ On the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$). Female students significantly different from male students. Asian students significantly different from Black, Hispanic, White, and multiracial students; and Black students significantly different from Hispanic and multiracial students.

*** Persons of Hispanic origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

††† Prevalence estimates with a denominator <30 were considered statistically unreliable and therefore were suppressed.

had not eaten breakfast daily (80.1% versus 69.9%) and had drunk <3 glasses/day of plain water (46.1% versus 42.2%). In contrast, a higher percentage of male than female students had drunk sugar-sweetened soda or pop ≥1 time/day (16.5% versus 12.7%) and had drunk a sports drink ≥1 time/day (13.6% versus 8.4%). Although certain exceptions were observed, the prevalence of these poor dietary behaviors was lower among Asian students, but higher among Black students, than among students from other racial and ethnic groups.

During 2019–2021, increases occurred for three of the poor dietary behaviors examined (Table 3). The percentage of students who had eaten fruit or drank 100% fruit juices <1 time/day increased overall and among female, male, Hispanic, and White students. The percentage of students who had eaten vegetables <1 time/day also increased overall and among female and White students. In addition, the percentage of students who had not eaten breakfast daily increased overall and among female, male, Black, Hispanic, and White students.

Physical Activity Behaviors

In 2021, 23.9% of students had been physically active for ≥60 minutes/day on all 7 days, 44.9% had exercised to strengthen or tone their muscles ≥3 days/week, 16.0% had met both aerobic and muscle-strengthening guidelines, 19.0% had attended physical education classes on all 5 days, and 49.1% had played on ≥1 sports team (Table 4).

Physical activity behaviors varied by demographic characteristics. A higher percentage of male than female students had been physically active for ≥60 minutes/day on all 7 days (31.7% versus 15.7%), had exercised to strengthen or tone their muscles on ≥3 days/week (56.6% versus 32.3%), had met both aerobic and muscle-strengthening guidelines (22.9% versus 8.8%), had attended physical education classes on all 5 days (21.1% versus 16.7%), and had played on ≥1 sports team (52.0% versus 46.4%).

Differences by race and ethnicity illustrated no clear pattern across all the physical activity behaviors. For example, the

TABLE 3. Percentage of high school students* with poor dietary behaviors,[†] by survey year, sex, and race and ethnicity — Youth Risk Behavior Survey, United States, 2019 and 2021

Behavior	2019	2021	Change from 2019 to 2021 [§]
Ate fruit or drank 100% fruit juices <1 time/day			
Overall	41.8	47.1	Increased
Sex			
Female	43.0	50.5	Increased
Male	40.6	43.6	Increased
Race and ethnicity[¶]			
American Indian or Alaska Native	44.0	49.1	No change
Asian	33.5	40.6	No change
Black or African American	47.8	47.0	No change
Native Hawaiian or other Pacific Islander	51.8	48.8	No change
White	42.1	46.9	Increased
Hispanic or Latino	39.5	48.2	Increased
Multiracial	41.7	48.0	No change
Ate vegetables <1 time/day			
Overall	40.7	45.3	Increased
Sex			
Female	40.4	45.0	Increased
Male	41.1	45.2	No change
Race and ethnicity[¶]			
American Indian or Alaska Native	38.5	37.4	No change
Asian	22.3	30.4	No change
Black or African American	54.8	55.7	No change
Native Hawaiian or other Pacific Islander	40.9	59.0	No change
White	35.5	41.7	Increased
Hispanic or Latino	46.8	50.7	No change
Multiracial	41.4	41.1	No change
Did not eat breakfast daily			
Overall	66.9	75.0	Increased
Sex			
Female	71.5	80.1	Increased
Male	62.4	69.9	Increased
Race and ethnicity[¶]			
American Indian or Alaska Native	82.3	77.9	No change
Asian	52.5	61.9	No change
Black or African American	72.0	83.8	Increased
Native Hawaiian or other Pacific Islander	66.3	80.0	No change
White	65.5	72.4	Increased
Hispanic or Latino	67.3	77.7	Increased
Multiracial	77.4	78.1	No change
Drank sugar-sweetened soda or pop ≥1 time/day			
Overall	15.1	14.7	No change
Sex			
Female	11.7	12.7	No change
Male	18.2	16.5	No change

prevalence of being physically active for a total of ≥60 minutes/day on all 7 days was higher among AI/AN students than among Asian, Black, and Hispanic students. Whereas, the prevalence of meeting both aerobic and muscle-strengthening guidelines, and playing on ≥1 sports team was higher among White students than among Black, Hispanic, and multiracial students.

During 2019–2021, decreases occurred overall for three of the five physical activity behaviors examined (Table 5).

TABLE 3. (Continued) Percentage of high school students* with poor dietary behaviors,[†] by survey year, sex, and race and ethnicity — Youth Risk Behavior Survey, United States, 2019 and 2021

Behavior	2019	2021	Change from 2019 to 2021 [§]
Race and ethnicity[¶]			
American Indian or Alaska Native	25.0	22.8	No change
Asian	4.6	5.4	No change
Black or African American	16.9	15.1	No change
Native Hawaiian or other Pacific Islander	10.3	18.2	No change
White	15.2	15.8	No change
Hispanic or Latino	16.1	14.0	No change
Multiracial	13.4	12.5	No change
Drank a sports drink ≥1 time/day			
Overall	10.6	11.2	No change
Sex			
Female	7.1	8.4	No change
Male	14.0	13.6	No change
Race and ethnicity[¶]			
American Indian or Alaska Native	27.2	21.0	No change
Asian	2.1	3.9	No change
Black or African American	15.6	18.7	No change
Native Hawaiian or other Pacific Islander	9.4	—**	—
White	9.3	10.2	No change
Hispanic or Latino	11.9	11.5	No change
Multiracial	13.5	9.6	No change
Drank <3 glasses/day of plain water			
Overall	44.6	44.2	No change
Sex			
Female	44.1	46.1	No change
Male	45.0	42.2	No change
Race and ethnicity[¶]			
American Indian or Alaska Native	49.4	37.6	No change
Asian	34.4	28.1	No change
Black or African American	54.8	48.1	No change
Native Hawaiian or other Pacific Islander	38.5	41.3	No change
White	44.2	46.0	No change
Hispanic or Latino	44.2	43.1	No change
Multiracial	38.6	40.8	No change

* 2019: N = 13,677 respondents; 2021: N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] Refer to Table 1 for variable definitions.

[§] On the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$). An increase indicates a worsening of dietary behavior.

[¶] Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

** Prevalence estimates with a denominator <30 were considered statistically unreliable and therefore were suppressed.

The percentage of students who had exercised to strengthen or tone their muscles on ≥3 days/week decreased overall and among female, Black, NH/OPI, and multiracial students. The percentage of students who had attended physical education classes on all 5 days decreased overall and among male, Asian, Hispanic, and NH/OPI students. The percentage of students who had played on ≥1 sports team decreased overall and among

TABLE 4. Percentage of high school students* with physical activity behaviors,[†] by sex and race and ethnicity — Youth Risk Behavior Survey, United States, 2021

Characteristic	Were physically active for a total of ≥60 minutes/day on all 7 days [§] % (95% CI)	Did exercises to strengthen or tone muscles on ≥3 days [¶] % (95% CI)	Met both aerobic and muscle-strengthening guidelines ^{**} % (95% CI)	Went to physical education classes on all 5 days ^{††} % (95% CI)	Played on ≥1 sports team ^{§§} % (95% CI)
Overall	23.9 (22.8–25.0)	44.9 (42.5–47.2)	16.0 (14.2–17.9)	19.0 (15.7–22.7)	49.1 (46.3–51.8)
Sex					
Female	15.7 (14.1–17.4)	32.3 (29.7–35.1)	8.8 (7.3–10.6)	16.7 (13.4–20.6)	46.4 (43.4–49.4)
Male	31.7 (30.2–33.2)	56.6 (54.4–58.8)	22.9 (20.5–25.4)	21.1 (17.2–25.6)	52.0 (49.1–55.0)
Race and ethnicity^{¶¶}					
American Indian or Alaska Native	40.0 (22.5–60.3)	54.8 (39.2–69.5)	29.9 (15.1–50.5)	23.0 (14.7–34.2)	52.8 (41.8–63.6)
Asian	19.4 (14.6–25.3)	41.7 (35.2–48.5)	13.5 (7.9–22.1)	9.6 (5.7–15.6)	45.0 (33.7–56.8)
Black or African American	19.7 (17.5–22.0)	40.7 (36.1–45.4)	10.8 (8.4–13.7)	19.6 (13.9–27.0)	47.2 (43.1–51.3)
Native Hawaiian or other Pacific Islander	23.2 (16.1–32.2)	43.2 (31.6–55.6)	15.0 (10.9–20.4)	15.9 (8.4–28.2)	50.6 (32.6–68.4)
White	27.7 (25.1–30.4)	47.0 (43.3–50.6)	18.6 (15.8–21.8)	19.0 (15.0–23.6)	55.3 (51.4–59.2)
Hispanic or Latino	18.9 (17.3–20.5)	44.2 (41.9–46.5)	13.5 (11.8–15.4)	21.0 (17.4–25.2)	39.4 (36.7–42.1)
Multiracial	21.3 (17.8–25.2)	39.4 (35.1–43.7)	13.5 (10.5–17.1)	16.5 (10.5–24.9)	48.8 (43.8–53.8)

* N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] Refer to Table 1 for variable definitions.

[§] On the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$). Female students significantly different from male students. American Indian or Alaska Native (AI/AN) students significantly different from Asian, Black or African American (Black), and Hispanic or Latino (Hispanic) students; and Asian, Black, Hispanic, and multiracial students significantly different from White students.

[¶] On the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$). Female students significantly different from male students. White students significantly different from multiracial students.

^{**} On the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$). Female students significantly different from male students. AI/AN students significantly different from Asian and Black students; Black students significantly different from Hispanic and White students; and Hispanic and multiracial students significantly different from White students.

^{††} On the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$). Female students significantly different from male students. Asian students significantly different from AI/AN, Black, Hispanic, White, and multiracial students.

^{§§} On the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$). Female students significantly different from male students. AI/AN students significantly different from Hispanic students; Black students significantly different from Hispanic and White students; Hispanic students significantly different from White and multiracial students; and White students significantly different from multiracial students.

^{¶¶} Persons of Hispanic origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

female, male, Black, Hispanic, White, and multiracial students. In addition, although the percentage of students who had met the aerobic and muscle-strengthening guidelines did not change overall, the percentage decreased among NH/OPI students.

Associations Between Physical Activity Behaviors

The findings in this report illustrated decreases from 2019 to 2021 in both the prevalence of students who had attended physical education classes on all 5 days and students who had played on ≥1 sports team but no changes in the prevalence estimates of having been physically active for ≥60 minutes/day on all 7 days or having met both aerobic and muscle-strengthening guidelines. These observations warranted an examination of the potential effect of physical education and sports participation on being physically active and meeting both guidelines.

In 2021, after adjusting for sex, race and ethnicity, and grade, students who played on ≥1 sports team compared with those who did not were 2.6 times more likely to be physically active

for ≥60 minutes/day on all 7 days (APR = 2.6; CI = 2.4–2.8) and 3.6 times more likely to have met both aerobic and muscle-strengthening guidelines (APR = 3.6; CI = 3.3–4.0). Similarly, students who attended physical education classes on all 5 days compared with those who did not were 1.8 times more likely to be physically active for ≥60 minutes/day on all 7 days (APR = 1.8; CI = 1.5–2.0) and 2.1 times more likely to have met both aerobic and muscle-strengthening guidelines (APR = 2.1; CI = 1.7–2.5).

Discussion

Although healthy dietary and physical activity behaviors are important for adolescents' overall physical health, this study found that none of the 11 behaviors examined in this report have improved since 2019. Certain dietary and physical activity behaviors have worsened overall and for certain sex and racial and ethnic groups. These findings are particularly concerning because of the association between poor dietary behaviors and insufficient physical activity and numerous chronic health

TABLE 5. Percentage of high school students* with physical activity behaviors,[†] by survey year, sex, and race and ethnicity — Youth Risk Behavior Survey, United States, 2019 and 2021

Behavior	2019	2021	Change from 2019 to 2021 [§]
Were physically active for a total of ≥60 minutes/day on all 7 days			
Overall	23.2	23.9	No change
Sex			
Female	15.4	15.7	No change
Male	30.9	31.7	No change
Race and ethnicity[¶]			
American Indian or Alaska Native	26.5	40.0	No change
Asian	15.3	19.4	No change
Black or African American	21.1	19.7	No change
Native Hawaiian or other Pacific Islander	37.0	23.2	No change
White	25.6	27.7	No change
Hispanic or Latino	20.9	18.9	No change
Multiracial	21.5	21.3	No change
Did exercises to strengthen or tone muscles on ≥3 days			
Overall	49.5	44.9	Decreased
Sex			
Female	39.7	32.3	Decreased
Male	59.0	56.6	No change
Race and ethnicity[¶]			
American Indian or Alaska Native	53.1	54.8	No change
Asian	42.4	41.7	No change
Black or African American	47.0	40.7	Decreased
Native Hawaiian or other Pacific Islander	66.3	43.2	Decreased
White	50.8	47.0	No change
Hispanic or Latino	48.1	44.2	No change
Multiracial	51.5	39.4	Decreased
Met both aerobic and muscle-strengthening guidelines			
Overall	16.5	16.0	No change
Sex			
Female	10.1	8.8	No change
Male	23.1	22.9	No change
Race and ethnicity[¶]			
American Indian or Alaska Native	19.1	29.9	No change
Asian	8.5	13.5	No change
Black or African American	13.4	10.8	No change
Native Hawaiian or other Pacific Islander	34.9	15.0	Decreased
White	18.4	18.6	No change
Hispanic or Latino	16.0	13.5	No change
Multiracial	13.6	13.5	No change

conditions and poor mental health (1–3). Understanding current dietary and physical activity behaviors among students and comparing them to pre-pandemic data can identify areas of high need and be used to influence longer-term physical and mental health outcomes through primary chronic disease prevention strategies.

Overall, these findings illustrate that certain students are not engaging in healthy dietary behaviors. Specifically, in 2021, consumption of fruits, vegetables, and daily breakfast remained low with certain disparities by sex and race and ethnicity, and these behaviors worsened overall from 2019 to 2021. Multiple factors could have contributed to these changes. For example,

TABLE 5. (Continued) Percentage of high school students* with physical activity behaviors,[†] by survey year, sex, and race and ethnicity — Youth Risk Behavior Survey, United States, 2019 and 2021

Behavior	2019	2021	Change from 2019 to 2021 [§]
Went to physical education classes on all 5 days			
Overall	25.9	19.0	Decreased
Sex			
Female	22.8	16.7	No Change
Male	28.9	21.1	Decreased
Race and ethnicity[¶]			
American Indian or Alaska Native	22.6	23.0	No change
Asian	27.3	9.6	Decreased
Black or African American	23.8	19.6	No change
Native Hawaiian or other Pacific Islander	41.6	15.9	Decreased
White	24.3	19.0	No change
Hispanic or Latino	29.9	21.0	Decreased
Multiracial	25.6	16.5	No change
Played on ≥1 sports team			
Overall	57.4	49.1	Decreased
Sex			
Female	54.6	46.4	Decreased
Male	60.2	52.0	Decreased
Race and ethnicity[¶]			
American Indian or Alaska Native	48.6	52.8	No change
Asian	46.5	45.0	No change
Black or African American	56.1	47.2	Decreased
Native Hawaiian or other Pacific Islander	64.7	50.6	No change
White	62.0	55.3	Decreased
Hispanic or Latino	51.6	39.4	Decreased
Multiracial	57.8	48.8	Decreased

* 2019: N = 13,677 respondents; 2021: N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] Refer to Table 1 for variable definitions.

[§] On the basis of *t*-test analysis with Taylor series linearization (*p*<0.05). A decrease indicates a worsening of the physical activity behavior.

[¶] Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

during the pandemic, certain students might have shifted away from healthy foods in favor of unhealthy alternatives to alleviate stress (10).

Although no differences were observed from 2019 to 2021 in consuming sports drinks ≥1 time/day, consuming soda ≥1 time/day, or consuming water <3 times/day, consumption of sugary drinks remained elevated in 2021. This poor dietary behavior is concerning because of its association with chronic diseases (1).

In 2021, with the exception of low fruit consumption, all poor dietary behaviors were lower among Asian students compared with students from other racial and ethnic groups. A previous study illustrated similar results for Asian students for sugar-sweetened beverage consumption but no significant findings for fruit and vegetable intake; breakfast consumption was not examined in that study (11). This study also found that three of the poor dietary behaviors (i.e., ate vegetables

<1 time/day, had not eaten breakfast on any of the past 7 days, and drank a sports drink ≥ 1 time/day) were higher among Black students compared with Hispanic, White, and multiracial students. This observation is consistent with findings from 2019 (12).

The prevalence of all five physical activity behaviors was below 50%, and three of these behaviors decreased from 2019 to 2021. This observation was not surprising because of changes in adolescents' school and extracurricular schedules as a result of the COVID-19 pandemic. Being physically active for ≥ 60 minutes/day on all 7 days (i.e., meeting guideline for aerobic activity) and meeting both aerobic and muscle-strengthening guidelines did not change from 2019 to 2021, which is inconsistent with findings from the beginning of the pandemic illustrating that physical activity decreased (4). However, the prevalence estimates for 2021 are still troubling, with less than one fourth (23.9%) of students getting the recommended ≥ 60 minutes of physical activity daily and only 16.0% meeting both aerobic and muscle-strengthening guidelines. Not meeting national physical activity guidelines means that students are not receiving the multiple physical and mental health benefits of physical activity (e.g., reducing stress, anxiety, and depression) and preventing various chronic disease risk factors (2).

The results in this report indicate decreases from 2019 to 2021 in physical education class attendance and sports team participation overall and for certain sex and racial and ethnic groups. Both of these physical activity behaviors were affected by school closures during the COVID-19 pandemic. It is unclear why these two physical activity opportunities declined although meeting guidelines did not; however, the results of the logistic regression in this study illustrated that students who attend physical education classes daily or participate on a sports team are more likely to get ≥ 60 minutes of daily physical activity and meet the guidelines, indicating that opportunities for physical activity in and out of school are both important for meeting guidelines. Physical education classes and sports opportunities are also critical for developing social and emotional learning competencies (e.g., social interaction skills, communication skills, teamwork, and goal setting) as well as fostering school connectedness (<https://www.shapeamerica.org/standards/guidelines/sel-crosswalk.aspx>). School and other types of COVID-19 closures also might have maintained or exacerbated inequities related to accessing physical activity because students might have stayed at or close to their home and neighborhood with varying levels of safety and access to physical activity supports (13).

Similar to dietary behaviors, differences across racial and ethnic groups were inconsistent for the physical activity behaviors. However, this study illustrates that being physically

active for ≥ 60 minutes/day on all 7 days, meeting both aerobic and muscle-strengthening guidelines, and playing on a sports team were higher among White students compared with Black, Hispanic, and multiracial students. A recent study had similar findings, indicating that White female adolescents had higher physical activity participation compared with Black, Hispanic, and other minority female students (14). Other differences across race and ethnicity found in this study warrant further investigation to determine what factors supported higher prevalence of physical activity behaviors among certain groups.

Limitations

General limitations for the 2021 YRBS are available in the overview report of this supplement (9). The findings in this report are subject to at least four additional limitations. First, the national YRBS collects data on frequency of consumption rather than amount; therefore, these data cannot directly determine whether students are meeting specific dietary recommendations. Second, individual measures of socioeconomic status are not accounted for and are known to be associated with dietary consumption and physical activity opportunities (8,15). Third, this study did not investigate how these behaviors differed by sex within race and ethnicity to further examine health disparities. Finally, specific student experiences during COVID-19 are unknown (e.g., the extent of remote learning, school closure, and community burden of COVID-19). Therefore, quantifying the effect of COVID-19 is limited.

Future Directions

Schools face multiple priorities, including addressing mental health issues, mitigating learning loss among students, and offering opportunities for students to learn about and practice health behaviors. These priorities do not need to compete. Ensuring regular access to school-based physical activity and school meals that meet U.S. Department of Agriculture nutrition standards support students' health and readiness to learn (2,16). For example, schools can address poor dietary behaviors among high school students by encouraging participation in the National School Lunch and School Breakfast Programs and providing multiple opportunities for students to access breakfast, including Grab and Go and Second Chance models (https://frac.org/wp-content/uploads/how_it_works_bic_fact_sheet.pdf; <https://fns-prod.azureedge.us/sites/default/files/resource-files/SBPfactsheet.pdf>) that do not require students to arrive early to eat in the cafeteria. In addition, the Community Preventive Services Task Force recommends school-based gardening programs combined with nutrition

education as a strategy to increase vegetable consumption ([https://www.thecommunityguide.org/sites/default/files/assets/Nutrition-Gardening-Fruit-Vegetable-Consumption-Children-508.pdf#:~:text=The Community Preventive Services Task Force recommends school-based,increase children%E2%80%99s vegetable consumption. Rationale Basis of Finding](https://www.thecommunityguide.org/sites/default/files/assets/Nutrition-Gardening-Fruit-Vegetable-Consumption-Children-508.pdf#:~:text=The%20Community%20Preventive%20Services%20Task%20Force%20recommends%20school-based,increase%20children%E2%80%99s%20vegetable%20consumption.)).

Schools are also uniquely suited to provide students with multiple opportunities for physical activity participation. The actions of schools can be supported by other community strategies to increase physical activity promoted by Active People, Healthy Nation, an initiative led by CDC (<https://www.cdc.gov/physicalactivity/activepeoplehealthynation/index.html>). Further, implementing a Comprehensive School Physical Activity Program (CSPAP) increases opportunities for students to be physically active before, during, and after school, and can be tailored based on available resources, interests, time allotments, and community support (<https://www.cdc.gov/healthyschools/physicalactivity/index.htm>). A CSPAP approach enables schools to engage community partners, staff members, families, and before- and after-school leaders to increase the total amount of physical activity access for adolescents throughout the day.

Conclusion

Certain poor dietary behaviors (e.g., skipping breakfast and infrequent consumption of fruits and vegetables) appear to have worsened during the pandemic, and certain students continue to fall short of recommended levels of physical activity. Understanding current dietary and physical activity behaviors among high school students nationwide can support schools, communities, and families to make decisions about strategies needed to improve these behaviors during the pandemic recovery phase and beyond.

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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Alcohol and Other Substance Use Before and During the COVID-19 Pandemic Among High School Students — Youth Risk Behavior Survey, United States, 2021

Brooke E. Hoots, PhD¹; Jingjing Li, PhD, MD²; Marci Feldman Hertz, MS²; Marissa B. Esser, PhD³; Adriana Rico, MPH²; Evelyn Y. Zavala, MPH²; Christopher M. Jones, PharmD, DrPH⁴

¹Division of Overdose Prevention, National Center for Injury Prevention and Control, CDC; ²Division of Adolescent and School Health, National Center for HIV, Viral Hepatitis, STD, and TB Prevention, CDC; ³Division of Population Health, National Center for Chronic Disease Prevention and Health Promotion, CDC; ⁴Office of the Director, National Center for Injury Prevention and Control, CDC

Abstract

Adolescence is a critical phase of development and is frequently a period of initiating and engaging in risky behaviors, including alcohol and other substance use. The COVID-19 pandemic and associated stressors might have affected adolescent involvement in these behaviors. To examine substance use patterns and understand how substance use among high school students changed before and during the COVID-19 pandemic, CDC analyzed data from the nationally representative Youth Risk Behavior Survey. This report presents estimated prevalences among high school students of current (i.e., previous 30 days) alcohol use, marijuana use, binge drinking, and prescription opioid misuse and lifetime alcohol, marijuana, synthetic marijuana, inhalants, ecstasy, cocaine, methamphetamine, heroin, and injection drug use and prescription opioid misuse. Trends during 2009–2021 were assessed using logistic regression and joinpoint regression analyses. Changes in substance use from 2019 to 2021 were assessed using prevalence differences and prevalence ratios, stratified by demographic characteristics. Prevalence of substance use measures by sexual identity and current co-occurring substance use were estimated using 2021 data. Substance use prevalence declined during 2009–2021. From 2019 to 2021, the prevalence of current alcohol use, marijuana use, and binge drinking and lifetime use of alcohol, marijuana, and cocaine and prescription opioid misuse decreased; lifetime inhalant use increased. In 2021, substance use varied by sex, race and ethnicity, and sexual identity. Approximately one third of students (29%) reported current use of alcohol or marijuana or prescription opioid misuse; among those reporting current substance use, approximately 34% used two or more substances. Widespread implementation of tailored evidence-based policies, programs, and practices likely to reduce risk factors for adolescent substance use and promote protective factors might further decrease substance use among U.S. high school students and is urgently needed in the context of the changing marketplaces for alcohol beverage products and other drugs (e.g., release of high-alcohol beverage products and increased availability of counterfeit pills containing fentanyl).

Introduction

Adolescence is a critical phase of physical, cognitive, social, and emotional development and is frequently a period of initiating and engaging in risky behaviors, including alcohol and other substance use. The majority of adolescents engage in some form of substance use before finishing high school (1,2). Substance use during adolescence is associated with adverse health outcomes, such as mental health problems, teen pregnancy, and sexually transmitted diseases as well as consequences, such as delinquency, violence, and academic underachievement (2,3). Substance use initiation during adolescence can increase the risk for substance use later in adulthood and increase the risk for substance use disorders (<https://addiction.surgeongeneral.gov/sites/default/files/surgeon-generals-report.pdf>).

Adolescent substance use is of particular concern as overdose deaths among adolescents have increased dramatically (4). The Drug Enforcement Administration has warned of readily available counterfeit pills containing highly lethal substances (e.g., illicit fentanyl) and other synthetic opioids that are designed to look like commonly misused prescription medications that might be contributing to these increases (<https://www.dea.gov/press-releases/2021/05/21/dea-issues-warning-over-counterfeit-pills>; <https://www.dea.gov/sites/default/files/2021-05/Counterfeit%20Pills%20fact%20SHEET-5-13-21-FINAL.pdf>). The alcohol industry and regulatory environment is also changing, including the release of high-alcohol content products (<https://www.samhsa.gov/resource/ebp/implementing-community-level-policies-prevent-alcohol-misuse>). In addition, alcohol-related deaths, including those involving other substances, have increased among adolescents (5).

In 2021, CDC's Adolescent Behaviors and Experiences Survey (ABES) found that students experienced adversities and challenges during the COVID-19 pandemic, such as poor

Corresponding author: Brooke E. Hoots, PhD, National Center for Injury Prevention and Control, CDC. Telephone: 404-639-8334; Email: vie2@cdc.gov.

mental health, persistent feelings of sadness or hopelessness, suicidal ideation, and physical and emotional abuse, all of which are risk factors for substance use (<https://www.cdc.gov/healthyyouth/data/abes/reports.htm>). In addition, measures to protect adolescents from COVID-19 infection, such as remote schooling, social isolation, and event cancelation, might have contributed additional risk for adolescent substance use. One third of students participating in ABES who had ever drunk alcohol or used drugs used those substances more during the pandemic (6).

Other studies examining adolescent substance use during the pandemic have had varying findings. For example, the Monitoring the Future survey indicated declines in current marijuana use, alcohol use, and binge drinking when comparing 2020 and 2021 prevalence estimates (1). However, another study comparing prevalence estimates from the early stages of the pandemic to prepandemic estimates found increases in the frequency of both marijuana and alcohol use (3), and another demonstrated no change in the use of either substance (7).

The variability in the previous studies highlighted the need for additional studies of nationally representative data to assess changes in alcohol and other substance use before and during the pandemic. This report used Youth Risk Behavior Survey (YRBS) data to improve understanding of how substance use changed before and during the COVID-19 pandemic. Specifically, this report examined overall trends in alcohol and other substance use, characterized changes in alcohol and other substance use by demographic groups, and examined co-occurring substance use among U.S. high school students. Public health practitioners, clinicians, school officials, and policymakers can use these findings to expand evidence-based prevention programs, practices, and policies that reduce adolescent substance use risk factors and promote protective factors.

Methods

Data Source

This report includes data from the 2009–2021 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 (8). The prevalence estimates for current and lifetime alcohol and other substance use for the overall study population and by sex, race and ethnicity, grade, and sexual identity are available at

<https://nccd.cdc.gov/youthonline/App/Default.aspx>. The full YRBS questionnaire, data sets, and documentation are available at <https://www.cdc.gov/healthyyouth/data/yrbs/index.htm>. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.*

Measures

Four current (i.e., previous 30 days before the survey) and 10 lifetime substance use behaviors were measured. The four current substance use behaviors were alcohol use, marijuana use, binge drinking, and prescription opioid misuse. The 10 lifetime substance use behaviors were alcohol use, marijuana use, inhalant use, ecstasy use, cocaine use, methamphetamine use, heroin use, injection drug use, synthetic marijuana use, and prescription opioid misuse. Use of specific substances was ascertained from questions on frequency of use except for lifetime alcohol use, which was determined from a question on age of initiation. All measures were dichotomized (yes versus no).

Demographic characteristics assessed included sex (female or male), sexual identity (heterosexual; lesbian, gay, or bisexual; or questioning or other), and race and ethnicity (Black or African American [Black], White, and Hispanic or Latino [Hispanic]). (Persons of Hispanic origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.) The numbers of students from other races or multiracial groups were too small for analyses ($n < 30$) for the majority of the substance use measures and were excluded from race and ethnicity analyses. Information on missing data for substance use measures is available in the User's Guide for each year of data collection at <https://www.cdc.gov/healthyyouth/data/yrbs/data.htm>.

Analysis

First, prevalence of each substance use behavior was estimated by survey year during 2009–2021 with available data. Temporal linear and quadratic trends for current and lifetime use of substances were examined using logistic regression models, controlling for sex, grade, and race and ethnicity (https://www.cdc.gov/healthyyouth/data/yrbs/pdf/2019/2019_YRBS_Conducting_Trend_Analyses.pdf). Joinpoint (version 4.9.1.0; National Cancer Institute) was used to identify the year or years where the trend changed direction. Second, 2-year changes in substance use behaviors were assessed by comparing prevalence estimates from 2019 and 2021 using *t*-tests with Taylor series linearization. Changes were considered statistically significant if the *p* value was

* See e.g., 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

<0.05. Third, weighted prevalences of substance use behaviors were estimated for 2019 and 2021 by sex and race and ethnicity. Only 2021 demographic pairwise differences were examined in this report; 2019 estimates by sexual identity and demographic pairwise comparisons were published elsewhere (2). Across years, changes in substance use from 2019 to 2021 were assessed using both absolute (i.e., prevalence difference [PD]) and relative (i.e., prevalence ratio [PR]) measures for comparisons by demographic characteristics and frequency of use (https://www.cdc.gov/pcd/issues/2017/16_0516.htm). Changes were considered statistically significant if p values were <0.05 and 95% CIs did not cross zero (for PD) or 1.0 (for PR). Only 2021 data for sexual identity are presented because of a change in the survey question assessing sexual identity from 2019. Finally, prevalences of current co-occurring substance use behaviors (alcohol use, marijuana use, and prescription opioid misuse) among those with any current substance use were calculated. All analyses were conducted using SAS-callable SUDAAN (version 11.0.3; RTI International) to account for the complex sampling design and weighting.

Results

In 2021, substance use was common among U.S. high school students and varied by substance. Approximately one third of students (30%) reported current use of alcohol or marijuana or prescription opioid misuse. Among current use measures, alcohol (22.7%) and marijuana (15.8%) were the most commonly reported substances used by U.S. high school students (Table 1). Current binge drinking was reported by 10.5% and current prescription opioid misuse by 6.0%. Among lifetime use measures, 47.4% of U.S. high school students reported alcohol use, 27.8% marijuana use, 12.2% prescription opioid misuse, 8.1% inhalant use, and 6.5% synthetic marijuana use. Among lifetime use measures, ecstasy (2.9%), cocaine (2.5%), methamphetamine (1.8%), injection drug use (1.4%), and heroin (1.3%) were less commonly reported.

Trend data were available for all substance use measures except current prescription opioid misuse. All substance use measures with available trend data decreased linearly over the period assessed (2009–2021 for most substances, 2015–2021 for lifetime synthetic marijuana use, and 2017–2021 for current binge drinking and lifetime prescription opioid misuse). From 2019 to 2021, prevalence of current substance use decreased for alcohol (from 29.2% to 22.7%), marijuana (from 21.7% to 15.8%), and binge drinking (from 13.7% to 10.5%). No change was observed in prevalence of current prescription opioid misuse. Lifetime alcohol use, marijuana use, cocaine

use, and prescription opioid misuse also decreased from 2019 to 2021; lifetime inhalant use increased from 6.4% to 8.1%.

Compared with males, females had a higher prevalence of current substance use in 2021 for alcohol (26.8% versus 18.8%), marijuana (17.8% versus 13.6%), binge drinking (12.2% versus 9.0%), and prescription opioid misuse (8.0% versus 4.0%) (Table 2). Females also had a higher prevalence of lifetime alcohol use (53.2% versus 42.0%), lifetime marijuana use (30.9% versus 24.8%), lifetime prescription opioid misuse (14.8% versus 9.5%), and lifetime inhalant use (9.4% versus 6.8%) compared with males. However, males had a higher prevalence of lifetime heroin use (1.6% versus 0.8%) and injection drug use (1.7% versus 0.9%).

Changes in substance use from 2019 to 2021 varied by sex (Table 2). Current alcohol use decreased for both females and males. Males also had a 3.7% absolute decrease and a 30% relative decrease in binge drinking and a 2.1% absolute decrease and a 30% relative decrease in current prescription opioid misuse. Among lifetime use measures, alcohol and marijuana use decreased among both females and males. Decreases also were observed in ecstasy use, cocaine use, and prescription opioid misuse for males. However, for females, a 2.5% absolute increase and a 40% relative increase occurred in inhalant use from 2019 to 2021.

Prevalence of substance use measures varied by racial and ethnic group, with different groups reporting higher prevalences of use for different substances. For example, Black students reported a higher prevalence of current marijuana use (20.5%) compared with Hispanic (16.7%) and White (14.8%) students (Table 3). Black students reported a lower prevalence of current alcohol use (13.2%) compared with White (25.9%) and Hispanic (22.9%) students. White students reported a lower prevalence of current prescription opioid misuse (4.6%) compared with Black (8.6%) and Hispanic (8.3%) students.

By race and ethnicity, current and lifetime marijuana use decreased for both White and Hispanic high school students, and lifetime alcohol use decreased for all three racial and ethnic groups from 2019 to 2021. White students reported less binge drinking in 2021 compared with 2019 and more lifetime inhalant use. Hispanic students reported decreases in lifetime ecstasy use, cocaine use, and synthetic marijuana use. Lifetime use measures for cocaine, methamphetamine, and heroin decreased among Black students.

Prevalence of all substance use measures varied by sexual identity in 2021, with students identifying as lesbian, gay, or bisexual reporting a higher prevalence of all current and lifetime substance use measures compared with students identifying as heterosexual (Table 4). Compared with students who identified as heterosexual, students who identified as

TABLE 1. Trends in prevalence of current and lifetime use of specific substances among high school students — Youth Risk Behavior Survey, United States, 2009–2021*

Behavior/Substance	Prevalence							Linear change [†]	Quadratic change [†]	Change during 2019–2021 [§]
	2009 %	2011 %	2013 %	2015 %	2017 %	2019 %	2021 %			
Current use[¶]										
Alcohol	41.8	38.7	34.9	32.8	29.8	29.2	22.7	Decreased 2009–2021	No change	Decreased
Marijuana	20.8	23.1	23.4	21.7	19.8	21.7	15.8	Decreased 2009–2021	Increased 2009–2013 Decreased 2013–2021	Decreased
Binge drinking	NA	NA	NA	NA	13.5	13.7	10.5	Decreased 2017–2021	—**	Decreased
Prescription opioid misuse	NA	NA	NA	NA	NA	7.2	6.0	—	—	No change
Lifetime use										
Alcohol	68.4	66.7	63.4	60.9	56.5	56.5	47.4	Decreased 2009–2021	Decreased 2009–2017 Decreased 2017–2021	Decreased
Marijuana	36.8	39.9	40.7	38.6	35.6	36.8	27.8	Decreased 2009–2021	Increased 2009–2013 Decreased 2013–2021	Decreased
Inhalants	11.7	11.4	8.9	7.0	6.2	6.4	8.1	Decreased 2009–2021	Decreased 2009–2017 Increased 2017–2021	Increased
Ecstasy	6.7	8.2	6.6	5.0	4.0	3.6	2.9	Decreased 2009–2021	No change 2009–2013 Decreased 2013–2021	No change
Cocaine	6.4	6.8	5.5	5.2	4.8	3.9	2.5	Decreased 2009–2021	No change 2009–2017 Decreased 2017–2021	Decreased
Methamphetamine	4.1	3.8	3.2	3.0	2.5	2.1	1.8	Decreased 2009–2021	No change	No change
Heroin	2.5	2.9	2.2	2.1	1.7	1.8	1.3	Decreased 2009–2021	No change	No change
Injection drug use	2.1	2.3	1.7	1.8	1.5	1.6	1.4	Decreased 2009–2021	No change	No change
Synthetic marijuana	NA	NA	NA	9.2	6.9	7.3	6.5	Decreased 2015–2021	—	No change
Prescription opioid misuse	NA	NA	NA	NA	14.0	14.3	12.2	Decreased 2017–2021	—	Decreased

Abbreviation: NA = not available.

* 2009: N = 16,410 respondents; 2011: N = 15,425 respondents; 2013: N = 13,583 respondents; 2015: N = 15,624 respondents; 2019: N = 13,677 respondents; 2021: N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] On the basis of trend analyses from a logistic regression model controlling for sex, race and ethnicity, and grade ($p < 0.05$).

[§] On the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$).

[¶] Previous 30 days before the survey.

** Dashes indicate insufficient years of data to assess trends.

questioning or other reported a higher prevalence of current marijuana use and prescription opioid misuse, and a higher prevalence of all lifetime use measures except for lifetime alcohol use, marijuana use, and synthetic marijuana use. However, compared with students who identified as lesbian, gay, or bisexual, students who identified as questioning or other reported a lower prevalence of most current use measures (alcohol use, marijuana use, and binge drinking) and multiple lifetime use measures (alcohol, marijuana, ecstasy, and synthetic marijuana). Frequency of current and lifetime use among high school students reporting use of specific substances in 2021 was not substantially different from 2019 (Supplementary Table, <https://stacks.cdc.gov/view/cdc/125216>) (2).

Students commonly reported current co-occurring substance use (Figure). Among high school students who reported current alcohol use, marijuana use, or prescription opioid misuse, 35.1% reported using two or more substances. Alcohol and marijuana were the most commonly co-used substances among those who reported any current substance use, with 30.2% reporting co-use. Alcohol use and prescription opioid misuse was reported by 7.9%, marijuana use and prescription opioid misuse by 6.7%, and use (misuse) of all three substances by 4.8%.

Discussion

This report documents that substance use prevalence among U.S. high school students had been declining for a decade before the COVID-19 pandemic. For the majority of substance use outcomes, prevalence further declined from 2019 to 2021, including for current alcohol use, marijuana use, and binge drinking and for lifetime alcohol use, marijuana use, cocaine use, and prescription opioid misuse. Despite these declines, approximately one in three high school students (30%) reported past 30-day substance use in 2021. Among those reporting current substance use, approximately 35% used two or more substances, suggesting that use of multiple substances is common, an important consideration when implementing prevention and intervention strategies. The decline in adolescent substance use during the COVID-19 pandemic is consistent with other studies of U.S. adolescents, including from the Monitoring the Future study, which also reported significant decreases in lifetime and past 30-day marijuana use, binge drinking, and lifetime cocaine and heroin use in 2021 (1).

This report highlights disparities in substance use by race and ethnicity and sexual identity. For example, current and lifetime

TABLE 2. Prevalence of and changes in prevalence of current and lifetime use of specific substances among high school students, by sex — Youth Risk Behavior Survey, United States, 2019 and 2021*

Behavior/Substance	Sex							
	Male				Female			
	2019 %	2021 %	PD (95% CI)	PR (95% CI)	2019 %	2021 %	PD (95% CI)	PR (95% CI)
Current use[†]								
Alcohol	26.4	18.8	−7.7 (−0.3 to −5.1) [§]	0.7 (0.6 to 0.8) [§]	31.9	26.8 [¶]	−5.1 (−8.3 to −1.9) [§]	0.8 (0.8 to 0.9) [§]
Marijuana	22.5	13.6	−8.9 (−1.3 to −6.4) [§]	0.6 (0.5 to 0.7) [§]	20.8	17.8 [¶]	−3.0 (−6.0 to 0.0)	0.9 (0.7 to 1.0)
Binge drinking	12.7	9.0	−3.7 (−5.6 to −1.7) [§]	0.7 (0.6 to 0.8) [§]	14.6	12.2 [¶]	−2.5 (−5.2 to 0.2)	0.8 (0.7 to 1.0)
Prescription opioid misuse	6.1	4.0	−2.1 (−3.5 to −0.8) [§]	0.7 (0.5 to 0.9) [§]	8.3	8.0 [¶]	−0.3 (−2.2 to 1.6)	1.0 (0.8 to 1.2)
Lifetime use								
Alcohol	53.1	42.0	−11.1 (−14.2 to −8.0) [§]	0.8 (0.7 to 0.8) [§]	60.0	53.2 [¶]	−6.9 (−10.2 to −3.5) [§]	0.9 (0.8 to 0.9) [§]
Marijuana	37.0	24.8	−12.3 (−15.9 to −8.7) [§]	0.7 (0.6 to 0.8) [§]	36.5	30.9 [¶]	−5.6 (−9.3 to −1.9) [§]	0.9 (0.8 to 1.0) [§]
Inhalants	5.7	6.8	1.1 (−0.1 to 2.3)	1.2 (1.0 to 1.5)	6.9	9.4 [¶]	2.5 (1.1 to 3.9) [§]	1.4 (1.1 to 1.6) [§]
Ecstasy	4.6	2.9	−1.7 (−2.8 to −0.7) [§]	0.6 (0.5 to 0.8) [§]	2.4	2.7	0.4 (−0.5 to 1.3)	1.2 (0.8 to 1.7)
Cocaine	4.9	2.6	−2.3 (−3.3 to −1.4) [§]	0.5 (0.4 to 0.7) [§]	2.7	2.2	−0.5 (−1.6 to 0.5)	0.8 (0.5 to 1.2)
Methamphetamine	2.7	1.9	−0.8 (−1.6 to 0.0)	0.7 (0.5 to 1.0)	1.5	1.4	−0.1 (−0.8 to 0.6)	1.0 (0.6 to 1.5)
Heroin	2.3	1.6	−0.7 (−1.5 to 0.1)	0.7 (0.5 to 1.0)	1.0	0.8 [¶]	−0.3 (−0.9 to 0.4)	0.8 (0.4 to 1.5)
Injection drug use	2.1	1.7	−0.4 (−1.2 to 0.4)	0.8 (0.5 to 1.2)	1.1	0.9 [¶]	−0.2 (−0.9 to 0.6)	0.9 (0.4 to 1.8)
Synthetic marijuana	7.2	5.8	−1.4 (−2.9 to 0.1)	0.8 (0.6 to 1.0)	7.4	7.1	−0.3 (−1.9 to 1.3)	1.0 (0.8 to 1.2)
Prescription opioid misuse	12.4	9.5	−2.9 (−4.7 to −1.2) [§]	0.8 (0.7 to 0.9) [§]	16.1	14.8 [¶]	−1.4 (−3.9 to 1.1)	0.9 (0.8 to 1.1)

Abbreviations: PD = prevalence difference; PR = prevalence ratio.

* 2019: N = 13,677 respondents; 2021: N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] Previous 30 days before the survey.

[§] Statistically significant results (p<0.05).

[¶] Significantly different from male students in 2021, on the basis of *t*-test analysis with Taylor series linearization (p<0.05).

marijuana use decreased from 2019 to 2021 among White and Hispanic students, whereas no change was noted for Black students. These disparities could be the result of exacerbation of preexisting health inequities, such as access to prevention and treatment services, experiences of racism and historical trauma, and economic challenges (9). Social determinants of health specific to COVID-19, such as disproportionate representation of parents and caregivers among front line workers and being in a family that experienced COVID-19–related severe illness and death, might also have influenced outcome disparities (9,10). In addition, the higher prevalence estimates of current and lifetime substance use in 2021 among students identifying as lesbian, gay, or bisexual compared with students identifying as heterosexual are generally consistent with the results from the 2019 YRBS (2). This finding could be a result of increased experiences of violence and other types

of victimization, discrimination, adversity, and isolation that these adolescents might have experienced (11).

An analysis of National Survey on Drug Use and Health data found that among adolescents and adults who reported drinking alcohol and misusing prescription pain relievers, approximately 40% misused a prescription pain reliever while drinking or within a couple of hours of drinking alcohol (12). In this context, the finding of high rates of using two or more substances among U.S. high school students who reported substance use is particularly concerning. Using alcohol and other substances increases the risk for health problems and overdose and can increase the effects of the substances if the substances are used at the same time (<https://www.cdc.gov/alcohol/fact-sheets/alcohol-and-other-substance-use.html>). In addition, although the prevalence of current prescription opioid misuse did not change among high school students, adolescent overdose

TABLE 3. Prevalence of and changes in prevalence of current and lifetime use of specific substances among high school students, by race and ethnicity — Youth Risk Behavior Survey, United States, 2019 and 2021*

Behavior/Substance	Race and ethnicity [†]											
	Black or African American				White				Hispanic or Latino			
	2019 %	2021 %	PD (95% CI)	PR (95% CI)	2019 %	2021 %	PD (95% CI)	PR (95% CI)	2019 %	2021 %	PD (95% CI)	PR (95% CI)
Current use[§]												
Alcohol	16.8	13.2 [¶]	-3.6 (-7.7 to 0.5)	0.8 (0.6 to 1.0)	34.2	25.9	-8.3 (-11.4 to -5.3)**	0.8 (0.7 to 0.8)**	28.4	22.9 ^{¶,††}	-5.5 (-9.5 to -1.6)**	0.8 (0.7 to 1.0)**
Marijuana	21.7	20.5 [¶]	-1.2 (-5.4 to 2.9)	0.9 (0.8 to 1.2)	22.1	14.8	-7.3 (-10.2 to -4.5)**	0.7 (0.6 to 0.8)**	22.4	16.7 ^{††}	-5.7 (-9.2 to -2.2)**	0.7 (0.6 to 0.9)**
Binge drinking	6.2	4.1 [¶]	-2.2 (-4.8 to 0.5)	0.7 (0.4 to 1.0)	17.3	13.3	-4.0 (-6.6 to -1.4)**	0.8 (0.7 to 0.9)**	12.4	10.1 ^{¶,††}	-2.3 (-4.8 to 0.1)	0.8 (0.7 to 1.0)
Prescription opioid misuse	8.7	8.6 [¶]	-0.1 (-4.2 to 3.9)	1.0 (0.6 to 1.6)	5.5	4.6	-1.0 (-2.5 to 0.5)	0.8 (0.6 to 1.1)	9.8	8.3 [¶]	-1.5 (-4.0 to 1.1)	0.9 (0.6 to 1.1)
Lifetime use												
Alcohol	47.2	39.4 [¶]	-7.8 (-13.5 to -2.0)**	0.8 (0.7 to 1.0)**	58.8	50.0	-8.8 (-12.0 to -5.6)**	0.9 (0.8 to 0.9)**	60.4	50.4 ^{††}	-10.0 (-14.5 to -5.5)**	0.8 (0.8 to 0.9)**
Marijuana	37.5	33.3 [¶]	-4.2 (-10.5 to 2.2)	0.9 (0.7 to 1.1)	36.8	26.2	-10.7 (-14.1 to -7.2)**	0.7 (0.6 to 0.8)**	39.2	31.2 [¶]	-7.9 (-12.5 to -3.4)**	0.8 (0.7 to 0.9)**
Inhalants	7.2	7.0	-0.2 (-2.5 to 2.1)	1.0 (0.7 to 1.3)	6.3	8.3	1.9 (0.3 to 3.6)**	1.3 (1.1 to 1.6)**	6.6	8.2	1.6 (-0.1 to 3.3)	1.2 (1.0 to 1.6)
Ecstasy	3.8	2.7	-1.1 (-2.9 to 0.7)	0.7 (0.4 to 1.2)	2.7	2.9	0.1 (-0.9 to 1.2)	1.1 (0.7 to 1.5)	4.4	2.7	-1.7 (-2.7 to -0.7)**	0.6 (0.5 to 0.8)**
Cocaine	4.0	1.9	-2.1 (-3.8 to -0.4)**	0.5 (0.3 to 0.8)**	2.9	2.4	-0.5 (-1.4 to 0.4)	0.8 (0.6 to 1.1)	5.6	2.9	-2.7 (-4.4 to -1.0)**	0.5 (0.3 to 0.8)**
Methamphetamine	3.8	2.0	-1.9 (-3.7 to 0.0)	0.5 (0.3 to 0.9)**	1.2	1.4	0.2 (-0.3 to 0.7)	1.2 (0.8 to 1.7)	2.7	2.3 [¶]	-0.4 (-1.6 to 0.8)	0.9 (0.5 to 1.3)
Heroin	3.4	1.7	-1.7 (-3.4 to -0.1)**	0.5 (0.3 to 0.9)**	0.9	1.0	0.1 (-0.3 to 0.5)	1.2 (0.8 to 1.8)	2.4	1.6 [¶]	-0.9 (-2.1 to 0.4)	0.7 (0.4 to 1.1)
Injection drug use	2.9	1.9	-0.9 (-3.0 to 1.1)	0.7 (0.3 to 1.5)	0.8	1.1	0.3 (-0.3 to 0.8)	1.4 (0.8 to 2.4)	2.5	1.8	-0.7 (-1.8 to 0.3)	0.7 (0.4 to 1.2)
Synthetic marijuana	5.7	6.8	1.1 (-1.2 to 3.3)	1.2 (0.8 to 1.7)	6.7	6.5	-0.2 (-1.6 to 1.3)	1.0 (0.8 to 1.2)	9.8	6.8	-3.1 (-4.9 to -1.3)**	0.7 (0.6 to 0.9)**
Prescription opioid misuse	15.3	13.6	-1.7 (-5.4 to 1.9)	0.9 (0.7 to 1.1)	12.7	11.2	-1.4 (-3.7 to 0.8)	0.9 (0.7 to 1.1)	16.0	13.8	-2.2 (-5.5 to 1.2)	0.9 (0.7 to 1.1)

Abbreviations: PD = prevalence difference; PR = prevalence ratio.

* 2019: N = 13,677 respondents; 2021: N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

[§] Previous 30 days before the survey.

[¶] Significantly different from White students in 2021, on the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$).

** Statistically significant results ($p < 0.05$).

^{††} Significantly different from Black or African American students in 2021, on the basis of *t*-test analysis with Taylor series linearization ($p < 0.05$).

deaths have increased substantially in recent years (4), in parallel to increased availability of counterfeit pills containing illicitly made fentanyl (<https://www.dea.gov/press-releases/2021/05/21/dea-issues-warning-over-counterfeit-pills>). That finding suggests an urgent need for new strategies to raise awareness among adolescents about exposure to highly lethal substances disguised as commonly misused prescription drugs and for expanded access to harm reduction interventions such as naloxone and fentanyl test strips.

The declines in adolescent substance use might be partially explained by pandemic-specific contextual factors, including decreased access to substances because of reduced contact with peers and increases in parental supervision (13). Inhalant use increased, a finding consistent with other research, and might also be the result of access. Inhalants (i.e., noncombusted and

nonheated gases that can be inhaled for euphoric effect) are easily accessible inside most homes (1). Consequently, it is possible that as social interactions resume, access to substances could increase, supervision might decrease, and adolescent substance use could revert to prepandemic levels (1).

Effective strategies to prevent and mitigate adolescent substance use are multilevel and focus on reducing risk factors associated with use and increasing protective factors likely to decrease use in the environments where adolescents interact (<https://addiction.surgeongeneral.gov/sites/default/files/surgeon-generals-report.pdf>). Feeling connected to family, positive peers (those not engaging in substance use risk behaviors), school, and community is an important protective factor that can buffer against adverse childhood experiences (ACEs), poor mental health, and health risk

TABLE 4. Prevalence of current and lifetime use of specific substances among high school students, by sexual identity — Youth Risk Behavior Survey, United States, 2021*

Behavior/Substance	Heterosexual %	Lesbian, gay, or bisexual %	Questioning or other %
Current use[†]			
Alcohol	21.6	29.3 [§]	20.9 [¶]
Marijuana	14.0	25.6 [§]	16.5 ^{§,¶}
Binge drinking	10.3	13.6 [§]	7.6 ^{§,¶}
Prescription opioid misuse	4.3	11.7 [§]	10.3 [§]
Lifetime use			
Alcohol	45.8	58.0 [§]	46.2 [¶]
Marijuana	25.8	41.2 [§]	27.5 [¶]
Inhalants	6.0	15.1 [§]	13.4 [§]
Ecstasy	2.1	6.0 [§]	3.9 ^{§,¶}
Cocaine	1.8	4.4 [§]	3.1 [§]
Methamphetamine	1.1	3.4 [§]	3.0 [§]
Heroin	0.8	1.9 [§]	2.4 [§]
Injection drug use	1.0	1.9 [§]	2.7 [§]
Synthetic marijuana	5.9	9.7 [§]	6.1 [¶]
Prescription opioid misuse	9.4	21.5 [§]	18.6 [§]

* N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[†] Previous 30 days before the survey.

[§] Significantly different from heterosexual students, based on *t*-test analysis with Taylor series linearization ($p < 0.05$).

[¶] Significantly different from lesbian, gay, or bisexual students, based on *t*-test analysis with Taylor series linearization ($p < 0.05$).

behaviors, including substance use and sexual risk behaviors (14). Family and parent substance use programs that focus on parental communication, monitoring, and modeling of positive problem-solving and coping strategies, can be effective in influencing adolescents' substance use behavior (14). Interventions that promote a positive school climate and increase students' feelings of connectedness to the school and decrease student dissatisfaction, in conjunction with effective health education, can improve substance use outcomes (15). For example, CDC's What Works in Schools approach (<https://www.cdc.gov/healthyyouth/whatworks/index.htm>), focused on creating safe and supportive environments, effective health education, and linking teens to health services, has demonstrated an effect on various mental health and health outcomes, including substance use.

Community-school partnerships that increase access to evidence-based substance use prevention curricula and substance use treatment services also have demonstrated protective effects on substance use into adulthood for both illicit drugs and prescription drug misuse, such as PROMoting School-community-university Partnerships to Enhanced Resilience (PROSPER) and Communities That Care (CTC) (<https://store.samhsa.gov/sites/default/files/d7/priv/pep19-pl-guide-1.pdf>). The majority of adolescents are registered in school; therefore, schools can have an important role

in substance use prevention and treatment by providing a supportive school environment including access to a counselor or a psychologist; school policies regarding the use of tobacco products, alcohol, and marijuana; and evidence-based programs to prevent substance use and violence and promote coping and problem-solving skills and mental health (16).

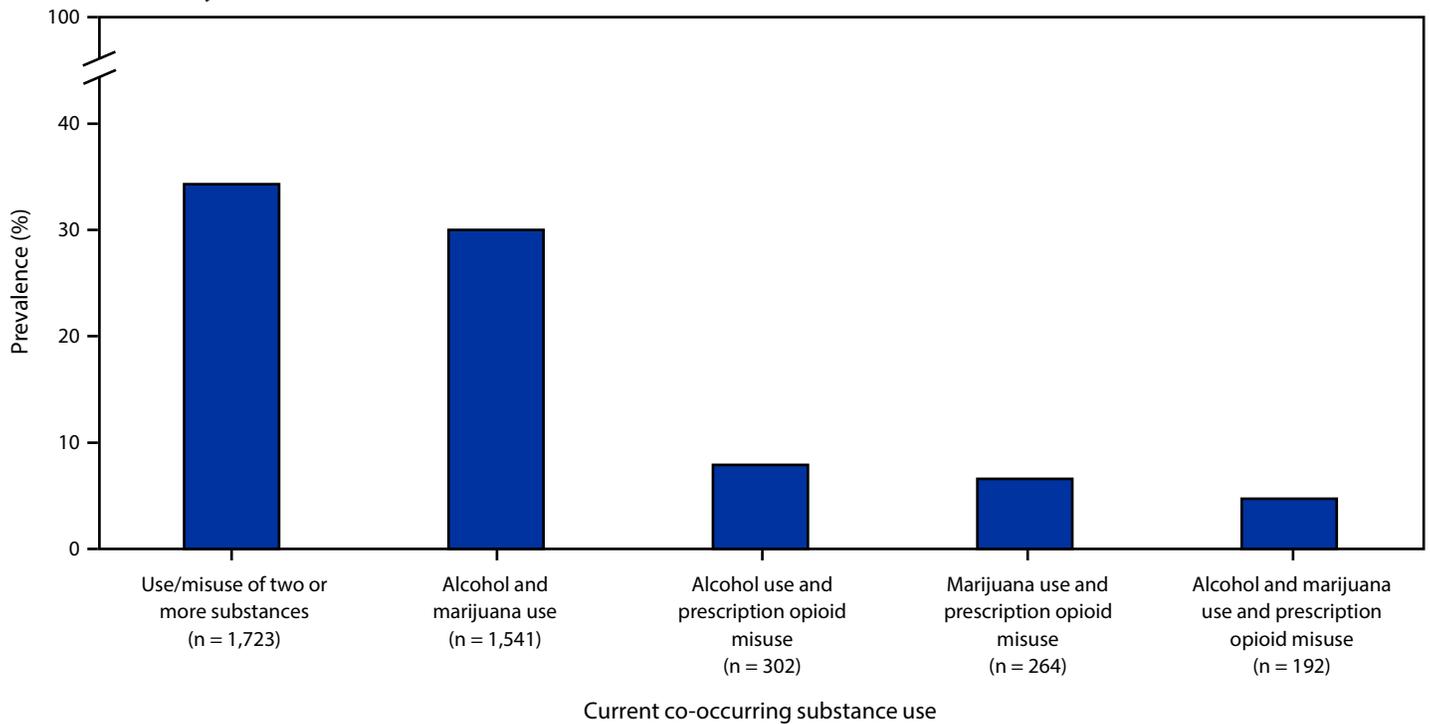
Youth substance use can also be reduced and prevented with evidence-based policies that reduce the availability of substances where youths live and decrease their access to them (<https://addiction.surgeongeneral.gov/sites/default/files/surgeon-generals-report.pdf>). One example is to reduce the number and concentration of places that sell alcohol. Increasing the price of alcohol through alcohol taxes, enhanced enforcement of laws that prohibit sales of marijuana and alcohol to minors, and enforcement of other substance use policies (e.g., prescription drug monitoring programs) also can reduce adolescent substance use (<https://www.cdc.gov/alcohol/fact-sheets/alcohol-and-other-substance-use.html>; <https://www.thecommunityguide.org/topics/excessive-alcohol-consumption.html>).

Disparities occur in adolescent substance use by race and ethnicity as well as sexual identity. Tailoring adolescent substance use prevention strategies to reach different population subgroups can be effective when implemented in tandem with broader strategies that prevent and mitigate ACEs and other individual, family, school, and community factors that influence risk for substance use (<https://www.cdc.gov/violenceprevention/pdf/preventingACES.pdf>).

Limitations

General limitations for the YRBS are available in the overview report of this supplement (8). The findings in this report are subject to at least three additional limitations. First, the survey questions on prescription opioid misuse refer to prescription pain medications and then provide examples of medications containing opioids only. Prescription opioid misuse prevalence might be overestimated if respondents included the use of nonopioid prescription pain medications; however, overestimation of prevalence should not have affected measures of difference between survey years. Second, substantial data were missing for certain substance use variables (e.g., prescription opioid misuse), which might be because of the order of the survey questions or other factors related to survey administration (2). These missing data could have resulted in overestimation or underestimation of prevalence. Finally, the YRBS questionnaire was updated in 2021 to be more inclusive of student sexual identities. This change limited the ability to assess changes in substance use by sexual identity in 2021 compared with earlier years.

FIGURE. Prevalence of current* co-occurring substance use among high school students who reported any current substance use† — Youth Risk Behavior Survey, United States, 2021



* Previous 30 days before the survey; n = 5,203 high school students who reported any current substance use. This n represents students who reported current use of at least one of the three substances, regardless of potential missing values for the other two substances.

† Current substance use measures were current alcohol use, current marijuana use, and current prescription opioid misuse. Missing observations were excluded in the calculation of percentages in each category. For alcohol and marijuana use, missing = 11 of 5,023 (0.2%); for marijuana use and prescription opioid misuse, missing = 37 of 5,023 (0.7%); for alcohol use and prescription opioid misuse, missing = 56 of 5,023 (1.1%).

Conclusion

Youth substance use has declined over the past decade, including during the COVID-19 pandemic; however, substance use remains common among U.S. high school students, and continued monitoring is important in the context of the changing marketplaces for alcohol beverage products and other drugs. Scaling-up tailored, evidence-based policies, programs, and practices to reduce factors that contribute to risk for adolescent substance use and promote factors that protect against risk might help build on recent declines.

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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Electronic Vapor Product Use Among High School Students — Youth Risk Behavior Survey, United States, 2021

Briana E. Oliver, MPH¹; Sherry Everett Jones, PhD, JD²; Emily Devora Hops, MPH¹; Carmen L. Ashley, MPH²; Richard Miech, PhD³; Jonetta J. Mpofu, PhD^{2,4}

¹Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion, CDC; ²Division of Adolescent and School Health, National Center for HIV, Viral Hepatitis, STD, TB Prevention, CDC; ³Institute for Social Research, University of Michigan, Ann Arbor, MI; ⁴U.S. Public Health Service Commissioned Corps, Rockville, MD

Abstract

Commercial tobacco use is the leading cause of preventable disease and death in the United States. Despite declines in overall tobacco product use among youths, disparities persist. This report uses biennial data from the 2015–2021 cycles of the nationally representative Youth Risk Behavior Survey to assess prevalence and trends in electronic vapor product (EVP) use among high school students, including ever use, current use (past 30 days), and daily use. Data from 2021 also included usual source of EVPs among students who currently used EVPs. Overall, in 2021, 36.2% had ever used EVPs, 18.0% currently used EVPs, and 5.0% used EVPs daily, with variation in prevalence by demographic characteristics. Prevalence of ever use and current use of EVPs was higher among female students than male students. Prevalence of ever use, current use, and daily use of EVPs was lower among Asian students than Black or African American (Black), Hispanic, Native Hawaiian or other Pacific Islander, White, and multiracial students. Prevalence of ever use, current use, and daily use of EVPs was higher among bisexual students than among students who were not bisexual. During 2015–2021, although ever use of EVPs decreased overall (from 44.9% to 36.2%) and current use of EVPs was stable overall, daily EVP use increased overall (from 2.0 to 5.0%) and among female (from 1.1% to 5.6%), male (from 2.8% to 4.5%), Black (from 1.1% to 3.1%), Hispanic (from 2.6% to 3.4%), multiracial (from 2.8% to 5.3%) and White (from 1.9% to 6.5%) students. Among students who currently use EVPs, 54.1% usually got or bought EVPs from a friend, family member, or someone else. Continued surveillance of EVP and other tobacco product use is necessary to document and understand youth tobacco product usage. These findings can be used to inform youth-focused tobacco prevention and control strategies at the local, state, tribal, and national levels.

Introduction

Tobacco product use is the leading cause of preventable disease and death in the United States (1). The term “tobacco product” in this report refers to commercial tobacco products and not to sacred and traditional use of tobacco by certain American Indian communities. Initiation of tobacco product use during adolescence is associated with increased nicotine dependence and sustained tobacco product use into adulthood (2). Comprehensive tobacco control interventions have made substantial gains in decreasing tobacco product use among youths (1–3). Among U.S. high school students, current use of cigarettes declined from 36.4% in 1997 to 6.0% in 2019 (3). Although cigarette use among youths has declined, youths have engaged in the use of other tobacco products such as cigars, hookah, smokeless tobacco, and electronic vapor products (EVPs).

EVPs are known by many names including e-cigarettes, vapes, hookah pens, and mods (2). In 2018, the Surgeon General declared that e-cigarette use among youths had become an epidemic (4). EVPs use a heating element to aerosolize a liquid solution that users inhale. Vaping liquids come in a variety of flavors and typically contain nicotine, a highly addictive chemical that can affect brain development (4,5). Nicotine also might increase the likelihood of youths using combustible tobacco products and increase the risk for addiction to other substances (4,5). Moreover, EVPs can be used to deliver additional psychoactive substances such as tetrahydrocannabinol (THC) (6). In 2019, vitamin E acetate, an additive sometimes found in THC-containing EVPs, was linked to e-cigarette- or vaping product use-associated lung injuries (6).

Multiple factors influence the use of EVPs and other tobacco products among youths, such as targeted marketing to youths by the tobacco industry, the appealing flavors in EVPs, misperceptions that vaping relieves stress, peer and family influences, and low perceptions of harm (1–5,7). Other risk factors that prime youths for experimentation with tobacco products and other substances include social isolation, grief, trauma, and stress; these risk factors were commonly seen

Corresponding Author: Briana E. Oliver, MPH, Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion, CDC. Telephone: 404-498-3142; Email: BOliver@cdc.gov.

during the COVID-19 pandemic (8). The 2021 National Youth Tobacco Survey found that, among youths who currently use e-cigarettes, the most common reasons for use were feelings of anxiety, stress, or depression and the “high or buzz” associated with nicotine use (7).

Continued surveillance of tobacco product use among youths is crucial for guiding and evaluating tobacco prevention and control strategies at the local, state, tribal, and national levels. This report presents the latest data from the 2021 national Youth Risk Behavior Survey (YRBS) to assess ever, current, and daily use of EVPs among U.S. high school students and usual source of obtaining EVPs. This report also presents data from previous YRBSs (2015, 2017, and 2019) to examine trends in EVP use over time. These findings can be used to inform youth-focused tobacco prevention and control strategies at the local, state, tribal, and national levels.

Methods

Data Source

This report includes data from the 2015 (N = 15,624), 2017 (N = 14,765), 2019 (N = 13,677), and 2021 (N = 17,232) YRBSs, 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 (9). The prevalence estimates for all tobacco product use questions for the entire study sample and stratified by sex, race and ethnicity, grade, and sexual orientation are available at <https://nccd.cdc.gov/youthonline/App/Default.aspx>. The full YRBS questionnaire, data sets, and documentation are available at <https://www.cdc.gov/healthyyouth/data/yrbs/index.htm>. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.*

Measures

Student demographic characteristics analyzed included sex (female or male), sexual identity (heterosexual, gay or lesbian, bisexual, and other or questioning), and race and ethnicity. For sexual identity, the “other or questioning” category included students who selected, “I describe my sexual identity some other way” or “I am not sure about my sexual identity (questioning).” Students were classified into seven racial

and ethnic categories, including American Indian or Alaska Native (AI/AN), Asian, Black or African American (Black), Native Hawaiian or other Pacific Islander (NH/OPI), White, Hispanic or Latino (Hispanic), and persons of multiple races (multiracial). (Persons of Hispanic origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.)

On the basis of how the questions were asked in the survey, electronic vapor products in this report refer to products “such as JUUL, SMOK, Suorin, Vuse, and blu” and include “e-cigarettes, vapes, vape pens, e-cigars, e-hookahs, hookah pens, and mods.” This study included four questions about EVP use, including ever use of EVPs, current EVP use (≥ 1 day during the 30 days before the survey), daily use of EVPs (during the 30 days before the survey), and usual source of EVPs (among youths who currently use EVPs) (Table 1).

Analysis

Analyses were completed using SUDAAN (version 11.0.3; RTI International) to account for the complex survey design and weighting. Prevalence estimates and 95% CIs for questions assessing ever, current, and daily EVP use were calculated overall and for each sex, racial and ethnic, and sexual identity group. Statistically significant pairwise differences by demographic characteristics were determined by *t*-tests with Taylor series linearization. In addition, prevalence of behavior reported in 2021 was compared with the prevalence in 2019 by using *t*-tests with Taylor series linearization. Differences between prevalence estimates were considered statistically significant if the *t*-test *p* value was <0.05 . Only statistically significant findings are described.

To identify temporal trends in EVP use, logistic regression analyses were used to model linear time effects while controlling for sex, grade (9, 10, 11, and 12), and race and ethnicity (10). EVP use was first introduced into the YRBS questionnaire in 2015; therefore, trends during 2015–2021 were examined for ever use of EVPs, current use of EVPs, and daily use of EVPs by sex and race and ethnicity. Students were presented with more response options for the question asking about sexual identity in 2021, which precludes the ability to examine trends in EVP use across sexual identity groups. Additional information about the methods used to conduct YRBS trend analyses are provided in the overview report of this supplement (9).

* See e.g., 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

TABLE 1. Question wording and analytic coding for included electronic vapor product variables* — Youth Risk Behavior Survey, United States, 2021

Variable	Question	Response options	Analytic coding	Years data available
Ever used an electronic vapor product	Have you ever used an electronic vapor product?	Yes, no	Yes versus no	2015–2021
Currently use electronic vapor products	During the past 30 days, on how many days did you use an electronic vapor product?	0 days, 1–2 days, 3–5 days, 6–9 days, 10–19 days, 20–29 days, or all 30 days	≥1 day versus 0 days	2015–2021
Daily use of electronic vapor products	During the past 30 days, on how many days did you use an electronic vapor product?	0 days, 1–2 days, 3–5 days, 6–9 days, 10–19 days, 20–29 days, or all 30 days	All 30 days versus 0–29 days	2015–2021
Usually got or bought their own electronic vapor products from a friend, family member, or someone else	During the past 30 days, how did you usually get your electronic vapor products? (Select only one response.)	I did not use any electronic vapor products during the past 30 days; I got or bought them from a friend, family member, or someone else; I bought them myself in a vape shop or tobacco shop; I bought them myself in a convenience store, supermarket, discount store, or gas station; I bought them myself at a mall or shopping center kiosk or stand; I bought them myself on the Internet, such as from a product website, vape store website, or other website like eBay, Amazon, Facebook Marketplace, or Craigslist; I took them from a store or another person; I got them in some other way	Got or bought them from a friend, family member, or someone else versus all other sources, among those who were current electronic vapor product users	2021

*The introduction to the electronic vapor products section of the YRBS questionnaire stated: “The next 3 questions ask about electronic vapor products, such as JUUL, SMOK, Suorin, Vuse, and blu. Electronic vapor products include e-cigarettes, vapes, vape pens, e-cigars, e-hookahs, hookah pens, and mods.”

Results

Ever Used an Electronic Vapor Product

Overall, 36.2% of high school students ever used EVPs in 2021 (Table 2). The prevalence of ever use of an EVP varied by sex, race and ethnicity, and sexual identity. For example, the prevalence of EVP use was higher among female students (40.9%) than male students (32.1%); higher among Hispanic (40.4%), multiracial (36.8%), White (36.7%), NH/OPI (36.1%), Black (33.6%), and AI/AN students (33.5%) than Asian students (19.5%); and higher among bisexual students (48.9%) than heterosexual (34.7%), gay or lesbian (34.4%), and other or questioning students (33.5%).

During 2015–2021, a linear decrease occurred in ever use of an EVP (from 44.9% to 36.2%), overall and among male (from 46.1% to 32.1%), AI/AN (from 61.3% to 33.5%), Black (from 42.4% to 33.6%), Hispanic (from 51.9% to 40.4%), NH/OPI (from 61.4% to 36.1%), and multiracial students (from 48.1% to 36.8%) (Table 3). In addition, from 2019 to 2021, decreases were observed in ever use of an EVP, overall (from 50.1% to 36.2%), among female (from 50.7% to 40.9%), male (from 49.6% to 32.1%), AI/AN (from 57.9% to 33.5%), Black (from 40.0% to 33.6%), Hispanic (from 49.5% to 40.4%), NH/OPI (from 58.7% to 36.1%), White (from 54.7% to 36.7%), and multiracial students (from 55.3% to 36.8%).

Current Electronic Vapor Product Use

Overall, 18.0% of students currently used an EVP in 2021. The prevalence of current EVP use varied by sex, race and ethnicity, and sexual identity. For example, the prevalence of EVP use was higher among female students (21.4%) than male students (14.9%); higher among NH/OPI (24.7%), AI/AN (23.2%), White (20.3%), Hispanic (17.8%), multiracial (17.1%), and Black students (14.0%) than Asian students (5.5%); and higher among bisexual students (29.0%) than heterosexual (16.4%), gay or lesbian (15.8%), and other or questioning students (15.7%).

During 2015–2021, there was no linear change in current use of an EVP overall; however, there was a linear increase among female students (22.6% in 2015; 10.5% in 2017; 33.5% in 2019; 21.4% in 2021) and a linear decrease among male students (from 25.6% to 14.9%). There also was a linear decrease among Asian students (from 14.5% to 5.5%), but not among any other racial or ethnic group. From 2019 to 2021, decreases were observed in current use of an EVP overall (from 32.7% to 18.0%), among female (from 33.5% to 21.4%) and male (from 32.0% to 14.9%) students, and among AI/AN (from 47.3% to 23.2%), Asian (from 13.0% to 5.5%), Black (from 19.7% to 14.0%), Hispanic (from 31.2% to 17.8%), NH/OPI (from 38.8% to 24.7%), White (from 38.3% to 20.3%), and multiracial students (from 33.5% to 17.1%).

TABLE 2. Prevalence of electronic vapor product* use among high school students, by sex, race and ethnicity, and sexual identity — Youth Risk Behavior Survey, United States, 2021

Behavior	Ever used an electronic vapor product [†]	Currently used electronic vapor products [§]	Daily use of electronic vapor products [¶]
	% (95% CI)**	% (95% CI)	% (95% CI)
Total	36.2 (33.7–38.8)	18.0 (16.3–19.8)	5.0 (4.4–5.7)
Sex			
Female	40.9 (37.6–44.2)	21.4 (19.2–23.8)	5.6 (4.6–6.8)
Male	32.1 (29.7–34.5)	14.9 (13.3–16.7)	4.5 (3.9–5.2)
Race and ethnicity^{††}			
American Indian or Alaska Native	33.5 (23.8–44.8)	23.2 (16.5–31.7)	4.4 (1.7–10.7)
Asian	19.5 (14.1–26.5)	5.5 (4.2–7.2)	1.2 (0.5–2.8)
Black	33.6 (30.4–37.0)	14.0 (12.3–16.0)	3.1 (2.0–4.7)
Native Hawaiian or other Pacific Islander	36.1 (29.2–43.7)	24.7 (17.2–34.3)	8.0 (3.6–16.8)
White	36.7 (34.2–39.3)	20.3 (18.4–22.2)	6.5 (5.6–7.6)
Hispanic/Latino	40.4 (36.7–44.2)	17.8 (15.3–20.5)	3.4 (2.9–4.1)
Multiracial	36.8 (30.9–43.2)	17.1 (13.4–21.5)	5.3 (4.0–6.8)
Sexual identity			
Heterosexual	34.7 (32.4–37.1)	16.4 (15.1–17.8)	4.4 (3.8–5.1)
Gay or lesbian	34.4 (25.5–44.6)	15.8 (11.1–22.0)	5.0 (2.9–8.6)
Bisexual	48.9 (44.2–53.6)	29.0 (25.4–32.8)	7.5 (5.7–9.9)
Other or questioning ^{§§}	33.5 (29.2–38.0)	15.7 (12.9–18.9)	4.6 (3.3–6.3)

* Refer to Table 1 for variable definitions.

[†] On the basis of *t*-test analysis using Taylor series linearization, $p < 0.05$. Responses from female students were significantly different than male students. Responses from Asian students were significantly different than American Indian or Alaska Native (AI/AN), Black, Hispanic, Native Hawaiian or other Pacific Islander (NH/OPI), White, and multiracial students. Responses from Black students were significantly different than Hispanic students. Responses from Bisexual students were significantly different than heterosexual, gay or lesbian, and other or questioning students.

[§] On the basis of *t*-test analysis using Taylor series linearization, $p < 0.05$. Responses from female students were significantly different than male students. Responses from Asian students were significantly different than AI/AN, Black, Hispanic, NH/OPI, White, and Multiracial students. Responses from Black students were significantly different than AI/AN, Hispanic, NH/OPI, and White students. Responses from bisexual students were significantly different than heterosexual, gay or lesbian, and other or questioning students.

[¶] On the basis of *t*-test analysis using Taylor series linearization, $p < 0.05$. Responses from Asian students were significantly different than Black, Hispanic, NH/OPI, White, and multiracial students. Responses from Black students were significantly different than White and multiracial students. Responses from Hispanic students were significantly different than White and multiracial students. Responses from White students were significantly different than multiracial students. Responses from bisexual students were significantly different than heterosexual and other or questioning students.

** $N = 17,232$ respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

^{††} Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

^{§§} Includes students who responded, “I describe my sexual identity some other way” or “I am not sure about my sexual identity (questioning).”

Daily Use of Electronic Vapor Products

Overall, 5.0% of students reported daily use of an EVP in 2021. The prevalence of daily use of an EVP varied by race and ethnicity and sexual identity. For example, the prevalence of daily use of an EVP was higher among NH/OPI (8.0%), White (6.5%), multiracial (5.3%), Hispanic (3.4%), and Black students (3.1%) than among Asian students (1.2%). Prevalence also was higher among bisexual students (7.5%) than among other or questioning (4.6%) and heterosexual students (4.4%).

During 2015–2021, a linear increase occurred in daily use of an EVP overall (from 2.0% to 5.0%), among female (from 1.1% to 5.6%) and male students (from 2.8% to 4.5%), and among Black (from 1.1% to 3.1%), Hispanic (from 2.6% to 3.4%), White (from 1.9% to 6.5%), and multiracial students (from 2.8% to 5.3%). From 2019 to 2021, decreases were observed in daily use of an EVP use overall (from 7.2% to 5.0%), among male students (from 7.9% to 4.5%), and among Hispanic (from 5.2% to 3.4%) and White students (from 9.3% to 6.5%).

Usual Source of Electronic Vapor Products

Among the 18.0% of students who currently used EVPs, 54.1% indicated they usually “got or bought them from a friend, family member, or someone else.” Other responses to the question about where students usually obtained EVP included, “bought them in a vape shop or tobacco shop” (12.4%), “bought them in a convenience store, supermarket, discount store, or gas station” (6.8%), “bought them at a mall or shopping center kiosk or stand” (0.5%), “bought them on the Internet, such as from a product website, vape store website, or other website like eBay, Amazon, Facebook Marketplace, or Craigslist” (1.7%), “took them from a store or another person” (2.8%), or “got them in some other way” (21.7%).

Discussion

In 2021, more than one in three (36.2%) students had ever used EVPs and almost one in five (18.0%) students currently

TABLE 3. Trends in electronic vapor product use,* by sex and race and ethnicity — Youth Risk Behavior Survey, United States, 2015–2021

Behavior	2015 [†]	2017 [†]	2019 [†]	2021 [†]	Linear change 2015–2021 [§]	Change during 2019–2021 [¶]
Ever used an electronic vapor product						
Total	44.9	42.2	50.1	36.2	Decreased	Decreased
Sex						
Female	43.6	39.7	50.7	40.9	No linear change	Decreased
Male	46.1	44.9	49.6	32.1	Decreased	Decreased
Race and ethnicity**						
American Indian or Alaska Native	61.3	54.9	57.9	33.5	Decreased	Decreased
Asian	29.5	20.8	24.9	19.5	No linear change	No change
Black	42.4	36.2	40.0	33.6	Decreased	Decreased
Native Hawaiian or other Pacific Islander	61.4	49.1	58.7	36.1	Decreased	Decreased
White	43.2	41.8	54.7	36.7	No linear change	Decreased
Hispanic/Latino	51.9	48.7	49.5	40.4	Decreased	Decreased
Multiracial	48.1	46.8	55.3	36.8	Decreased	Decreased
Currently use electronic vapor products						
Total	24.1	13.2	32.7	18.0	No linear change	Decreased
Sex						
Female	22.6	10.5	33.5	21.4	Increased	Decreased
Male	25.6	15.9	32.0	14.9	Decreased	Decreased
Race and ethnicity						
American Indian or Alaska Native	30.2	27.8	47.3	23.2	No linear change	Decreased
Asian	14.5	3.7	13.0	5.5	Decreased	Decreased
Black	18.0	8.5	19.7	14.0	No linear change	Decreased
Native Hawaiian or other Pacific Islander	28.5	9.7	38.8	24.7	No linear change	Decreased
White	25.2	15.6	38.3	20.3	No linear change	Decreased
Hispanic/Latino	26.3	11.4	31.2	17.8	No linear change	Decreased
Multiracial	25.8	12.9	33.5	17.1	No linear change	Decreased
Daily use of electronic vapor products						
Total	2.0	2.4	7.2	5.0	Increased	Decreased
Sex						
Female	1.1	1.1	6.4	5.6	Increased	No change
Male	2.8	3.8	7.9	4.5	Increased	Decreased
Race and ethnicity						
American Indian or Alaska Native	3.2	7.7	11.5	4.4	No linear change	No change
Asian	1.2	0.6	3.0	1.2	No linear change	No change
Black	1.1	1.0	3.4	3.1	Increased	No change
Native Hawaiian or other Pacific Islander	5.4	3.1	5.4	8.0	No linear change	No change
White	1.9	3.1	9.3	6.5	Increased	Decreased
Hispanic/Latino	2.6	1.7	5.2	3.4	Increased	Decreased
Multiracial	2.8	2.6	8.2	5.3	Increased	No change

* Refer to Table 1 for variable definitions.

[†] 2015: N = 15,624 respondents; 2017: N = 14,765 respondents; 2019: N = 13,677 respondents; 2021: N = 17,232 respondents. Because the state and local questionnaires differ by jurisdiction, students in these schools were not asked all national YRBS questions. Therefore, the total number (N) of students answering each question varied. Percentages in each category are calculated on the known data.

[§] Logistic regression models were used to assess linear trends for 2015–2021, controlling for sex, race and ethnicity, and grade, $p < 0.05$.

[¶] On the basis of *t*-test analysis using Taylor series linearization, $p < 0.05$.

** Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.

used EVPs. Overall, ever EVP use decreased and daily EVP use increased during 2015–2021; however, ever, current, and daily use of EVPs decreased from 2019 to 2021, a finding that is consistent with findings from other national surveillance systems, such as Monitoring the Future (11).

The 2021 YRBS documented variation in the patterns of EVP use between demographic groups. Prevalence of ever use and current use of EVPs were higher among female students than male students. During 2019–2022, adolescent females

reported higher rates of eating disorders, emotional distress, anxiety, and depression related to the ongoing COVID-19 pandemic, all of which might explain increases in EVP use and other substances (12). Youths who engage in vaping behaviors as a method of dealing with stressors can potentially create a cycle of nicotine dependence because symptoms of nicotine withdrawal include symptoms of anxiety and depression (1).

This report disaggregated bisexual students from lesbian and gay students, revealing differences in EVP use among these two

groups. Bisexual students had a higher prevalence of ever and current EVP use than lesbian or gay, other or questioning, or heterosexual students. This finding contributes to the evidence base that tobacco product usage among sexual minority (e.g., lesbian or gay, bisexual, and other or questioning [LGBQ+]) youths differs by sexual orientation (13).

EVP use was lower among Asian students in comparison with other racial and ethnic student groups. In general, prevalence of ever use, current use, and daily use of EVPs among Asian students was lower than among Black, Hispanic, NH/OPI, White, and multiracial students. This finding might be explained by other research that found social and cultural influences were protective factors against tobacco product and other substance use behaviors among Asian youths (14). Identifying risk and protective factors among youths is essential for developing tobacco prevention and cessation programs that address the various needs of youths.

It is concerning that daily EVP use increased among Black, Hispanic, multiracial and White students during 2015–2021. Observed patterns of increased daily use might be, in part, related to the increase in nicotine concentrations in U.S. e-cigarettes (15). A recent study found that, during 2013–2018, the average nicotine concentration in e-cigarettes sold increased by more than 80% for all flavor categories and rechargeable e-cigarettes (15). Exposure to nicotine during adolescence can affect learning, memory, and attention and increases risk for future nicotine dependence (2,4). Evidence-based cessation programs that are tailored and culturally specific to youths are needed to help youths who are nicotine dependent abstain from tobacco product usage.

Overall, ever use, current use, and daily use of EVPs among high school students decreased from 2019 to 2021. Certain factors might have contributed to this decline, including the implementation of policies restricting the sale of flavored tobacco products, and the COVID-19 pandemic, which provided youths fewer opportunities to purchase EVPs or interact with peers who use tobacco products and other substances (4,11,12). Regulatory efforts are ongoing at the national, state, and local levels to restrict youths access to EVPs and, thus, decrease the use of EVPs among youths. Findings from the 2021 YRBS found that among those who currently use EVPs, more than half (54.1%) got their EVPs from a friend, family member, or someone else, indicating students are finding other means to purchase or gain access to EVPs.

Limitations

General limitations for YRBS are available in the overview report of this supplement (9). The findings in this report are

subject to at least three additional limitations. First, the YRBS question addressing how students usually obtained EVPs limited respondents to only one response. Students might have obtained these products through multiple sources; therefore, the extent to which students use various sources are likely underrepresented. Second, EVP use as defined in this survey was not limited to vaping products that deliver nicotine. Therefore, results might overestimate nicotine-containing EVP use among youths. Finally, it was not possible to assess EVP use among subpopulations within the racial and ethnic categories included in this report (e.g., disaggregating students by racial and ethnic subgroups: Indian, Vietnamese, and Korean). Thus, the categories for race and ethnicity in this survey might not reflect the diversity of participants' identities, and potentially masks nuanced differences in EVP use within racial and ethnic populations.

Future Directions

The declines in ever, current, and daily EVP use among high school students during 2019–2021 is encouraging; however, prevalence of EVP use among students remains high. To reduce prevalence of EVP use among youths, public health professionals should consider using community-based participatory research to develop tobacco prevention and cessation programs that are tailored to youths (<https://pubmed.ncbi.nlm.nih.gov/20147663>). For example, an intervention was piloted among rural high school students in Kentucky where students were informed about the risks for e-cigarette use by their peers and provided cessation resources and information on how to help their friends abstain from cigarette use (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7789399>). Results of that study yielded positive outcomes of the peer-led intervention related to increased awareness of risks associated with e-cigarette use and the desire of students to address the e-cigarette epidemic in their communities.

Future research could explore factors that influence EVP use among youths (e.g., neighborhood poverty or socioeconomic status), access to health care, access to healthy food, and opportunities for physical activity. Such factors can be conceptualized as social determinants of health that might influence EVP use among students. Addressing social determinants of health when developing youth-centric tobacco control programs could improve evidence-based interventions to reduce tobacco product use initiation among students and provide tailored cessation services to youths who use tobacco products.

Future research could explore EVP use among youths with identities not examined in this report. There is a dearth of research describing EVP use among nonbinary, gender fluid, gender expansive youths (<https://www.edi.nih.gov/people/sep/lgbti/safezone/terminology>);

those whose sexual orientation is not captured by the categories of “lesbian,” “gay” or “bisexual”; and youths with intersectional identities including those who are LGBQ+ and of certain racial and ethnic minority groups. Future research that uses an intersectional approach to understanding EVP use among LGBQ+ youths and youths of various racial and ethnic identities can inform evidence-based tobacco control interventions and promising practices for persons most at risk for EVP use.

Finally, approximately half of high school youths who currently use EVPs were getting or buying these products from a friend, family member, or someone else. These findings provide an opportunity to use practices that focus on the social influences of tobacco product usage among youths. Programs like the Truth Initiative’s *This is Quitting* (<https://truthinitiative.org/thisisquitting>) are tailored to youths to address the social and behavioral factors that lead to EVP and other tobacco product use. Evidence-based interventions at the individual- and community-level can provide tools to youths that address peer pressure, encourage self-efficacy and goal-setting, and increase the knowledge base of EVP use and associated harms to reduce or eliminate tobacco product use among youths (<https://catch.org/wp-content/uploads/2021/05/SAMHSA-CATCH-My-Breath-Reducing-Vaping-Among-Youth-and-Young-Adults.pdf>).

Conclusion

EVP use among U.S. high school students remains a public health concern. During 2015–2021, no linear decrease was observed in current EVP use among high school students overall; a linear increase was observed among female students who reported current EVP use. In addition, daily EVP use increased overall and among female, male, Black, Hispanic, multiracial, and White students during 2015–2021. Eliminating EVP use among youths requires evidence-based strategies and practices that are culturally relevant and tailored to the communities most at risk for sustained EVP use. Continued surveillance of EVP use among youths is necessary to guide and evaluate public health strategies 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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ISSN: 2380-8950 (Print)