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Adolescent Health Risk Behaviors, Adverse Experiences, and Self-reported Hunger: Analysis of 10 States from the 2019 Youth Risk Behavior Surveys

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Abstract

We examined associations between adolescent self-reported hunger, health risk behaviors, and adverse experiences during the 2018–2019 school year. Youth Risk Behavior Survey data were pooled from 10 states. Prevalence ratios were calculated, and we assessed effect measure modification by sex. The prevalence of self-reported hunger was 13%. Self-reported hunger was associated with a higher prevalence of every health risk behavior/adverse experience analyzed, even after adjusting for sex, grade, and race/ethnicity. Sex did not modify associations. Findings underscore needs for longitudinal research with more robust measures of adolescent food insecurity to clarify the temporality of relationships.

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Disclosure Statement

No potential conflict of interest was reported by the author(s).

Keywords

Food insecurity; self-reported hunger; adolescence; YRBS; health risk behaviors

Introduction

Food insecurity (FI) is a condition where people lack consistent and dependable access to adequate food.[1] In 2019, 13.6% of United States (US) households with children reported FI at some point during the year,[1,2] and despite caregivers' attempts to shield children from disrupted eating patterns,[2] roughly 2.4 million households with children experienced times when children were inconsistently fed or inadequately nourished.[1]

Population-based studies consistently demonstrate the deleterious outcomes associated with FI in childhood.[3] Yet, methodological limitations to assessing FI creates challenges to understanding the unique burden of FI among adolescents. For example, each year the US Department of Agriculture provides high-quality estimates to describe the distribution of household FI in the US, both overall and among households with children.[1,4] However, estimates of childhood FI are aggregated to the household level and do not specifically describe the proportion of households with adolescent-aged children. Additionally, survey methods rely on caregiver-report, which may differ from adolescents' self-reported experiences with FI.[5,6] To the best of our knowledge, Feeding America's Map the Meal Gap study provides the most recent estimates of adolescent-specific FI.[7,8] Based on their reports, approximately 6.8 million adolescents (ages 10–17 years) lived in food insecure households in 2016, which included 2.9 million who experienced very low food security (i.e., experiencing periods of hunger).[8] These figures likely underestimate the true prevalence of FI among adolescents, given the stigma or fear often associated with disclosing FI.[9] Moreover, during the Coronavirus Disease 2019 (COVID-19) pandemic, the number of households with children that experienced FI significantly increased (14.8% in 2020).[2] Thus, understanding the burden of FI among adolescents may be even more important, given its growing prevalence.

Adolescence is a critical period of physical, psychological, and cognitive development.[10] Amidst hormonal changes associated with puberty, the adolescent brain undergoes immense structural and functional changes[11]; nutritional health and adequate energy intake are essential during this developmental period.[12] These developmental changes often manifest in greater attempts to establish independence and a sense of control over eating. As such, teens often engage in more independent eating occasions, and caregivers' influence over child eating decreases.[13]Adolescence is also a period when household dynamics are in flux and older children may be less protected by parental efforts to shield against the negative effects of FI.[14] When adolescents are aware of household FI, they may attempt to manage food resources independently by reducing meal sizes, eating outside the home, or skipping snacks.[7] Furthermore, sensitivity to peer judgment may result in underutilization of public resources to address FI.[8]

Even after accounting for the negative health impacts of poverty, FI during adolescence is linked to poorer physical health outcomes, including iron deficiency, tooth decay,

chronic health conditions, and asthma.[4,15] Among US youth (ages 12–16 years), insufficient household food is associated with school suspensions, difficult social relationships, utilization of psychological services,[16] and may contribute to greater misconduct, such as fighting and violence.[17] Finally, FI is associated with higher odds of mood, anxiety, behavior, and substance use disorders among adolescents.[18]

Multiple complex pathways likely shape the relationship between FI and poorer health; one pathway may be increased risky health behaviors and adverse experiences resulting from efforts to secure basic needs. Focus groups of US teenagers found that, in order to make money or secure resources, some adolescents turn to criminal activities.[8] In a qualitative study in Baltimore, Maryland, adolescent boys described selling drugs while girls described engaging in sexual relationships to secure basic needs, like food.[19] Another limited body of literature suggests adolescents may use substances to cope with basic needs being unmet.[18,20] While evidence of such pathways from large-scale quantitative datasets is limited among adolescents, a recent cross-sectional analysis using nationally representative data of US young adults (ages 24–32 years) from 2008 found FI was significantly associated with greater odds of substance use, including marijuana, methamphetamine, prescription opioids, sedatives, and stimulants. Among young women in the study, FI was associated with contracting sexually transmitted infections and exchanging sex for money.[21]

Health risk behaviors (e.g., substance use or risky sexual activities) and adverse experiences (e.g., exposure to violence or forced sexual intercourse) during adolescence have serious consequences for adolescent health and well-being that may persist into adulthood. In the short-term, risky sexual behaviors, like unprotected sex or early sexual debut, place adolescents at elevated risk for teenage pregnancy or sexually transmitted diseases,[22] and potentially increase the likelihood of encountering other adverse experiences.[22] In the long-term, behaviors like substance use during adolescence are associated with substance use problems in adulthood.[23] Improving adolescent health and well-being is a national priority in the US, as expressed in Healthy People 2030, which outlines objectives including reducing drug and alcohol use, improving sexual health, preventing violence, and improving nutrition among adolescents.[24] Thus, examining potential determinants of health risk behaviors and adverse experiences may inform health promotion strategies which move the needle across multiple adolescent health objectives.

We hypothesized that FI during adolescence may be one important determinant, and empirical evidence examining FI during this developmental period, relative to health risk behaviors and adverse experiences, is limited. We addressed this gap in the literature by examining the prevalence of substance use, risky sexual behaviors, and adverse experiences relative to self-reported experience of hunger, as a proxy for very low FI, among a pooled sample of adolescents from 10 states.

Methods & Materials

Study Design

Data are from the 2019 Youth Risk Behavior Survey (YRBS). The YRBS includes on-going biennial surveys, overseen by the Centers for Disease Control and Prevention (CDC),

designed to assess priority health risk behaviors among 9th through 12th grade students from the US. The sampling design for state-level surveys has been previously described,[25] but is briefly summarized here.

State-level YRBS use a two-stage cluster sample design to generate representative samples of public high school students. In 2019, state-level data were weighted to account for student non-response, student grade, sex, and race/ethnicity if response rates were ≥60% or no significant bias was indicated by a non-response bias analysis. Prior to administering a YRBS in any school, the administrative agency obtains parental permission for participation.[25] We restricted our pooled analysis to include data from states who elected to add a question about adolescents' experiences with hunger in their 2019 survey, which included a total of 19 states. Of these states, 17 had sufficiently high response rates to weight data to be representative of students in the individual states and made data publicly available. Given variability in which health risk behaviors and adverse experiences are surveyed across states (described below), we further restricted our analytic sample to includes states that surveyed students on the health risk behaviors and adverse experiences relevant to our analysis. Thus, our analytic sample consisted of data from adolescents in grades 9–12 from 10 states that (1) obtained sufficient response rates or demonstrated minimal non-response bias to have weighted data, (2) authorized distribution of data, (3) included the self-reported experience of hunger question in their state-level YRBS, and (4) surveyed students on the health risk behaviors and adverse experiences selected for our analysis. Data used are exempt from institutional review board review, as they are deidentified and publicly available.

Measures

Our main exposure was self-reported experience of hunger (herein referred to as self-reported hunger), which was assessed with a single question: "*During the past 30 days, how often did you go hungry because there was not enough food in your home*?"[26] Ordinal response options included never, rarely, sometimes, most of the time, or always. For this analysis, we described adolescents as having self-reported hunger if they responded always, most of the time, or sometimes.

Our outcomes of interest consisted of select health risk behaviors and adverse experiences related to substance use, sexual health, and violence among adolescents (Table 1). Each state develops their own questionnaire with technical assistance from CDC. The YRBS standard questionnaire is used as the starting point for site-level YRBS questionnaires. Sites may modify their questionnaire depending on community needs and interests but are required to use at least 60 questions from the standard questionnaire. This results in variability in which health risk behaviors and adverse experiences were surveyed across states. To develop our sample, we examined which questionnaire items, pertaining to substance use, sexual health, and violence, consistently appeared across surveys for states that asked about adolescents' experience with hunger and provided publicly available weighted data. We were interested in 13 outcome variables. Of the 10 states included in our analytic sample (i.e., obtained sufficient response rates or lack of bias, authorized distribution of data, asked about hunger, and surveyed students on the health risk behaviors and adverse experiences relevant to our

analysis), seven states included all 13 outcome variables: Arizona, Arkansas, Colorado, Hawaii, North Carolina, Pennsylvania, and Virginia. Three states (Nevada, Vermont, and Wisconsin) were missing data for at least one of the following outcome variables: current binge drinking, in a physical fight during the past 12 months, and ever forced to have sexual intercourse (Table 1).

We considered a range of sociodemographic variables as possible covariates based on previously noted associations with FI or hunger and health risk behaviors,[1,8,19] including sex (male or female), grade (9th, 10th, 11th, 12th), and race/ethnicity (White, Black or African American, Hispanic/Latino, All other races).

Analytic Approach

Analyses used YRBS state-level sampling weights as outlined in the combined data sets user's guide.[26] Estimates are generalizable to public high school students (grades 9–12) from the states included in each model. We account for the complex survey design in our variance estimates using Taylor series linearization. All analyses were completed using Stata version 16 (StataCorp, College Station, Texas).[27]

Descriptive statistics (percentages and 95% confidence intervals [CIs]) described the distribution of demographic characteristics and health risk behaviors or experiences overall and by self-reported hunger status (Table 2). We used Poisson regression with robust standard errors[28] to estimate the relative prevalence of health risk behaviors and adverse experiences in relation to self-reported hunger. Unadjusted and adjusted prevalence ratios (PRs and APRs) are presented with 95% CIs. APRs controlled for grade, sex, and race/ethnicity and were considered statistically significant if their 95% CIs did not include 1.0. We present all results in Tables 3–4. However, given the numerous outcome variables, only APRs ≥ 2.0 are discussed in the results section.

We tested for effect measure modification according to sex by constructing interaction terms between self-reported hunger and sex for each health risk behavior or experience we modeled. We examined the statistical significance of each interaction term using the design-corrected multivariate Wald statistic. However, to account for the numerous statistical tests, we adjusted for multiple comparisons using the Bonferroni correction (corrected alpha = 0.05/13 interactions).[29] P values < 0.004 suggested heterogeneity of the association.

Results

Adolescents were equally represented by female and male students (48.9% and 50.4%, respectively) and evenly distributed across high school grades. Overall, adolescents identified predominantly as White (53.9%), followed by Hispanic/Latino (20.8%), Black or African American (12.3%), and All other races (11.0%) (Table 2).

The prevalence of self-reported hunger was 13.1% in 2019. The distribution of race/ethnicity differed according to self-reported hunger; the proportion of White adolescents was lower while the proportion of all other race/ethnicity groups was greater among adolescents with self-reported hunger, when compared with adolescents without self-reported hunger (Table

2). The overall prevalence of health risk behaviors ranged from 2.8% (had sexual intercourse for the first time before age 13 years) to 26.6% (were currently sexually active) (Table 3). Self-reported hunger was associated with a higher prevalence of every health risk behavior and adverse experience included in our analyses. Associations between self-reported hunger and health risk behaviors and adverse experiences persisted even after controlling for covariates (Table 3).

After adjusting for sex, grade, and race/ethnicity, the prevalence of smoking cigarettes for adolescents with self-reported hunger was 2.2 times (95% CI: 1.9–2.5) that of adolescents who did not experience hunger. For adolescents with self-reported hunger, the prevalence of having sexual intercourse for the first time before the age of 13 years and having ≥ 4 sexual partners in their lifetime was 2.8 times (95% CI: 2.2–3.6) and 2.0 times (95% CI: 1.7–2.3) that of adolescents who did not experience hunger, respectively. Finally, the APRs of ever being forced to have sexual intercourse and experiencing dating violence were 2.4 (95% CI: 2.1–2.7) and 2.6 (95% CI: 2.2–3.1), respectively (Table 3).

Associations between health risk behaviors/adverse experiences and self-reported hunger were stratified according to sex and presented in Table 4. While the relative prevalence of various health risk behaviors and adverse experiences appeared to vary according to sex (e.g., experiencing physical dating violence), no interactions between self-reported hunger and sex were statistically significant after accounting for the Bonferroni correction for multiple comparisons; none of the 13 interactions had $P < .004$.

Discussion

We examined the prevalence of key health risk behaviors and adverse experiences, including substance use, sexual health, and violence-related behaviors, among adolescents from 10 states in 2019, relative to their experience with self-reported hunger, as a proxy measure for very low FI. We chose to highlight risk behaviors and experiences within these categories because they align with objectives for improving adolescent health and well-being included in Healthy People 2030.[24] Among the 10 states included in our analysis, 13.1% of adolescents self-reported experiencing hunger in the past 30 days, and self- reported hunger was associated with a greater prevalence of all health risk behaviors and adverse experiences studied. These relationships persisted even after accounting for differences in sex, grade, and race/ethnicity. We found no statistical evidence suggesting associations differed by sex.

The World Health Organization defines adolescence as the developmental period between 10 to 19 years of age that includes tremendous biological and psychological transitions responsible for critical aspects of growth.[30] During these rapid changes, FI can be particularly damaging. Literature documents the serious negative physical and psychological health outcomes associated with FI in adolescence,[4] underscoring that the experience of FI during this developmental period deserves greater attention. Increased health risk behaviors and adverse experiences may be one of many complex pathways linking FI to poorer health among adolescents. In environments where an individual's basic needs are unmet, cognitive processes may be disrupted due to shifted focus toward securing resources to meet those

needs.[31] For adolescents with FI, this experience of scarcity may be exacerbated by a developmental predisposition toward emotional decision-making.[11]

In support of our hypothesis, we found that adolescent self-reported hunger was associated with a greater prevalence of substance use behaviors; among these behaviors, the magnitude of the association between self-reported hunger and cigarette smoking was the greatest. Empirical evidence links tobacco use, particularly cigarette smoking, to FI, independent of sociodemographic characteristics and mental health variables.[32] Yet, adolescents are underrepresented in studies examining such associations.[32] To the best of our knowledge, only one study reports cross-sectional associations between FI and current cigarette use among high school students from Pennsylvania between the 2014–2015 school year.[33] Results indicated the odds of smoking cigarettes among students with FI were 1.65 times that of their food secure peers. Our study builds upon this evidence by demonstrating adolescents, from 10 states during the 2018–2019 school year, reported a higher prevalence of current cigarette smoking when they self-reported experiencing hunger. Mechanisms linking adolescent FI to cigarette smoking are unclear, as relationships between FI and smoking are likely bidirectional[32]; expenditures associated with buying cigarettes may worsen financial barriers to acquiring adequate food, yet the psychological distress and hunger experienced during extreme cases of FI may promote smoking,[34] given the appetite suppression and temporary stress relief experienced with nicotine use.[35] While FI is a financial stressor that disproportionately burdens the socioeconomically disadvantaged, literature suggests socioeconomic disparities in smoking may not emerge until early adulthood.[36,37] Our findings suggest such disparities, in the form of very low FI, may emerge sooner in life. Therefore, adolescence may be an important developmental period for future studies aimed at disentangling reciprocal effects of smoking and FI to inform future prevention efforts.

Our hypothesis was also supported by our finding that self-reported hunger was associated with a higher prevalence (APR ≥ 2.0) of early initiation of sexual intercourse (before age 13 years) and having sexual intercourse with ≥ 4 people in a lifetime. These results align with themes identified in focus groups with teenagers experiencing FI who referred to the use of transactional sexual relationships to secure food and other resources.[8,19] Adolescents engaging in such behaviors may increase their risk for adverse sexual experiences. One study of YRBS data from 2011–2013 found that among girls who had sexual intercourse before the age of 13 years, the prevalence of ever being forced to have sexual intercourse was 4.4 (95% CI: 3.5–5.5) times that of girls whose first sexual intercourse was ≥ 16 years of age.[3] In our analysis, adolescents with self-reported hunger were disproportionately affected by adverse experiences, including dating violence and forced sexual intercourse. Empirical evidence examining relationships between adolescent FI and adverse experiences, such as intimate partner violence,[20] or sexual abuse[38] is limited. However, the contexts in which FI most often occurs (e.g., poverty and/or poor mental health) may also give rise to different types of violence,[31] and interventions designed to curb FI at any stage of development may require multifaceted approaches designed to address a variety of social inequalities.

We did not find evidence for effect measure modification by sex. This contrasts with previous studies that found differences between girls and boys in the prevalence of certain health risk behaviors or experiences. In an exploratory qualitative study of how adolescents from Baltimore cope with FI, focus groups revealed that girls, as young as the eighth grade, would sometimes turn to prostitution to raise money for food, while some boys turned to selling drugs or gambling.[19] An analysis of the Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K), a nationally representative cohort of children from the US spanning kindergarten entry (during years 1998–1999) to early adolescence, found that, for boys experiencing household FI between third and fifth grade, the odds of fighting with other youth or bullies in early adolescence (approximately 13–14 years of age) were > 2 times that of boys who were food secure ($P < 0.05$); no statistically significant relationship between FI and fights was detected among girls.[17] Finally, a cross-sectional analysis of data from Wave IV (2008) of the National Longitudinal Study of Adolescent to Adult Health, a nationally representative cohort of young adults (ages 24–32), found FI was significantly associated with greater odds of exchanging sex for money, having multiple sexual partners, and contracting any sexually transmitted infection among young women, but not young men, even after controlling for other potential explanatory variables.[21] One reason for why we did not detect effect measure modification by sex may be the lack of questions explicitly assessing behaviors, such as transactional sex or selling drugs, in state-level YRBS data. Therefore, more nuanced research examining potential sex differences in health risk behaviors among adolescents with FI may offer valuable insight on this critical public health issue.

Our study has several limitations. First, the generalizability of our findings is limited; our data only apply to youth who attended public schools in the 10 states included in our analyses and data for three health risk behaviors included in our analysis were not available for all states. Furthermore, our analyses relied on pooled state-level data from states varying in population density (i.e., larger states were more represented in our analytic sample than smaller states). Second, causality cannot be inferred; the cross-sectional nature of these data makes it impossible to disentangle the temporality of relationships investigated. However, the consistency of the associations between self-reported hunger and health risk behaviors across three timeframes (“before age 13,” “past 12 months,” “current”) suggests that the causal webs may extend well into childhood. Additionally, monitoring trends cross-sectionally is valuable for identifying cooccurring factors that are relevant for adolescent health, and our use of 2019 data positions future research efforts, using the 2021 YRBS data, to examine whether trends worsened amid the COVID-19 pandemic. Third, the sensitive nature of questions included in the YRBS may contribute to underreporting of risky behaviors. Fourth, the use of a single, non-validated item to approximate FI may have resulted in misclassification of our exposure. Unlike other common methods for measuring FI, which rely on longer reference periods (e.g., 6-months or 12-months),[39] the single item included in our analysis asked about the past 30 days. Previous analyses have compared the sensitivity of a 30-day measure of FI to a 12-month measure using data from the Current Population Study.[40] Results indicated the 30-day measure identified very low FI (i.e., FI with hunger) among 70% of households with very low FI that were identified using the 12-month measure.[40] Given the episodic and seasonal nature of FI,[41,42] the 30-day measure

of FI available for our analysis was likely unsuccessful at identifying a subset of adolescents who may have been food insecure at earlier parts of the year. Moreover, our measure of FI focused on hunger, which may have identified a relatively severe level of FI and lacked the sensitivity necessary to identify adolescents experiencing marginal or low FI. Yet, the item did not distinguish between the social problem of hunger, which stems from an extended period of involuntary shortage of food, versus the physiological sensation experienced by most people at one time or another.[43] This lack of specificity may have resulted in an over-estimation of the prevalence of FI. Therefore, efforts to validate and examine the reliability of the single item for assessing self-reported experiences with hunger in the YRBS are essential for enhancing the utility of these data. Finally, given YRBS methodology,[25,26] we were unable to account for characteristics that may influence both FI and risk behaviors, such as the respondent's length of time residing in the US[44] and socioeconomic position.[4,15] Residual confounding likely led to overestimation of associations. Recognizing the potential for overestimation, we prioritized results with an APR ≥ 2.0 for discussion. Moreover, empirical evidence consistently identifies FI as an important risk factor for poor health outcomes, above and beyond other indicators of socioeconomic (dis)advantage.[4,44] Given the magnitude, precision, and consistent direction of estimates highlighted in our study, we believe our investigation offers valuable insight into the experience of FI among US adolescents.

Conclusions

Links between adolescent FI and multiple health risk behaviors and adverse experiences are concerning, especially as the burden of FI in America has worsened since the onset of the COVID-19 pandemic.[2,45] FI is related to poorer health outcomes and the mechanisms linking FI to poor health are likely complicated. While we hypothesized health risk behaviors and adverse experiences present pathways by which FI influences health, it remains unclear whether health risk behaviors and FI are causally related or concurrent public health concerns. Regardless, adolescence represents a vulnerable stage of life when developmental disruptions have major implications for public health. Future surveillance efforts including robust measures of adolescent FI that are collected longitudinally may be necessary to better determine the extent to which FI affects adolescents and how it relates to risky behaviors and adverse experiences. Professionals, such as school counselors or social workers, working with adolescents exhibiting risky health behaviors might consider adopting screening protocols, like those encouraged among pediatricians.[46] Screening for FI among adolescents may offer opportunities to disseminate concrete nutrition and economic supports which may be intervention strategies with benefits that extend beyond reducing the risk of FI.[47]

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Table 1.

Health risk behaviors and experiences from the 2019 youth risk behavior survey included in analysis.

Health Risk Behavior	Questionnaire Item	Analytic Coding
Substance Use		
Currently drank alcohol	During the past 30 days, on how many days did you have at least one drink of alcohol?	≥ 1 day vs 0 days
Had their first drink of alcohol before age 13 years	How old were you when you had your first drink of alcohol other than a few sips?	Yes vs No
Currently were 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**)?	≥ 1 day vs 0 days
Currently smoked cigarettes	During the past 30 days, on how many days did you smoke cigarettes?	≥ 1 day vs 0 days
Currently used an electronic vapor product	During the past 30 days, on how many days did you use an electronic vapor product?	≥ 1 day vs 0 days
Currently used marijuana	During the past 30 days, how many times did you use marijuana?	≥ 1 day vs 0 days
Sexual Health		
Had sexual intercourse for the first time before age 13 years	How old were you when you had sexual intercourse for the first time?	Yes vs No
Were currently sexually active	During the past 3 months, with how many people did you have sexual intercourse?	≥ 1 vs 0
Used a condom during last sexual intercourse *	The **last time** you had sexual intercourse, did you or your partner use a condom?	Yes vs No
Had sexual intercourse with ≥ 4 persons during their life	During your life, with how many people have you had sexual intercourse?	Yes vs No
Violence		
In a physical fight over past 12 months ##	During the past 12 months, how many times were you in a **physical fight**?	≥ 1 vs 0
Ever forced to have sexual intercourse ###	Have you ever been physically forced to have sexual intercourse when you did not want to?	Yes vs No
Experienced physical dating violence	During the past 12 months, how many times did **someone you were dating or going out with** physically hurt you on purpose? (Count such things as being hit, slammed into something, or injured with an object or weapon.)	Yes vs No

‡ Question not asked in state-level YRBS Wisconsin

* Among adolescents who indicated they were currently sexually active

Question not asked in state-level YRBS for Nevada and Wisconsin

Question not asked in state-level YRBS for Vermont

Table 2.

The prevalence of food insecurity and characteristics of adolescents in the 2019 youth risk behavior survey, overall and according to self-reported experienced hunger.

	Overall		Experienced Hunger		Did not Experience Hunger		
	(N = 40,396)		(n = 4,811)		(n = 35,585)		
	%	(N)	%	(95% CI)	%	(95% CI)	P Value
Overall Prevalence			13.1	12.3–13.9	86.9	(86.1–87.7)	
Prevalence by Food Insecurity							
Sex							
Female	48.9	(20478)	48.7	(46.1–51.3)	49.3	(48.0–50.6)	0.63
Male	50.4	(19684)	51.3	(48.7–53.9)	50.7	(49.4–52.0)	
Missing	0.7	(234)	-	-	-	-	
Grade							
9^{th}	25.8	(11473)	25.7	(22.5–29.1)	26.1	(23.6–28.8)	0.07
10^{th}	25.1	(10867)	23.5	(20.8–26.6)	25.6	(23.5–27.8)	
11^{th}	24.2	(9713)	24.0	(21.2–26.9)	24.5	(22.4–26.7)	
12^{th}	24.0	(8009)	26.8	(23.8–30.2)	23.8	(21.6–26.1)	
Missing	0.9	(334)	-	-	-	-	
Race/ethnicity							
White	53.9	(23587)	41.7	(37.9–45.6)	57.0	(53.8–60.1)	<0.0001
Black or African American	12.3	(2476)	14.8	(12.3–17.6)	12.2	(10.4–14.3)	
Hispanic/Latino	20.8	(5937)	28.5	(24.9–32.3)	20.1	(17.9–22.5)	
All other races	11.0	(7679)	15.1	(13.2–17.2)	10.7	(9.7–11.7)	
Missing	2.1	(717)	-	-	-	-	

Note: Data are from 10 states which included the single-item on self-reported hunger in their 2019 YRBS, gave blanket permission to public distribute weighted data, and included health risk behavior questions for this analysis in their state-level YRBS. States include Arizona, Arkansas, Colorado, Hawaii, Nevada, North Carolina, Pennsylvania, Vermont, Virginia, and Wisconsin. FI data was missing for 2,646 observations (6.1%; 95% CI: 4.8–7.8). Proportions are survey weighted, sample sizes are unweighted, and variance estimates account for the complex survey design. Columns may not sum to 100% due to rounding. P values summarize results from the Rao-Scott X^2 test comparing self-reported hunger status groups.

CI = confidence interval

Table 3.

The overall and relative prevalence of health risk behaviors and adverse experiences among adolescents with self-reported hunger compared to adolescents without self-reported hunger in the 2019 youth risk behavior survey.

	Overall		Relative Prevalence of Health Risk Behaviors and Adverse Experiences among Adolescents who Self-reported Experiencing Hunger					
	%	(95% CI)	Experienced Hunger (%)	Did not Experience Hunger (%)	PR	(95% CI)	APR	(95% CI)
Health Risk Behaviors and Adverse Experiences								
General Substance Use								
Currently drank alcohol	26.3	(25.2–27.4)	35.0	25.1	1.4	(1.3–1.5)	1.4	(1.3–1.5)
Had their first drink of alcohol before age 13 years	15.7	(14.9–16.5)	26.3	13.8	1.9	(1.7–2.1)	1.8	(1.6–2.0)
Currently were binge drinking[ǂ]	12.6	(11.7–13.6)	17.9	11.7	1.5	(1.4–1.7)	1.5	(1.4–1.7)
Currently smoked cigarettes	6.4	(5.7–7.0)	11.8	5.4	2.2	(1.9–2.6)	2.2	(1.9–2.5)
Currently used an electronic vapor product	25.3	(23.8–26.8)	35.2	23.6	1.5	(1.4–1.6)	1.5	(1.4–1.7)
Currently used marijuana	20.5	(19.5–21.6)	32.9	18.3	1.8	(1.7–1.9)	1.7	(1.6–1.9)
Sexual Health								
Had sexual intercourse for the first time before age 13 years	2.8	(2.5–3.1)	6.5	2.2	3.0	(2.3–3.9)	2.8	(2.2–3.6)
Were currently sexually active	26.6	(25.3–27.9)	36.9	24.8	1.5	(1.4–1.6)	1.4	(1.3–1.6)
Did not use a condom during last sexual intercourse[*]	46.1	(43.9–48.3)	58.7	43.2	1.4	(1.2–1.5)	1.4	(1.2–1.5)
Had sexual intercourse with ≥ 4 persons during their life	8.7	(8.1–9.4)	16.1	7.4	2.2	(1.9–2.5)	2.0	(1.7–2.3)
Violence								
In a physical fight during past 12 months[ǂǂ]	21.6	(20.6–22.6)	33.2	19.1	1.7	(1.6–1.9)	1.7	(1.5–1.8)
Ever forced to have sexual intercourse[ǂǂǂ]	8.0	(7.4–8.5)	16.1	6.5	2.5	(2.2–2.8)	2.4	(2.1–2.7)
Experienced physical dating violence	7.8	(7.2–8.5)	17.3	6.3	2.7	(2.3–3.2)	2.6	(2.2–3.1)

Note: PR = prevalence ratio; APR = adjusted prevalence ratio; CI = confidence interval; Except where otherwise noted, data are from Arizona, Arkansas, Colorado, Hawaii, Nevada, North Carolina, Pennsylvania, Vermont, Virginia, and Wisconsin. Proportions are survey weighted, sample sizes are unweighted, and variance estimates account for the complex survey design. Adjusted prevalence ratios control for sex, grade, and race/ethnicity. Strata with 1 PSU were treated a certainty unit.

[ǂ] Question not asked in Wisconsin (N = 36, 812)

[*] Among adolescents who indicated they were currently sexually active (N = 9,384)

[ǂǂ] Question not asked in state-level YRBS for Nevada and Wisconsin (N = 36, 913)

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Question not asked in state-level YRBS for Vermont (N = 22, 373)

Table 4.

The relative prevalence of health risk behaviors and adverse experiences among adolescents with self-reported hunger compared to adolescents without self-reported hunger in the 2019 youth risk behavior survey, stratified by sex.

	Males				Females				
	Experienced Hunger (%)	Did not Experience Hunger (%)	APR	(95% CI)	Experienced Hunger (%)	Did not Experience Hunger (%)	APR	(95% CI)	P Value
Health Risk Behaviors and Adverse Experiences									
General Substance Use									
Currently drank alcohol	33.2	22.7	1.5	(1.3–1.6)	36.9	27.4	1.4	(1.2–1.5)	0.25
Had their first drink of alcohol before age 13 years	27.1	15.5	1.6	(1.4–1.9)	25.2	12.0	2.0	(1.8–2.3)	0.03
Currently were binge drinking[ǂ]	17.8	11.0	1.6	(1.3–2.0)	18.3	12.4	1.5	(1.2–1.7)	0.36
Currently smoked cigarettes	13.4	6.0	2.1	(1.7–2.7)	9.5	4.7	2.2	(1.6–2.8)	0.79
Currently used an electronic vapor product	35.8	22.8	1.6	(1.4–1.8)	34.7	24.3	1.5	(1.3–1.7)	0.34
Currently used marijuana	33.3	18.5	1.7	(1.5–1.9)	32.4	18.1	1.8	(1.6–2.0)	0.69
Sexual Health									
Had sexual intercourse for the first time before age 13 years	7.8	3.0	2.4	(1.8–3.2)	4.9	1.3	3.6	(2.4–5.5)	0.19
Were currently sexually active	37.8	23.6	1.5	(1.4–1.7)	35.9	25.8	1.4	(1.2–1.5)	0.05
Did not use a condom during last sexual intercourse[*]	51.9	35.9	1.4	(1.2–1.7)	65.1	50.0	1.3	(1.2–1.4)	0.29
Had sexual intercourse with ≥ 4 persons during their life	18.0	8.3	1.9	(1.6–2.2)	14.1	6.4	2.1	(1.7–2.6)	0.80
Violence									
In a physical fight during past 12 months[ǂǂ]	42.2	25.6	1.6	(1.5–1.8)	23.5	12.4	1.8	(1.6–2.1)	0.11
Ever forced to have sexual intercourse[ǂǂǂ]	9.8	3.9	2.2	(1.7–2.9)	22.4	9.1	2.4	(2.1–2.9)	0.85
Experienced physical dating violence	16.7	5.0	3.2	(2.5–4.1)	17.4	7.5	2.3	(1.8–2.8)	0.03

Note: PR = prevalence ratio; APR = adjusted prevalence ratio; CI = confidence interval; Except where otherwise noted, data are from Arizona, Arkansas, Colorado, Hawaii, Nevada, North Carolina, Pennsylvania, Vermont, Virginia, and Wisconsin. Proportions are survey weight, sample sizes are unweighted, and variance estimates account for the complex survey design. Adjusted prevalence ratios control for sex, grade, and race/ethnicity. Strata with 1 PSU were treated a certainty unit. The P value summarizes results from the design-corrected multivariate Wald test for the interaction term (food self-reported hunger * gender).

[ǂ]Question not asked in Wisconsin (N = 36, 812)

[*]Among adolescents who indicated they were currently sexually active (N = 9,384)

#Question not asked in state-level YRBS for Nevada and Wisconsin (N = 36, 913)

##Question not asked in state-level YRBS for Vermont (N = 22, 373)