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Examining the Association of Second Grade Children's Sleep and Screen Time Recommendations

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Abstract

Background: Adequate sleep is essential for various health outcomes (e.g., obesity, diabetes, and cardiovascular disease). However, sleep time is threatened by the increased opportunities for unsupervised screen time available to children of all ages. The American Academy of Sleep Medicine recommends that elementary school-aged children sleep between 9-12 hours per night. Furthermore, the American Academy of Pediatrics recommends that children's recreational screen time be limited to less than 2 hours per day. Excess screen use can delay bedtime and lead to less restful sleep. The purpose of this study was to examine the association between adhering to screentime guidelines (<2 hours/day) and the likelihood of meeting sleep guidelines (9-12 hours/day) in 2nd-grade children.

Methods: This study utilized two waves (2015-2016 and 2019-2020) of 2nd graders' parent-reported weighted survey data from the Texas School Physical Activity and Nutrition (SPAN) cross-sectional survey.

Results: The final analytic sample included 3193 individuals (53% female, 62% Hispanic) across two years of data collection. sixty-five percent of parents/guardians reported their children met the sleep guidelines, while 33% of parents/guardians reported their children meeting the screentime guideline. After controlling for body mass index (BMI), race/ethnicity, school disadvantage, education, sex, and year of collection, parents who reported their children met the screentime guideline had 1.53 greater odds of meeting sleep guidelines compared to children whose parents/guardians reported their children did not meet the screentime guidelines (OR 1.53; 95%CI = 1.18, 1.99). In stratified analyses, we found that the associations between meeting sleep and screen time guidelines were primarily true for White children. A higher proportion of White children were more likely to meet both sleep-time and screen-time recommendations compared to Black and Hispanic children, while Black and Hispanic children were as likely to meet screen-time guidelines as White children; both groups had significantly lower odds of meeting sleep guidelines compared to White children (OR 0.32; 95% CI = 0.18, 0.58 and OR 0.49; 95% CI = 0.29, 0.83, respectively).

Discussion: Children's ability to meet the recommended sleep guidelines is associated with screentime guideline adherence. Further exploration is needed to understand racial/ethnic differences in guideline adherence for screentime and sleep. Interventions targeting sleep characteristics (e.g., duration, quality, and timing) should consider concomitantly targeting screentime adherence in elementary school-aged children.

Introduction

Childhood obesity continues to be an international public health concern.[1,2] Recent data from the United States estimate that more than 35% of children aged 2-19 years are overweight or have obesity.[3] Obesity is linked with a variety of chronic diseases, including elevated fasting glucose, sleep apnea, asthma, insulin resistance, sleep apnea, asthma, and type 2 diabetes.[4-6] Over time, children classified as overweight or obese are more likely to become adults who are overweight or obese.[7] Obesity and its associated comorbidities are estimated to cost Americans more than $260 billion per year.[8]

Obesity is a multifactorial condition influenced by social, environmental, and genetic determinants.[9] Obesogenic behaviors such as physical activity, sleep, sedentary/screen time, and dietary intake have all been identified as contributing factors for obesity by manipulating an individual's total energy expenditure.[10-14] Sufficient sleep is associated with a healthy weight in children, while excessive screen use has shown an increased likelihood of obesity.[15,16] Recent data also suggest that greater use of screens is associated with shorter sleep duration and an increase in the prevalence of sleep-wake disturbances in children.[17] Because these behaviors have strong links with obesity, and other cardiometabolic outcomes, recommendations for certain obesogenic behaviors have been established. The American Academy of Sleep Medicine recommends that 6- to12-year-old children sleep between 9-12 hours per night.[18] The American Academy of Pediatrics and the Canadian 24-hour movement guidelines recommend that children's daily recreational screen time be less than 2 hours per day.[19,20]

Research has also demonstrated how structured routines and parenting practices are associated with children's more favorable behavior and weight outcomes.[21,22] Less is known regarding the complementary impact that meeting these guidelines may have on one another.[19,23] Therefore, the purpose of this study was to examine the odds that meeting recommended recreational screen use (<2 hours/day)[19] may have on meeting the recommended sleep guidelines (9-12 hours/night) in 2nd-grade children.[18] Given the dearth of literature on screen use and sleep, we hypothesized that children would be more likely to meet weekday sleep guidelines if they meet the recommended recreational screen use guidelines.

Methods

Design and Sampling

This study utilized two school years (2015-2016 and 2019-2020) of statewide representative cross-sectional data of 2nd-grade students from the Texas School Physical Activity and Nutrition (SPAN) study. SPAN is a statewide surveillance system that monitors students' health and school-related behaviors in Texas elementary, middle, and high schools.[24] The full description of the methods and protocols has been published elsewhere.[24,25] SPAN uses a multi-stage probability-based complex sampling design to generate a statewide representative sample of elementary, middle, and high school students. Sampling weights and adjustment for controls totals were calculated using a proportional probability of selection from school enrollment.[25] SPAN student surveys were administered in school classrooms following a standard protocol, and parental consent and child assent were obtained. Parent surveys were distributed as take-

home surveys and were available in English and Spanish. The University of Texas Health Science Center at Houston School of Public Health Committee for the Protection of Human Subjects and local school district research committees reviewed and approved the SPAN study.

Measures and Study Variables

Sleep Recommendation Adherence. For this analysis, the primary outcome measure was the child's sleep duration reported by the parent/guardian. This ordinal variable was adopted from the Youth Risk Behavior Surveillance System questionnaire.[26] The survey question was designed and operationalized as follows: "On an average school night, how many hours of sleep does your 2nd-grade child get?" Possible responses to this survey question were: "4 or less hours", "5 hours", "6 hours", "7 hours", "8 hours", "9 hours", or "10 or more hours".

Screentime Recommendation Adherence. Non-school-related screen use was captured using a validated question reported by the parent/guardian.[27] This ordinal variable was designed and operationalized as follows:: "How many hours per day does your 2nd-grade child usually spend using a computer, tablet/iPad, or smartphone away from school for anything except school work?" Possible answers to this survey question were: "My child 'doesn't use a computer or tablet, iPad, or smartphone away from school for anything except work," "Less than 1 hour", "1 hour", "2 hours", "3 hours", "4 hours", "5 hours", or "6 or more hours".

Race/ethnicity. Self-reported race/ethnicity was included as a covariate to examine if race/ethnicity differentially was associated with children's sleep and screen use behaviors. Parents were asked to describe their childs/children's race/ethnicity from a list of 10 possible response options. For this study, the variable was designed and then operationalized as a three-level nominal variable (coded as 1= African American or Black, 2= Hispanic non-White, and 3= White non-Hispanic/ Other) to generalize to the most prominent representative racial/ethnic groups in Texas.

School-level Economic Disadvantage (School ED). School ED was based on the percentage of a given school's student population who were economically disadvantaged. The Texas Education Agency (TEA) defines the economically disadvantaged classification based on National School Lunch Program eligibility for free or reduced-price meals as families with incomes at or below 130% or between 130% and 185% of the federal poverty level, respectively.[28] Students are considered economically disadvantaged if they meet one of the three following criteria: 1) eligible for reduced-priced meals, 2) eligible for free meals, or 3) meet some other level of economic disadvantage. The three economically disadvantaged categories are then summed and divided by student enrollment to establish a percentage of economically disadvantaged. Economic disadvantage scores were obtained from the TEA for the 2015-2016 and 2019-2020 school years, and all students attending a given school were assigned that school's overall economic disadvantage score. Four categories were created based on the overall sample's quartile distribution of economic disadvantage.

Household Education. This variable was designed and operationalized as a four-level nominal variable (coded as 1= graduated high school, 2= some college, technical degree, or associates degree, 3= bachelor's degree, and 4= graduate/professional degree). Highest level of education

attained by the parent/guardian was additionally included as a proxy measure of socioeconomic status.[29] Parents were asked to mark the highest level of education among all adults living in the household.

Body Mass Index. Heights and weights were collected using standard protocols.[30,31] During data collection, trained research assistants instructed participants to remove any heavy clothes and shoes before having their height and weight recorded. Participant height was measured to the nearest 0.1 centimeter with a stadiometer (Perspective Enterprises Portable Adult Measuring Unit PE-AIM-101). Participant weight was measured to the nearest 0.1 kilogram with a portable digital scale with remote display (Tanita Professional Digital Scales with Remote Display, BWB-800S) calibrated to 113kg before each series of measurements. Research assistants recorded both measures on student questionnaires. Body mass index (BMI) was then computed as weight (kilograms) divided by height (meters) squared. Following the Centers for Disease Control and Prevention growth charts, we then categorized percentiles as follows: healthy/normal weight (<85th percentile), overweight (≥85th percentile), and obese (≥95th percentile).[32]

Other Sociodemographic Characteristics assessed included parents/guardians who self-reported their child's/children's gender (coded as 1 = male and 2 = female). Because two separate waves of 2nd-grade survey collection were included (2015 and 2019), a time variable (coded as 2015 = 0 and 2019 = 1) was included to understand if differences by collection period impacted our outcome of interest.

Analysis

All statistical analyses were performed using Stata software version 16 (StataCorp, College Station, TX). Descriptive statistics were based on percentages for categorical outcomes and means and standard deviations for continuous outcomes. The SPAN study and survey design incorporate a multi-stage probability-based complex sampling design generating a statewide representative sample of elementary, middle, and high school students. Sampling weights and adjustment for control totals were calculated using a proportional probability of selection from school enrollment.[25] Probability weights were estimated to account for differential inclusion probabilities in cluster sampling at the school level. Weights were the inverse of selection probability for the sampling ratio at each selection stage. Poststratification weight adjustments were made to ensure that the racial/ethnic composition of the sample was the same as that of the total school enrollment in Texas. Sample design features (stratification of the selection and clustering of students within schools) were accounted for in weighting estimates and statistical tests.[24] All models account for the complex sampling and survey design described and include time (2015 or 2019 data collection period) in each of the following models.

Using a multistep-analysis approach, our goal was to examine associations of the outcome of interest (ie, meeting vs. not meeting the sleep guideline) with the primary exposure, (ie, meeting vs. not meeting the recommended screentime guideline (<120 minutes)), utilizing multiple nested logistic regressions.[33] First, a single logistic regression examined the odds of meeting the recommended sleep guideline (9-12 hours. per night) as a function of the binary independent variable of interest, meeting vs. not meeting the recommended screentime

guideline (<120 minutes), and participant sex. We included sex in this initial model because differences in the prevalence of US obesity exist by sex.[34] This model evaluated the odds of meeting the recommended sleep guideline, given that participants either met or did not meet the recommended screentime guideline after accounting for gender. Henceforth, this initial model is referred to as "Model 1". "Model 2" extended Model 1 by adding race/ethnicity as a covariate. This model allowed us to explore if race/ethnicity differentially impacted participants' odds of meeting the sleep guideline after adjusting for gender differences. Model 3 added measures of socioeconomic status, specifically school disadvantage and household parental education, to Model 2. This model allowed us to explore if socioeconomic status measures differentially impacted participants' odds of meeting the sleep guideline after adjusting for gender and race/ethnicity. Model 4 was the final logistic regression model, adding an objectively measured BMI category to Model 3. This model allowed us to explore if BMI status differentially impacted participants' odds of meeting the sleep guideline while incorporating gender, race/ethnicity, and socioeconomic status. Variables of race/ethnicity and measures of socioeconomic status were included in the final models because the literature surrounding the effects of race/ethnicity and/or socioeconomic status and health outcomes is consistent; therefore, we included these variables to examine if obesity-contributing behaviors are consistent by race/ethnicity and socioeconomic status as well.[35-37] All models included year of data (reported in the model as "time") collection by default.

Table 1. Demographics of 2nd-grade students from Texas SPAN, 2015-2016 and 2019-2020

Final Sample N= 3,193		
	n	**%**
Sex		
Male	1,449	46.2%
Female	1,690	53.8%
Race/Ethnicity		
Hispanic	1,947	62.0%
Black	289	9.2%
Non-Hispanic White/Other	903	28.8%
Highest Education in the Household		
High School Diploma or less	1,218	38.8%
Some College, Technical Degree, Associates	847	27.0%
Bachelor's Degree	700	22.3%
Graduate/Professional Degree	374	11.9%
School Level Disadvantage		
Percentage of Economically Disadvantaged	2974	74.4%
BMI Category		
Healthy (<85TH)	1,934	61.6%
Overweight (85-95TH)	476	15.2%
Obese (>95TH)	729	23.2%
Screentime Guideline		
Met	1,039	33.1%
Not Met	2,100	66.9%
Sleep Guideline		
Met	2,054	34.6%
Not Met	1,085	65.4%

All data are weighted following Texas SPAN protocols
Sleep guidelines for 6-12 yrs. (9-12 hours/night)
Screen guidelines for 6-12 yrs. (<2 hours/day)
School Disadvantage based on meeting one of the following: 1) eligible for reduced-priced meals, 2) eligible for free meals, or 3) another economic disadvantage
BMI categories based on CDC BMI growth charts

Results

Descriptive and socio-demographic information of the final sample is shown in **Table 1**. The final sample included (3193) 2nd-grade children from the combined 2015 and 2019 SPAN data collection waves. Overall, 53.84% (n= 1690) of the sample were female, and 62.03% (n=1,947) identified as Hispanic. Of the final sample, 34.57% (n= 1085) reported meeting the recommended sleep guideline, and 66.90% (n= 2,100) reported meeting the recommended screentime guideline. Parents reported their children's race/ethnicity as Hispanic 62.03% (n= 1,947), White/other 28.77% (n= 903), and Black 9.21% (n= 289). Furthermore, 38.80% (n= 1,218), 26.98% (n= 847), 22.30% (n= 700), and 11.91% (n= 374) reported their household education as high-school diploma or less, some college/associates degree, college degree, or a graduate/professional degree respectively. After utilizing the TEA and SPAN protocols for student disadvantage, 74.35% (n= 2,974) were classified as experiencing some level of economic disadvantage. Finally, 61.61% (n= 1,934), 15.15% (n= 476), and 23.22% (n= 729) were classified as healthy/underweight, overweight, and having obesity, respectively.

Table 2. Logistic Regression Results, Texas SPAN 2nd Grade Students 2015-2016 and 2019-2020 Screen-time and Sleep Recommendations

Model #	Variables	OR	95% CI		p-value
1	Sex + Time	**2.05**	**1.41**	**2.96**	**<0.01**
2	Model 1 + Race/Ethnicity	**1.71**	**1.27**	**2.31**	**<0.01**
3	Model 2 + School Disadvantage and Highest Parental Education Attainment	**1.55**	**1.18**	**2.03**	**<0.01**
4	Model 3 + BMI Category (full model)	**1.53**	**1.40**	**2.66**	**<0.01**

All models account for complex sampling and survey design
All models include time (data collection period for school years 2015-2016 & 2019-2020) as a constant covariate.
All models test the association meeting the screentime guideline has on meeting the sleep guideline while incorporating key covariates.
* p<0.05

Results of the logistic regression models examining the odds of meeting sleep guidelines are found in **Table 2.** The initial logistic regression model (Model 1) included gender and time as covariates and indicated that children whose parents reported their daily non-school screen use as less than 120 minutes were significantly more likely to subsequently meet the recommended sleep guideline (OR 2.05; 95% CI 1.41, 2.96). Model 2, which included Model 1 covariates, with the addition of race/ethnicity, indicated that children whose parents reported their daily non-school screen use as less than 120 minutes were significantly more likely to subsequently meet the

recommended sleep guideline (OR 1.71; 95% CI 1.27, 2.31). Model 3, which included Model 2 covariates, with the addition of school disadvantage and highest parental education attained, indicated that children whose parents reported their daily non-school screen use as less than 120 min were significantly more likely to subsequently meet the recommended sleep guideline (OR 1.55; 95% CI 1.18, 2.03). Model 4, which included Model 3 covariates, with the addition of the BMI category, indicated that children whose parents reported their daily non-school screen use as less than 120 minutes were significantly more likely to subsequently meet the recommended sleep guideline (OR 1.53; 95% CI 1.40, 2.66).

To further examine how included covariates impacted sleep guideline adherence, the entire Model 4 can be found in **Table 3.** This model indicated that race/ethnicity significantly impacts the odds of sleep guideline adherence. Both Black and Hispanic children experienced a

significant decrease in their odds of meeting the sleep guidelines (OR= 0.32; 95% CI 0.18, 0.58) and (OR 0.49; 95% CI 0.29, 0.83), respectively. This relationship was further explored by stratifying logistic regression models by race/ethnicity to examine how race/ethnicity may be associated with sleep and screentime guideline adherence. Stratified models can be found in

Table 3. Logistic Regression Results, Texas SPAN 2nd grade students 2015-2016 and 2019-2020 Screen Time and Sleep Guidelines Model 4

	OR	95% CI		p-value
Meeting screen time guideline*	**1.53**	**1.18**	**1.99**	**<0.01**
BMI Category				
Overweight*	**0.64**	**0.42**	**1.00**	**0.05**
Obese	0.73	0.5	1.09	0.12
Race/Ethnicity				
Black*	**0.32**	**0.18**	**0.58**	**<0.01**
Hispanic*	**0.49**	**0.29**	**0.83**	**<0.01**
School Disadvantage Quartile				
2	0.73	0.39	1.36	0.31
3*	**0.55**	**0.3**	**0.99**	**0.05**
4	0.67	0.34	1.35	0.27
Highest Parental Education				
Some College, Technical Degree, Associates	1.2	0.77	1.85	0.42
Bachelor's Degree	1.25	0.83	1.89	0.28
Graduate/Professional Degrees*	**2.29**	**1.35**	**3.88**	**<0.01**
Gender				
Female*	**0.71**	**0.53**	**0.94**	**0.02**
Time	0.72	0.5	1.04	0.08

All models include time (data collection period for school years 2015-2016 & 2019-2020) as a constant covariate.
Referent group for BMI category is "healthy weight"
Referent group for Race/Ethnicity is "White/Other"
Referent group for School Disadvantage is "lowest quartile=1" quartile 1 = lowest percent disadvantaged
Referent group for Highest Parental Education is "max high school diploma"
Referent group for Gender is "Male"
*p<0.05

Table 4. Model 1 and Model 4 are presented as a "crude" model and complete model to understand the impact of race/ethnicity better. Black children whose parent/guardians reported their screentime as less than 120 minutes were not more likely to meet subsequent sleep guidelines compared to Black children who did not meet the screentime guideline (OR 2.71; 95% CI 0.64, 11.56). Furthermore, Black children whose parent/guardians reported their screentime as less than 120 minutes were not more likely to meet subsequent sleep guidelines compared to Black children who did not meet the screentime guideline (OR 2.02; 95% CI 0.57, 7.19) when examining Model 4. Similarly, Hispanic children whose parent/guardians reported their screentime as less than 120 minutes were not more likely to meet subsequent sleep guidelines compared to Hispanic children who did not meet the screentime guideline (OR 1.18; 95% CI 0.81, 1.72). Furthermore, Hispanic children whose parent/guardians reported their screentime as less than 120 minutes were not more likely to meet subsequent sleep guidelines compared to Hispanic children who did not meet the screentime guideline (OR 1.17; 95% CI 0.82, 1.67) when examining Model 4. However, White children whose parent/guardians reported

Table 4. Stratified Logistic Regression Results, Texas SPAN 2nd grade students 2015-2016 and 2019-2020 Screen Time and Sleep Guidelines

	OR	95% CI		p-value
Black				
Model 1	2.71	0.64	11.56	0.17
Model 4	2.02	0.57	7.19	0.27
Hispanic				
Model 1	1.18	0.81	1.72	0.38
Model 4	1.17	0.82	1.67	0.39
White				
Model 1*	**3.1**	**1.27**	**7.59**	**<0.01**
Model 4*	2.3	0.93	5.7	0.07

All models account for complex sampling and survey design.
All models include time (data collection period for school years 2015-2016 & 2019-2020) as a constant covariate.
All models test the association meeting the screentime guideline has on meeting the sleep guideline while incorporating additional below covariates.
Model 1: gender + time
Model 4: gender + time + School Disadvantage + educational attainment + BMI category
* p<0.05

their screentime as less than 120 minutes were significantly more likely to meet subsequent sleep guidelines

compared to White children who did not meet the screentime guideline (OR 3.10; 95% CI 1.27, 7.59). Finally, White children whose parent/guardians reported their screentime as less than 120 minutes were significantly more likely to meet subsequent sleep guidelines compared to White children who did not meet the screentime guideline (OR 2.30; 95% CI 0.93, 5.70) when examining Model 4.

Discussion

This study examined the association of screentime guideline adherence with subsequent sleep guideline adherence using two waves of representative health data from a large surveillance study representative of Texas youth. Across all models, when controlling for a diverse set of socio-demographic variables, screentime adherence appears to be directly associated with sleep guideline adherence in this sample of 3193 2nd-grade students.

Behaviors such as screentime and sleep have been independently linked to obesity, among other health outcomes such as insulin resistance and type 2 diabetes.[38-41] Specifically, throughout the last decade, research has demonstrated that youth's time spent in front of screens is continually associated with increased body fat, lower fitness, and higher cardiometabolic risk.[42-44] The link between sleep duration and childhood obesity has been established,[38,39,45] with one extensive systematic review concluding that children with shorter sleep durations had a 58% higher risk for obesity and that with every hour increase in sleep, the risk of overweight/obesity was reduced by approximately 9%.[45] To our knowledge, this is the first study to examine screentime and sleep guideline adherence in elementary-aged children. However, Guerrero and colleagues noted that sleep duration mediated the effects of screentime on problem behaviors in a sample of more than 11,000 ten-year-old U.S. children.[46] Conversely, one systematic review of reviews concluded there is weak evidence for the association between screentime and poor sleep in children and adolescents.[47]

Findings from our stratified models to further examine how race/ethnicity may differentially impact screentime and sleep guideline adherence revealed that children who are White appear

to be contributing to both screentime and sleep guideline adherence found in model 4. Specifically, parents of White children were significantly more likely to meet sleep guidelines when their parents/guardians reported they met the screentime guideline. This finding was not evident for children who are either Black or Hispanic. Upon a deeper examination of the final sample, we found that 37.4% of White children met both screentime and sleep guidelines, as reported by their parents/guardians. In contrast, only 12.1% and 19.0% of Blacks and Hispanics, respectively met both guidelines, as reported by their parents. We suspect that the unbalanced nature of children who meet both guidelines is potentially driving the differences by race/ethnicity found in Model 4. Similarly, Guglielmo et al. concluded after a review of the literature that White youth generally had more sufficient sleep than minority youth.[48] In addition, these data indicate that race/ethnicity may be associated with sleep and screentime guideline adherence in 2nd-grade children. One potential explanation may be the intersection of socioeconomic status and race/ethnicity. When quartiling the school disadvantage variable, we found that more than 65% of children in the lowest quartile (least disadvantage) were White. Of the 374 participants whose parents reported their highest educational attainment as at least a graduate or professional degree, more than 55% of those children were also White. Research has consistently concluded that socioeconomic status and health measures are highly correlated in that those with the highest socioeconomic status consistently experience fewer adverse health outcomes compared to the lowest.[35,36] Furthermore, in the United States, researchers have noted that socioeconomic status is a significant contributor to the racial disparities in health that have been established.[49]

In light of the current findings, another consideration worth noting is how knowledge, beliefs, and attitudes may explain the observed differences by race/ethnicity. Literature examining the knowledge, beliefs, and attitudes in other disciplines, such as sexual behaviors, and vaccine efficacy, has highlighted key differences by race/ethnicity.[50,51] A recent study examining adults' knowledge, attitudes, and beliefs regarding the COVID-19 pandemic reported that COVID-19 knowledge was lower among non-Hispanic Blacks and Hispanic participants and that varied beliefs and attitudes exist among different racial/ethnic groups.[51] Given what is known regarding the sleep environment among minoritized populations, these have more sleep distractions and fewer rules regarding bedtime routines.[52,53] It is also plausible that parenting practices and the home environment may contribute to this phenomenon across the obesogenic behavior spectrum.[54,55] Thus, given the observed differences in meeting screentime and sleep guidelines by race/ethnicity, qualitative research that can help researchers and public health professionals understand these differences is warranted.

This study has several strengths, including incorporating two waves of representative data from the state of Texas. To our knowledge, this is the first study to examine the association of meeting guidelines for two obesogenic behaviors among a diverse representative sample. Finally, this study incorporated appropriate statistical analyses with follow-up stratified analysis. However, this study also has limitations. Because the SPAN study only captures one geographic region and state, the findings may not apply to other US regions or states. Power was not specifically conducted to detect differences by race; therefore results of Table 4 should be interpreted with caution. This study only included school-night sleep duration, with no indication of timing or other sleep characteristics. The cross-sectional nature of this study limits

the ability to make causal inferences about the relationship between meeting screen and sleep guidelines among children. Furthermore, this study included only 2nd-grade students, limiting generalizability to other elementary school-age children. Within this age group, surveys were completed by the parent/guardians as a proxy measure of children's self-report. This age group limited the ability to have children self-report as these reports for behaviors become more reliable with age.[56]

Conclusion

The findings presented herein highlight the potential relation that meeting one behavior guideline may have on meeting a subsequent guideline. Additional research is needed to explain a causal within-subject relationship that meeting screen guidelines may have on overall healthy sleep. Studies employing longitudinal designs should examine developmental trajectories in obesogenic behaviors and their relationship with risk for numerous health outcomes while accounting for parent rules and cultural norms. One might assume that parent rules and routines could contribute to the relationships presented herein. Furthermore, the prevalence of rules and routines may differ by socioeconomic status or race/ethnicity. Finally, public health interventions should consider numerous health obesogenic behaviors and equitable intervention pathways to impact sleep and sedentary behaviors among different populations.

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