Percentage of Youth Meeting Federal Fruit and Vegetable Intake Recommendations, Youth Risk Behavior Surveillance System, United States and 33 States, 2013

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ABSTRACT

Background National- and state-level self-reported frequency of fruit and vegetable (F/V) consumption is available for high school students from the Centers for Disease Control and Prevention's Youth Risk Behavior Surveillance System (YRBSS). YRBSS monitors priority health-risk behaviors among a nationally representative sample of US high school students and representative samples of students in states and selected large urban school districts. However, YRBSS measures intake in times per day and not the cup equivalents that national goals use, which limits interpretation.

Objective To help states track youth progress, scoring algorithms were developed from external data and applied to 2013 YRBSS data to estimate the percentages of high school students in the nation and 33 states meeting the US Department of Agriculture's Food Patterns F/V intake recommendations.

Design Twenty-four—hour dietary recalls were used from the 2007-2010 National Health and Nutrition Examination Survey to fit sex-specific models for 14- to 18-year-olds that estimate probabilities of meeting recommendations as a function of reported frequency of consumption and race/ethnicity, adjusting for day-to-day dietary variation. Model regression parameters were then applied to national cross-sectional YRBSS data (n=12,829) and to data from the 33 states (n=141,006) that had complete F/V data to estimate percentages meeting recommendations.

Results Based on the prediction equations, 8.5% of high school students nationwide met fruit recommendations (95% CI 4.9% to 12.1%) and 2.1% met vegetable recommendations (95% CI 0.0% to 8.1%). State estimates ranged from 5.3% in Nebraska and Missouri to 8.9% in Florida for fruit and 1.0% in New Jersey, North Dakota, and South Carolina to 3.3% in New Mexico for vegetables.

Conclusions This method provides a new tool for states to track youth progress toward meeting dietary recommendations and indicates that a high percentage of youth in all states examined have low intakes of F/V.
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HEALTHY EATING PATTERNS ARE ASSOCIATED WITH a reduced risk for cardiovascular disease; type 2 diabetes; certain types of cancers, such as colorectal and breast cancers; overweight; and obesity.[1] Higher intakes of fruits and vegetables (F/V) have consistently been identified as characteristics of healthy eating patterns and are important sources of many nutrients that are underconsumed in US diets, including dietary fiber, potassium, magnesium, choline, and vitamins A, C, and E.[1] Despite these benefits, data from the 2007-2010 National Health and Nutrition Examination Surveys (NHANES) indicate that 75% of the US population consumed less fruit than recommended and 87% consumed fewer vegetables than recommended.[2]

Unhealthy dietary behaviors established early in life may extend into adulthood.[3] Among children, adherence to F/V intake recommendations declines with age.[2] About one-quarter of 1- to 3-year-old children consumed fewer fruit than recommended vs 85% to 87% of 14- to 18-year-olds.[2] Approximately 85% of 1- to 3-year-olds did not consume enough vegetables vs 96% to 98% of 14- to 18-year-olds.[2] Children and adolescents who are inactive should be consuming 1 to 2 cup equivalents of fruits and 1 to 3 cup equivalents of vegetables daily, depending on their age and sex, according to the US Department of Agriculture's Food Patterns intake recommendations, one pattern consistent with the 2015-2020 Dietary Guidelines for Americans.[4,5] Active individuals should consume more.

One cup is approximately 1 small apple (149 g) or 12 baby carrots (120 g).[4,5]

Twenty-four–hour dietary recall data from NHANES are the source for monitoring national progress toward meeting the US Department of Agriculture's Food Patterns F/V recommendations, hereafter referred to as federal recommendations. However, national estimates may mask significant state-level variation.[6,7] NHANES is not designed to produce state-specific estimates. The Centers for Disease Control and Prevention's Youth Risk Behavior Surveillance System (YRBSS) and Behavioral Risk Factor Surveillance System (BRFSS) monitor state- and local-level priority health behaviors and risk factors among high school students and adults, respectively. Both surveys measure the frequency of F/V intake, but frequency of intake cannot be directly compared to federal recommendations.[4,5,8] Federal recommendations are measured in cup equivalents and frequency of intake is not equal to cup equivalents consumed.[9,10] For example, males aged 18 to 27 years drink a median of 1.5 cups of 100% fruit juice each time they have juice, but only consume one-third cup of salad each time.[10]

Scoring procedures that estimate the state-specific percentages of adults meeting federal recommendations using BRFSS were recently developed using 2007-2010 NHANES.[7] Comparable scoring algorithms are needed for YRBSS, which focuses on a younger population than the BRFSS and uses different questions to measure F/V frequency of intake. To address this state-level surveillance gap, scoring algorithms were derived based on prior methods for BRFSS[7] and applied to 2013 YRBSS frequency data to estimate the percentage of high school students meeting F/V intake recommendations.

MATERIALS AND METHODS

This study was deemed exempt by the Centers for Disease Control and Prevention's Institutional Review Board because only public use data were used.

NHANES Background

NHANES data from 2007 to 2010 were used to derive the scoring algorithms to apply to YRBSS data. A full description of NHANES methods is available elsewhere.[11] Briefly, since 1999, NHANES has conducted annual interviews and physical examinations on a nationally representative sample of about 5,000 adults and children in the United States to assess health and nutritional status. Survey participants 12 years and older completed an initial interviewer-administered 24-hour dietary recall during the physical examination and a second 24-hour dietary recall by telephone approximately 3 to 10 days after the exam. All NHANES 2007-2010 participants aged 14 to 18 years of age with a complete 24-hour dietary recall were included in the development of the scoring algorithm (n=1,535 participants; 220 participants with only one 24-hour dietary recall and 1,315 participants with two 24-hour dietary recalls).

YRBSS Background

Conducted biennially since 1991, the YRBSS monitors priority health-risk behaviors, including F/V intake, via a nationally representative survey of 9th- to 12th-grade students in all public and private US high schools and separate state surveys that are representative samples of students in states and selected large urban school districts.[12] A full description of the surveillance system is provided elsewhere.[12] On the YRBSS national questionnaire, students are asked how often, during the past 7 days, they consumed 100% fruit juice, such as orange juice, apple juice, or grape juice (not including punch, Kool-Aid [Kraft Foods, Inc], sport drinks, or other fruit-flavored drinks); fruit (not including 100% fruit juice); green salad; potatoes (not including french fries, fried potatoes, and potato chips); carrots; and other vegetables (not including green salad, potatoes, or carrots) via a self-administered questionnaire in their classrooms. Response options included 0, 1 to 3, or 4 to 6 times during the past 7 days or 1, 2, 3, or 4 or more times per day. In 2013, 33 states asked each of these six questions about F/V intake and had a sufficient overall response rate to obtain data weighted to be representative of the state; these states were included in analyses. Five states were excluded from analysis because they did not have a sufficient response rate for state-representative data (response rates <60% for California, Colorado, Indiana, Iowa, and Pennsylvania). Nine states were excluded because data on these six F/V questions were not asked or modified or were unavailable (Arizona, Delaware, Hawaii, Louisiana, Maine, Massachusetts, New Hampshire, New York, and Wisconsin). Three states did not participate in the 2013 YRBSS (Minnesota, Oregon, and Washington).

In 2013, the overall response rate for the YRBSS national sample was 68.0%.[13] The overall response rates for states in YRBSS surveys included in this analysis ranged from 60% to 87%.[14] Students from the YRBSS national sample and the 33 state samples who answered all six F/V frequency questions as on the national survey and who reported their race/ethnicity were included in analyses. Among the 13,583 students in the 2013 national Youth Risk Behavior Survey dataset, 407 (3%) did not answer all six F/V frequency questions and 307 (2%) did not report their race/ethnicity or age; these students were excluded from analyses. An additional 40 students younger than 14 years of age were excluded to correspond to data from the NHANES participants used to create the scoring algorithms. The final analytic sample for the national dataset was 12,829 students. On average, 6% of students were excluded from the state samples due to missing data ranging from 1% in Oklahoma to 12% in Maryland. Responses that included a range of values were assigned the midpoint of the range and then divided by 7 to determine daily intake. Daily frequencies were capped at four times per day for those respondents who indicated that they consumed a fruit or vegetable four or more times per day. Student self-reported race/ethnicity was classified as non-Hispanic black, Hispanic, or all others including non-Hispanic whites, to be consistent with prior work estimating percentages meeting recommendations.[7,15]

Development of the Prediction Model

Scoring algorithms to estimate the percentage of the nation's and each state's youth population meeting F/V intake recommendations were derived and applied to YRBSS following methods developed previously for BRFSS.[7] The steps involved in the development and application of the final scoring algorithm are outlined in the Figure 1. Two types of variables derived from the NHANES 24-hour dietary recall data were