Individual and Collective Positive Health Behaviors and Academic Achievement Among U.S. High School Students, Youth Risk Behavior Survey 2017

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Abstract

Purpose: We examined associations between academic grades and positive health behaviors, individually and collectively, among U.S. high school students.

Design: Cross-sectional study design.

Setting: Data were from the 2017 national Youth Risk Behavior Survey. Response rates were 75% for schools, 81% for students, and 60% overall (n = 14,765 students).

Subjects: Youth in grades 9th–12th.

Measures: We focused on youth behaviors that can prevent or delay the onset of chronic health conditions. Seven dietary, 3 physical activity, 2 sedentary screen time, and 4 tobacco product use behaviors were assessed. Variables were dichotomized (0/1) to indicate that a score was given to

the positive health behavior response (e.g.,, did not smoke cigarettes = 1). A composite score was created by summing each positive health behavior response among 16 total health behaviors.

Analysis: Multivariable logistic regression analyses for each individual health behavior, and a multivariable negative binomial regression for the composite score, were conducted with self-reported academic grades, controlling for sex, grade in school, race/ethnicity, and body mass index (BMI) categories.

Results: Controlling for covariates, students who reported mostly A's had 2.0 ($P < .001$) more positive health behaviors; students who reported mostly B's had 1.3 ($P < .001$) more positive health behaviors; and students who reported mostly C's had .78 ($P < .001$) more positive health behaviors, compared to students who reported mostly D's/F's.

Conclusions: Higher academic grades are associated with more positive individual and cumulative health behaviors among high school students. Understanding these relationships can help inform efforts to create a healthy and supportive school environment and strive for health equity.

Keywords

academic achievement; academic grades; health behaviors; health policy; interventions; youth

Purpose

Understanding the association between health and academic achievement can help school officials improve the health of their students and promote collaboration between the health and education sectors.[1,2] Systematic reviews have shown a consistent association between health and academic achievement.[1,3–5] Specifically, these studies have examined how health-related behaviors and programs are associated with different aspects of academic achievement by assessing academic performance (e.g.,, test scores and grades), educational behavior (e.g.,, attendance, dropout, and classroom behavior), and cognitive ability and attitude (e.g.,, attention, memory, and mood).

Schools have made it a priority to address chronic health conditions by improving nutrition and physical activity levels, reduce sedentary behaviors, and prevent tobacco product use among students, and these efforts have been examined in association with academic achievement. For example, research has shown consistent positive associations between improved academic achievement and healthy eating behaviors, including regular breakfast consumption, higher fruit and vegetable consumption, micronutrient intake, lower intake of low energy dense foods (i.e.,, junk foods), and lower intake of sugary drinks.[1,2,6] Likewise, participation in physical activity and physical education class, time spent in recess, engagement in brief classroom physical activity breaks, and participation in extracurricular physical activities have been positively associated with different aspects of academic achievement, including better concentration and attention, higher achievement tests scores, and positive classroom behaviors.[1,2]

Inverse associations have also been found between health-risk behaviors and academic achievement. For example, students who smoke cigarettes are more likely to have lower

grades.[7] However, new tobacco products have emerged in recent years, and less is known about the extent to which products such as electronic vapor products (e.g.,, e-cigarettes) are associated with academic achievement. Research also has shown time spent viewing television and playing video games has been linked to poor academic achievement, although this might be affected by the quantity of time spent in the sedentary behavior and the amount of physical activity engaged in throughout the day.[8]

Although past studies have shown consistent associations between many health behaviors and academic achievement, further exploration of the nuances could help better communicate the connection and garner support for health-related policies and practices in schools. A recent article published in the *Morbidity and Mortality Weekly Report* found that high school students who received better grades had higher prevalence estimates for most protective health-related behaviors and lower prevalence estimates for most health-related risk behaviors compared with students with lower grades.[2] However, the study did not consider how these health behaviors collectively affect student grades. Another study that investigated multiple health behaviors individually and collectively among students in grades 8 and 10 found that negative health behaviors were associated with higher odds of academic disengagement and lower academic expectations.[9]

To date, no study has examined youth behaviors cumulatively, nor considered a combined measure of multiple *positive* health behaviors in relation to academic grades among a nationally representative sample. To address this gap in the scientific literature, we examined associations between multiple health behaviors that can prevent or delay the onset of chronic health conditions, which included dietary, physical activity, sedentary screen time, and tobacco product use behaviors and academic grades among U.S. high school students. Research indicates that three health-risk behaviors, physical inactivity, an unhealthy diet, and using tobacco products (either individually or in combination) can increase the risk of developing four major chronic health conditions—diabetes, cancer, cardiovascular disease, and chronic lower respiratory disease. These four conditions are known to cause more than 50% of mortalities in communities across the US.[10]

The objectives of this study were to (1) provide updated estimates of associations between *individual* positive health behaviors and academic grades and (2) assess how cumulative, or *collective*, positive health behaviors are associated with academic grades. Better information about these associations could underscore the need for comprehensive school policies and practices that promote the health and academic success of students.

Methods

Design

The national Youth Risk Behavior Survey (YRBS) is a school-based survey of U.S. high school students conducted biennially by the Centers for Disease Control and Prevention (CDC). Methodology has been published previously,[11] and studies have examined test–retest reliability and validity of the survey items.[12,13] For the 2017 YRBS, a sample design consisting of a three-stage cluster sample was used to produce a nationally representative sample of students enrolled in grades 9–12 who attended public or private schools. The

national YRBS has been reviewed and approved by an IRB at the Centers for Disease Control and Prevention (CDC).

Sample

Before survey administration, local, school-level parental permission procedures were followed. Participation in the survey was voluntary. Survey procedures allowed for anonymous participation, so student privacy was protected. During a single class period, students completed the self-administered questionnaire and recorded their responses on a computer-scannable booklet or answer sheet.

Response rates were 75% for schools, 81% for students, and 60% overall. We used weighting procedures based on sex, race/ethnicity, and grade level (9th–12th) to adjust for oversampling of Black and Hispanic students and non-response. The final data set was 14,765 students in grades 9–12.

Measures

Figure 1 summarizes the questions and analytic coding for each variable analyzed. Seven dietary behaviors, three physical activity behaviors, two sedentary screen time use behaviors, and four tobacco product use behaviors (total of 16) were considered for this study. For dietary behaviors, students were asked about daily breakfast intake, fruit and fruit juice intake, vegetable intake, consumption of sugar-sweetened beverages (soda and sports drinks), and water intake. For physical activity behaviors, they were asked about daily physical activity for at least 60 minutes, sports team participation, and PE class attendance. For sedentary behaviors, they were asked about screen time use, specifically time spent watching television and using a computer or playing video games. For tobacco product use behaviors, they were asked about not smoking cigarettes; not using an electronic vapor product; not using smokeless tobacco; and not smoking cigars, cigarillos, or little cigars.

The primary outcome variable of interest was self-reported academic grades (mostly A's, mostly B's, mostly C's, and mostly D'/F's). Self-reported student demographic variables were grade level (9–12), sex, race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic/Latino, and non-Hispanic other), and body mass index (BMI) categories. BMI was calculated from self-reported height and weight. Students with BMI ≥ 95th percentile for sex and age were considered to be obese; those with 85th ≤ BMI < 95th percentile were considered to be overweight; those with 5th ≤ BMI < 85th percentile were considered to be normal weight; and those with BMI <5th percentile were considered to be underweight. We included BMI in our models because a recent systematic review found it to be negatively but weakly associated with academic achievement.[14]

Analysis

All analyses were conducted with SAS-Callable SUDAAN version 11.0.3 (version 11.0.3; RTI International, Research Triangle Park, NC) to account for the complex survey data. All estimates were weighted to be nationally representative. Model specification tests were conducted. Multivariable logistic regression analysis for each individual health behavior (dependent variable) was conducted with self-reported academic grades (mostly A's, mostly

B's, mostly C's, and mostly D's/F's) as the primary independent variable. Models controlled for sex, grade level (9th–12th), race/ethnicity, and BMI categories. Adjusted prevalence ratios (aPR) for the logistic regressions are reported.

All health behavior variables were dichotomized (0 vs 1) to indicate that a score was given to the positive health behavior response (e.g., did not smoke cigarettes = 1). A count variable, the composite score (possible range: 0–16) was created by summing each positive health behavior response among all 16 individual health-related behaviors included in the study. A factor analysis using the Eigenvalue-one Criterion, the Scree test, and an investigation of the proportions of variance accounted for was conducted. The results of the factor analysis concluded that all 16 health behaviors should be included in the composite score. A negative binomial model, using the LOGLINK procedure for count data, was then employed along with robust standard errors.[15] The average marginal effect with standard errors is reported. An ordinary least squares (OLS) regression was also conducted as part of model specification and sensitivity analysis. Results were similar in terms of directionality and significance (results not shown).

Results

Descriptive characteristics of students are reported in Table 1. In brief, most students reported earning mostly A's (39.4%) or mostly B's (38.3%). Students were evenly distributed across grade and sex categories. About half were non-Hispanic White (53.5%), and about two-thirds had a BMI category classified as "normal weight" (66.6%).

Individual Positive Health Behaviors

Table 2 provides the prevalence of each of the 16 health behaviors and results of the multivariable logistic regressions for academic grades and each health behavior. All models controlled for categorical covariates, specifically sex, grade in school (9th–12th), race/ethnicity, and BMI category. Mostly D's/F's was the referent group.

Students who reported mostly A's were 2 times ($P < .001$) as likely to eat breakfast on all 7 days, 20% ($P < .05$) more likely to eat fruit or drink 100% fruit juices one or more times per day, and 20% ($P < .001$) more likely to eat vegetables one or more times per day, compared to students with mostly D's/F's. They also were 2.1 times ($P < .001$) as likely to not drink a can, bottle, or glass of soda or pop; 10% ($P < .01$) more likely to not drink a sports drink; and 30% ($P < .001$) more likely to drink water three or more times per day. Drinking one or more glasses per day of milk was not associated with academic grades. Almost all of the dietary behaviors were significant for students who reported mostly B's, with the exception of "drank one or more glasses of milk per day" and "did not drink a sports drink." However, only "ate breakfast on all 7 days" and "drank water three or more times per day" were significant among students who reported mostly C's.

Students who reported mostly A's were 30% ($P < .05$) more likely to be physically active at least 60 minutes per day and 60% ($P < .001$) more likely to play on at least one sports team, compared to students with mostly D's/F's. Similar patterns were found for students

who reported mostly B's and mostly C's. Students who reported mostly B's were 20% (P < .05) more likely to attend physical education (PE) on all 5 days.

Students with mostly A's were 20% (P < .001) more likely to watch television 2 hours or less per day and 20% (P < .05) more likely to use a computer or play video games 2 hours or less per day, compared to students with mostly D's/F's. Results for students reporting mostly B's and mostly C's were not statistically significant.

Students who reported mostly A's were 30% (P < .001) more likely to not smoke cigarettes; 30% (P < .001) more likely to not use an electronic vapor product; 10% (P < .001) more likely to not use smokeless tobacco; and 20% (P < .001) more likely to not smoke cigars, cigarillos, or little cigars, compared to students with mostly D's/F's. Results were statistically significant (P < .05) for all grade categories (mostly A's, mostly B's, and mostly C's).

Collective Positive Health Behaviors

Across the 16 positive health behaviors, the total weighted average number of behaviors among students was 9.7. Stratified by academic grades, the weighted average number of health behaviors for students who reported mostly A's was 10.2; mostly B's was 9.6; mostly C's was 9.1; and mostly D's/F's was 8.2 (data not shown).

Table 3 presents the results of the multivariable negative binomial regression. After adjustment, students who reported mostly A's had 2.0 (P < .001) more positive health behaviors, compared to students who reported mostly D's/F's. Students who reported mostly B's had 1.3 (P < .001) more positive health behaviors, and students who reported mostly C's had .78 (P < .001) more positive health behaviors, compared to students with mostly D's/F's.

Discussion

Although much is known about the relationship between individual health behaviors and academic achievement, less is known about the relationship between cumulative, or collective, health behaviors and academic achievement. To our knowledge, this study is the first to provide evidence from a nationally representative sample of U.S. high school students to show that students who report higher grades also have a higher number of multiple positive health behaviors that can prevent or delay the onset of chronic health conditions. The difference of only one or two behaviors illustrates the substantial effect that even one behavior could have on academic grades; or conversely, the considerable effect academic grades could have on the acquisition and engagement in positive health behaviors.

Overall, our results are consistent with previous studies. For dietary behaviors, eating breakfast on all 7 days, eating fruit one or more times per day, eating vegetables one or more times per day, not drinking soda, and not drinking sports drinks were associated with academic grades, which is consistent with other literature.[1,2,6] Students who had higher academic grades were also more likely to drink water three or more times per day, adding evidence to support the connection between adequate hydration and improved cognitive

function, memory, and attention.[16] Drinking milk one or more times per day was not statistically significant for any grade category. However, results from previous studies have indicated that drinking milk is associated with academic grades.[2]

The physical activity findings in our study also corroborate previous research.[1,2,5] Being physically active at least 60 minutes per day and playing on a sports team were statistically significant for all academic grades. This study also found that attending PE on all 5 school days during a typical school week was barely significant ($P = .049$) for students reporting mostly B's. This is similar to other research that has found this behavior to be non-significant.[2]

Sedentary behaviors, specifically watching television or playing on a computer or video games, can have detrimental effects on both physical health[17] and mental health.[18] Our study found a significant association only for students who reported mostly A's. These findings are consistent with a recent systematic review that examined several screen time use behaviors and found that watching television and playing video games were the activities most negatively associated with academic outcomes.[19]

Not using tobacco products was associated with higher academic grades among students reporting mostly A's, mostly B's, or mostly C's. These results are similar to recent research that reported lower academic grades among students who had high probabilities of using cigarettes, e-cigarettes, and cigarillos.[20]

These results reveal a distinct relationship, both individually and collectively, between health behaviors and academic grades and have implications for school health policies, practices, and programs, as well as communities, parents, and families. Although causality cannot be implied from this study's analyses, causal relationships are understood to occur between health and education in both directions.[3,21]

A multi-component, school-based approach can be implemented to support healthy dietary behaviors among students,[22] including the promotion of school meal programs, adding Smart Snacks standards to school nutrition standards for foods sold outside of meal programs, incorporating nutrition education into the school day, marketing and promoting healthy foods and beverages, and providing access to free drinking water throughout the school.

The *Physical Activity Guidelines for Americans, second edition* recommends that adolescents engage in 60 minutes of moderate-to-vigorous physical activity daily.[23] However, less than one-third (26.1%) of U.S. high school students are meeting this recommendation. Schools can promote physical activity behaviors by implementing a Comprehensive School Physical Activity Program (CSPAP). PE is the foundation of the CSPAP framework because it provides a curriculum and instruction for students on how to be physically active and teaches the importance of lifelong physical activity.

Limiting the use of cell phones and other devices that play video games in the classroom and at home could help reduce sedentary behaviors. Encouraging children and adolescents ages

6 to 17 years to get the recommended 60 minutes of moderate-to-vigorous physical activity per day[23] and get adequate sleep,[24] could also help reduce sedentary behaviors.

The use of any tobacco product is unsafe, whether it is smoked, smokeless, or electronic.[25,26] The sustained implementation of population-based strategies, in coordination with the regulation of tobacco products the by U.S. Food and Drug Administration, are critical to reducing all forms of tobacco product use and initiation among U.S. youth. Population-based strategies to reduce tobacco product use among youth include increasing the price of tobacco products, implementing comprehensive smokefree policies, implementing advertising and promotion restrictions and national public education media campaigns, and raising the minimum age of purchase for tobacco products to 21 years.[25–27] In addition, school-based prevention initiatives that are free of tobacco industry influence, such as curricula on the risks of all forms of tobacco product use, can be undertaken. However, because evidence on the long-term effectiveness of school-based programs to prevent tobacco product use is limited, school programs may not be effective alone and should be implemented with proven population-based strategies.[25,28]

Although we did not examine all possible influences on youth behavior, specifically, the social determinants of health, it is critically important to acknowledge the substantial role they play in influencing a student's ability and opportunity to acquire and develop positive youth behaviors.[29] Trauma or adverse childhood experiences, for instance, negatively affect adaptive youth behaviors and academic outcomes.[30] Furthermore, certain youth may live in neighborhoods that have closer proximities to fast food restaurants, do not have safe routes to school, or be faced with food insecurity.[31] Homelessness, justice-involvement, or estrangement from families, can be significant barriers to acquiring and developing positive health behaviors.[32,33] Youth who face health disparities and inequities experience increased challenges in acquiring and developing positive health behaviors, which put them at higher risks of developing chronic health conditions. Thus, affecting academic achievement and performance.

The National Academies of Sciences, Engineering, and Medicine recently published a report titled *Promoting Positive Adolescent Health Behaviors and Outcomes: Thriving in the 21st Century* that highlights the importance of health programs that promote the development of healthy behaviors early in life.[34] Health programs inside and outside the school setting can teach children and adolescents the skills necessary for developing positive health behaviors that can influence how they make healthy decisions.[34] Programs that also focus on the social determinants of health can decrease health inequities and disparities linked to economic and social disadvantage.[34,35] Reducing health disparities is an important element in closing the academic achievement gap.[21]

Encouraging and promoting the development of positive health behaviors inside and outside the school setting could also improve academic achievement, including academic grades. Schools can collaborate with parents and community members to adopt and implement the Whole School, Whole Community, Whole Child (WSCC) framework, a model that centers on the needs of students and incorporates a collaborative approach between schools, communities, public health, and sectors of health care to support the whole child.[36,37] For

example, school-based social and emotional learning (SEL), part of a component of WSCC, has been shown to contribute to academic achievement.[38] Along with youth development programs, SEL can nurture the development of skills, such as impulse control and self-regulation,[34] and can affect decisions that lead to positive health behaviors. Youth who are marginalized, have a disability, come from a racial/ethnic minority background, or from lower-income groups, may need additional resources compared to counterparts from more advantaged backgrounds.[32,33] Equipped with this knowledge, schools and their communities can create and sustain school environments that support positive health behaviors for all students and strive for health equity.[37]

Limitations

This study is subject to several limitations First, because the data are cross-sectional, causality or directionality cannot be determined. A longitudinal study design may provide further insight to patterns and trends over time. Second, because data were self-reported, certain sensitive items may be underrated or overrated. Third, we gave equal score value for each positive health behavior in the composite score, even though some behaviors may have stronger associations with academic achievement. We did not consider all positive health behaviors that may affect academic grades. Furthermore, we did not have variables on income, student health insurance status, or free or reduced priced lunch or similar social determinants of health to control for in our models. Future research could explore other health behaviors, including risky behaviors related to sexual activity, drug or alcohol consumption or abuse, and mental health-related behaviors.

Conclusions

Decision makers and educators could implement policies and practices to create school environments that support healthy dietary behaviors, encourage physical activity, minimize sedentary screen time behaviors, and prevent tobacco product use. Promoting positive health behaviors yield health benefits independent of academic achievement, which strengthens the case for schools and communities to take action. Public health and health care professionals in the community can promote health and wellness activities among school-aged youth and reach those who may have lower academic achievement. These youths may have the greatest needs in terms of health care, but the most to gain from any academic benefit linked to positive health behaviors. Focusing on the whole child also ensures that comprehensive school health policies (e.g.,, local school wellness policies) and practices are enacted to create an environment that fully supports student health and their academic success.

Funding

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So What?

What is already known on this topic?

Previous studies have shown a consistent relationship between health-related behaviors and academic achievement among school-aged youth.

What does this article add?

To date, no study has considered a combined measure of multiple positive health behaviors in relation to academic grades among a nationally representative sample. Therefore, we examined associations between 16 health behaviors, including dietary, physical activity, sedentary screen time, and tobacco product use behaviors and academic grades among U.S. high school students.

What are the implications for health promotion practice or research?

Understanding new aspects of the relationship between health behaviors and academic grades can help inform school administrators, educators, and other decision makers implement policies and practices to create school environments that support healthy dietary behaviors, encourage physical activity, minimize sedentary screen time behaviors, prevent tobacco product use, and strive for health equity. Outside of school, public health and health care professionals in the community can also promote health and wellness activities among school-aged youth, including the most vulnerable.

Variable	Question[a]	Analytic Coding
Dietary Behaviors		
Ate breakfast on all 7 days	During the past 7 days, on how many days did you eat breakfast?	Ate breakfast all 7 days vs. did not eat breakfast on all 7 days
Ate fruit or drank 100% fruit juices one or more times per day	Based on two questions: • 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.) • During the past 7 days, how many times did you eat fruit? (Do not count fruit juice.)	Summed both items to determine total fruit intake and was coded as ate fruit or drank 100% fruit juice ≥1 times per day vs. did not eat fruit or drink fruit juice
Ate vegetables one or more times per day	Based on four questions: 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.)	Summed four items to determine total vegetable intake and was coded as ate vegetables ≥1 times per day vs. did not eat vegetables
Drank one or more glasses per day of milk	During the past 7 days, how many glasses of milk did you drink? (Count the milk you drank in a glass or cup, from a carton, or with cereal. Count the half pint of milk served at school as equal to one glass.)	Drank ≥1 glasses per day of milk vs did not drink milk
Did not drink a can, bottle, or glass of soda or pop	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.)	Did not drink soda or pop vs. drank a can, bottle, or glass of soda or pop ≥1 times per day
Did not drink a sports drink	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.)	Did not drink a sports drink vs. drank a sports drink ≥1 times per day
Drank three or more glasses of plain water per day	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.)	Drank ≥3 glasses per day vs. drank less than 3 glasses per day
Physical Activity Behaviors		
Physically active at least 60 minutes per day[b]	During the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day? (Add up all the time you spent in any kind of physical activity that increased your heart rate and made you breathe hard some of the time.)	Being physically active for at least 60 minutes on all 7 days vs. less than 7 days

Played on at least one 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.)	Played on ≥1 sports team vs. none
Attended physical education (PE) on all 5 days[c]	In an average week when you are in school, on how many days do you go to physical education (PE) classes?	Attended physical education classes on all 5 days vs. less than 5 days
Sedentary Behaviors		
Did not watch television for more than 2 hours per day[d]	On an average school day, how many hours do you watch TV?	≤2 hours vs. more than 2 hours per day
Did not use a computer or play video games for more than 2 hours per day[d]	On an average school day, how many hours do you play video or computer games or use a computer for something that is not school work? (Count time spent on things such as Xbox, PlayStation, an iPad or other tablet, a smartphone, texting, YouTube, Instagram, Facebook, or other social media.)	≤2 hours vs. more than 2 hours per day
Tobacco Product Use Behaviors		
Did not smoke cigarettes	During the past 30 days, on how many days did you smoke cigarettes?	Did not smoke cigarettes (0 days) vs smoked cigarettes ≥1 days
Did not smoke an electronic vapor product	During the past 30 days, on how many days did you use an electronic vapor product?	Did not smoke an electronic vapor product (0 days) vs smoked an electronic vapor product ≥1 days
Did not use smokeless tobacco	During the past 30 days, on how many days did you use chewing tobacco, snuff, dip, snus, or dissolvable tobacco products, such as Redman, Levi Garrett, Beechnut, Skoal, Skoal Bandits, Copenhagen, Camel Snus, Marlboro Snus, General Snus, Ariva, Stonewall, or Camel Orbs? (Do not count any electronic vapor products.)	Did not use smokeless tobacco (0 days) vs used smokeless tobacco ≥1 days
Did not smoke cigars, cigarillos, or little cigars	During the past 30 days, on how many days did you smoke cigars, cigarillos, or little cigars?	Did not smoke cigars, cigarillos, or little cigar (0 days) vs smoked cigars, cigarillos, or little cigars ≥1 days

[a]Questions and responses originate from the 2017 national Youth Risk Behavior Survey at https://www.cdc.gov/healthyyouth/data/yrbs/pdf/2017/2017_yrbs_national_hs_questionnaire.pdf. This table was adapted from a previously published study.[18]

[b]Aligns with *The Physical Activity Guidelines for Americans, 2nd edition.*[23]

[c]Aligns with CDC's School health Guidelines at https://www.cdc.gov/healthyschools/npao/strategies.htm.

[d]The American Academy of Pediatrics (AAP) recommends limits on screen time with the use of media and the types of media for adolescents to ensure it does not replace adequate sleep, physical activity, and other health behaviors. The screen time use cut-off for these variables was based on the prior recommendation of "2 hours or less."

Figure 1.
Question and analytic coding for positive health behaviors, Youth Risk Behavior Survey—United States, 2017.

Table 1.

High School Student Characteristics, Youth Risk Behavior Survey—United States, 2017.

Characteristic	Total % (95% CI)[a]
Academic grades	
Mostly A's	39.4 (36.4, 42.4)
Mostly B's	38.3 (36.7, 40.0)
Mostly C's	17.3 (15.4, 19.4)
Mostly D's/F's[b]	5.0 (4.1, 6.1)
Grade in high school	
9th	27.3 (25.7, 29.0)
10th	25.7 (24.6, 26.8)
11th	23.9 (23.3, 24.6)
12th[b]	23.1 (22.0, 24.2)
Sex	
Female	50.7 (48.1, 53.3)
Male[b]	49.3 (46.8, 51.9)
Race/Ethnicity	
Non-Hispanic other	10.3 (9.0, 11.7)
Non-Hispanic Black	13.4 (11.0, 16.3)
Hispanic/Latino	22.9 (19.2, 26.9)
Non-Hispanic White[b]	53.5 (48.4, 58.5)
Body mass index (BMI) category	
Underweight (BMI < 5th percentile)	3.0 (2.6, 3.5)
Overweight (85th ≤ BMI < 95th percentile)	15.6 (14.7, 16.6)
Obesity (BMI ≥ 95th percentile)	14.8 (13.8, 15.8)
Normal weight (5th ≤ BMI < 85th percentile)[b]	66.6 (65.1, 68.0)

[a] Estimates are weighted and nationally representative; N = 14,765.

[b] Reference category for the multivariable logistic and multivariable negative binomial regressions.

Table 2.

Prevalence of High School Students with Each Positive Health Behavior and Adjusted Prevalence Ratios (aPRs) from the Multivariable Logistic Regressions, by Letter Grades Earned (Mostly D's/F's as Referent), Youth Risk Behavior Survey—United States, 2017.

Health behavior	Total % (95% CI)[a] Yes / No	aPR (95% CI)[b] Mostly A's	Mostly B's	Mostly C's
Dietary behaviors				
Ate breakfast on all 7 days	35.3 (33.8, 36.8)	2.0 (1.6, 2.5)	1.5 (1.2, 1.9)	1.4 (1.1, 1.8)
	64.7 (63.2, 66.2)	<.001	.001	.011
Ate fruit or drank 100% fruit juices one or more times per day	60.8 (58.7, 62.7)	1.2 (1.0, 1.3)	1.1 (1.0, 1.2)	1.1 (.9, 1.2)
	39.3 (37.3, 41.3)	.01	.041	.47
Ate vegetables one or more times per day	59.4 (57.6, 61.2)	1.2 (1.1, 1.3)	1.1 (1.0, 1.2)	1.1 (1.0, 1.2)
	40.6 (38.8, 42.4)	<.001	.047	.194
Drank one or more glasses per day of milk	31.3 (29.4, 33.2)	1.2 (.9, 1.4)	1.0 (.9, 1.2)	1.1 (.9, 1.3)
	68.7 (66.8, 70.6)	.19	.74	.25
Did not drink a can, bottle, or glass of soda or pop [c]	27.9 (25.5, 30.3)	2.1 (1.5, 2.9)	1.5 (1.1, 2.1)	1.3 (.9, 1.8)
	72.2 (69.7, 74.5)	<.001	.015	.22
Did not drink a sports drink [c]	87.6 (86.2, 88.9)	1.1 (1.0, 1.1)	1.0 (1.0, 1.1)	.98 (.95, 1.0)
	12.4 (11.1, 13.8)	.009	.77	.40
Drank water three or more times per day	51.3 (49.1, 53.5)	1.3 (1.2, 1.5)	1.2 (1.1, 1.4)	1.2 (1.0, 1.4)
	48.7 (46.6, 50.9)	<.001	<.001	.014
Physical activity behaviors				
Physically active at least 60 minutes per day	26.1 (24.1, 28.3)	1.3 (1.0, 1.6)	1.3 (1.1, 1.6)	1.4 (1.1, 1.7)
	73.9 (71.7, 75.9)	.03	.003	.004
Played on at least one sports team	54.3 (50.6, 58.0)	1.6 (1.3, 1.9)	1.5 (1.3, 1.8)	1.3 (1.1, 1.5)
	45.7 (42.0, 49.4)	<.001	<.001	.002
Attended physical education (PE) on all 5 days	29.9 (23.6, 37.0)	1.0 (.8, 1.4)	1.2 (1.0, 1.5)	1.2 (.95, 1.4)
	70.1 (63.0, 76.4)	.77	.049	.13
Sedentary behaviors				
Did not watch television for more than 2 hours per day [c]	79.3 (77.6, 80.9)	1.2 (1.1, 1.3)	1.1 (.98, 1.2)	1.0 (.93, 1.1)
	20.7 (19.1, 22.3)	<.001	.083	.66

P-Value

Health behavior	Total % (95% CI)[a]		aPR (95% CI)[b]		
				P-Value	
			Mostly A's	Mostly B's	Mostly C's
Did not use a computer or play video games for more than 2 hours per day[c]	Yes	57.0 (55.1, 58.9)	1.2 (1.0, 1.3)	1.1 (.95, 1.3)	1.1 (.94, 1.2)
	No	43.0 (41.1, 44.9)	.038	.19	.36
Tobacco product use behaviors					
Did not smoke cigarettes[c]	Yes	91.2 (89.3, 92.8)	1.3 (1.2, 1.4)	1.2 (1.1, 1.3)	1.2 (1.0, 1.2)
	No	8.8 (7.2, 10.7)	<.001	<.001	.002
Did not smoke an electronic vapor product[c]	Yes	86.8 (84.8, 88.6)	1.3 (1.2, 1.4)	1.2 (1.1, 1.3)	1.1 (1.0, 1.2)
	No	13.2 (11.4, 15.2)	<.001	<.001	.006
Did not use smokeless tobacco[c]	Yes	94.6 (93.3, 95.6)	1.1 (1.0, 1.2)	1.1 (1.0, 1.2)	1.1 (1.0, 1.1)
	No	5.5 (4.4, 6.7)	<.001	<.001	.018
Did not smoke cigars, cigarellos, or little cigars[c]	Yes	92.0 (91.1, 92.8)	1.2 (1.1, 1.3)	1.2 (1.1, 1.2)	1.1 (1.0, 1.2)
	No	8.0 (7.2, 8.9)	<.001	<.001	.001

aPR, adjusted prevalence ratio; CI, confidence interval.

[a]Estimates are weighted and nationally representative; N = 14,765.

[b]Multivariable logistic regression adjusted for sex, grade in school (9th–12th), race/ethnicity, and BMI category.

[c]These variables are to be interpreted in the positive direction with "Yes" equal to *not* participating in the negative health behavior. An example: 92.0% of U.S. high school students did not smoke cigars, cigarellos, or little cigars, while 8.0% did smoke cigars, cigarellos, or little cigars during the past 30 days.

Table 3.

Multivariable Negative Binomial Regression for the Number of Positive Health Behaviors Among High School Students, Youth Risk Behavior Survey—United States, 2017.

Characteristic	AME (SE)[a]	P-value
Academic grade		
Mostly A's	2.0 (.17)	<.001
Mostly B's	1.3 (.14)	<.001
Mostly C's	.78 (.14)	<.001
Mostly D's/F's	1.00	
Sex		
Female	−.57 (.073)	<.001
Male	1.00	
Grade in school		
9th	.70 (.13)	<.001
10th	.46 (.08)	<.001
11th	.31 (.11)	.011
12th	1.00	
Race/Ethnicity		
Non-Hispanic Other	.22 (.12)	.06
Non-Hispanic Black	−.25 (.11)	.03
Hispanic/Latino	.38 (.12)	.002
Non-Hispanic White	1.00	
Body mass index (BMI) category		
Underweight (BMI < 5th percentile)	−1.0 (.19)	<.001
Overweight (85th BMI < 95th percentile)	−.29 (.09)	.002
Obesity (BMI 95th percentile)	−.42 (.07)	<.001
Normal weight (5th BMI < 85th percentile)	1.00	

Observations used in the analysis, N = 7415; weighted count, N = 8829 AME, average marginal effect; SE, standard error

[a]Multivariable negative binomial regression adjusted for sex, grade in school (9th–12th), race/ethnicity, and BMI category.