A New Decade of *Healthy People*: Considerations for Comparing Youth Physical Activity Across 2 Surveillance Systems

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Background: *Healthy People 2030* includes objectives to increase meeting the aerobic physical activity guideline for ages 6–13 years (of ages 6–17 y, monitored by National Survey of Children’s Health [NSCH]) and grades 9 to 12 (mostly aged 14–18+ y, monitored by Youth Risk Behavior Survey [YRBS]). This study compares methodologies, prevalence, and patterns of meeting the guideline, particularly for overlapping ages 14–17 years. **Methods:** Nationally representative surveys, 2016–2017 NSCH (adult proxy report, 6–17 y) and 2015 and 2017 YRBS (self-report, grades 9–12), assess meeting the guideline of ≥ 60 minutes of daily moderate to vigorous physical activity. Prevalence and odds ratios were estimated by age group and demographics. **Results:** For youth aged 14–17 years, 17.4% (95% confidence interval [CI], 16.1–18.7; NSCH) and 27.0% (95% CI, 25.6–28.5; YRBS) met the guideline. 25.9% (95% CI, 24.8–27.2) aged 6–13 years (NSCH) and 26.6% (95% CI, 25.3–28.0) in grades 9 to 12 (YRBS) met the guideline. Across surveys, fewer females ($P < .001$) and Asian youth ($P < .001$ except among NSCH 14–17 y) met the guideline. **Conclusions:** Neither methodology nor estimates for meeting the aerobic guideline are similar across surveys, so age continuity between juxtaposed estimates should not be assumed by magnitude nor age for separate *Healthy People 2030* youth physical activity objectives.

Keywords: measurement, children, adolescent, exercise, public health

Increasing physical activity is important for the health of children and adolescents, with strong evidence showing benefits, such as better cardiorespiratory and muscular fitness; smaller increases in body weight and adiposity; and improved bone mass, structure, and strength.¹ Regular physical activity can be a preventive measure for chronic disease risk factors, providing youth with a higher likelihood of a healthy adulthood; it also improves brain health and cognition, impacting learning, memory, and attention, as well as decreasing symptoms of depression.¹ For children and adolescents ages 6–17 years, the *Physical Activity Guidelines for Americans*, second edition recommends the aerobic guideline of 60 minutes (1 h) or more of moderate to vigorous physical activity daily.²

Healthy People is the leading disease prevention and health promotion road map in the United States, providing 10-year objectives in a variety of topic areas for promoting healthy behaviors, such as increasing physical activity,³ including for

youth (defined in this study as a broad term including any age through the end of high school). For the past decade, *Healthy People 2020* included a youth physical activity objective to increase the proportion of adolescents (defined in this study, according to this objective, as youth in grades 9–12 surveyed by the national Youth Risk Behavior Survey [YRBS]) who met the physical activity guideline for aerobic physical activity, which continues in *Healthy People 2030* with objective PA-06.⁴ *Healthy People 2030* also expands monitoring of youth meeting the aerobic guideline with a new objective (PA-09) among children (defined in this study, according to PA-09, as youth ages 6–13 y surveyed by the National Survey of Children’s Health [NSCH]).⁵

Two surveillance systems are being used to monitor prevalence estimates for the new decade’s youth aerobic physical activity objectives. As part of the Youth Risk Behavior Surveillance System, the YRBS⁶ will monitor adolescents in grades 9 to 12, mostly aged 14–18+ years (as was done for *Healthy People 2020*) for PA-06,⁴ allowing the continued assessment of both longer aerobic trends over time, as well as the full youth physical activity guidelines that include muscle-strengthening activity. Since $<1\%$ of YRBS data are comprised of high school students aged 13 years or younger,^{7,8} there was a gap in monitoring youth younger than high school age, 13 years or younger. Consequently, the NSCH⁹ will be a new surveillance addition for monitoring children ages 6–13 years for PA-09.⁵

The baseline for PA-06 is 26.1% (YRBS, 2017) and the baseline for PA-09 is 25.9% (NSCH, 2016–2017).^{4,5} Because both objectives are set using the same physical activity guideline, people may assume similarity and age continuity between the children’s (aged 6–13 y) and adolescents’ (mostly aged 14–18+ y) baseline magnitudes, though the 2 estimates are from different systems. However, previous comparisons of surveillance systems with differing methodologies have resulted in different prevalence estimates,^{10–12} with implications for monitoring trends and objectives

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over time. Moreover, levels of physical activity in youth have been found to decrease as age increases,^{13–15} so investigating prevalence by various age groups, including those beyond the objectives and overlapping across systems, can help clarify overarching age patterns. Other demographic patterns between systems and age groups can also point to where targeted interventions may be needed to meet each objective.

Therefore, an analysis of how these 2 system surveys compare is timely for the interpretation of *Healthy People 2030* data, particularly in examining data collection methodology and estimates and patterns by overlapping ages. Adding to this information's importance, the Health Resources and Services Administration's Maternal and Child Health Bureau monitors the Title V Maternal and Child Health Services Block Grant National Performance Measure number 8,¹⁶ which displays juxtaposed physical activity estimates from NSCH and YRBS data to drive improvement related to youth obesity. A closer examination of these systems can also assist state efforts in measuring progress for this performance measure. First, this study will provide a summary of physical activity data collection methods in the 2 system surveys, NSCH and YRBS. Second, this study will use these data for 3 purposes: (1) to compare unadjusted prevalence estimates across NSCH and YRBS of youth who met the aerobic physical activity guideline in overlapping ages, specifically 14–17 years, (2) to compare demographic patterns across NSCH and YRBS in the overlapping ages 14–17 years, and (3) to compare demographic patterns across NSCH and YRBS in the age groups used for *Healthy People 2030* objectives PA-06 and PA-09. Understanding how these systems, estimates, and patterns are similar or different will enable users of these data to better interpret comparisons, utilizing the data in appropriate ways for measuring progress, guiding decisions, and prioritizing those in need to increase youth physical activity and achieve *Healthy People 2030* objectives.

Methods

Survey Descriptions

The NSCH and YRBS, the 2 surveillance system surveys being used to monitor the *Healthy People 2030* youth aerobic physical activity objectives, were compared. Data were combined from the 2 most recent and comparable survey periods for each system, 2016–2017 NSCH and 2015 and 2017 YRBS, to increase the sample size for subgroup estimates. The systems' survey design, operation, and other characteristics are described in detail elsewhere^{6,9,17–19} and are summarized here.

The NSCH. The NSCH, funded and directed by the Health Resources and Services Administration's Maternal and Child Health Bureau, is a self-administered mail- and web-based survey of a random address-based sample of US households in the 50 states and the District of Columbia selected from the Census Master Address File. A screener survey was used to identify households with children (0–17 y). One child per household was randomly selected, and a parent or guardian respondent in the household who knew about the health and health care of the selected child was given an age-specific topical survey regarding the child. Since 2016, NSCH has been conducted annually, collecting physical activity data every year. In 2017, the survey's weighted interview completion rate was 70.9% and weighted overall response rate was 37.4%; in 2016, they were 69.7% and 40.7%, respectively.^{9,17,18} Using 2016–2017 NSCH data as consistent with the *Healthy People 2030* baseline, our analytic sample included 50,191 adult respondents answering as proxies for youth ages 6–17 years; data

from 965 respondents were excluded due to missing responses to the physical activity question.

The YRBS. The national YRBS, conducted as part of the Youth Risk Behavior Surveillance System by the Division of Adolescent and School Health at the Centers for Disease Control and Prevention, is a self-administered school-based survey of a nationally representative sample of US public and private school students in grades 9 to 12 in the 50 states and the District of Columbia. It used a 3-stage cluster sample design, with the first-stage sampling frame of counties as primary sampling units. The second-stage sampling frame of schools with grades 9 to 12 was sampled from those primary sampling units. The third stage randomly sampled one or 2 classrooms of a required subject or period in each grade. All students in these classrooms were eligible to be respondents. YRBS is conducted biennially, collecting physical activity data each administration. In both 2015 and 2017, the survey's overall response rate was 60%; in 2015, the school response rate was 69% and the student response rate was 86%, while in 2017, they were 75% and 81%, respectively.^{6,19} Although the *Healthy People 2030* baseline uses only 2017 data, our analytic sample used 2015 and 2017 data to be consistent in comparing with NSCH and included 29,483 respondents; data from 906 respondents were excluded due to missing responses to the physical activity question.

Measures

Specific information about how each surveillance system assessed youth aerobic physical activity is in Table 1. Respondents were classified as meeting the aerobic component of the guideline with daily (every day or 7 d) moderate to vigorous physical activity for at least 60 minutes per day during the past week, according to the *Physical Activity Guidelines for Americans*, second edition.² The demographic characteristics reported for both NSCH and YRBS included sex (male and female); age groups (NSCH: 6–13, 14–17 y; YRBS: overall grades 9–12, 14–17 y); and race/ethnicity (non-Hispanic Asian only, non-Hispanic Black or African American only, non-Hispanic White only, non-Hispanic Other or 2 or more races, Hispanic or Latino). The demographic characteristics reported only for NSCH included household income level categorized by federal poverty level (FPL) (0%–99% FPL, 100%–199% FPL, 200%–399% FPL, 400% FPL or above); highest education of adult in household (less than high school, high school degree or general educational development [equivalent to high school completion], some college or technical school, college degree or higher); and region (Northeast, Midwest, South, and West).

Statistical Analysis

Data from the 2 surveillance system surveys were analyzed separately to estimate the prevalence and 95% confidence intervals (95% CIs) of youth meeting the aerobic physical activity guideline. Analysis of these data was exempt from the Centers for Disease Control and Prevention's Institutional Review Board approval because they are public use data. For 2016–2017 NSCH, data were analyzed in 2 age groups: 6–13 years (consistent with *Healthy People* children's objective PA-09) and 14–17 years (overlaps with the YRBS sample). For 2015 and 2017 YRBS, data were analyzed overall (consistent with *Healthy People* adolescents' objective PA-06) and 14–17 years (overlaps with the NSCH sample). Significant differences by sex and race/ethnicity (NSCH and YRBS) and age group, household income level, highest education of adult in

Table 1 Characteristics of Youth Surveillance System Surveys for Aerobic Physical Activity

Category	NSCH	YRBS
Survey years included in the analysis	2016, 2017	2015, 2017
Sampling design and frame	Random address-based sample of households in the 50 states and the District of Columbia; only one child sampled per given household	3-stage, cluster sample design producing a nationally representative sample of US public and private school students in grades 9–12 in the 50 states and the District of Columbia
Overall response rate ^a for years of data analyzed	37.4% (2017), 40.7% (2016)	60% (2017), 60% (2015)
Respondent	Adult proxy report (parent or guardian who lived in the household)	Self-reported
Collection method (mode)	Self-administered mail- and web-based survey	Self-administered school-based survey
Age or grade range	Aged 6–17 y	Grades 9–12
Aerobic physical activity question	During the past week, on how many days did this child exercise, play a sport, or participate in physical activity for at least 60 min?	During the past 7 d, on how many days were you physically active for a total of at least 60 min 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.)
Recall period(s)	Past week	Past 7 d
Response options	0 d, 1–3 d, 4–6 d, every day	0 d, 1 d, 2 d, 3 d, 4 d, 5 d, 6 d, 7 d
Survey years with consistent aerobic physical activity question	2016, 2017, 2018	2005, ^b 2007, 2009, 2011, 2013, 2015, 2017
Other forms of youth physical activity assessed	Sports team or lessons participation	Muscle-strengthening exercises, physical education class attendance, sports team participation

Abbreviations: NSCH, National Survey of Children's Health; YRBS, Youth Risk Behavior Survey.

^aThe YRBS overall response rate is calculated as (number of participating schools/number of eligible sampled schools) × (number of usable questionnaires/number of eligible students sampled). NSCH weighted overall response rate is calculated as (resolved addresses/total addresses) × (completed screeners/resolved households) × (completed topicals/screened households with children), or the resolution rate × screener conversion rate × topical conversion rate. ^bQuestionnaire changes preclude comparison of ≤2009 and ≥2011. A change in the sequence of survey questions affected survey responses for 2009 and 2011. In 2009, the question assessing the youth aerobic physical activity guideline was in the middle of the physical activity section of the questionnaire. In 2011, the same question was at the beginning of the physical activity section of the questionnaire. Thus, 2009 is not included because the 2009 estimate is not comparable with data from other survey years. In 2014, *Healthy People 2020* revised the original baseline of 18.4% (2009) to 28.7% (2011) and adjusted the target accordingly using the new baseline.

household, and region (NSCH only) were assessed with pairwise *t* tests. Simple logistic regression analyses were conducted for both NSCH and YRBS to assess the unadjusted association between youth characteristics and meeting the aerobic physical activity guideline in ages 14–17 years. Significance level was $P < .05$. Bonferroni adjustments were used for multiple comparisons. Because of the heterogeneity of the race/ethnicity group of Non-Hispanic Other or 2 or more races, results for this group are not interpreted. SAS-callable SUDAAN (version 11.0; Research Triangle Institute, Research Triangle Park, NC) was used for all analyses to account for survey design and weights.

Results

Comparison

In the overlapping ages 14–17 years, 17.4% of youth surveyed by NSCH met the aerobic physical activity guideline, as compared with the 27.0% surveyed by YRBS. Across both NSCH and YRBS in ages 14–17 years, males had more than 2 times higher odds of meeting the guideline than did females (Table 2). In YRBS but not NSCH, Asian youth ages 14–17 years had half the odds of meeting the guideline than did White youth of the same age group.

National Survey of Children's Health

Overall, 23.1% of youth aged 6–17 years met the aerobic physical activity guideline. Significantly more children aged 6–13 years

(25.9%) met the guideline than did youth aged 14–17 years (17.4%) ($P < .001$) (Table 3).

Among youth aged 14–17 years, more males than females met the guideline ($P < .001$), and the proportion who met the guideline decreased linearly with increasing household income level ($P < .001$).

Among children aged 6–13 years, significant differences were observed across all characteristics (Table 3). A higher proportion of males than females ($P < .001$), non-Hispanic Black or African American (Black) and non-Hispanic White (White) children than non-Hispanic Asian (Asian) children ($P < .001$), children living in households where the highest education of at least one adult was some college or technical school than those in households where the highest education was a college degree and higher ($P < .001$), and children living in the Midwest than those living in the South regions ($P < .01$) met the guideline. The prevalence of meeting the guideline decreased linearly with increasing household income level ($P < 0.001$).

Youth Risk Behavior Survey

Among youth aged 14–17 years, 27.0% met the guideline. The prevalence of meeting the guideline was higher for males than females ($P < .001$) and Black, White, and Hispanic or Latino youth than Asian youth ($P < .001$) (Table 4).

Overall, for adolescents in grades 9 to 12, 26.6% met the aerobic guideline. The same patterns, as with adolescents aged 14–17 years, were seen by sex and race/ethnicity.

Table 2 The ORs With 95% CI of Youth Ages 14–17 Years Meeting Aerobic Physical Activity Guideline by Sex and Race/Ethnicity, NSCH 2016–2017 and YRBS 2015–2017

Characteristics	NSCH 2016–2017 ^a	YRBS 2015–2017 ^b
Sex		
Male	2.15 (1.79–2.59)	2.63 (2.41–2.87)
Female	Referent	Referent
Race/ethnicity		
Non-Hispanic Asian only	0.96 (0.57–1.60)	0.52 (0.40–0.68)*
Non-Hispanic Black or African American only	1.32 (1.00–1.75)	0.84 (0.70–1.00)
Non-Hispanic White only	Referent	Referent
Non-Hispanic Other or 2 or more races	1.08 (0.81–1.43)	1.11 (0.94–1.30)
Hispanic or Latino	1.05 (0.79–1.39)	0.86 (0.75–0.99)

Abbreviations: CI, confidence interval; NSCH, National Survey of Children's Health; OR, odds ratio; YRBS, Youth Risk Behavior Survey.

^aRespondents for whom aerobic physical activity data were missing (n = 440) have been excluded for our analysis. ^bRespondents for whom aerobic physical activity data were missing (n = 787) have been excluded for our analysis. For estimates stratified by sex, those with unknown sex (n = 99) were excluded; for estimates stratified by race/ethnicity, those with unknown race/ethnicity (n = 456) were excluded.

*Based on the Bonferroni correction, this racial/ethnic group was the only group significantly different from the referent group.

Table 3 Prevalence of Youth Meeting Aerobic Physical Activity Guideline by Age Group, NSCH 2016–2017^a

Characteristics	6–13 y		14–17 y	
	Sample size unweighted	% Meet Aerobic Guideline (95% CI)	Sample size unweighted	% Meet Aerobic Guideline (95% CI)
Total ^b	29,531	25.9 (24.8–27.2)	20,660	17.4 (16.1–18.7)
Sex ^c				
Male	15,149	^v 28.5 (26.9–30.2)	10,513	^v 22.6 (20.5–24.8)
Female	14,382	^w 23.2 (21.5–25.0)	10,147	^w 11.9 (10.6–13.4)
Race/ethnicity				
Non-Hispanic Asian only	1561	^v 16.5 (13.1–20.7)	1089	16.0 (10.3–23.9)
Non-Hispanic Black or African American only	1810	^w 27.5 (24.1–31.2)	1264	20.7 (16.7–25.5)
Non-Hispanic White only	20,352	^w 27.7 (26.5–29.0)	14,868	16.5 (15.4–17.8)
Non-Hispanic Other or 2 or more races	2305	^w 26.9 (23.2–30.9)	1366	17.6 (14.0–21.9)
Hispanic or Latino	3503	22.9 (19.8–26.4)	2073	17.2 (13.7–21.4)
Household income level ^d				
0%–99% FPL	3245	^v 31.9 (28.5–35.5)	2041	^v 20.7 (17.4–24.4)
100%–199% FPL	4823	26.2 (23.5–29.0)	2991	^v 20.3 (17.0–24.0)
200%–399% FPL	8985	^w 24.0 (22.1–26.0)	6164	16.5 (14.0–19.2)
400% FPL or above	12,478	^w 23.1 (21.7–24.6)	9464	^w 14.1 (12.6–15.7)
Highest education of adult in household				
Less than high school	662	29.0 (23.3–35.5)	492	17.6 (12.1–24.9)
High school degree or GED	3690	26.6 (23.7–29.7)	2848	20.1 (16.8–24.0)
Some college or technical school	6683	^v 29.0 (26.6–31.6)	4922	18.8 (16.2–21.7)
College degree or higher	18,055	^w 23.5 (22.2–24.9)	12,089	15.3 (14.0–16.6)
Region				
Northeast	5546	24.6 (22.2–27.2)	4005	16.5 (14.1–19.2)
Midwest	7465	^v 28.4 (26.5–30.3)	5280	17.7 (15.7–19.8)
South	8927	^w 24.4 (22.7–26.3)	6229	18.0 (15.8–20.5)
West	7593	27.1 (24.0–30.4)	5146	16.5 (13.6–19.9)

Abbreviations: CI, confidence interval; FPL, federal poverty level; GED, General Educational Development; NSCH, National Survey of Children's Health.

^aRespondents for whom aerobic physical activity data were missing (n = 965) have been excluded for our analysis. For estimates stratified by highest education of adult in household, those with unknown values (6–13 y old, n = 441; 14–17 y old, n = 309) were excluded. ^bSignificant difference ($P < .001$) between age groups. ^cSignificant difference ($P < .001$) between males and females for each age group. ^dSignificant linear effect ($P < .001$) within subgroup, for each age group. ^{v,w}Within subgroups, values are significantly different from each other (Bonferroni corrected $P < .05$).

Table 4 Prevalence of Youth Meeting Aerobic Physical Activity Guideline by Age Group, YRBS 2015–2017^a

Characteristics	Overall ^b		14–17 y	
	Sample size unweighted	% Meet Aerobic Guideline (95% CI)	Sample size unweighted	% Meet Aerobic Guideline (95% CI)
Total	29,483	26.6 (25.3–28.0)	25,387	27.0 (25.6–28.5)
Sex ^c				
Male	14,325	^v 35.7 (34.1–37.3)	12,229	^v 36.5 (34.7–38.2)
Female	14,927	^w 17.6 (16.4–18.9)	13,059	^w 17.9 (16.6–19.3)
Race/ethnicity				
Non-Hispanic Asian only	1251	^v 17.1 (14.1–20.7)	1073	^v 17.1 (14.0–20.8)
Non-Hispanic Black or African American only	4173	^w 24.3 (22.0–26.8)	3556	^w 25.0 (22.2–28.0)
Non-Hispanic White only	12,904	^w 28.1 (26.3–30.1)	11,329	^w 28.5 (26.5–30.6)
Non-Hispanic Other or 2 or more races	2017	^w 29.9 (26.9–33.1)	1347	^w 30.4 (27.3–33.8)
Hispanic or Latino	8490	^w 25.2 (23.5–27.0)	7192	^w 25.5 (23.7–27.5)

Abbreviations: CI, confidence interval; YRBS, Youth Risk Behavior Survey.

^aRespondents for whom aerobic physical activity data were missing (n = 906) have been excluded for our analysis. For estimates stratified by sex, those with unknown sex (n = 231) were excluded; for estimates stratified by race/ethnicity, those with unknown race/ethnicity (n = 648) were excluded. ^bOverall respondents are students in grades 9 to 12, including those of unknown age (n = 136), 13 years or younger (n = 129), and 18 years or older (n = 3831); however, estimates for these age groups are not reported.

^cSignificant difference ($P < .001$) between males and females overall and for the age group 14–17 years. ^{v,w}Within subgroups, values are significantly different from each other (Bonferroni corrected $P < .05$).

Discussion

Similar to *Healthy People 2030*'s baseline estimates for monitoring the new decade's objectives,^{4,5} this study found that 25.9% of children aged 6–13 years surveyed by NSCH and 26.6% of adolescents surveyed by YRBS (grades 9–12) met the youth aerobic physical activity guideline. However, when estimates across the 2 surveillance systems were compared in the overlapping age group of 14–17 years, prevalence of youth meeting the guideline differed by 9.6 percentage points between the combined 2016–2017 NSCH data (17.4%) and the combined 2015 and 2017 YRBS data (27.0%). Users of these data and *Healthy People 2030* might be tempted to assume similarity between estimates from the 2 systems or age continuity in estimates between *Healthy People 2030*'s child and adolescent physical activity objectives. However, this study's comparisons demonstrate that similarity and age continuity, based on estimates' magnitudes between objectives, should not be assumed.

Differences Between NSCH and YRBS

Several methodological differences may inform comparisons across the 2 system surveys. Perhaps the most notable difference between them is that each relies on different respondents; YRBS uses self-reporting adolescents as respondents while NSCH uses adult proxies (ie, a parent or guardian who lives in the household and who knows about the health and health care of the child).^{17,18} It is possible that some of the 9.6 percentage point difference between NSCH and YRBS youth aged 14–17 years is due to differences in the accuracy of reporting by adult proxies and adolescents. However, this study is not able to examine this specifically. One study showed that adolescents can report hours of very hard physical activity with moderate validity as correlated with minutes spent in same-day activity intervals with heart rate ≥ 140 and ≥ 160 ,²⁰ and a systematic review found that the correlations of adolescents' physical activity questionnaires with their accelerometer scores were stronger than those for children.²¹ As correlations of physical activity reports in children were weaker²¹; asking adult proxies may help address

potential issues with reports from younger children, such as their cognitive limitations.²² Despite this, examples from research on topics other than physical activity have shown that adult proxies report differently than the youth they report on, which can result in both underreporting and overreporting depending on the outcome,^{23–25} particularly for youth behaviors occurring outside the home that adults may not be aware of.²⁶ The influence that different respondents, particularly various adult proxies, have on reporting youth physical activity may be an area of future research to help explain the differences in physical activity estimates between NSCH and YRBS.

Specific physical activity assessment characteristics, such as different questions assessing activity, may be another difference informing comparisons across the 2 system surveys. For example, the question posed by NSCH included examples of activities (ie, exercise and playing a sport), while the question posed by YRBS defined moderate- to vigorous-intensity activity (ie, increased heart rate and breathing hard some of the time). Previous research demonstrates that variations in surveillance questions may produce different estimates, such as with domains (ie, leisure, household, transport), intensities, and amounts of activities mentioned.¹⁰ Though neither system specifies domains, NSCH's inclusion of more examples and lack of defined intensity may have resulted in the higher prevalence estimates observed, with the possibility of respondents counting lighter intensity activities as exercising and playing sports. In contrast, YRBS's specific definition of moderate- to vigorous-intensity activity and lack of examples may have resulted in the lower estimates observed.

Finally, the system surveys also differed in general characteristics, such as sampling design and response rate, adding to the inappropriateness of comparison without context. For example, NSCH's address-based sampling design excluded institutionalized youth and youth not associated with an address.^{17,18} YRBS's school-based sampling design excluded out-of-school youth.^{6,19} Compared with YRBS's response rates around 60%,^{6,19} NSCH had lower rates around 40%, though nonresponse bias analyses concluded no strong evidence of nonresponse bias in 2016 and 2017 NSCH data.^{27,28} Physical activity behaviors related to excluded or

nonresponsive students in either or both NSCH and YRBS samples could differentially influence the estimates of physical activity to be lower or higher.

Patterns of Youth Meeting the Aerobic Physical Activity Guideline

Research comparing physical activity surveillance systems with methodological differences have noted that while prevalence estimates may differ,^{10–12} similar patterns by characteristics emerge.^{10,12} In this study, all prevalence estimates, including those compared in youth 14–17 years, were significantly lower in females than in males. Patterns by sex and age found in comparing surveys and age groups in this study were similar to those in other studies.^{13–15,29}

For the most part, aerobic physical activity patterns were similar by race/ethnicity in NSCH and YRBS, with one particular exception in NSCH youth 14–17 years. In the overlapping age group of 14–17 years, the exception was that there were no significant differences by race/ethnicity for youth surveyed by NSCH though prevalence was lowest in Asian youth, whereas significantly fewer Asian youth than youth of all other races/ethnicities (YRBS) engaged in the recommended amount of aerobic physical activity. Prevalence was also significantly lower in Asian youth than Black and White youth for children 6–13 years (NSCH) and youth of all other races/ethnicities for overall adolescents in grades 9 to 12 (YRBS), the 2 *Healthy People 2030* objective groups.

The significant findings by race/ethnicity are supported by other studies. For example, Asian males and females in a nationally representative sample of grades 7 to 12 were least likely to engage in high levels of moderate to vigorous activity when compared with their White, Black, and Hispanic counterparts¹⁵; in a longitudinal study of adolescent students, both Asian males and females in middle school had significantly lower levels of moderate to vigorous activity than their White counterparts.³⁰ For both surveys in all age groups, there were no significant differences among other races/ethnicities. Previous evidence on differences by other racial/ethnic groups is inconsistent, particularly by age. Some studies found that white children are less active than black children^{31,32} and another found the opposite in adolescents.³³ As fewer Asian children and adolescents met the aerobic physical activity guideline than other youth in both *Healthy People 2030* objective groups, strategies to increase activity among Asian youth may help reduce racial/ethnic disparities in youth physical activity to achieve *Healthy People's* goal of health equity.

As assessed by NSCH's wider age range of 6–17 years, prevalence of meeting the aerobic guideline in youth 14–17 years was significantly lower than in children 6–13 years in the single survey. Middle and high school students are less likely to be physically active for 60 minutes every day than elementary school children.^{31,34} In addition, 3 nationally representative studies of US youth throughout younger and older age ranges found lower levels of activity in older ages, as well as in females when compared with males.^{13–15} Strategies that help to engage females and address the issue of decreasing activity from childhood into adolescence may be important to achieving *Healthy People 2030* objectives. Notably, the observed decline in meeting the guideline between children and older youth in NSCH provides further evidence that the lack of a change in physical activity between the child and adolescent objectives measured with 2 different surveillance systems should not be interpreted as reflecting actual patterns in age.

Investigating other demographic characteristics beyond sex and race/ethnicity across NSCH's wider age range displays how differences may appear between younger and older youth, even in a single system survey. Differences by socioeconomic status (SES) were only assessed by NSCH; youth in both age ranges of 6–13 and 14–17 years presented a significant linear decrease in prevalence of meeting the aerobic guideline with increasing household income level, while a significant difference by highest household education was only seen in children 6–13 years, with higher prevalence among children in a household with some college or technical school compared with those in a household with a college degree and higher. In contrast to our findings, some studies observed a relationship between higher household SES (ie, income and adult educational attainment) and increased physical activity,^{35,36} possibly from restricted opportunities or barriers to activity with lower SES.^{36–38} However, other studies found no relationship between SES and child or adolescent activity^{33,39} or an inverse relationship⁴⁰ similar to those in this study. Conflicting findings may be due to different measures of SES³³ and physical activity.^{39,40} In one example, family SES, a proxy combining income with household education, showed a significant positive relationship with children's sports participation but not overall, moderate, and vigorous physical activity, while parental education alone positively predicted children's sports participation and physical activity.⁴¹ Further research may be warranted to elucidate the influences of various SES measures on multiple aspects of youth physical activity at different ages.

Differences by region were only seen in children 6–13 years in NSCH, with higher prevalence of meeting the aerobic guideline for those living in the Midwest than in the South. A study that examined physical activity environment reinforced these regional patterns, as the South had environments with low physical activity scores and the Midwest had high scores.⁴² A longitudinal study found that youth in the Midwest had higher physical activity levels, though not significant, than youth in other regions; as they aged from 9 to 15 years, Midwestern youth's activity levels declined at significantly faster rates for both genders,⁴³ which may explain why the current study found no significant difference by region in youth aged 14–17 years. Information on regional youth physical activity from NSCH can be used to help inform efforts to increase activity, particularly for children living in the South; in addition, available state-level data⁴⁴ for NSCH⁴⁵ and YRBS⁴⁶ can also help inform specific state efforts toward achieving *Healthy People* objectives.

Limitations

This study has several limitations. In addition to each system's limitations of recall and social desirability biases from respondent reporting^{21,47–49} and nonresponse bias related to response rates, another limitation of this study is that it could not be used to assess which of the measures was more accurate. Furthermore, the different survey questions compared between NSCH and YRBS use language that may not be specific enough to measure only aerobic physical activity, resulting in the possibility of underestimated over- or underestimates of aerobic physical activity; differences in comparing surveillance systems and surveys may extend beyond differences in device-based instruments and methods, further limiting broad comparison of physical activity estimates. Also, seasonal variations in response to the physical activity question could not be accounted for. Other factors that may influence physical activity were not assessed, such as disability

or long-standing conditions. Finally, assessing physical activity daily, per the guideline followed in this study, rather than on average, could substantially affect prevalence estimates to appear lower than if assessing by average activity.⁵⁰

Conclusions

A total of 25.9% of children aged 6–13 years surveyed by 2016–2017 NSCH and 26.6% of adolescents in grades 9 to 12 surveyed by 2015 and 2017 YRBS met the aerobic physical activity guideline. However, the 9.6 percentage point difference between NSCH and YRBS estimates for youth aged 14–17 years suggests that the estimates of similar magnitude between the child and adolescent *Healthy People 2030* objective groups may be a result of using 2 different surveillance systems. Those using *Healthy People 2030* youth physical activity objectives data should not assume the same activity levels nor age continuity between child and adolescent objectives. Regardless, patterns by sex and race/ethnicity were generally similar across system surveys. As a new decade of monitoring youth physical activity objectives begins, it is important to understand similarities and differences between systems for contextualizing estimates and guiding decisions to increase physical activity.

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