Proportions of youth with visual impairments meeting 24-hr movement guidelines

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Abstract

Background: Recent movement behaviour guidelines prescribe the optimal time spent in physical activity, screen time, and sleep across a 24-hr period. The proportion of youth with visual impairments meeting 0, 1, 2, or all 3 of these 24 movement guidelines is unknown. The primary purpose of this observational, cross-sectional analysis was to examine the proportions of youth with visual impairments in the United States who partially or fully meet the physical activity, screen time, and sleep duration guidelines. A secondary purpose of this analysis was to examine whether demographic variables were associated with the odds of youth with visual impairments meeting these guidelines.

Methods: This study included 561 youth with visual impairments from the 2016 to 2017 National Survey of Children's Health (NSCH). Accounting for the NSCH sampling plan, Complex Samples was used to estimate the prevalence of meeting 24-hr movement guidelines, and a multinomial logistic regression analysis was conducted to examine the odds ratio of guidelines met across different demographic factors.

Results: Of the participants in this study, 18.7%, 50.7%, and 73.2% met physical activity, sleep, and screen time guidelines, respectively. Just 5.8% of the sample met all three of the 24-hr movement guidelines, whereas 10.6% did not meet any of the three guidelines.

Conclusions: The proportion of the sample meeting of all three guidelines was low, thus depriving the majority of this population of the physiological and psychological health benefits of meeting each guideline. Moreover, the study identifies physical inactivity as a key risk factor that requires attention in this population.

Keywords

blindness; health; NSCH; obesity; population-based

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1 | INTRODUCTION

Physical activity (PA) has been identified as a modifiable lifestyle behaviour that can help reduce the likelihood of developing obesity and other physiological (e.g., diabetes and heart disease) and psychological (e.g., anxiety and depression) health issues (Centers for Disease Control & Prevention, 2016; Laurson, Lee, Gentile, Walsh, & Eisenmann, 2014; Zhu, Haegele, & Healy, 2019). Because of the health enhancing effects of regular PA, guidelines internationally recommend that youth aged 5–17 years engage in at least 60 min of moderate-to-vigorous PA daily (World Health Organization, 2010). Unfortunately, however, youth with visual impairments (VIs) tend not to meet recommended PA guidelines and therefore may be deprived of the associated health-related benefits (Augestad & Jiang, 2015; Haegele, Aigner, & Healy, 2019). For example, in an analysis of the 2016 National Survey of Children's Health (NSCH), just 23.16% of children (aged 6–12 years) and 12.50% of adolescents (aged 13–17) years engaged in at least 60 min of daily PA (Haegele et al., 2019).

PA guidelines target just a fraction of each 24 hr and do not account for other modifiable lifestyle behaviours, such as sleep duration (SD) and screen time, which are also predictive of health-related outcomes (Berglind, Ljung, Tynelius, & Brooke, 2018; Carson, Chaput, Janssen, & Tremblay, 2016; Tremblay et al., 2016). Reflecting the emerging belief that "the whole day matters," recent years have seen the development and adoption of movement behaviour guidelines across the entire 24-hr period (Chastin, Palarea-Albaladejo, Dontje, & Skelton, 2015; Tremblay et al., 2016). The 24-hr movement framework, presented by Tremblay et al. (2016), includes recommendations for youth to engage in (a) 60 min of moderate-to-vigorous PA, (b) 120 min of recreational screen time, and (c) 9 to 11 hr of sleep per night for those aged 5–13 years and 8 to 10 hr per night for those aged 14–17 years. Research supports this more holistic and comprehensive perspective of health behaviours; meeting all of these 24-hr movement guidelines has been associated with more positive physiological (e.g., body mass index and systolic and diastolic blood pressure) and psychological (e.g., well-being indices and symptoms of anxiety and depression) outcomes, compared with meeting health behaviour guidelines in isolation (Carson et al., 2016; Roman-Vinas et al., 2016; Zhu et al., 2019).

Population-based studies examining the prevalence of meeting PA, screen time, and sleep behaviours among youth (Haegele et al., 2019) and adults (Loprinzi & Joyner, 2016) with VIs are beginning to emerge in the literature. For example, using the 2016 NSCH, Haegele et al. (2019) determined that although few children (28.51%) and adolescents (18.34%) with VIs engaged in 60 min of moderate-to-vigorous PA daily, the majority of children and adolescents met screen time guidelines (78.59% and 71.71%, respectively) and SD guidelines (64.01% and 70.29%, respectively) guidelines recommended by the American Academy of Pediatrics (2013) and American Academy of Sleep Medicine (Paruthi et al., 2016). However, to date, research in this area has largely investigated adherence to the guidelines in isolation, without considering the collective, integrative benefits of meeting multiple or all of these guidelines. As such, the proportion of youth with VIs meeting 0, 1, 2, or all three of these 24 movement guidelines is largely unknown. In addition, no studies thus far have applied Tremblay et al.'s (2016) 24-hr movement framework to the examination of health-related behaviours among this population. Thus, the primary purpose of this

observational, cross-sectional analysis was to examine the proportions of youth with VIs in the United States who partially or fully meet the PA, screen time, and SD guidelines. This examination can help generate evidence to identify which health-related behaviour(s) are most critically in need of intervention for the promotion of health among this population.

Sociodemographic variables may influence the types of activities that youth choose, as well as the barriers they may experience, when attempting to engage in health-related behaviours (Borodulin et al., 2016). Currently, however, research focusing on health-related behaviours among youth with VIs, which primarily focuses on PA, is largely conflicting with regard to the influence of sociodemographic variables (Haegele & Porretta, 2015). Examining the relationship between demographic variables, such as sex, household income, and parental education level and meeting movement guidelines can help target specific public health prevention efforts to specific subpopulations of youth who are in particular need of intervention. Thus, a secondary purpose of this analysis was to examine whether demographic variables were associated with the odds of youth with VIs meeting these guidelines.

2 | METHODS

2.1 | Data source

This cross-sectional analysis utilized data from the 2016 to 2017 NSCH. The 2016–2017 NSCH includes a nationally representative cross-sectional probability sample of noninstitutionalized youth aged from 0 to 17 years in the United States. The 2016–2017 NSCH is a combined data set, which was constructed to provide the opportunity to conduct analyses on low prevalence populations (e.g., those with VIs). Data were collected by the US Census Bureau from parents or guardians via a two-phase, self-administered data collection design. Parents/guardians first completed a household screening questionnaire and then completed a child-level questionnaire either online or by mail if the household was selected. The weighted response rate was 40.7% and 37.4% for the 2016 and 2017 NSCH, respectively. All consent and/or assent from human subjects were obtained from the Child and Adolescent Health Measurement Initiative during data collection. The IRB/Ethics Committee at the first author's university affiliation rules this study to be exempt from review because of the use of publicly available, deidentified data.

2.2 | Sample

This study focused on 561 youth aged 10–17 years who were identified via parent report as having a VI in the 2016–2017 NSCH data set. See Table 1 for detailed demographic information. Participants were identified as having a VI when parents answered "yes" to the following question: "Does this child have the following: blindness or problems with seeing, even when wearing glasses?" This identification strategy is consistent with that used in previous research using large-scale data sets (Little, Dean, Tomchek, & Dunn, 2017).

2.3 | Measures

Three questions were utilized to evaluate if participants met the 24-hr movement guidelines. To assess PA, parents were asked "during the past week, on how many days did this child

exercise, play a sport, or participate in PA for at least 60 min?" Potential responses included "0 days," "1–3 days," "4–6 days," and "every day." A dichotomous variable was then created, where "every day" was coded as "meeting PA guidelines," and all other responses were coded as "not meeting PA guidelines." For screen time, parents were asked "On an average weekday, about how much time does this child usually spend in front of the TV watching TV programs, videos, or playing video games?" Potential responses included "none," "1 hour," "2 hours," "3 hours," and "4 or more hours." A dichotomous variable was then created where responses of "3 hours" and "4 or more hours" were coded as "not meeting screen time guidelines," and all other responses were coded as "meeting screen time guidelines." To assess SD, parents were asked "During the past week, how many hours of sleep did this child get on an average weeknight?" Potential responses included "less than 6 hours," "6 hours," "7 hours," "8 hours," "9 hours," "10 hours," and "11 or more hours." For SD, responses of 9, 10, and 11 hr for participants aged 10–13 years, and 8, 9, and 10 hr for participants aged 14–17 years, were coded as "meeting sleep guidelines," and all other responses were coded as "not meeting sleep guidelines." Thresholds used for dichotomizing variables for PA, screen time, and SD were based on 24-hr movement guidelines explicated by Tremblay et al. (2016).

Several demographic variables were also used in this analysis. Age was reported in years, and sex was reported dichotomously (i.e., male/female participants). Household income was reported as one of four categories based on the federal poverty level (FPL) guidelines from the US Department of Health and Human Services (2019; 0–199% FPL, 200–299% FPL, 300–399% FPL, and 400% FPL or greater). Race/ethnicity was presented using four categories: Hispanic, White/non-Hispanic, Black/non-Hispanic, and other/multiracial/non-Hispanic. Parental education was recorded as the highest degree or year of school completed: less than high school or General Education Development, some college or technical school, and college degree or higher.

2.4 | Data analysis

Youth with VIs aged between 10 and 17 years old were identified from the combined NSCH 2016–2017 data set. To properly estimate the demographic frequency of youth with VIs and their prevalence of meeting proportions of the 24-hr movement guidelines, the 2016–2017 NSCH data analysis plan was adopted to incorporate the data set's weighting and sampling design. A frequency table and 95% confidence interval (95% CI) were used to estimate participant demographics and the prevalence of meeting 24-hr movement guidelines using the Complex Samples module of SPSS (Ver. 25, IBM; Armonk, NY). Additionally, to estimate the odds ratio of meeting 0, 1, 2, or 3 guidelines as a function of the demographic variables, a multinomial logistic regression analysis was done on the number of guidelines met. Within the logistic regression model, "meeting no guideline" was used as the reference category.

3 | RESULTS

The NSCH data set yielded a sample of 561 youth (10–17 years old) with VIs who had complete data on the study variables. As shown in Table 1, the sample consisted of 55.9%

female participants and 44.1% male participants and averaged 13.80 ± 2.33 years of age. Ethnically, the sample 11.0% Black/non-Hispanic, 20.8% Hispanic, 58.6% White/non-Hispanic, and 9.6% other/multiracial/non-Hispanic. About two-thirds (66.7%) of the sample were living in households with an income level of 0–199% FPL.

Less than 20% of the sample (18.7%) met the PA guideline of 60 min or more per day and about half met the SD guideline for their age (50.7%). As shown in Table 1, however, about three quarters of the youth with VIs met the screen time guideline (73.2%). The detailed percentage of youth with VIs meeting all combinations of the movement guidelines is shown in Figure 1. Taken together, just 5.8% of the sample collectively met all three of the 24-hr movement guidelines, and 10.6% did not meet any of the three guidelines. Most participants met some proportion of the 24 movement guidelines, with 44.4% meeting one and 39.1% meeting two guidelines.

Among the demographic variables used in this study, sex, race/-ethnicity, and household poverty level were significantly associated with the number of guidelines met by youth with VIs, and parents' highest level of education was not (Wald $F_{30,447} = 2.60$, McFadden's Pseudo $R^2 = 0.13$, $p < .01$). As seen in Table 2, female participants in general were more likely to meet the 24-hr movement guidelines and were significantly more likely to meet one guideline than male participants (OR = 3.57, 95% CI [1.38, 9.24]). Participants identified as Black (OR = 0.05, 95% CI [0.01, 0.58]) and other/multiracial ethnicities (OR = 0.06, 95% CI [0.01, 0.40]) were generally less likely to meet the 24-hr movement guidelines and were significantly less likely to meet all three guidelines than their White, non-Hispanic peers. Holding other demographic variables constant, youth with VIs living in higher poverty level households were more likely to meet all three guidelines than those in more affluent household (OR = 4.06, 95% CI [1.02, 16.20]).

4 | DISCUSSION

The unique contribution of this study is the analysis of the proportions of youth with VIs who individually and jointly adhered to the 24-hr movement guidelines. Findings from previous research support the integrated paradigm that underpins the 24-hr movement guidelines and the focus on the combined or synergistic effects of movement behaviours on health rather than a focus on health behaviours in isolation (Carson et al., 2016; Tremblay et al., 2016). Supporting this, meeting all three guidelines has been identified as being significantly more beneficial for several health-related indices (e.g., body mass index *z*-scores, waist circumference, and well-being) than meeting two or less guidelines (Carson et al., 2016). Of concern, few youth with VIs in this study (5.8%) adhered to all three 24-hr movement guidelines. This figure appears lower than estimates of proportions of youth without disabilities in prior research, which can range from 7.2% (Roman-Vinas et al., 2016) to 18.4% (Berglind et al., 2018). As such, most youth with VIs in this study (94.2%) did not meet all three of the 24-hr movement guidelines and therefore did not take advantage of the collective, integrative physiological (e.g., favourable body mass index) and psychological (e.g., reductions in symptoms of anxiety and depression) benefits of meeting each of these guidelines (Carson et al., 2016; Zhu et al., 2019).

Of the three 24-hr movement guidelines, considerations to improve adherence to the PA guideline may be particularly important for this population. Alarmingly, just 18.7% of the participants in this study met the PA guideline. Given the relatively high percentage of individuals meeting the other two guidelines but not all three (27%), the PA guideline may be the linchpin for many participants to meet all three 24-hr movement guidelines and enjoy the associated benefits. This finding, along with prior research, which has demonstrated that those with VIs tend not to meet PA guidelines (Augestad & Jiang, 2015; Haegele & Porretta, 2015), should call attention to the importance of specific and targeted interventions that focus on improving PA among this youth population. Although limited, intervention research has been successful in improving PA behaviours among youth with VIs (Cervantes & Porretta, 2014; Haegele & Porretta, 2015). Recommendations to enhance adherence to the PA guideline, as well as other 24-hr movement guidelines, among those without disabilities are clearly also relevant for this population. For example, as noted by Knell, Durand, Kohl, Wu, and Gabriel (2019), those interested in enhancing adherence to movement guidelines among youth with VIs may adopt the 5 A's Behavior Change Framework (Dosh et al., 2005), which includes *asking* about these behaviours for potentially interested parties, *advising* youth and parents on the importance of the behaviours, *assessing* potential barriers, *assisting* with overcoming those barriers with best practices, and *arranging* for follow-up assessments, if needed.

Similar to previous research that reported the majority of youth (79.59% of children and 71.71% of adolescents) with VIs adhere to the screen time guidelines set forth by the American Academy of Pediatrics (2013), in the current study, youth with VIs were also likely to meet the 24-hr movement screen time guideline. Interestingly, however, although the prior study by Haegele et al. (2019) found that most participants (64.01% of children and 70.29% of adolescents) met SD guidelines, just 50.7% of the current sample were identified as doing so. These discrepancies in findings may be attributed to the utilization of a narrower age range in the current study, as well as differences in how SD guidelines by the American Academy of Sleep Medicine (Paruthi et al., 2016) were applied in the Haegele and colleagues study and how the Tremblay et al. (2016) recommendations were used here. More specifically, Haegele and colleagues created dichotomous variables where 9 or more hours (for children aged 6–12 years) or 8 or more hours (for adolescents aged 13–17 years) were considered meeting SD recommendations, where the current study coded responses of 9, 10, and 11 hr for participants aged 10–13 years, and 8, 9, and 10 hr for participants aged 14–17 years as meeting guidelines. Thus, it appears that the prior analysis by Haegele and colleagues included a broader response window for meeting guidelines, which may have inflated figures in comparison with the current study.

Examining the influence of sociodemographic variables on adherence to the 24-hr movement guidelines can help identify subpopulations of youth with VIs in need of intervention. According to this analysis, several sociodemographic variables were associated with participants' adherence to all three 24-hr movement guidelines. For example, female participants were generally more likely to meet guidelines and were significantly more likely to meet at least one guideline, than their male counterparts. This finding is somewhat surprising, as it conflicts with research examining youth without disabilities, which generally shows male participants to be more likely to meet 24-hr movement guidelines

(Laurson et al., 2014) as well as research showing male adults with VIs being more active than female adults (Haegele, Zhu, Lee, & Lieberman, 2016). Of additional interest, youth with VIs living in higher poverty level households were more likely to meet all three guidelines than those in more affluent households. This contradicts prior research suggesting that those in higher poverty households would experience additional barriers, such as challenges associated with parent work schedules and limited access to high-quality facilities, to accessing opportunities for health-related behaviours (Borodulin et al., 2016). This finding should be interpreted with caution, however, because of the wide confidence interval variation from 1.02 to 16, due to the relatively small sample size for this analysis. Lastly, Black/non-Hispanic youth, as well as other/multiracial youth, with VIs were significantly less likely to meet all three guidelines than their White/non-Hispanic peers. This finding is consistent with research examining populations without disabilities that asserts that Black/non-Hispanic youth, as well as those categorized in "other" categories, tend to engage in fewer health-related behaviours (Powell, Slater, & Chaloupka, 2004). Collectively, these findings suggest the need for targeted interventions that reducing barriers to health-related behaviours among Black/non-Hispanic or other/multiracial male youth with VIs, to help enhance health and wellbeing among this population.

This analysis includes several strengths, including the use of a nationally representative sample of youth with VIs and the utilization of a contemporary movement framework to understand health behaviours of those with VIs. However, limitations are also evident. First, NSCH is subject to non-random errors, such as nonresponse and coverage biases. Second, the broad range of topics included in the NSCH may be a limitation, as additional depth about variables of interest (e.g., participants' specific VI diagnoses, time, and intensity of PA, SD disturbances) is largely unavailable. Third, just one question was used for each 24-hr movement behaviour, making it challenging to evaluate the reliability of responses. Fourth, the way variables are dichotomized limits variability and may represent a liberal approach to the definitions of PA, SD, and ST participation. Finally, the cross-sectional nature of the analysis, and relatively low responses rate, may also be considered limitations.

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Key messages

- Reflecting the emerging belief that "the whole day matters" recent research supports the holistic benefits of meeting 24-hr movement guidelines associated with physical activity, sleep, and screen time.

- Few youth with visual impairments (5.8%) adhered to all three 24-hr movement guidelines in this analysis.

- Of the three guidelines, considerations to improve adherence to the physical activity guideline may be most important, as just 18.7% of participants met this guideline.

- Targeted interventions that reduce barriers to health-related behaviours among Black/non-Hispanic male youth with VI may be particularly relevant.
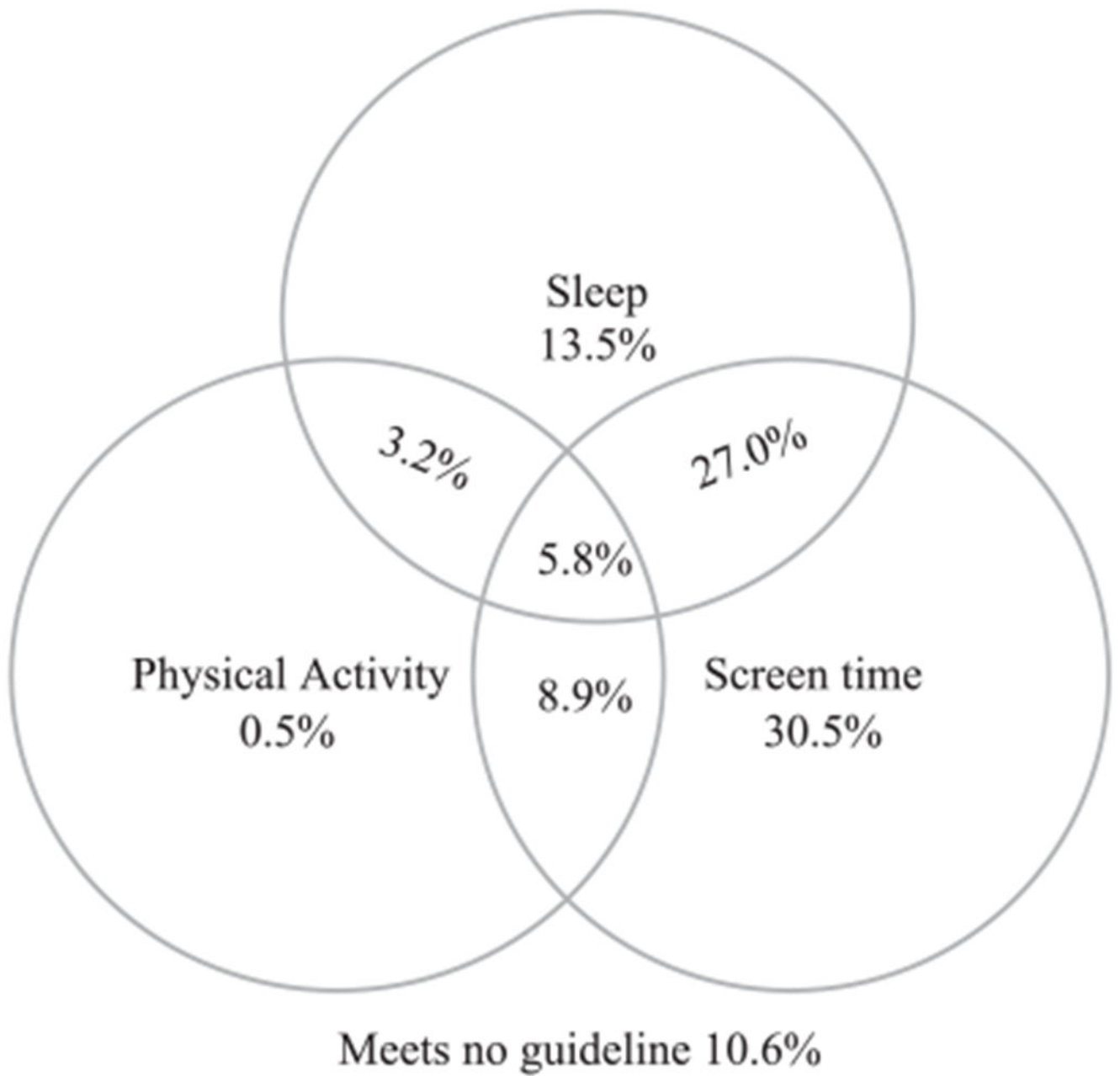
FIGURE 1.
Percentage of youth with visual impairment (10–17 years) meeting 24-hr movement guidelines

TABLE 1

Demographic characteristics of 2016–2017 National Survey of Children's Health for youth with visual impairment

Age range	10–17 years old
Sample size, no.	561
Age (year), *M* (*SD*)	13.80 (2.33)
Sex (%, 95% CI)	
Male	44.1% (34.1–54.5%)
Female	55.9% (45.5–65.9%)
Race/ethnicity (%, 95% CI)	
Black/non-Hispanic	11.0% (8.7–16.3%)
Hispanic	20.8% (15.2–26.0%)
White, non-Hispanic	58.6% (54.3–62.9%)
Other/multiracial/non-Hispanic	9.6% (7.0–11.3%)
Highest level of education (%, 95% CI)	
Less than high school	32.3% (21.7–45.2%)
High school or GED	31.7% (21.0–44.7%)
Some college or technical school	16.8% (11.9–23.3%)
College degree or higher	19.1% (14.1–25.5%)
Household poverty level based on CHIP (%, 95% CI)	
0–199% FPL	66.7% (57.7–74.6%)
200–299% FPL	10.2% (6.1–16.5%)
300–399% FPL	10.8% (7.4–15.5%)
400% FPL or greater	12.3% (8.1–18.1%)
Physical activity participation (%, 95% CI)	
Less than 60 min/day	81.3% (75.3–86.1%)
60 min or more/day	18.7% (13.9–24.7%)
Average weeknight sleep (%, 95% CI)	

Age range	10–17 years old
Below age-appropriate hours	49.3% (38.7–60.1%)
Meet age-appropriate hours	50.7% (39.9–61.3%)
Weekday screen time viewing (%, 95%CI)	
2 hr or less per day	73.2% (65.8–79.6%)
More than 2 hr/day	26.8% (20.4–34.2%)
24-hr movement guideline (%, 95% CI)	
Meet none of the guidelines	10.6% (7.3–15.3%)
Meet 1 of the guidelines	44.4% (34.1–55.2%)
Meet 2 of the guidelines	39.1% (29.6–49.6%)
Meet all 3 of the guidelines	5.8% (3.7–9.1%)

Abbreviations: CI, confidence interval; CHIP, Children's Health Insurance Program; FPL, federal poverty level; GED, General Education Development; *M*, mean; *SD*, standard deviation.

TABLE 2

Adjusted odds ratio estimates of meeting 24-hr movement guideline for youth with visual impairments from 2016 to 2017 National Survey of Children's Health

Demographic characteristics	Adjusted odds ratio (95% CI vs. meet no guideline)		
	Meet 1 guideline	Meet 2 guidelines	Meet 3 guidelines
Sex			
Female	3.57 (1.38–9.24) **	1.76 (0.66–4.69)	2.15 (0.59–4.69)
Male	1 (referent)	1 (referent)	1 (referent)
Race/Ethnicity			
Black/non-Hispanic	0.42 (0.11–1.71)	0.64 (0.16–2.62)	0.05 (0.01–0.58) **
Hispanic	2.07 (0.64–6.69)	0.49 (0.14–1.70)	1.98 (0.53–7.36)
Other/multiracial/non-Hispanic	0.47 (0.09–2.47)	0.52 (0.12–2.16)	0.06 (0.01–0.40) **
White, non-Hispanic	1 (referent)	1 (referent)	1 (referent)
Parent level of education			
Less than high school	1.51 (0.36–6.33)	1.62 (0.29–9.20)	0.80 (0.11–6.09)
High school or GED	0.70 (0.20–2.40)	0.45 (0.11–1.77)	0.36 (0.07–1.94)
Some college or technical school	0.43 (0.14–1.39)	0.37 (0.10–1.40)	1.56 (0.39–6.18)
College degree or higher	1 (referent)	1 (referent)	1 (referent)
Household poverty level			
0–199% FPL	0.96 (0.33–2.82)	1.20 (0.33–4.37)	4.06 (1.02–16.20) *
200–299% FPL	1.19 (0.19–7.61)	3.01 (0.45–20.12)	2.94 (0.42–20.78)
300–399% FPL	1.19 (0.26–5.50)	2.84 (0.75–10.79)	2.48 (0.31–19.67)
400% FPL or greater	1 (referent)	1 (referent)	1 (referent)

Abbreviation: FPL, federal poverty level.

*
$p < .05$.

**
$p < .01$.