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Television and Electronic Device Use and Overweight/Obesity Status: Children and Adolescents with and without Autism Spectrum Disorders

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Abstract Because of its association with obesity, excessive "screen time" is a concern. Children and adolescents with autism spectrum disorders (ASD's) have been found to spend much of their free time watching television more than children and adolescents without ASD's. Thus, the purpose of the current study was to determine if the time spent watching television, videos, playing video games and using other electronic devices contributed to overweight and obesity status among children and adolescents with ASD's compared to children and adolescents without ASD's. The current study analyzed data (n = 95,677) that had been previously collected through the 2011/2012 National Survey of Children's Health (NSCH). Children and adolescents with an ASD had significantly higher odds of being overweight or obese than children and adolescents without an ASD. Time watching television was a predictor of overweight/obesity status for children and adolescents both with ASD's and without ASD's. However, only children and adolescents with ASD's who used electronic devices four or more hours per day were significantly more likely to be overweight/obese than those who did not use electronic devices. A discussion of the results and limitations of the study are also provided.

Keywords Autism, Obesity, Screen Time, Television, Video Games

1. Introduction

In the United States between the years 2011 and 2012, 17.7 percent of children between the ages of 6 and 11 years were obese and 19.4 percent of youth between the ages of 12 and 19 years were reported to be obese [1]. Being overweight or obese predisposes children and adolescents to earlier onset of potentially life-threatening chronic diseases typically more common during adulthood such as Type 2 diabetes [2-3] and hypertension [4]. Thus, it is imperative to identify, control, and prevent risk factors contributing to being overweight or obese. Among the many behavioral factors contributing to increasing rates of childhood and adolescent obesity are those of increasing usage of media devices such as television and computers [5-6]. A number of current studies refer to "screen time", which is the amount of time using media by watching a screen such as television, computers, and video games [7-10].

In 2013, the American Academy of Pediatrics (AAP) recommended "limiting the total entertainment to <1 to 2 hours per day [11, p. 959]". However, the actual amount of screen time among children and youth is much higher than the recommended, with average screen time for children between the ages of 8 to 10 years old exceeding eleven hours per day [9]. Even with the increase of computers, tablets and cell phones, television remains the leading mode of screen time, accounting for greater than four hours per day [10].Furthermore, 98.5 percent of adolescents between the ages of 12 and 15 report watching television on a daily basis [12].

With the increase of screen time there has also been an increase in obesity [8]. Children who exceed the recommended two hours of screen time per day are more likely to be overweight or obese compared to children who do not exceed the recommendations [7]. It has also been indicated that children who exceed recommended screen time have increased caloric intake and decreased physical activity levels [13-15]. Increased screen time is associated with the increased number of children having televisions in their bedrooms. Currently 71 percent of children have televisions in their bedrooms [9]. Adolescents between the ages of 12 to 17 years old who have televisions in their bedrooms are more likely to exceed screen time recommendations and be overweight or obese [16-17].

Internationally, increases screen time has been associated with overweight and obesity status among children and adolescents. Among Pakistani children, engaging in sedentary activities such as watching television, using a computer, or playing video games were significantly

associated with being overweight or obese [5]. Among Canadian children, increased access to electronic devices contributed to increased body weight as well as poor sleep quality [6]. For Swedish children and adolescents, having a television in the bedroom and watching more than two hours of television per day were statistically significant predictors of being overweight, but using the computer for more than two hours per day was not significantly associated with being overweight [18].

Because of the suggested contribution between screen time and obesity, it is important to address segments of the population which may be spending more time engaged in increased sedentary activity such as watching television or using computers. Race [19-20] as well as gender and age [21] are only several of the demographic factors contributing to increased screen time. Furthermore, a perception of living in an unsupportive or unsafe neighborhood may also lead to increase screen time for children and adolescents [22-23]. However, one population which has been shown to engage in excessive screen time is that of children and adolescents with autism spectrum disorders (ASD's) [24].

Findings from a study conducted by Mazurek, Shattuck, Wagner, and Cooper [24] indicated that children with ASD's spent significantly more time playing video games than children without ASD's. This is especially concerning when considering the findings of a study conducted by Phillips et al. [25], who reported that children with ASD's not only had a higher prevalence of obesity than children without a developmental disability but also had a higher prevalence of obesity than children with other types of developmental disabilities. While sedentary activities such as the use of electronic devices have been identified as factors contributing to overweight and obesity status among the general population of children and adolescents, it is unclear if such factors influence weight status among children and adolescents with autism spectrum disorders (ASD's). In 2010, one in 68 eight-year-old children in the United States had an ASD [26]. With this high prevalence of ASD's, it is important to address the specific health behaviors of this segment of the population as well as of American children. Therefore, the purpose of the current study is to determine the association of the use of electronic media (e.g., television, computers) with overweight or obesity status among American children and adolescents with and without ASD's.

2. Materials and Methods

2.1. Study Population

For the current study, data collection methods were approved for exempt status by the Institutional Review Board at the authors' institution. The current study analyzed data that had been previously collected in the United States through the 2011/2012 National Survey of Children's Health [27-28]. The National Center for Health Statistics (NCHS) of the Centers for Disease Control (CDC) collected these data as a part of the Child and Adolescent Health Measurement Initiative [27].

The study design of the NSCH was cross-sectional [27]. Telephone numbers were randomly dialed, but only parents or guardians with at least one child 17 years of age or younger living in the household were interviewed [27]. Unique to this data collection was the random dialing of cell phone numbers in addition to landline phone numbers. Complex sampling designs, including cluster and stratified sampling techniques, had been used for data collection [27. The sample ranged from 1,811 to 2,200, resulting in a total sample size of 95,677 children and adolescents [27-29].

2.2. Variables and Measures

Exposure variables analyzed in the current study were categorical or ordinal in nature and related to screen time for children and adolescent participants in the NSCH. These variables included the amount of time (in hours) the child or adolescent spent watching television, videos, or playing video games each day and the amount of time (in hours) the child or adolescent spent using electronic devices (e.g., computers, cell phones) each day outside of their use for school work [29].

For one analysis, current ASD status was entered as an independent variable and for several other analyses, it was entered as a stratification variable. Data addressing the children's current autism status had been collected through the children's parents' or legal guardian's responses to two separate survey items [29]. First, NSCH interviewers asked the question, "Has a doctor or other health care provider ever told you that [the SHCN child] had autism, Asperger's disorder, pervasive developmental disorder, or other autism spectrum disorder? [29]" Parents or guardians had the option to respond "yes", "no", "don't know", or they could refuse to respond. Parents or legal guardians who participated in the detailed interview then responded to the question, "Does [child] currently have autism or an autism spectrum disorder?" for which parents or guardians had the same response options as with the previous autism question. For additional information, the *2011-2012 National Survey of Children's Health SAS Code for Data Users* [29] may be accessed at the following URL: http://childhealthdata.org/docs/nsch-docs/sas-codebook_-2011-2012-nsch-v1_05-10-13.pdf?sfvrsn=1.

The outcome variable was that of current overweight/obesity status. Information concerning height in inches and weight in pounds had been collected for each child and adolescent participant [29]. However, BMI category for each participant was assessed in comparison to other children and adolescents of the same gender and age as follows: underweight: less than 5th percentile; healthy weight: 5th to 84th percentile; overweight: 85th to 94th percentile; missing in error; and skip (child was under the age of 10 years). (comparing the child's weight to other children) rather than the criterion-referenced measurement used for

adults [29-30].The authors of the current study recoded the BMI category variable.as defined by the NSCH into an "Overweight/Obese" variable with three possible responses: participants with no responses (because of a legitimate skip of being under 10 years of age or the response was missing in error) were coded as "0"; participants who were underweight or were at a healthy weight were coded as "1"; participants who were overweight or obese were coded as "2".

In addition to the exposure variables of time watching television and time using electronic devices, the stratification variable of ASD status, and the outcome variable of overweight/obesity status, the authors of the current study also controlled for the covariates of race, gender, age, and neighborhood cohesion. For the covariate of race [29], responses included "Hispanic", "White, non-Hispanic," "Black, non-Hispanic", and "Multi-racial, Other, non-Hispanic". For the covariate of gender [29], responses included "Male", "Female", and "Don't know/Refuse to answer". The covariate of age [29] was measured as the age in years of the child or adolescent. Finally, the covariate of neighborhood cohesion [29] was measured as a score between 1 and 4, for which 2.25 was considered the minimum score for living in a supportive neighborhood (NSCH).

2.3. Statistical Analysis

Table 1. Distribution of Participants by Gender, Race, and Autism Spectrum Disorder Status (N = 95,677)

Characteristic	*n*	%
Gender		
Male	49219	51.44
Female	46349	48.44
Not reported	109	0.11
Race		
Hispanic	12682	13.26
White, non-Hispanic	61381	64.15
Black, non-Hispanic	8875	9.28
Multi-racial/Other, non-Hispanic	10446	10.92
Not reported	2293	2.40
Current autism spectrum disorder (ASD) status		
Does not have ASD	83515	87.29
Ever told, but not current	343	0.36
Currently has ASD	1624	1.70
Question skip (child less than 2 years of age)	10040	10.49
Don't know/refused to answer/missing in error	155	0.16

For the presentation of prevalence of overweight/obesity by current ASD status (Table 1), frequencies and percentages are provided for the three levels of the autism variable: "currently has autism", "had autism at one point but not currently", and "does not have autism". However, for multiple logistic regression analysis, only the children reported to currently have autism and children who were never told they had autism were included in the analyses.

Frequencies and percentages were calculated for summary statistics of overweight/obesity status by current autism status. However, ordinal logistic regression analyses with odds ratios were executed to determine the strength of screen time (e.g., time spent watching television and time spent using electronic devices) in predicting overweight/obesity status. In the latter analyses, current autism status (currently has autism and never had autism) was used to stratify results in the analyses examination of television and electronic device use in the prediction of overweight/obesity status. Given its ability to account for the complex sampling procedures used in the collection of NSCH data, SAS 9.2 [31] was used to execute the analysis for the current study. The authors also consulted the *2011-2012 National Survey of Children's Health SAS Code for Data Users* while conducting the analysis [29].

3. Results

Of the 95,677 children included in the NSCH, 51.4% were males, 48.44% were females, and the genders of 0.11% children were not reported (Table 1). Participants were between the ages of 0 and 17 years, with a mean age of 8.59 years (SE = 0.04). The greatest percentage (64.15%) of the children was White, non-Hispanic, followed by Hispanic (13.26%), Multi-racial/Other, non-Hispanic (10.92%), Black, non-Hispanic (9.28%), and not reported (2.40%). The number of participants who had never been diagnosed with an ASD was 85,139 (89.0%), who were less than 2 years of age and were not eligible to respond to the question was 10,446 (10.92%), and who had an ASD at the time of data collection was 1,624 (1.70%).

Because of the ordered categories of the response variable overweight/obesity status, the researchers initially used ordinal logistic regression analysis to determine the predictive strength of explanatory variables in the two regression models addressed in the current study. However, results of the score test for the proportional odds assumption indicated a significance level ($p < .0001$) for each of the regression models in the study and proportional odds across all levels of the dependent variable could not be assumed [32]. Thus, the researchers selected multinomial logistic regression to execute their analyses [32].

The first logistic regression model was developed to determine the prediction of overweight/obesity status by current autism spectrum disorder (ASD) status. Upon adjusting this model for race, gender, age of participants in years, and neighborhood cohesion score, neither having an ASD at the time of data collection nor having an ASD before data collection (but not at the time of data collection) were statistically significant predictors of overweight/obesity status compared to never having an ASD (Table 2).

The second regression model was the prediction of overweight/obesity status by daily amount of time spent

watching television or videos. Results were stratified by current ASD status at the time of the study. Results were reported only for participants who never had an ASD (Table 3) and for participants who had an ASD at the time of data collection (Table 4). The model was adjusted for race, gender, age of participants in years, and neighborhood cohesion score. Children and adolescents without ASD's who spent one hour or more hours but less than four hours (OR = 1.37; 95% CI = 1.04, 1.80; $p = 0.03$) and four or more hours (OR = 1.75; 95% CI = 1.30, 2.35; $p = 0.0002$) watching television, videos, or playing video games per day had significantly higher odds of being overweight or obese than children and adolescents without ASD's who did not spend time watching television, videos, or playing video games during the day (Table 3). Children and adolescents with ASD's who spent one hour or less (OR = 3.30; 95% CI = 1.21, 8.98; $p = 0.02$), more than one hour but less than four hours per day (OR = 3.09; 95% CI = 1.14, 8.33; $p = 0.03$), and four or more hours per day (OR = 3.63; 95% CI = 1.26, 10.44; $p = 0.02$) watching television, videos, or playing video games per day had significantly higher odds of being overweight or obese than children and adolescents with ASD's who did not spend time watching television, videos, or playing video games during the day (Table 4)

Table 2. Summary of Multinomial Logistic Regression Analysis of Autism Spectrum Disorder Status (Adjusted for Race, Gender, Age, and Neighborhood Cohesion) as a Predictor of Overweight/Obesity Status (N = 93,469)[a, b]

Characteristic	B	SE	OR	95% CI OR	Wald Statistic	p
Current autism spectrum disorder (ASD) status						
Does not have ASD (ref.)	-	-	1.00	-	-	-
Ever told, but not current	0.0870	0.34	1.09	[0.57, 2.11]	0.07	0.80
Currently has ASD	0.2631	0.18	1.30	[0.92, 1.84]	2.23	0.14
Gender						
Male (ref.)	-	-	1.00	-	-	-
Female	-0.3120	0.05	0.73	[0.66, 0.81]	38.53	<.0001
Race						
White, non-Hispanic (ref.)	-	-	1.00	-	-	-
Hispanic	0.5410	0.08	1.72	[1.47, 2.00]	47.39	<.0001
Black, non-Hispanic	0.6160	0.07	1.85	[1.62, 2.12]	78.29	<.0001
Multi-racial/Other, non-Hispanic	0.0501	0.09	1.05	[0.88, 1.25]	0.32	0.57

a: Of the 95,677 participants in the current study, observations were missing for 2,208; thus, 93,469 were entered.

b. Although responses for all participants (including those who did not report a specific ASD status, BMI class [recoded as "overweight/obesity status] race, gender, age, or neighborhood cohesion) were entered into the analysis for the current study, the authors have only reported the results for those participants who had provided specific responses to the survey items measuring these variables.

Table 3. Summary of Multinomial Logistic Regression Analysis of Daily Amount of Time Spent Watching Television, Videos, or Playing Video Games (Adjusted for Race, Gender, Age, and Neighborhood Cohesion) as a Predictor of Overweight/Obesity Status among Children and Adolescents Ages 1 to 17 Years without Autism Spectrum Disorders (N = 85,139)[a]

Characteristic	B	SE	OR	95% CI OR	Wald Statistic	p
Time spent watching TV, videos, or playing video games (per day)						
Does not watch TV or videos (ref.)	-	-	1.00	-	-	-
Spends one hour or less	0.1142	0.14	1.12	[0.85, 1.48]	0.64	0.42
Spends more than one hour but less than four hours	0.3116	0.14	1.37	[1.04, 1.80]	4.91	0.03
Spends four or more hours	0.5593	0.15	1.75	[1.30, 2.35]	13.69	0.0002
Race						
White, non-Hispanic (ref.)	-	-	1.00	-	-	-
Hispanic	0.5436	0.08	1.72	[1.47, 2.01]	46.68	<.0001
Black, non-Hispanic	0.5406	0.07	1.72	[1.49, 1.98]	57.17	<.0001
Multi-racial/Other, non-Hispanic	0.0753	0.09	1.08	[0.90, 1.29]	0.70	0.40
Gender						
Male (ref.)	-	-	1.00	-	-	-
Female	-0.2843	0.05	0.75	[0.68, 0.83]	30.65	<.0001
Age (in years)	-0.1173	0.01	-	-	139.76	<.0001
Neighborhood cohesion	0.2609	0.04	-	-	39.67	<.0001

a. Although responses for all participants (including those who did not report a specific ASD status, time spent watching television or videos, BMI class [recoded as "overweight/obesity status] race, gender, age, or neighborhood cohesion) were entered into the analysis for the current study, the authors have only reported the results for those participants who had provided specific responses to the survey items measuring these variables.

Table 4. Summary of Multinomial Logistic Regression Analysis of Daily Amount of Time Spent Watching Television, Videos, or Playing Video Games (Adjusted for Race, Gender, Age, and Neighborhood Cohesion) as a Predictor of Overweight/Obesity Status among Children and Adolescents Ages 1 to 17 Years with Autism Spectrum Disorders (N = 1,624)[a]

Characteristic	B	SE	OR	95% CI OR	Wald Statistic	p
Time spent watching TV, videos, or playing video games (per day)						
Does not watch TV, videos, or play video games (ref.)	-	-	1.00	-	-	-
Spends one hour or less	1.1932	0.51	3.30	[1.21, 8.98]	5.45	0.02
Spends more than one hour but less than four hours	1.1268	0.51	3.09	[1.14, 8.33]	4.95	0.03
Spends four or more hours	1.2878	0.54	3.63	[1.26, 10.44]	5.69	0.02
Race						
White, non-Hispanic (ref.)	-	-	1.00	-	-	-
Hispanic	-0.0082	0.51	0.99	[0.37, 2.69]	0.00	0.99
Black, non-Hispanic	1.4182	0.54	4.13	[1.44, 11.83]	6.98	0.01
Multi-racial/Other, non-Hispanic	0.0365	0.54	1.04	[0.36, 3.00]	0.00	0.95
Gender						
Male (ref.)	-	-	1.00	-	-	-
Female	-0.3052	0.34	0.74	[0.38, 1.44]	0.80	0.37
Age (in years)	0.0399	0.06	-	-	0.41	0.52
Neighborhood cohesion	0.4596	0.20	-	-	5.21	0.02

a. Responses for all participants (including those who did not report a specific ASD status, time spent watching television or videos, BMI class [recoded as "overweight/obesity status] race, gender, age, or neighborhood cohesion or were ineligible to respond to a specific survey item measuring any of these variables) were entered into the analysis for the current study. However, the authors have only reported the results for those participants who had provided specific responses to the survey items measuring these variables.

Table 5. Summary of Multinomial Logistic Regression Analysis of Daily Amount of Time Spent Using Electronic Devices (Adjusted for Race, Gender, Age, and Neighborhood Cohesion) as a Predictor of Overweight/Obesity Status among Children and Adolescents Ages 6 to 17 Years without Autism Spectrum Disorders (N = 83,515)[a]

Characteristic	B	SE	OR	95% CI OR	Wald Statistic	p
Time spent using electronic devices (cell phones, computers) per day						
Does not use electronic devices (ref.)	-	-	1.00	-	-	-
Spends one hour or less	-0.2529	0.10	0.78	[0.64, 0.94]	13.89	0.0002
Spends more than one hour but less than four hours	-0.0049	0.10	1.00	[0.82, 1.21]	0.00	0.96
Spends four or more hours	0.0371	0.11	1.04	[0.83, 1.29]	0.11	0.74
Race						
White, non-Hispanic (ref.)	-	-	1.00	-	-	-
Hispanic	0.5399	0.08	1.72	[1.47, 2.01]	45.76	<.0001
Black, non-Hispanic	0.5631	0.07	1.76	[1.53, 2.02]	62.37	<.0001
Multi-racial/Other, non-Hispanic	0.0551	0.09	1.06	[0.88, 1.26]	0.37	0.54
Gender						
Male (ref.)	-	-	1.00	-	-	-
Female	-0.3052	0.34	0.73	[0.66, 0.81]	36.28	<.0001
Age (in years)	0.0399	0.06	-	-	143.05	<.0001
Neighborhood cohesion	0.4596	0.20	-	-	41.99	<.0001

a. Responses for all participants (including those who did not report a specific ASD status, time spent using electronic devices, BMI class [recoded as "overweight/obesity status] race, gender, age, or neighborhood cohesion or were ineligible to respond to a specific survey item measuring any of these variables) were entered into the analysis for the current study. However, the authors have only reported the results for those participants who had provided specific responses to the survey items measuring these variables.

Table 6. Summary of Multinomial Logistic Regression Analysis of Daily Amount of Time Spent Using Electronic Devices (Adjusted for Race, Gender, Age, and Neighborhood Cohesion) as a Predictor of Overweight/Obesity Status among Children and Adolescents with Autism Spectrum Disorders (N = 1,624)[a]

Characteristic	B	SE	OR	95% CI OR	Wald Statistic	p
Time spent using electronic devices (cell phones, computers, handheld video games) per day						
Does not use electronic devices (ref.)	-	-	1.00	-	-	-
Spends one hour or less	0.3537	0.46	1.42	[0.58, 3.52]	0.59	0.44
Spends more than one hour but less than four hours	0.7688	0.48	2.16	[0.85, 5.49]	2.60	0.11
Spends four or more hours	1.2826	0.63	3.61	[1.05, 12.34]	4.17	0.04
Race						
White, non-Hispanic (ref.)	-	-	1.00	-	-	-
Hispanic	-0.0095	0.43	0.99	[0.43, 2.28]	0.00	0.08
Black, non-Hispanic	1.4774	0.53	4.38	[1.56, 12.32]	7.84	0.005
Multi-racial/Other, non-Hispanic	-0.0768	0.56	0.93	[0.31, 2.76]	0.02	0.89
Gender						
Male (ref.)	-	-	1.00	-	-	-
Female	-0.4299	0.35	0.65	[0.33, 1.29]	1.53	0.22
Age (in years)	-0.0065	0.06	-	-	0.01	0.92
Neighborhood cohesion	0.4948	0.21	-	-	5.39	0.02

a. Responses for all participants (including those who did not report a specific ASD status, time spent using electronic devices, BMI class [recoded as "overweight/obesity status] race, gender, age, or neighborhood cohesion or were ineligible to respond to a specific survey item measuring any of these variables) were entered into the analysis for the current study. However, the authors have only reported the results for those participants who had provided specific responses to the survey items measuring these variables

After adjusting for race, gender, age, and neighborhood cohesion score, the use of electronic devices (such as computers or cell phones) did not contribute to the same extent to being overweight or obese as watching television or videos had contributed. For children and adolescents without ASD's, using electronic devices one hour or less during the day decreased the odds of being overweight or obese (OR = 0.78; 95% CI = 0.64, 0.94; $p = 0.0002$) compared to being at a healthy weight or underweight (Table 5). However, for children and adolescents with ASD's, using electronic devices four or more hours per day (OR = 3.61; 95% CI = 1.05, 12.34; $p = 0.04$) were significantly more likely to be overweight or obese than children and adolescents with ASD's who did not use electronic devices during the day (Table 6).

4. Discussion

Philips et al. [25] reported that children in the United States with ASD's had a higher prevalence of obesity than children without ASD's. However, after controlling for race, gender, age in years, and neighborhood cohesion, having ASD was not a statistically significant predictor of being overweight or obese for the children in the United States whose data had been collected in the 2011/2012 NSCH and analyzed for the current study. Although not a statistically significant predictor of being overweight or obese, having an ASD in the current study were did contribute to an increased odds of being overweight or obese. To some degree, it is possible the smaller group size of children and adolescents with ASD's (n = 1,624) compared to children and adolescents without ASD's (n = 85,139) may have impacted the ratio for the odds between the groups of being overweight or obese.

However, because of the high prevalence of ASD's diagnosed among children in the United States, the authors of the current study examined the use of television and electronic devices as predictors of overweight/obesity status for children and adolescents with ASD's and for children and adolescents without ASD's at the time of data collection. Even after controlling for the covariates of race, gender, age of participants, and neighborhood cohesion in the current study, watching television and videos for one or more hours per day were significant predictors of being overweight or obese among children and adolescents without ASD's. However, while controlling for the covariates of race, gender, age of participants, and neighborhood cohesion watching television or videos or playing video games for any amount of time (even less than one hour per day) was a significant predictor of being overweight or obese among the children and adolescents with ASD's. These findings of the current study are consistent with those of Atkin, Sharp, Corder, Van Sluijs [7]; Sisson, Broyles, Newton, Baker, and Chernausek [16]; and Wethington, Pan, Sherry [17]. However, the authors of these previous studies had not specifically stratified their study participants by autism spectrum disorder status as done in the current study.

While time spent watching television, videos, or playing video games had a similar impact on being overweight or obese for both groups of participants (without ASD's and with ASD's}, the contribution of the use of electronic devices (such as computers, cell phones, and handheld video games) on overweight/obesity status was different for the two groups. After controlling for race, gender, age in years, and neighborhood cohesion, increased usage (specifically four or more hours per day) of electronic devices significantly increased the odds of being overweight or obese only for the children and adolescents with ASD's, which is consistent with the findings of Chahal, Fung, Kuhle, and Veugelers [6]. By contrast, using electronic devices for increased amounts of time did not significantly increase the odds of being overweight or obese among children and adolescents without ASD's, which is consistent with findings of Garmy, Clausson, and Nyberg & Jakobsson [18].

Interestingly, children and adolescents without ASD's who used electronic devices for less than one hour per day were significantly less likely to be overweight or obese than children and adolescents without ASD's who did not use electronic devices during the day. Christison and Khan [33] concluded that the use of a video game requiring children to engage in physical activity may contribute to a decrease in BMI. Thus, it is possible that the children and adolescents who spent less than one hour per day using electronic devices may be viewing a computer program or streaming a video online which encourages physical activity (e.g., a dance video geared towards children on YouTube.com [34]).

5. Study Limitations

While the current study utilized a large sample size, several limitations may exist in the data collection and analysis. First, the study design discussed in the current paper was cross sectional. However, while a cohort study may allow an observation of the time between the exposure and outcome variables, it may be difficult to recruit the large, population-based sample that may be recruited for a cross-sectional study.

Another possible limitation is the potential for bias, as data had had been collected through self-report of parents and guardians of the children and adolescents participating in the 2011/2012 NSCH. Furthermore, data had not been collected nor analyzed for all potential confounders, such as the BMI of parents or the amount of time parents spent watching television or using electronic devices. Nevertheless, the authors adjusted for common potential confounders such as gender, race, and age (as well as the less common factor of neighborhood cohesion). Additional confounders may be considered and adjusted for in future research.

Additionally, the BMI classification of underweight, normal weight, overweight, and obese was based on the BMI guidelines from the U.S. Centers for Disease Control and Prevention, which may limit the generalizability of the current study's findings to children and adolescents outside of the United States.

Finally, while responses for all participants (including those for whom a response was not provided) were included in each analysis of the current study, missing responses were not reported in the current paper (Tables 2 through 6). For example, BMI class was not reported for 51,813 participants. Nevertheless, the presented regression coefficients and odds ratios are accurate for the more than 43,000 participants who had a reported BMI class.

6. Conclusions and Recommendations

The World Health Organization (WHO) has recognized the need to address the health behaviors of individuals with ASD's:

People with ASD have the same health problems that affect the general population. Furthermore, they may have specific health care needs related to ASD or other co-occurring conditions. They may be more vulnerable to developing chronic non-communicable conditions because of behavioural risk factors such as physical inactivity and poor dietary preferences, and are at greater risk of violence, injury and abuse [35].

This statement supports the need for the current study, which examined ASD status among children and adolescents in the United States as a predictor of the amount of time spent engaging in screen time. The findings of the current study also suggest children and adolescents who spend a greater amount of time watching television or using the computer may be at greater risk of being overweight or obese. This relationship between excessive screen time and overweight/obesity status was observed to an even greater extent among children and adolescents in the current study that had ASD's. However, while data collected for the current study specified the approximate amount of time children and adolescents spent watching television or using electronic devices, they did not specify the types of television programs being watched or computer programs being used. Therefore, it may be beneficial to determine if children and adolescents with ASD's tend to watch different television programs than children and adolescents without ASD's which may be influencing other health-related behaviors, such as consuming foods with a high percentage of empty calories or promoting a lack of exercise. Furthermore, future research should use a cohort study design in order to establish the time between formal diagnosis of autism spectrum disorders and amount of time spent watching television or using electronic devices.

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