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The Effects of Family and Social Engagement on the Screen Time of Youth with Developmental Disabilities: A Dissertation

Charmaine B. Lo
University of Massachusetts Medical School

THE EFFECTS OF FAMILY AND SOCIAL ENGAGEMENT ON THE SCREEN TIME OF YOUTH WITH DEVELOPMENTAL DISABILITIES: A DISSERTATION

A Dissertation Presented

By

Charmaine Bernice Lo, MPH

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The signatures of the Dissertation Defense Committee signify completion and approval as to style and content of the Dissertation

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Stephenie C. Lemon, Ph.D., Thesis Advisor

Sherry L. Pagoto, Ph.D., Member of Committee

Molly E. Waring, Ph.D., Member of Committee

Kristin L. Schneider, Ph.D., Member of Committee

The signature of the Chair of the Committee signifies that the written dissertation meets the requirements of the Dissertation Committee

---

Carole C. Upshur, Ed.D, Chair of Committee

The signature of the Dean of the Graduate School of Biomedical Sciences signifies that the student has met all graduation requirements of the school.

Anthony Carruthers, Ph.D.,

Dean of the Graduate School of Biomedical Sciences

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Dedication

This dissertation is dedicated to my parents, Ben and Emelinda, who through their own perseverance to attain their goals and commitment to serving others inspired me to do the same in my own way. It is also dedicated to my brother Benson, whose support and belief in me never wavered on this journey.

I would also like to dedicate this work to my greatest partner and dearest friend Steve, your patience listening to me practice presentations, reluctant cooperation to learn and use People-First Language, and encouragement to fulfill my goals has meant more to me than you can know.

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ABSTRACT

Developmental disabilities (DEVDIS) such as attention deficit hyperactivity disorder (ADHD), autism spectrum disorders (ASD), developmental delay (DD), and learning disabilities, affect 14% of US youth, who also experience higher rates of obesity, approximately 19%, than youth without these conditions. Screen time is a risk factor for obesity, though it is not well-studied among youth with developmental disabilities. Youth with developmental disabilities experience challenges with learning, have underdeveloped social skills, and problematic behaviors. These predispositions can often result in peer rejection. The resulting social isolation may make these youth particularly vulnerable to engaging in solitary activities such as screen time. The objectives of this dissertation were to compare screen time rates among youth with developmental disabilities to typically developing youth and to examine the associations between social and family engagement with screen time among youth with developmental disabilities.

Data from the 2007 National Survey of Children's Health (NSCH), a national cross-sectional study that assesses the physical and emotional health of US children (N = 91,642), were used. Youth 6-17 years, with ADHD (n = 7,024), ASD (n = 1,200), DD (n = 3,276), LD (n = 7,482), and without special health care needs (n = 44,461) were studied.

Unadjusted analyses found that children with DEVDIS engage in higher rates of screen time than youth without special health care needs. For youth with DEVDIS who were medicated for their ADHD, these associations attenuated. Thus ADHD symptoms, a

common comorbidity across developmental disabilities, drove associations between the other developmental disabilities and screen time. Across all developmental disability groups, television in the bedroom was a significant screen time risk factor in both children and adolescents. Among children with ADHD, additional screen time risk factors included lack of caregiver knowledge of the child's friends and any social engagement outside of the household. Among adolescents with ADHD, additional screen time risk factors included lower frequency that caregiver attends adolescent's events and sport social engagement. Findings of this dissertation elucidate modifiable screen time risk factors that could potentially be adapted to decrease screen time among youth with developmental disabilities.

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Abstracts:

Lo, C, Lemon, S. "A comparison of screen time among youth with developmental disabilities and those without special health care needs-Results of the 2007 National Survey of Children's Health." American Public Health Association Annual Meeting in San Francisco, CA, October 2012

Lo, CB, Waring ME, Pagoto, SL, Lemon, SC. "Screen Time Behaviors among Youth with and without Developmental Disabilities." New England Science Symposium in Boston, MA, March 2013

Lo, CB, Lemon SC. "Racial ethnic differences in screen time among youth with Attention Deficit/Hyperactivity Disorder-Results of the 2007 National Survey of Children's Health." Health Disparities Research at the Intersection of Race, Ethnicity, and Disability: A National Conference in Washington, DC, April 2013

Chapter I

Introduction

Introduction

Developmental disabilities (DEVDIS) are severe chronic conditions occurring before the age of 22 that are attributed to mental and/or physical impairments and manifest in problems with language, mobility, learning, self-help, and independent living.[1] In 2006-2008, DEVDIS were reported in 15% of US children, an increase of 17% from 1997.[2] The prevalence of Attention Deficit Hyperactivity Disorder (ADHD) has increased by 33% between 1997 and 2008[2], making it one of the fastest growing DEVDIS in the US. Children with DEVDIS, and in particular those with ADHD are at increased risk of obesity.[3-5] Between 22-25% of children with ADHD are obese.[6] Consequently, the risk of obesity-related health conditions, such as diabetes, cardiovascular disease, and some cancers may also be greater among children with DD.[7]

One important determinant of overweight and obesity is sedentary behavior. Screen time, which is comprised of television (TV) viewing, video game playing, and time spent on the computer in activities not related to homework, encompasses the majority of sedentary behavior among children and adolescents. Screen time is associated with unhealthy behaviors such as snacking or consuming sugar sweetened beverages, which contributes to an increased risk of obesity, diabetes, and cardiovascular disease.[8-12] Screen time also is important to the overall health of all children because of the potential longitudinal health effects on the cardiovascular and skeletal systems as well as the social development of children.[7,13,14] The American Academy of Pediatrics recommends that children over the age of 2 years be exposed to no more than 2 hours of television and other screen-related activities per day.[15] Age is an important characteristic that affects

screen time because often parent control of TV and computer use is stronger at younger ages, but as children grow into adolescents, they gain more autonomy over their time.

The overall goal of this dissertation is to investigate screen time among youth with DEVDIS and the factors that may influence it, including: 1) to compare screen time for children and adolescents with DEVDIS to youth without special health care needs, 2) to compare how the family television environment effects screen time among youth with DEVDIS and those without special health care needs, and 3) to examine how social engagement effects screen time in a large, nationally representative sample of youth with ADHD. Investigation into the screen time of youth with ADHD is critical due to the high prevalence of this DEVDIS.

Children with DEVDIS, partly due to the limitations in their social abilities and fewer opportunities to engage with other children and adults, may be at increased risk for high engagement in sedentary behavior and in particular screen time. A case study found that adults with DEVDIS watch more television and participate in more screen-related activities than adults without DEVDIS.[16] However, there has been no research to substantiate these assertions.

The purpose of the first aim was to examine the differences in screen time, stratified by age group, among children and adolescents with DEVDIS, specifically Attention Deficit Disorder/Attention Deficit and Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), Developmental Delay (DD), and Learning Disability (LD), compared to youth without special health care needs (SHCN) in the 2007 National Survey of Children's Health. We hypothesized that children and adolescents with

DEVDIS would engage in more screen time than their peers without SHCN. The primary independent variable was DEVDIS, identified by parent-report of one of the four previously mentioned DEVDIS.

The purpose of the second aim was to compare how the family television environment effects screen time among youth with DEVDIS and those without SHCN among a nationally representative sample. We hypothesized that among youth with more positive family television environments, screen time would be lower than that of youth whose family television environments were considered to be negative. The primary independent variables that comprised the home television environment were whether or not there were rules about television programs that the youth was allowed to watch and whether or not there was a television in the youth's bedroom. Each item was analyzed separately.

The purpose of the third aim was to examine how family and social engagement affects screen time in a large, nationally representative sample of youth with ADHD. We hypothesized that among youth with ADHD who were more socially engaged with their families and outside of the home, screen time would be lower than among youth with ADHD who were not as engaged. The primary independent variables that comprised family engagement and social engagement were: (1) frequency that the caregiver attends the youth's events, (2) number of meals the household shares in a week, (3) caregiver knowledge of the youth's friends, (4) how well the youth can share/talk with the caregiver, (5) sport social engagement, (6) other social engagement, and (7) any social engagement.

1.1 Screen-related sedentary behavior

Low levels of physical activity contribute to weight gain and increased risk for obesity among children and adolescents[17-20] and consequently pose increased risk for associated chronic diseases, including diabetes, cardiovascular disease, and cancer.[21-23] Sedentary behavior, of which screen time is a major component, is important to the overall health of children and adolescents because of its inverse association with physical activity.[9,24] Additionally, a sedentary lifestyle can potentially promote other poor health behaviors such as snacking or consumption of sugar sweetened beverages[10,25-28] which can contribute to weight gain.

Sedentary activities are activities in which there is no substantial increase in energy expenditure above the resting level.[18] Sleeping, lying down, sitting, reading and television viewing, and other screen-related activities such as video game playing and computer use are considered sedentary activities. Non-school related screen-time represents time in which children could potentially spend in more active pursuits and is a behavior that has been significantly decreased in physical activity promotion studies.[29,30] Displacement of physical activity by screen time has been studied, but has not been empirically tested.[31-34] The American Academy of Pediatrics and Healthy People 2020 has put forth guidelines regarding the recommended amount of time children should spend in screen-related activities. Children aged 2 years and older should be allowed no more than 2 hours of screen-related activity per day.

1.2 Challenges in youth developmental disability population regarding screen time & sedentary time

Several factors may predispose children and adolescents with DEVDIS to high engagement in screen time-related behaviors. Variable cognitive abilities, underdeveloped social skills, problematic behaviors (i.e., impatience, aggression, and disruptive tendencies), and lack of independence are all characteristics that can influence a person with a DEVDIS' ability to be active. External contributing forces, such as a lack of inclusive programs or poorly trained staff, can also result in fewer opportunities for social engagement for children and adolescents with DEVDIS. This exclusion can potentially lead to more exposure to screen time, as a means of engagement, escape, or social interaction.[35]

There has been no scientific investigation of factors specific to the child or adolescent DEVDIS population in relation to screen time and sedentary activities. Small studies of adults with DEVDIS provide some insight into the amount of screen time adolescents with DEVDIS likely experience.[16,36] Adults with disabilities were less physically active than those without disabilities and a comparison of adults with disabilities, specifically mental retardation, living either in a group home or an institutional setting found that those in institutional settings were less active than those in a group home.[36] A small study of adults with mild mental retardation by Frey et al[16] described their perceptions of physical activity and the perceived benefits and barriers to physical activity. Of these 12 adults with mild mental retardation, 9 of them did not accrue at least 30 minutes of moderate to vigorous intensity physical activity a day, and

all of the participants reported enjoying TV viewing[16]. These studies, suggest that adults with disabilities may be more sedentary than the general population. A similar pattern may exist for children and adolescents with DEVDIS.

1.3 Importance of ADHD

Attention Deficit Hyperactivity Disorder (ADHD) is a subgroup of DEVDIS that is characterized by "developmentally inappropriate levels of inattentions and distractibility and/or hyperactivity and impulsivity that can cause impairment in adaptive functioning at home, school, or in social situations".[37,38] ADHD is one of the most prevalent DEVDIS in the US, with a 33% increase in ADHD from 5.69% in the years 1997-1999 and to 6.77% in 2006-2008.[2] The challenges that those with ADHD have regarding their behavior (e.g., interrupting others, easily distracted, not seeming to listen, and not taking turns) and behavioral issues (e.g., self-regulation and motivation) suggest that structured group-oriented physical activity may be an effective means of improving behaviors and motor skills.[39,40] Children, and especially adolescents, are more likely to be active if their friends are active[41] however, youth with ADHD often find socializing and demonstrating appropriate social behaviors challenging, which can result in a barrier to their participation in organized sports and active games.[42] The resulting social isolation, in concert with the ubiquitous nature of various screen-based entertainments, can potentially influence the amount of time that these children spend in front of a screen. Maccoby's 1951[43] frustration hypothesis posits that the more frustrated the child, the

more time the child will spend in front of the TV as a means of living vicariously through TV programs.

While not scientifically studied, anecdotal information from parents suggests that depending on the severity of ADHD, screen activities may be the only activity that a child with ADHD can engage in, while fulfilling the needs of entertainment, and social engagement. Those children with milder forms of ADHD may be more able to interact with other people and engage in other activities such as social groups or sport teams to amuse themselves, while those with more severe ADHD may find that watching television is the only activity that they can involve themselves while fulfilling their needs for social interaction. Consequently, careful examination of the severity of ADHD will be important to the analysis because of the potential differential effects on screen time. Additionally, the high prevalence of ADHD in youth with DEVDIS and high co-morbidity with other DEVDIS warrant special attention.

Table 1.1 Co-morbidity of ADHD with other DEVDIS in the 2007 National Survey of Children's Health

	ADHD
ASD	45.6%
DD	41.4%
LD	45.2%

1.4 Social Engagement

Difficulties with social skills are challenges faced by children and adolescents with DEVDIS that can limit their participation and engagement with others. This can unintentionally promote social isolation and screen time. TV and other screen-based activities can provide a means of socialization and is an activity that entertains and engages the viewer.[43] The displacement hypothesis, first described by Williams in 1986[31] and later by Neuman in 1988[32], is the assumption that time spent watching TV displaces the time that could be spent in other pursuits. A study in obese children found that promoting physically active behaviors resulted in reductions in time spent in sedentary activities.[20] However, Vandewater et al.[44] used data from a 1997 nationally representative sample of children (NHIS) between 0-12 years and found that despite the common assumption of time-use displacement, overall, TV did not interfere with time spent reading or in active play. These inconsistent results and the limitations associated with these studies (e.g., the variable validity of the measures used, biased reporting of time use) suggest that greater research efforts to establish or refute this commonly accepted assumption are needed.[34] It may well be that screen-time contributes to the decrease in physical activity, but it may not be the only cause. Additionally, none of this work has investigated if the displacement hypothesis holds true for youth with DEVDIS, specifically ADHD, whose patterns and uses of screen activities may be different from the general population of children.

1.5 Family Engagement

Family engagement in this study is defined as, how often a parent attends the child's events and activities, the number of days in the past week that members of the household had meals together, knowledge of the child's friends, and how well ideas can be shared between the parent and child. Recently, there has been exploration into how screen time affects the quality of relationships between family and friends.[45-48] A study in New Zealand that compared the effect of screen time on parental attachment found that for every extra hour of TV viewing, there was a 4-13% increase in the risk of low attachment to parents, and a 24% increased risk of low attachment to peers.[46] A European study of family engagement found that family engagement characterized by greater child autonomy is associated with a 9% increase in the risk of viewing more than 2 hours of TV daily and a 19% increase in the risk of playing more than 1 hour of computer games.[48] An American study of 160 adolescent-parent pairs of screen time rules among a convenience sample of adolescents and their families found that having TV rules, and especially parent-adolescent agreement to these rules, was associated with lower rates of TV viewing.[45] These findings, coupled with Salmon et al.[49] who found that the relationships between TV and the family environment to be complex, suggest that the association of a range of family engagement variables with screen time is less clear. Furthermore, none of these studies has looked into families that have a child or adolescent with a developmental disability, where children may be more socially isolated than their peers, and use of screen time may differ greatly than the general population. This is particularly relevant because TV is potentially a socially isolating activity, which could lead to greater social isolation for children with DEVDIS. Bickham and Rich[35]

found that in typically developing children between the ages of 6 and 12 years, the more time they spent watching television by themselves, the less time they spent with their friends or family participating in other activities. Family engagement's role in screen time in the general population is unclear, though the evidence tends to suggest that the there is some connection. However, in families that have a child with ADHD, there is insufficient evidence to estimate the strength of this connection.

1.6 Summary

The proposed study examines an important health issue, screen time, in an understudied and vulnerable population, children and adolescents with DEVDIS. Significant amounts of screen time can influence weight and the isolating nature of screen activities can impede socialization opportunities, which are critically important to the general health of children, especially those with ADHD and other DEVDIS. Additionally, some researchers posit that time spent watching television or in other screen-related activities is time that could be spent in other pursuits such as social engagement, physical activity, or more creative outlets (e.g., imaginative play). There has been no previous investigation of screen time in youth with DEVDIS in nationally representative samples, and overall markedly few studies are available on this topic relevant to this population. Research in populations with DEVDIS and ADHD is particularly important because these youth may be predisposed to a more sedentary and isolated lifestyle and are at increased risk for obesity. Next steps into furthering the research in this area should include identifying and establishing the factors that are promoting screen time and deterring physical activity in

this population. Only then can interventions be designed to promote more physically active and socially engaging programs to improve not only the health and wellbeing of these children, but encourage greater inclusion in society.

This dissertation will use data from the 2007 National Survey of Children's Health (NSCH) to examine screen time rates among youth with DEVDIS and without SHCN, investigate the effects of the family television environment on the screen time of youth with DEVDIS, and finally examine the effects of family and social engagement on youth with ADHD.

The NSCH is a nationally representative probability sample sponsored by the US National Center for Health Statistics and the US Maternal and Child Health Bureau. Some of the advantages of this dataset for this dissertation are its inclusion of children and adolescents of all health conditions, large sample size, and measures of screen time, social engagement, and family engagement. The overall purpose of the 2007 NSCH is to obtain information on various aspects (e.g., physical, emotional, and behavioral) of children's health and other factors, such as family engagement, community, and health systems at a state and national level [50]. The State and Local Area Integrated Telephone Survey (SLAITS) program, within the Centers for Disease Control and Prevention's (CDC) National Center for Health Statistics, is a surveillance system monitoring the health of the nation at a state and local level, and conducts the NSCH [50]. SLAITS-trained interviewers use a random-digit-dial telephone survey approach and employ a computer-assisted telephone interview (CATI) to reach around one million households across the US. SLAITS then screens for the existence of children in the household (ages 17 years

and younger), conducts the National Immunization Survey, if participants are eligible, and then proceeds with the NSCH. In households with multiple children under the age of 18 years in residence, one child is randomly selected to be the subject of the survey. After the child was selected, respondents were asked to identify the parent or guardian living in the household who knows the most about the health and health care of this child. SLAITS aims to obtain 1,700 complete interviews in each state. Data collection lasted from April 2007-July 2008, and a total of 91,642 interviews were completed in English, Spanish, Chinese, Korean, and Vietnamese [50]. The national response rate to the survey was 46.7% [50].

Chapter II

Screen time behaviors among youth with and without developmental disabilities

2.1 Abstract

Background: Developmental disabilities affect 14% of US youth. Youth with developmental disabilities experience higher rates of obesity. However, the association of developmental disabilities with screen time, an important obesity risk factor, has not been studied.

Objective: To compare screen time behaviors between youth with developmental disabilities and those without special health-care needs (SHCN).

Methods: Data from the 2007 National Survey of Children's Health (n=56, 004 aged 6-17 years), were used. Four developmental disabilities were evaluated: attention deficit hyperactivity disorder (ADHD), autism spectrum disorders (ASD), developmental delay (DD), and learning disabilities (LD). Multivariate linear regression models, stratified by two age groups (6-11 years and 12-17 years), compared weekday minutes of screen time between youth with developmental disabilities and without SHCN.

Results: Among children, those with ADHD (β=26.5 min/day; 95%CI=12.5-40.5), ASD (β=34.0 min/day; 95%CI=-0.3-68.2), and LD (β=24.3 min/day; 95%CI=10.2-38.5) had significantly more screen time than those without SHCN. After adjustment for confounders including ADHD medication use, only children with ADHD had higher screen time (β=34.1 min/day; 95%CI=-0.9-69.0). Screen time was significantly higher among adolescents with ADHD (β=18.7 min/day; 95%CI=4.8-32.7) compared to those without SHCN. However, in fully-adjusted models, developmental disabilities were not associated with increased screen time among adolescents.

Conclusions: Screen time behavior is universally high among youth. Our findings suggest that ADHD is the primary developmental disability impacting screen time behavior. Given the high rates of ADHD comorbidity among children with other developmental disabilities, it is important to target interventions aimed at reducing screen time at youth with these conditions.

Key Words: developmental disabilities, screen time, children with special needs, health needs

2.2 Introduction

Childhood obesity is a major health concern in the United States. Over the past 20 years, the prevalence of childhood obesity has tripled, reaching 16.9% among youth ages 2 to 19 years in 2009-2010.[51,52] Childhood obesity increases risk of developing chronic diseases such as diabetes, cardiovascular disease, and cancer later in life.[21-23,53] Sedentary behavior has been implicated in the development of obesity in children.[18,54,55]

Screen time, which is comprised of television viewing, video game playing, and leisure computer use encompasses a great amount of sedentary behavior among children and adolescents.[26] The American Academy of Pediatrics (AAP) recommends that youth over 2 years be exposed to no more than 2 hours of entertainment television and other screen-related activities per day.[16] However, screen time is the most common leisure activity among youth, with an estimated 49% children aged 6 to 11 years and 56% of adolescents aged 12 to15 years engaging in more than 2 hours of screen time daily.[56] Screen-time behavior is associated with lower rates of physical activity,[29,30,57] thus non-school related screen-time represents time youth could potentially engage in more active behaviors.

Fourteen percent of U.S. children and adolescents have a developmental disability, such as attention deficit hyperactivity disorder (ADHD), autism spectrum disorders (ASD), developmental delay (DD) and learning disabilities (LD).[2] Youth with these conditions experience higher rates of obesity, 18.9-19.7%, than those without these conditions, but it is not clear why.[4,58-63] Several factors associated with developmental disabilities, such as difficulty with mobility, difficulty learning, variable cognitive ability, underdeveloped social skills, and lack of independence[1] may predispose youth with

developmental disabilities to high engagement in screen time. Screen-based entertainments are activities that require little to no social interaction, thereby appealing to youth with social difficulties, such as youth with autism spectrum disorders.[64] The challenges that youth with developmental disabilities have, coupled with the ease of availability and variety of screen time activities, may contribute to elevated rates of sedentary time.

To date, however, there has been no empirical investigation of screen time among children and adolescents with developmental disabilities. The purpose of this study is to compare screen time behaviors among children and adolescents with developmental disabilities, including ADHD, ASD, DD and LD, to those youth without developmental disability or additional special health care needs.

2.3 Methods

2.3.1 Study Design

This study used data from the 2007 National Survey of Children's Health (NSCH), a nationally representative cross-sectional study that assessed the physical and emotional health of youth ages 0-17 years. The NSCH, conducted by the National Center for Health Statistics and the Maternal and Child Health Bureau of the Health Resources and Services Administration, was administered via random digit dial telephone survey. The Centers for Disease Control and Prevention's State and Local Area Integrated Telephone Survey program administered the survey. The study protocol first identified households with at least one child 0-17 years old. In eligible households, one child was randomly selected for inclusion, and the adult in the household identified as most

knowledgeable about the child's health and activities completed the interview. Interviews were conducted in English, Spanish, and four Asian languages. 91,642 interviews were conducted between April 2007 and July 2008. The NSCH dataset is publically available. The University of Massachusetts Medical School's Institutional Review Board approved this study.

2.3.2 Study Sample

Figure 2.1 depicts the NSCH sample included in the present study. The sample was restricted to youth aged 6-17 years. Compared to younger children, youth in this age range have similar opportunities for exposure to screen time given their similar school schedules and the increased availability of after-school activities and care. Furthermore, a diagnosis of a developmental disability is more likely and more accurate among youth ages 6 years and older.[65] We compared youth with the four developmental disabilities: ADHD, ASD, DD, and LD, to youth without special health care needs. A special health care need was determined using the Child with Special Health Care Needs Screener. This screener is a five item, parent-reported tool designed by the Maternal and Child Health Bureau as a consequence-based definition for youth with a current special health care need stemming from a physical, mental, behavioral, or other type of health condition lasting at least 12 months.[66] Among youth with none of the developmental disabilities under study, youth with special health care needs (n = 8,072) were excluded from the comparison group, resulting in an analytic sample of 56,004 youth.

2.3.3 Measures

Developmental Disabilities

Four developmental disabilities were assessed. Identification of the first three developmental disabilities stemmed from a series of items that asked the responding parent/guardian "Has a doctor or health care provider ever told you that [sampled youth] had [condition]?" This question was asked individually for attention deficit hyperactive disorder (ADHD); autism, Asperger's disorder, pervasive developmental disorder, or other autism spectrum disorder (ASD); and any developmental delay that affects the ability to learn (DD). An additional item asked, "Has a doctor, health care provider, teacher, or school official ever told you that [sampled youth] had a learning disability (LD)?" Each developmental disability was a dichotomous variable, in which the comparison group was children without SHCN.

Screen Time

Screen time was assessed by two items in which the parent/guardian respondents reported on the amount of time that the sampled youth spends on the average weekday watching television or playing video games, and using the computer unrelated to homework. A single variable was created by summing the responses of these two items. Screen time was used analytically in two ways. The first was a continuous measure of average screen time in minutes per weekday. An additional binary categorical variable defined in accordance with the maximum of 2 hours of screen time daily recommended by the AAP[15] was created: less than or equal to 2 hours (within guidelines) and exceeding 2 hours (exceeds guidelines).

Covariates

Potential confounding variables included youth age, gender, race/ethnicity, physical activity, body mass index (BMI), family-related factors, and ADHD medication use. Physical activity was assessed by a single item that asked "During the past week, on how many days did [sampled youth] exercise, play a sport, or participate in physical activity for at least 20 minutes that made [him/her] sweat and breathe hard?" BMI was calculated from respondent-reported height and weight and categorized as underweight (less than the 5th percentile), normal weight (5th percentile to less than the 85th percentile weight), overweight (85th to less than the 95th percentile), and obese (equal to or greater than the 95th percentile).[67] BMI was provided only for youth 10 years old and older.[50]

Several family-related factors were included as potential confounders due to their observed associations with youth screen time: relationship of the respondent to the child, family structure,[68] the number of siblings of the sampled youth,[44,69,70] family TV environment,[45,68,71-77] and family's socioeconomic status (SES). Family structure variable was categorized as two parents, single mother, and other family structure. The number of siblings of the sampled youth ages 17 years and under residing in the household was also assessed. Family TV environment included television rules in the household and whether there was a television in a youth's bedroom. Family socioeconomic status (SES) was assessed by an indicator of percentage above/below the federal poverty level, which was collapsed into four categories: at or below 100% poverty, above 100% to at or below 200%, above 200% to at or below 400%, and above 400%.

Because ADHD medication allows those affected with ADHD to concentrate and control their attention problems, it is thought that ADHD medications may impact screen

time and have been previously associated with weight status.[4,6] ADHD was highly comorbid with the other conditions assessed in this study (ASD = 45.6%; DD = 41.4%; LD = 45.2%). In analyses assessing the association of developmental disabilities with screen time, medication use for ADHD was considered a confounder. ADHD medication usage was assessed by the question "Is [sampled youth] currently taking medication for ADD or ADHD?"

2.3.4 Statistical analysis

Analyses were stratified by two age groups: middle childhood (6-11 years) and adolescence (12-17 years) because the social, emotional, and education needs differ for youth in middle childhood and adolescence, and with increasing age, youth gain independence, so their choices in how they spend their leisure time are increasingly autonomous. Within age strata, a comparison of the characteristics of youth with each of the four developmental disabilities to youth without SHCN was performed by t-tests and one-way ANOVA. Linear regression models were constructed to assess the association between the developmental disability and daily minutes of screen time. Because screen time was not normally distributed, a log-transformed total screen time variable was created. However, the results were similar to the non-transformed results (data not shown), and are not presented for ease of explanation. Logistic regression models of the association between each developmental disability with the outcome of adherence to AAP screen time guidelines were computed.

For each developmental disability, unadjusted models were first constructed (Model 1). Two sets of adjusted models were then created. The second set of models (Model 2)

adjusted for youth demographic factors, youth physical activity levels, and family-related factors. BMI was also adjusted for in the adolescent models, but because BMI data was unavailable for children under 10 years, BMI was not included as a covariate in the middle childhood models. Finally, the third model (Model 3) adjusted for ADHD medication use in addition to the covariates included in Model 2.

The NSCH provides sampling weights that were applied to these analyses to generate nationally-representative estimates. These weights adjust for non-response (i.e., unknown household status, unknown household eligibility, households with more than one child, incomplete interview of the sampled youth), non-coverage of youth in non-landline telephone households, and multiple telephone lines in a household. All analyses were performed using STATA 12 (StataCorp, College Station, Texas).

2.4 Results

2.4.1 Sample Description

Children were on average aged 8.5 years, 48.7% were female, and 54.8% were non-Latino white (Table 2.1). Children with ADHD (n = 2,471), ASD (n = 583), DD (n = 1,472), and LD (n = 2,667) were more likely to have a single mother and be of lower SES than children without SCHN (n = 20,082). Among adolescents, the mean age was 14.5 years, 48.8% were female, and 57.6% were non-Latino white (Table 2.2). Adolescents with a developmental disability were significantly more likely to have a single mother and be of lower SES than adolescents without SHCN.

2.4.2 Screen Time Behavior

Children spent an average of 142.3 (95% CI=138.4, 146.3) minutes per weekday engaged in screen time while adolescents spent an average of 199.8 (95% CI=195.9, 203.8) minutes per weekday. Among both children and adolescents, television viewing accounted for more screen time (children: 103.8 min/day; adolescents: 115.0 min/day) than computer use (children: 38.9 min/day; adolescents: 84.9 min/day). Among children, 46.3% with ADHD, 40.6% of children with ASD, 41.1% with developmental delay, and 46.6% with a learning disability exceeded the AAP's guideline of no more than 2 hours of screen time daily; 38.2% of children without SHCN exceeded this guideline. Among adolescents, 61.1% with ADHD, 67.8% with ASD, 63.0% with developmental delay, and 61.4% with a learning disability exceeded the guideline while 57.1% of adolescents without SHCN exceeded the guideline.

Children aged 6-11 years with ADHD (172.4 minutes/day; 95% CI=158.3, 186.6), ASD (176.4 minutes/day; 95% CI=137.3, 215.5), and LD (171.3 minutes/day; 95% CI=156.5, 186.0) had comparable total screen time and were higher than those with DD (156.9 minutes/day; 95% CI=139.4, 174.4; Figure 2.2). Each of these groups reported higher rates of screen time compared to children without SHCN (137.8 minutes/day; 95% CI=133.1, 142.5).

Adolescents with ADHD (225.0 minutes/day; 95% CI=212.5, 237.5) and ASD (222.8 minutes/day; 95% CI=198.9, 246.7) reported comparable total screen time, and these rates were higher than those adolescents with DD (210.0 minutes/day; 95% CI=195.3, 224.7) and LD (213.6 minutes/day; 95% CI= 202.4, 224.7; Figure 2.2). The

four developmental disability groups all reported higher rates of total screen time than adolescents without SHCN (195.6 minutes/day; 95% CI=190.8, 200.4).

2.4.3 Linear Regression Models

Among children, those with ADHD (β=26.5 min/day; 95%CI=12.5-40.5), ASD (β=34.0 min/day; 95%CI=-0.3-68.2), and LD (β=24.3 min/day; 95%CI=10.2-38.5) had significantly more screen time than those without SHCN (Table 2.3, Model 2). After adjustment for ADHD medication use, these associations attenuated (Table 2.3, Model 3). Screen time was significantly higher among adolescents with ADHD (β=18.7 min/day; 95%CI=4.8-32.7) compared to those without SHCN (Table 2.3, Model 2). However, after adjusting for ADHD medication use, this association was no longer statistically significant (β=14.6 min/day; 95%CI=-0.89-38.1; Table 2.3, Model 3).

2.4.4 Logistic Regression Models

There were no differences in screen time above 2 hours daily between children with ADHD (OR=1.1; 95%CI=0.7-1.7), DD (OR=1.0; 95%CI=0.7-1.4), and LD (OR=1.2; 95%CI=0.9-1.5) and those without SHCN after adjustment for covariates including ADHD medication use. However, children with ASD (OR=1.6; 95%CI=1.1-2.3) were significantly more likely to exceed 2 hours of daily screen time than children without SHCN. Among adolescents, in the fully-adjusted models, those with ADHD (OR=0.9; 95%CI=0.6-1.4), ASD (OR=1.3; 95%CI=0.7-2.5), DD (OR=1.0; 95%CI=0.7-1.5) and LD (OR=1.1; 95%CI=0.9-1.4) had similar likelihood of exceeding 2 hours of screen time daily as their peers without SHCN.

2.5 Discussion

To our knowledge, this is the first study to compare the screen time behavior of youth with and without developmental disabilities among a nationally representative sample. Screen time differences observed between children in middle childhood and adolescence suggests that as children age and gain independence, regardless of developmental disability status, screen time increases.

Youth with ADHD had the highest reported rates of total screen time among both age groups in the regression models. In analyses adjusted for ADHD medication use, children with ADHD also had significantly higher rates of screen time behavior than did those without SHCN; whereas, there were no differences amongst adolescents. Previous studies have found inconsistent associations between television watching and ADHD.[78,79] Possible explanations for the association between this disorder and screen time include: difficulties in behavior that isolate children from others; the capability of screen-based entertainments to engage attention for long periods of time; and the goal-focused nature of video games that increase motivation, attention, and effort in youth with ADHD.[80] The attenuating effect of medication use suggests that symptom management may be helpful in reducing symptoms that lead to increased screen time behavior. Further research is needed to explore the reasons that youth with ADHD have for engaging in screen time, and the potentially therapeutic benefit, such as modeling of desired behaviors, that can be conveyed by screen-based entertainments. Once medication is accounted for, investigation into household screen time rules, structure, and supervision may provide opportunities to further reduce total screen time.

Children with ASD, DD and LD had higher rates of screen time than children without SHCN in unadjusted analyses and analyses that adjusted for socio-demographic and family characteristics. However, when ADHD was controlled for, screen time rates among the other disability groups were comparable to youth without SHCN. ADHD was highly comorbid with each of the other developmental disabilities (ASD = 45.6%; DD = 41.4%; LD = 45.2%). These results suggest that ADHD is driving screen time behavior among children with ASD, DD, and LD. In future work developing interventions to reduce screen time in youth with developmental disabilities, treating ADHD with medications or behavior modification should be considered.

This study has limitations including the cross-sectional design of the NSCH. This makes it difficult to infer if differences observed across age strata are due to cohort and/or period effects. Parent-reported developmental disability status may be prone to inaccuracies. However, several nationally representative studies have used this approach[4,61,81] and demonstrated acceptable concordance between parent report and clinical determination.[82-84] Duration of ADHD medication was not reported which could have a marked effect in adolescents compared to younger children, as the consistent use of medication is therapeutic.[85,86]

Only weekday screen time was assessed, leaving open the question of how weekend screen time varies among youth with and without developmental disabilities.[87] Parent-reported screen time likely underestimates actual screen time due to recall and report bias. Further, parents of youth with a developmental disability may be more mindful of how their child spends his/her free time and therefore may report more accurate rates of

screen time. Parents of youth with no special health care needs, particularly adolescents, might be unaware of how time is spent by their children outside of the home, and be more likely to under-report screen time.

Furthermore, screen time may be underestimated in the NSCH as hand held devices, cell phones, and tablet devices were not included. However, because the data were collected in 2006-2007, such devices were not nearly as prevalent as they are currently, and so these data are likely accurate for the time.[88,89] Future studies examining screen time behavior will need to measure a broader range of screen-based technologies to enhance measurement accuracy.

Despite these limitations, this study adds to the literature by being the first to report and compare prevalence estimates of screen time among a nationally representative sample of youth with developmental disabilities and without SHCN. Youth with developmental disabilities spend a significant amount of time in front of a screen, with higher rates among older youth. Children and adolescents with a developmental disability are already at an increased risk for chronic diseases, and sedentary behavior may compound that risk.[21-23,53] Our findings suggest that ADHD is the primary developmental disability impacting screen time behavior. Given the high rates of ADHD comorbidity among children with developmental disabilities, it is important to target interventions aimed at reducing screen time at youth with these conditions.

Figure 2.1 Flow Chart

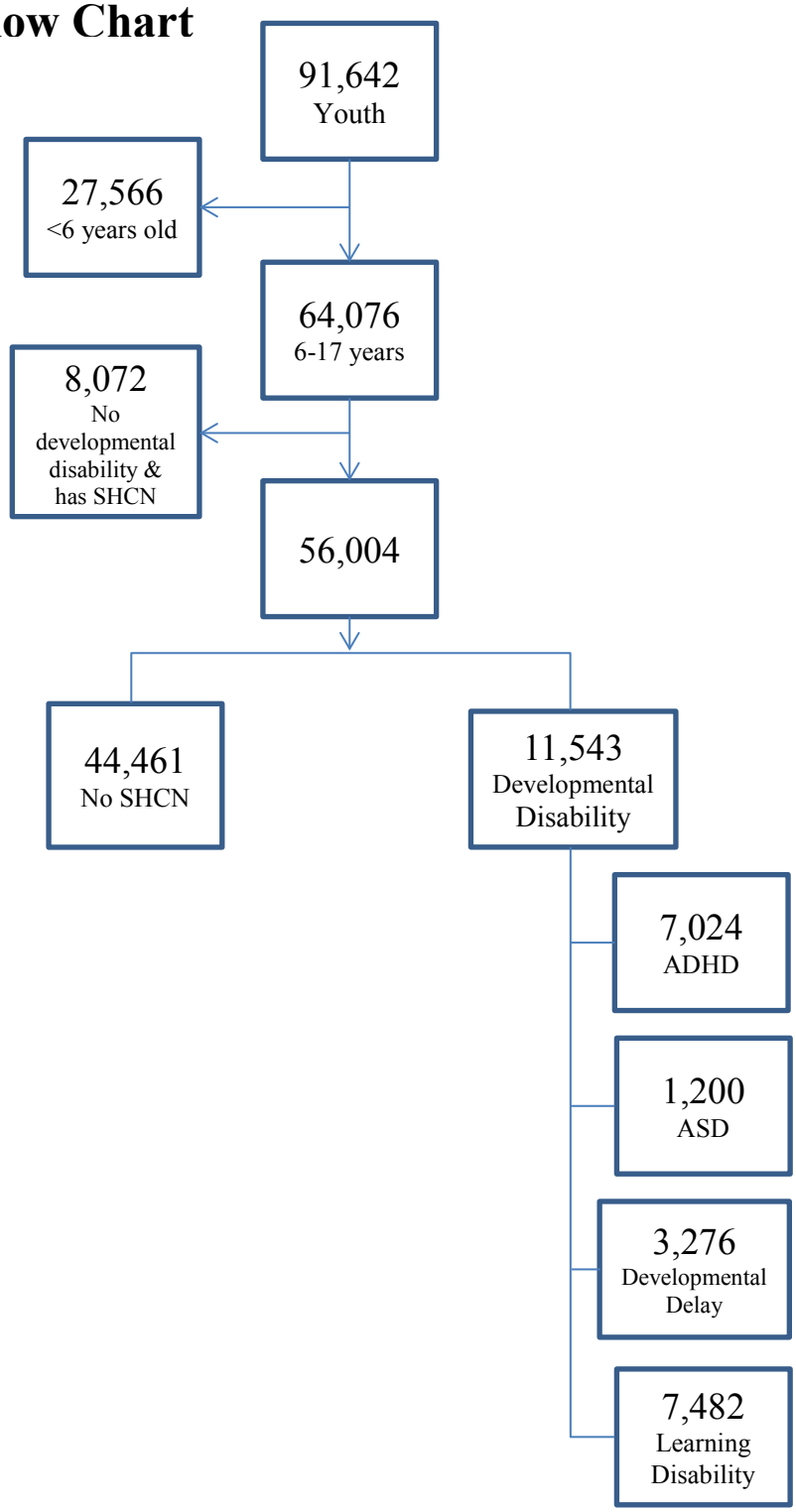

Table 2.1 Characteristics of Children Aged 6-11 Years (N = 27,792), M(SD) or %

	Total %	**ADHD** n = 2,471 %	**ASD** n = 583 %	**DD** n = 1,472 %	**LD** n = 2,667 %	**w/o SHCN** n = 20,082 %	**p-value**
Weighted n		1,648,011	524,531.5	1,426,926	2,482,339	17,145,387	
Characteristics of Youth							
Age (mean [95%CI])[b]	8.5 (8.5-8.5)	9.0 (8.9-9.1)	8.7 (8.3-9.0)	8.6 (8.4-8.8)	8.9 (8.8-9.0)	8.4 (8.4-8.5)	0.001
Sex							0.001
Male	51.2	74.0	79.6	65.6	64.8	47.6	
Female	48.7	26.0	20.4	34.4	35.2	52.2	
Race/Ethnicity							0.001
White, Non-Latino	54.8	61.1	61.9	55.9	50.5	53.7	
Black, Non-Latino	14.0	16.7	13.8	18.9	17.7	13.0	
Other, Non-Latino	9.4	6.8	4.5	6.3	6.4	10.2	
Latino	20.0	12.9	13.3	17.0	22.7	21.1	
# of Days in Past Week in Vigorous Physical Activity (mean [95%CI]) [b]	5.6 (5.3-5.8)	4.9 (4.7-5.1)	4.5 (4.0-4.9)	4.8 (4.6-5.1)	4.6 (4.4-4.8)	4.8 (4.7-4.9)	0.52
Family Structure							
Respondent Relationship to Child							0.03
Mother	74.4	75.8	81.7	79.1	79.1	73.4	
Father	19.3	14.7	13.9	14.8	14.2	20.5	
Other	6.4	9.4	4.4	6.0	6.7	6.0	
Family Structure							0.001
2 Parent	74.5	59.9	65.6	59.5	61.7	77.9	
Single Mother	18.5	30.1	29.5	30.9	30.5	15.7	
Other	7.0	10.0	4.9	9.6	7.8	6.4	
# Siblings Living in Household							0.12
0	14.6	18.6	17.4	17.6	16.7	13.7	

Table 2.1 Characteristics of Children Aged 6-11 Years (N = 27,792), M(SD) or %

	Total %	**ADHD** n = 2,471 %	**ASD** n = 583 %	**DD** n = 1,472 %	**LD** n = 2,667 %	**w/o SHCN** n = 20,082 %	**p-value**
1	41.0	39.2	42.8	38.8	37.1	41.9	
2	30.6	30.3	26.0	29.0	31.1	30.4	
3+	13.8	11.9	13.2	16.7	15.1	14.1	
Family SES							
Derived Poverty Level							0.001
At or below 100%	18.9	25.5	24.7	29.3	32.0	17.0	
Above 100% to at or below 200%	20.2	23.0	18.5	20.4	22.3	20.3	
Above 200% to at or below 400%	31.8	28.6	32.9	27.8	26.3	32.0	
Above 400%	29.2	22.9	23.9	22.3	19.4	30.8	
Family TV Environment							
TV Program Rules	93.1	93.6	88.6	92.7	90.7	93.2	0.32
TV in Child's Bedroom	44.6	56.1	52.0	50.7	55.2	42.3	0.001

[a]Sample weights were applied to estimates in order to be representative of US children.
[b]95%CIs around proportions are within +/- 2 percentage points.

Table 2.2 Characteristics of Adolescents aged 12-17 Years (N = 25,580), M(SD) or %

	Total %	ADHD n = 4,553 %	ASD n = 617 %	DD n = 1,804 %	LD n = 4,815 %	w/o SHCN n = 24,379 %	p-value
Weighted n		**2,334,305**	**393,128.3**	**1,234,356**	**3,490,533**	**17,214,569**	
Characteristics of Youth							
Age (mean [95%CI]) [b]	14.5 (14.5-14.5)	14.6 (14.5-14.8)	14.1 (13.8-14.4)	14.6 (14.3-14.8)	14.5 (14.4-14.7)	14.5 (14.4-14.5)	0.001
Sex							0.001
Male	51.0	68.7	74.9	68.5	66.6	47.5	
Female	48.8	31.1	25.1	31.4	33.1	52.3	
Race/Ethnicity							0.001
White, Non-Latino	57.6	63.8	59.8	56.2	57.0	56.0	
Black, Non-Latino	15.6	15.6	17.6	15.1	16.7	15.7	
Other, Non-Latino	7.1	8.3	7.2	8.4	5.9	7.5	
Latino	18.1	10.9	14.1	17.5	18.9	19.1	
# of Days in Past Week in Vigorous Physical Activity (mean [95%CI]) [b]	5.3 (4.9-5.7)	3.8 (3.7-4.0)	3.2 (2.6-3.7)	3.7 (3.3-4.0)	3.7 (3.5-3.9)	4.1 (4.0-4.2)	0.005
BMI for Age Classification							0.001
Underweight	4.4	3.6	9.0	6.1	6.0	4.4	
Normal Weight	66.4	61.0	51.1	53.9	58.7	68.4	
Overweight	14.7	16.1	16.3	16.2	14.6	14.4	
Obese	14.5	19.4	23.5	23.9	20.7	12.8	
Family Structure							
Respondent Relationship to Child							0.001
Mother	74.5	76.0	72.9	77.2	77.5	73.7	
Father	18.4	14.0	16.2	14.6	13.0	20.1	
Other	6.7	10.0	10.8	8.0	9.4	6.2	

Table 2.2 Characteristics of Adolescents aged 12-17 Years (N = 25,580), M(SD) or %

	Total %	ADHD n = 4,553 %	ASD n = 617 %	DD n = 1,804 %	LD n = 4,815 %	w/o SHCN n = 24,379 %	p-value
Family Structure							0.001
2 Parent	71.4	59.6	64.4	62.0	59.9	74.6	
Single Mother	21.5	30.2	24.8	29.0	30.9	19.4	
Other	7.1	10.3	10.8	8.9	9.2	6.3	
# Siblings Living in Household							0.10
0	29.4	33.4	34.6	34.8	32.5	28.3	
1	37.3	38.5	29.0	35.7	37.1	37.5	
2	23.8	20.8	28.4	18.5	21.2	24.4	
3+	9.5	7.3	7.9	11.1	9.3	9.8	
Family SES							
Derived Poverty Level							0.001
At or below 100%	15.6	18.8	11.8	21.8	20.7	14.6	
Above 100% to at or below 200%	21.0	22.0	25.5	22.4	26.2	20.6	
Above 200% to at or below 400%	32.8	30.9	33.8	35.7	30.8	33.6	
Above 400%	30.6	28.2	28.8	20.2	22.3	31.2	
Family TV Environment							
TV Program Rules	78.8	81.8	78.0	81.6	80.5	78.4	0.40
TV in Child's Bedroom	55.6	61.0	47.6	60.2	62.8	53.8	0.001

[a]Sample weights were applied to estimates in order to be representative of US children.
[b]95%CIs around proportions are within +/- 3 percentage points.

Figure 2.2. Screen Time and Developmental Disability Group

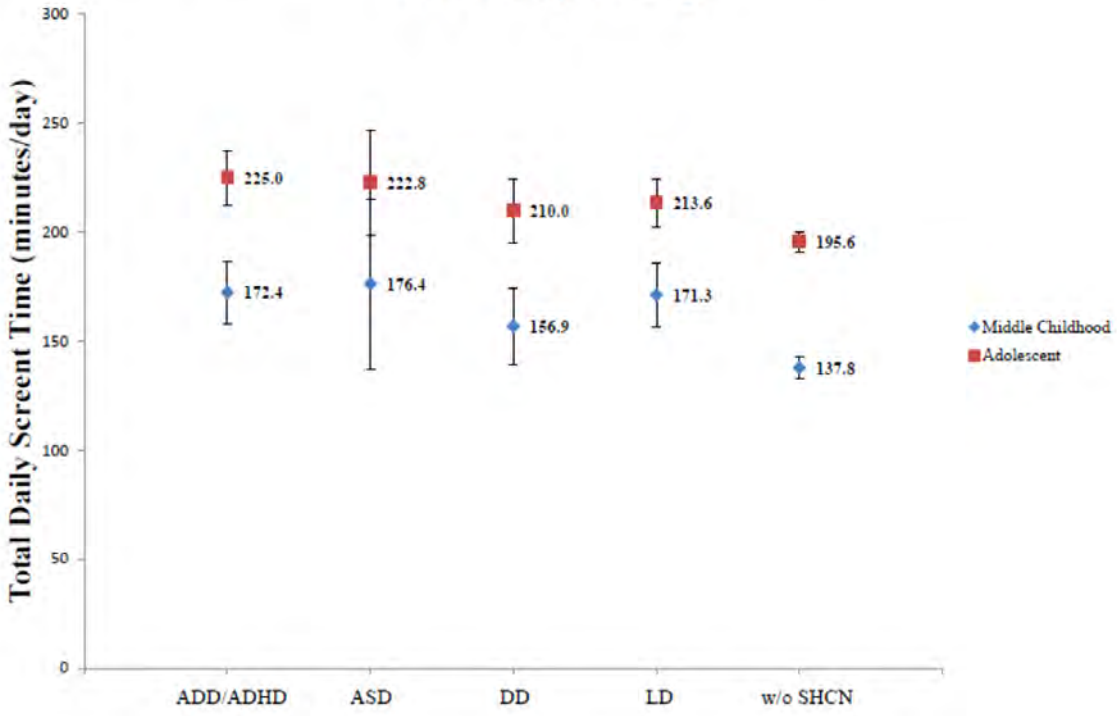

Table 2.3 Linear Regression Models of the Association between Total Screen Time and Developmental Disability Group

		M (95%CI) min/day	Model 1		Model 2[a]		Model 3[b]	
			β (95%CI)	**p-value**	**β (95%CI)**	**p-value**	**β (95%CI)**	**p-value**
Middle Childhood (6-11 Years)	NSHCN	137.8 (133.1-142.5)	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
	ADHD	**172.4 (158.3-186.6)**	**34.6 (19.7-49.4)**	**<0.001**	**26.5 (12.5-40.5)**	**<0.001**	**34.1 (-0.9-69.0)**	**0.06**
	ASD	**176.4 (137.3-215.5)**	**38.6 (-0.43-77.6)**	**0.05**	**34.0 (-0.3-68.2)**	**0.05**	**14.7 (-3.7-33.0)**	**0.12**
	DD	**156.9 (139.4-174.4)**	**19.1 (0.88-37.26)**	**0.04**	**12.4 (-3.8-28.6)**	**0.13**	**-4.5 (-19.9-10.8)**	**0.56**
	LD	**171.3 (156.5-186.0)**	**33.4 (17.9-49.0)**	**<0.001**	**24.3 (10.2-38.5)**	**<0.001**	**12.9 (-4.8-30.7)**	**0.15**
Adolescence (12-17 Years)	NSHCN	195.6 (190.8-200.4)	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
	ADHD	**225.0 (212.5-237.5)**	**29.5 (16.0-42.9)**	**<0.001**	**18.7 (4.8-32.7)**	**0.009**	**14.6 (-8.9-38.1)**	**0.22**
	ASD	**222.8 (198.9-246.7)**	**27.2 (3.1-51.4)**	**0.03**	**19.2 (-6.4-44.7)**	**0.14**	**-3.2 (-37.3-30.9)**	**0.85**
	DD	**210.0 (195.3-224.7)**	**14.4 (-1.1-30.0)**	**0.07**	**2.2 (-13.2-17.7)**	**0.78**	**-9.8 (-27.6-8.0)**	**0.28**
	LD	**213.6 (202.4-224.7)**	**18.0 (5.8-30.2)**	**0.004**	**8.5 (-3.5-20.6)**	**0.17**	**5.9 (-9.9-21.8)**	**0.46**

[a]Models were adjusted for: gender, race and ethnicity, child physical activity level, BMI (adolescents only), respondent relationship to child, family structure, number of siblings living in the household, derived poverty level, TV program rules, and TV in the child's bedroom.
[b]Models adjusted for all covariates in Model 2 and additionally for ADHD medications.

Chapter III

Family television environment and screen time among youth with developmental disabilities and without special healthcare needs

3.1 Abstract

BACKGROUND: Television viewing among youth is a risk factor for obesity, developmental, academic, and behavior problems. Youth with developmental disabilities (DEVDIS) engage in more screen time than youth without special health care needs (SHCN). The family TV environment may be associated with screen time, but has not previously been examined among youth with DEVDIS.

OBJECTIVE: This study assessed how the family TV environment effects screen time among youth aged 6 to 17with DEVDIS and without SHCN.

METHODS: Data from the 2007 National Survey of Children's Health (n=56,004) were used. Four DEVDIS were evaluated: attention deficit hyperactivity disorder (ADHD), autism spectrum disorders (ASD), developmental delay (DD), and learning disabilities (LD). Multivariate linear regression models assessed the effects of family TV rules and TV in the child's bedroom on screen time among youth with DEVDIS and without SHCN.

RESULTS: Youth with DEVDIS (ADHD=59.0%; ASD=50.1 %; DD=55.1%; LD=59.6%) were more likely to have a TV in their bedroom than youth without SHCN (48.1%; p=0.001). Adjusting for child and family characteristics, having a TV in the bedroom increased screen time among youth with ADHD (β=23.8 min/day; p<0.001), and without SHCN(β=20.7 min/day; p<0.001). There was, a similar non-significant finding for youth with LD(β=176 min/day; p=0.07).

CONCLUSION: Given the high rates of TVs in bedrooms, particularly among youth with ADHD and LD, removing TVs from bedrooms and instituting household rules may reduce screen time.

KEY WORDS: Children with Special Needs; Health Needs

3.2 Introduction

Screen time, including time spent viewing television/videos, computers, electronic games, and hand-held or other visual devices[90], is a risk factor for childhood obesity, attention problems, school performance, sleep disturbance, other developmental problems, and risky behaviors.[91-94] The American Academy of Pediatrics recommends that children under 2 years of age do not engage in screen time, and that those over 2 years engage in no more than 2 hours daily. However, more than half of youth aged 6 and over exceed these recommendations.[56]

Recent public health campaigns have focused on reducing screen time and promoting more active pursuits in its place, particularly among youth.[15,90,93] However, there remains a need to identify modifiable risk factors for high levels of screen time to increase the effectiveness of these programs. The home environment likely influences youth TV exposure and presents the opportunity to identify screen time risk factors. Lissner and colleagues[95] found that among children in seven European nations, there was a 30% increase in the risk for overweight if the child had a television in their bedroom. This study built on the work of Ramirez et al.[45] who found that having limits on screen time, household rules about television, and not having a television in the bedroom were associated with less screen time in adolescents. A 2004 review[96] of the correlates of television viewing among youth also identified having one parent in the household, parent television habits, and a television in the youth's bedroom to be associated with increased television viewing. Other family factors, including family structure[73], the

number of siblings living in the household[72,74,75], and family socioeconomic status (SES) have been previously associated with youth screen time as well.

In previous analysis of the dataset, youth with DEVDIS, such as attention deficit hyperactivity disorder (ADHD), autism spectrum disorder (ASD), developmental delay (DD), and learning disability (LD), are exposed to even more screen time (156.9-225.0 min/day) than youth without special health care needs (137.8-195.6 min/day). Among youth with developmental disabilities, television comprises the majority of screen time.[96-98]

These youth subgroups have developmental difficulties (e.g., problems with behavior, challenges in social situations, learning problems) that make them vulnerable to other on-going developmental issues. Exposure to screen time, especially in high amounts, may further impede development and exacerbate conditions.[99] Management of developmental disabilities can be further complicated given the higher rates of obesity in these subgroups.[4,5,59,61] The identification of modifiable screen time risk factors is an important step to developing interventions to reduce screen time in developmental disability populations. Furthermore, the risk factors for screen time may differ among developmental disability subgroups, as they likely differ from the typical population. However, the scientific literature on screen time among youth with developmental disabilities is sparse, and few studies have looked at screen time risk factors among these subgroups, and of those studies, most have focused on youth with ADHD.[78,100-102]

The home environment may be particularly influential on activities youth with developmental disabilities engage in during their discretionary time. Youth with

developmental disabilities, may find themselves socially isolated and at home with their family more than youth without special health care needs due to various reasons such as lack of inclusive after-school programs, less physical coordination or athletic ability, and behavioral problems. However, the role of the family television environment on screen time among youth with developmental disabilities has not been previously studied.

The purpose of this study is to compare how the family television environment effects screen time among youth with developmental disabilities and those without special health care needs among a nationally representative sample.

3.3 Methods

The National Survey of Children's Health (NSCH) is a publically available, cross-sectional random-digit-dial survey conducted by the National Center for Health Statistics and the Maternal and Child Health Bureau of the Health Resources and Services Administration.[50] NSCH is administered by the Centers for Disease Control and Prevention's State and Local Area Integrated Telephone Survey program every three years. The survey assesses the physical and emotional health of youth 0-17 years of age residing in the United States. Households with at least one child in that age range are first identified. In households with more than one child 0-17 years, one child is randomly selected for inclusion and the adult member of the household that is most knowledgeable about the child's health and activities is selected to complete the interview, which is conducted in English, Spanish, and four Asian languages. The 2007 NSCH interviewed 91,642 caregiver-proxies. The University of Massachusetts Medical School's Institutional Review Board approved this study.

3.3.1 Study Sample

The study was restricted to youth 6-17 years (N = 64,076) to account for the similar opportunities for exposure to screen time given time youth in this age range spend in school as well as the comparable availability of after-school activities. Youth were then categorized into the following groups: attention deficit hyperactivity disorder (n = 7,024), autism spectrum disorders (n = 1,200), developmental delay (n = 3,276), learning disability (n = 7,482), or without special health care needs (n = 44,461). The final analytic sample was 56,004 youth. For each condition, the caregiver responded to "Has a doctor or health care provider ever told you that [sampled youth] had [condition]?" or for the determination of learning disability "Has a doctor, health care provider, teacher, or school official ever to you that [sampled youth] had a learning disability?". Determination of a youth without SHCN was based on the results of the Child with Special Health Care Needs Screener, a consequence-based five-item tool designed by the Maternal and Child Health Bureau to determine is a child has a special health care need stemming from a condition lasting more than 12 months affecting physical, mental, and/or behavioral aspects of health.[66] Because of the high co-morbidity among youth within the four developmental disability groups, analyses were performed within each of the 5 groups.

3.3.2 Measures

<u>Family TV Environment</u>

The family television environment consists of two dichotomous items: “Are there family rules about what television programs [he/she] is allowed to watch?” and “Is there a television in [sampled child]’s bedroom?”. Each item was analyzed separately.

Screen Time

Daily television screen time was assessed by the item “On the average weekday, about how much time does [S.C.] usually watch television, watch videos, or play video games?”

Covariates

Youth age, gender, race/ethnicity, youth physical activity, ADHD medication status, and family factors were included as potential confounders. Child physical activity was assessed by the item “During the past week, on how many days did [sampled child] exercise, play a sport, or participate in physical activity for at least 20 minutes that made [him/her] sweat and breathe hard?” ADHD medication status, because of the significant attenuating effect on screen time that was found in Aim 1, was assessed by the item “Is [sampled child] currently taking medication for ADD or ADHD?” and was included in models as a 3-level variable (unmedicated ADHD, medicated ADHD, and ADHD with unknown medication status).

Family factors, such as family structure, the number of siblings under the age of 17 residing in the household, and SES were included in this analysis. Family structure was a 3-level item categorized as: two parents, single mother, and other type of family structure. The relatively high rate of non-response to household income questions compelled the NSCH to perform a multiple imputation of the household poverty-level

item.[103] This analysis used the imputed dataset in order to retain the 8.5% of the sample that was missing a response to the household poverty-level item. In addition, relationship of the respondent (e.g., mother, father, other) to the youth was assessed.

3.3.3 Statistical Analysis

Frequencies and means, stratified by developmental disability group, were computed to describe the study sample, and t-test and Chi-square statistics were performed to assess differences by group. We evaluated the association between family television environment factors and week day television screen time with linear regression models. The distribution of the television screen time was assessed and determined to be skewed toward higher values. The square-root transformation distribution of screen time was tested. Because the results did not differ from the non-transformed outcome, the non-transformed outcome results are presented in this study for ease of interpretation. Separate models were computed for each of the five groups (ADHD, ASD, LD, DD, and no SHCN). Unadjusted models were first computed. Multivariate models adjusted all covariates under investigation. Sampling weights, which adjust for non-response, non-coverage of youth in non-landline telephone households, and multiple telephone lines in a household were provided by the NSCH and applied to generate nationally representative estimates. Statistical analyses were performed in STATA 12 (StataCorp, College Station, TX).

3.4 Results

Table 1 describes participant characteristics in relation to developmental disability groups. Youth with ADHD (16.0%), ASD (15.4%), DD (17.1%), and LD (17.1%) were

more likely to be non-Latino Black than youth without SHCN (14.4%). Compared to youth without SHCN (47.7%), the proportion of youth who were male was high among the ADHD group (70.9%), ASD group (77.6%), DD group (67.0%), and LD group (66.0%). Youth without SHCN were more likely to come from a two-parent household (76.2%) than youth with ADHD (59.7%), ASD (65.1%), DD (60.7%), and LD (60.7%).

Roughly 85% of respondents reported household television program rules, with no differences across the developmental disability groups (Table 3.1). Significantly more youth with a developmental disability (ADHD = 59.0%; ASD = 50.1%; DD = 55.1%; LD = 59.6%) had televisions in their bedrooms compared to their peers without SHCN (48.1%; Table 3.1).

Table 3.1 also describes average television screen time by developmental disability group. Youth with ADHD (134.8 min/day), ASD (139.2 min/day), DD (127.5 min/day), and LD (134.4 min/day) engaged in roughly 30 minutes/day more television screen time compared to youth without SHCN (104.8 min/day). Presence of family television rules in youth was associated with lower screen time among youth with ADHD (151.8 min/day v. 132.7 min/day; $p = 0.05$) and without SHCN (112.7 min/day v. 103.8 min/day; $p = 0.004$; Table 3.2). Televisions in the child's bedroom was significantly associated with higher screen time rates among youth with ADHD (149.1 min/day v. 115.2; $p<0.001$), DD (146.9 min/day v. 104.0 min/day; $p<0.001$), LD (147.2 min/day v. 116.3 min/day; $p<0.001$), and without SHCN (122.3 v. 89.1; $p<0.001$; Table 3.2).

Table 3.3 shows the results of the linear regression models. Among youth with ADHD, house TV program rules were associated with less screen time (β=-19.1 min/day;

95%CI=-38.2--0.1) in the unadjusted model; a similar association was found among youth without SHCN (β=-8.9 min/day; 95%CI=-15.1--2.8)). After adjustment for the covariates previously noted, this effect was no longer statistically significant in youth without SHCN (β=-1.3 min/day; 95%CI=-7.5-4.8) but was still statistically significant in youth with ADHD (β=-19.7 min/day; 95%CI=-39.4-0.03). There were no significant differences among the other developmental disability groups. Among youth who have televisions in their bedrooms, in unadjusted analyses, those with ADHD (β=33.9 min/day; 95%CI=19.6-48.2), DD (β=42.8 min/day; 95%CI=23.6-62.1), and LD (β=30.9 min/day; 95%CI=17.9-43.8) had significantly higher rates of screen time than their peers without SHCN (β=33.2 min/day; 95%CI=28.9-37.5). After controlling for potential confounders, having a television in the bedroom increases screen time among youth with ADHD (β=23.8 min/day; 95%CI=11.4-36.2) and LD (β=17.6 min/day; 95%CI=-1.5-36.8).

3.5 Discussion

This study aimed to examine the impact of two factors related to the family television environment, television rules in the household and presence of a television in the bedroom, on television screen time among youth with developmental disabilities and youth without SHCN. We found that the presence of a television in the child's bedroom was associated with higher television screen time among youth with ADHD and without SHCN, and there was a trend toward an association among youth with LD. While the effect sizes of the association between television in the bedroom and screen time behavior were similar among youth with ADHD, LD and without SHCN, the proportion

of youth with ADHD and LD having a television in their bedroom was greater than that of youth without SHCN, implying that much of the high amounts of screen time may be attributed to youth having a television in their bedroom.

Youth with developmental disabilities engage in more television screen time than youth without SHCN. The high proportion of youth with developmental disabilities with a television in their bedrooms may contribute to the high screen time rates in these populations. There are several potential explanations of why televisions are more prevalent in the bedrooms of youth with ADHD and LD compared to youth without SHCN. First, televisions may be acting as babysitters, allowing parents of youth with ADHD and LD to participate in the regular activities of daily living (e.g., meal preparation, laundry, etc.) without having to supervise the youth. Second, television may be a method for youth with ADHD and LD to self-soothe or provide an outlet for social engagement. Youth with ADHD experience problems with inattention, distractibility, and impulsivity. Because of the social isolation that youth with these conditions often experience, viewing popular television programs may provide a way in which they can engage. Third, television is also a medium that can be used to teach behaviors. Youth with developmental disabilities, face difficulties with social interaction and communication, and those with ASD and DD exhibit a tendency to engage in repetitive behaviors. Viewing educational programs has been shown to be effective for teaching youth skills such as how to interpret body language, how to share, and positive health behaviors.[104,105] Parents may perceive this type of screen time as beneficial or therapeutic, and may even encourage screen time as a way to promote these pro-social behaviors and

learning, which can result in a family's decision to place a television in a youth's bedroom.

The presence of a television in a child's bedroom is a modifiable risk factor for higher television screen time. Families, especially those with children and adolescents who have a developmental disability, can remove televisions from youth bedrooms, or refuse to place televisions in a child's bedroom in the first place, as an important first step to decreasing screen time. Although the results of having family television rules were not robust in this analysis, there may be some merit in also setting television rules. This is suggested by the results of the unadjusted regression models. Previous work by others[12,45], suggested family rules regarding types of television programs that children can watch or limits to how much television is watched and with whom are effective in decreasing screen time among children.

There are several limitations to this study. First, the cross-sectional design of the NSCH does not allow for interpretations of causality. Also, parent-reported developmental disability status and screen time rates were used, both of which may be susceptible to recall bias and inaccuracy. Despite this, parent-report disability status has been an approach used in several nationally representative studies with acceptable concordance.[1,62l,81-84] Weekday screen time is likely an underestimate of actual screen time. Parents may be unaware of how much time their child spends with a screen when not in the presence of the family, which may be more likely among youth without SHCN and adolescents, given increased independence. Caution must also be applied to the interpretation of these results, as the quality of screen time is unknown. Youth with

developmental disabilities may be engaging in high amounts of screen time, but this screen time may consist of educational programs that are teaching them pro-social behaviors or other instructive content. Additionally, the NSCH did not assess the quality of a household's television rules; the only information available was whether or not there were household rules regarding television programs. We had no details regarding time limitations, content limitations, co-viewing, etc.

This study also has several strengths, foremost is that it adds to the literature by being the first study to examine how the family television environment affects screen time rates among a nationally representative cohort of youth with and without developmental disabilities. Our findings suggest that the presence of television in a child's bedroom is an influential risk factor for increased screen time and that youth with developmental disabilities are more likely to have a television in the bedroom than their peers without special health care needs. Determination of whether television is truly beneficial for the health of the youth must transpire, and if found to be not beneficial and only a means of entertainment, removal of televisions from children's bedroom may be a first step to reducing screen time and that can lead to reductions in sedentary time, obesity risk, and perhaps increase social engagement. Families can then work to identify other activities to entertain and engage youth that encourage better health behaviors.

Table 3.1 Participant characteristics by developmental disability group (n=56,004)

	w/o SHCN	ADHD		ASD		DD		LD	
	%	%	p-value	%	p-value	%	p-value	%	p-value
Sample N	44,461	7, 024		1,200		3,276		7,482	
Weighted N	33,755,490	5,222,975.1		910,111.7		2,611,920.9		5,861,245.9	
Characteristics of Youth									
Age (mean [SE])	11.5 (±0.04)	12.3 (±0.1)	<0.001	11.0 (±0.2)	0.01	11.4 (±0.2)	0.54	12.2 (±0.1)	<0.001
Sex									
Male	47.7	70.9	<0.001	77.6	<0.001	67.0	<0.001	66.0	<0.001
Race/Ethnicity									
White, Non-Latino	54.8	63.7	<0.001	61.0	0.05	56.0	0.18	54.3	0.33
Black, Non-Latino	14.4	16.0		15.4		17.1		17.1	
Other, Non-Latino	8.9	7.7		5.7		7.2		6.12	
Latino	20.1	11.7		13.6		17.2		20.5	
# Days in Past Week in Physical Activity (mean [SE])	5.4 (±0.1)	5.9 (±0.6)	0.46	5.0 (±0.6)	0.48	5.5 (±0.5)	0.95	5.8 (±0.6)	0.53
ADHD Medication									
Unmedicated ADHD	0	24.8	<0.001	24.3	<0.001	27.1	<0.001	27.6	<0.001
Medicated ADHD	0	50.8		62.9		59.1		51.3	
ADHD & Unknown Medication Status	0	24.4		12.8		13.8		21.1	
Family Characteristics									
Respondent Relationship to Child									
Mother	73.6	76.0	<0.001	77.9	0.07	78.3	0.01	78.2	<0.001
Father	20.3	14.3		14.9		14.7		13.5	
Other	6.1	9.8		7.2		7.0		8.3	
Family Structure									
2 Parent	76.2	59.7	<0.001	65.1	<0.001	60.7	<0.001	60.7	<0.001
Single Mother	17.4	30.2		27.5		30.0		30.7	
Other	6.3	10.1		7.4		9.3		8.6	
# Siblings Living in Household									
0	21.0	27.3	<0.001	25.1	0.57	25.6	0.08	25.9	0.004
1	39.7	38.8		36.9		37.3		37.1	
2	27.4	24.7		27.1		24.1		25.3	
3+	11.9	9.2		10.9		13.0		11.7	
Family SES: Derived Poverty Level									
At or below 100%	15.8	21.6	<0.001	19.2	0.41	25.8	<0.001	25.4	<0.001
Above 100% to at or below 200%	20.4	22.4		21.5		21.3		24.6	

Table 3.1 Participant characteristics by developmental disability group (n=56,004)

	w/o SHCN	ADHD		ASD		DD		LD	
	%	%	p-value	%	p-value	%	p-value	%	p-value
Above 200% to at or below 400%	32.8	30.0		33.3		31.6		28.9	
Above 400%	31.0	26.0		26.0		21.3		21.1	
Family Television Environment									
Television in Child's Bedroom	48.1	59.0	<0.001	50.1	0.58	55.1	0.003	59.6	<0.001
Television Program Rules in the Household	85.8	86.6	0.45	84.1	0.53	87.7	0.22	84.7	0.33
Screen Time (minutes/day)	104.8 (±1.1)	134.8 (±3.7)	<0.001	139.2 (±12.1)	0.01	127.5 (±5.3)	<0.001	134.4 (±3.6)	<0.001

†Sample weights were applied to estimates.
‡Due to the comorbidity amongst the developmental disability groups, independent tests were performed with the reference group as youth w/o SHCN, indicated by the p-values.

Table 3.2 Average weekday screen time in relation to family television environment among youth without SHCN, ADHD, ASD, DD, and LD

	w/o SHCN		ADHD		ASD		DD		LD	
	n 44,461		n = 7,024		n = 1,200		n = 3,276		n = 7,482	
	min/day	p-value	min/day	p-value	min/day	p-value	min/day	p-value	min/day	p-value
TV in Child's Bedroom										
Yes	122.3 (±1.7)	<0.001	149.1 (±5.3)	<0.001	159.3 (±22.5)	0.09	146.9 (±8.3)	<0.001	147.2 (±5.5)	<0.001
No	89.1 (±1.5)		115.2 (±5.0)		119.0 (±8.4)		104.0 (±5.2)		116.3 (±3.7)	
TV Program Rules										
Yes	103.8 (±1.2)	0.01	132.7 (± 4.1)	0.05	140.3 (±13.8)	0.81	127.3 (±5.7)	0.86	131.7 (±3.6)	0.12
No	112.7 (±2.9)		151.8 (± 8.8)		133.9 (±22.8)		129.9 (±13.3)		152.2 (±12.6)	

†Sample weights were applied to estimates.

Table 3.3 Linear regression models of the association of family television environment and screen time among youth with ADHD, ASD, DD, LD, and without SHCN

	Unadjusted Models		Adjusted Models	
	β (95%CI)	p-value	β (95%CI)	p-value
Television in the Child's Bedroom				
ADHD	33.9 (19.6-48.2)	<0.001	23.8 (11.4-36.2)	<0.001
ASD	40.3 (-6.7-87.4)	0.093	-26.3 (-67.0-14.5)	0.21
DD	42.8 (23.6-62.1)	<0.001	13.1 (-14.3-40.4)	0.35
LD	30.9 (17.9-43.8)	<0.001	17.6 (-1.5-36.8)	0.07
w/o SHCN	33.2 (28.9-37.5)	<0.001	20.7 (16.2-25.1)	<0.001
Television program rules in the household				
ADHD	-19.1 (-38.2--0.1)	0.05	-19.7 (-39.4-0.03)	0.05
ASD	6.4 (-45.9-58.7)	0.81	-5.2 (-87.1-76.7)	0.90
DD	-2.6 (-31.0-25.9)	0.86	4.2 (-53.9-62.3)	0.89
LD	-20.5 (-46.2-5.2)	0.12	-9.7 (-38.4-19.0)	0.51
w/o SHCN	-8.9 (-15.1--2.8)	<0.01	-0.6 (-6.9-5.8)	0.86

[a]Models are adjusted for age, sex, race/ethnicity, child physical activity level, ADHD medication status, respondent relationship to child, family structure, number of siblings living in the households, and derived poverty level.

Chapter IV

Family and social engagement factors and screen time in youth with ADHD

4.1 Abstract

Introduction: Youth with ADHD engage in the highest rates of screen time among youth with developmental disabilities, a population that already has higher rates of screen time and sedentary behavior than youth without special health care needs. Youth with ADHD, due to their challenges with impulsivity, inattention, and behavioral regulation are at particular risk of exclusion from their peers which may be driving these higher screen time rates. Few studies have moved past investigating the association between television and ADHD, and none of them have included both engagement with the family and social engagement outside of the youth's household.

Objective: The purpose of this study was to examine the potentially modifiable risk factors of family and social engagement on the screen time of youth with ADHD.

Methods: Data from the 2007 National Survey of Children's Health (n=7,024 aged 6-17 years), were used. Youth with attention deficit hyperactivity disorder (ADHD) were stratified into two age groups Middle Childhood (6-11 years) and Adolescence (12-17 years). Multivariate linear regression was performed to determine the association of screen time and several family and social engagement factors among children and adolescents with ADHD.

Results: After adjustment for covariates, among children with ADHD, caregiver having no knowledge of the child's friends, was associated with an hour decrease in screen time (β = -60.6 min/day [-97.7--23.6]), children with ADHD who had any social engagement also had decreased screen time (β = -35.1 min/day [-65.2--4.9]), and children with ADHD who engaged in other social engagement had decreased screen time (β = -37.1 min/day [-

68.1--6.2]). Adolescents with ADHD whose caregiver never attended their events, had significantly higher screen time (β = 86.7 min/day [5.7-167.6]). Sport social engagement among adolescents with ADHD was associated with decreases in screen time of 32 minutes (β = -32.0 min/day [-55.8--8.1]) in adjusted models.

Conclusion: The findings of this study further the research on screen time among youth with ADHD. It elucidates age-specific intervenable areas that could potentially decrease screen time. Strengthening the social networks among this population of youth, who engage in screen time at high levels and may have limited social opportunities, can potentially decrease screen time but foster pro-social behaviors.

4.2 Introduction

Recent studies have found that youth with Attention Deficit Hyperactivity Disorder (ADHD) are at greater risk for obesity than typically developing youth.[3-6,106] Screen time, an important risk factor for obesity, is also known to be high among youth with ADHD.[107] Excessive screen time may be particularly detrimental to youth with ADHD. In addition to increasing lifelong risk for several chronic conditions such as cardiovascular disease, diabetes, and obesity,[21-23,53] screen time in high amounts, especially among young children, has been shown to effect brain development[108]. Further, exposure to screen time can manifest into attention difficulties, which has been theorized as progressing and/or worsening ADHD.[107,109-111]

Decreasing screen time behavior among youth with ADHD requires an understanding of modifiable screen risk factors in this population. It has been well-established that youth with ADHD experience difficulties with social competencies[112-114] such as rule-breaking and aggression, ultimately resulting in peer rejection and subsequent social isolation. These factors can result in fewer opportunities to engage with others. Television has been identified as an activity that children with ADHD particularly enjoy[107], which may be because it is a solitary activity. Engagement and interaction with others is important for normal development in youth[37]. These social interactions represent opportunities for youth to learn and have implications on their future success and mastery of social competencies[37], such as learning how to deal with unhappiness and social conflict. Engaging youth in these social opportunities can also potentially affect screen time rates. However, to date, no studies have investigated the effects that family and

social engagement have on screen time in youth with ADHD. The objective of this study was to examine how social engagement affects screen time in a large, nationally representative sample of youth with ADHD.

4.3 Methods

Cross-sectional data from the 2007 National Survey of Children's Health (NSCH) was used in this study. This was a random digit-dial survey conducted by the Maternal and Child Health Bureau, and was administered by the Centers for Disease Control and Prevention, as part of the National Immunization Study. The NSCH is administered every three years in order to assess physical and emotional health in US youth 0-17 years. In households where more than one youth resides, the selected child is randomly selected and the caregiver most knowledgeable about the child answers the interview items. The interviews occur in English, Spanish, and 4 Asian languages. A total of 91,642 people youth were interviewed. This study was approved of by the University of Massachusetts Medical School's Institutional Review Board.

The sample for this study was restricted to youth aged 6-17 years with parent reported ADHD (n = 7,024). Determination of ADHD occurred via asking the caregiver "Has a doctor or health care provider ever told you that [sampled youth] had attention deficit or hyperactivity disorder?" The sample was restricted to ages 6 to 17due to their similar school schedules and after-school opportunities. Youth with ADHD were then stratified into two age groups, middle childhood (n = 2,471) and adolescence (n = 4,553),

in order to further account for other age-related opportunities that may differ between these two developmental stages.

4.3.1 Measures

Screen Time

Screen time was assessed as the combination of two items: “On the average weekday, about how much time does [sampled child] usually watch television, watch videos, or play video games?” and “On the average weekday, about how much time does [S.C.] use a computer for purposes other than schoolwork?” The resulting continuous variable captured total week day screen time in minutes per day.

Family and Social Engagement Factors

Seven social engagement factors were evaluated in this study for their effect on the screen time of youth with ADHD. The first four engagement factors focus on the caregiver relationship with the youth, what we considered family engagement, the latter three on the social engagement outside of the home. (1) The frequency that the caregiver attends the youth’s events was ascertained with the item “During the past 12 months, how often did you attend events or activities that [S.C.] participated in?” with response options always, usually, sometimes, or never. (2) The number of meals shared by the household was determine by the item “During the past week, on how many days did all the family members who live in the household have a meal together?” and ranged from 0-7. (3) The item that determines caregiver knowledge of the youth’s friends was “Regarding [S.C.]’s friends, would you say that you have met all of [his/her] friends, most of [his/her] friends, some of [his/her] friends, none of [his/her] friends, or the child

has no friends?" (4) The degree to which the youth and the caregiver can talk and share was based on the item "How well can you and [S.C.] share ideas or talk about things that really matter?" with caregiver responses of very well, somewhat well, and not well.

Social engagement outside of the home was comprised of three items. (5) Sport social engagement was a "yes" response to "During the past 12 months, was [S.C.] on a sports team or did [he/she] take sports lessons after school or on weekends?" (6) Other social engagement was a "yes" response to either of the following two items: "During the past 12 months, did [he/she] participate in any clubs or organizations after school or on weekends?" and "During the past 12 months, did [he/she] participate in any other organized events or activities?" The final social engagement variable, (7) any social engagement, was a "yes" response to either sports social engagement or other social engagement.

Covariates

Potential confounders that were assessed included gender, race/ethnicity, youth physical activity, ADHD medication status, body mass index (in adolescents), family characteristics, and SES factors. The youth's physical activity level was ascertained by the item "During the past week, on how many days did [S.C.] exercise, play a sport, or participate in physical activity for at least 20 minutes that made [him/her] sweat and breathe hard?" ADHD medication status was included as a three level item, unmedicated ADHD, ADHD diagnosis with medication, ADHD with unknown medication status. BMI data were only available for youth 10 years and older, and because of the age stratification, BMI was only controlled for in the adolescent (12-17 years) group.

Several family characteristics that were identified in the literature as potentially having an effect on the youth's screen time were controlled for in regression analyses. The family structure[73], which was categorized as two parent, single mother, or other. The number of siblings under the age of 17 years living in the household[74-76] has also been identified in the literature as having an effect on screen time and was added as a covariate. Finally, family socioeconomic status (SES), as a percentage below or above the federal poverty level was also included as a covariate. There was a relatively high non-response rate to the SES item, 8.5%, and so this analysis utilized the multiple imputed data from the NSCH for this item.[103]

4.3.2 Statistical Analyses

Statistical analyses were performed using STATA 12.0 (College Station, TX). All analyses were conducted stratified by age group (6-10 and 11-17 years). T-test and Chi-square descriptive statistics were performed to assess differences within age group. Multivariate linear regression models controlled for all covariates. In order to generate nationally representative estimates, sample weights provided by the NSCH, were applied. Associations between screen time, which for ease of explanation is presented here in its non-log transformed version, and engagement factors were adjusted for the potential confounders listed previously.

4.4 Results

Participants with ADHD were predominately male, white, non-Latino, and were on medication for ADHD (Table 4.1). The majority of participants came from a two parent household, with at least one or more siblings, had television rules, and a television

in their bedroom. The screen time rate among children with ADHD was 172.4 (±7.2) min/day, and it was higher among adolescents with ADHD, 225.0 (±6.4).

In terms of the various engagement factors, the majority of caregivers of youth with ADHD usually or always attended the sampled youth's events (children: 87.7%, adolescents: 78.6%). Caregivers of children with ADHD reported that their household had an average of 5 days a week sharing a meal, while caregivers of adolescents spent 4.5 days each week sharing a meal within the household. 73.5% of caregivers of children with ADHD knew at least most of the sampled youth's friends, while 76% of caregivers of adolescents with ADHD knew most of the adolescent's friends. 92.1% of caregivers of children with ADHD are able to talk with the child at least somewhat well while 91.9% of caregivers of adolescents with ADHD could do the same. In terms of social engagement outside of the home, 73.5% of children with ADHD participated in any social engagement, with 68.7% participating in other types of social engagement and 46.7% participating in some sort of sport social engagement. 77.1% of adolescents with ADHD participated in any social engagement, and 72.1% of them engaged in other types of social engagement, and 49.8% participated in sport social engagement.

4.4.1 Children with ADHD

Results of the multivariate linear regression models are presented in Table 2. Among children ages 6 to 10 with ADHD, caregiver having no knowledge of the child's friends is associated with a decrease in screen time of nearly 40 minutes daily (β = -39.3 min/day [-78.0--0.05]) and when adjusted for covariates, an hour (β = -60.6 min/day [-97.7--23.6]) (Table 4.2). Though not statistically significant, children with ADHD whose

caregiver reported that the child had no friends was associated with nearly an hour more screen time (β = 57.2 min/day [-48.0-162.4]) in the adjusted model. Children with ADHD who had any social engagement had decreased screen time (β = -39.3 min/day [-78.2--0.1]) in unadjusted models, and when adjusted for potential confounders, this association held (β = -35.1 min/day [-65.2--4.9]). Children with ADHD who engaged in other social engagement also had decreased screen time in both unadjusted (β = -44.1 min/day [-84.1--4.0]) and adjusted models (β = -37.1 min/day [-68.1--6.2]).

4.4.2 Adolescents with ADHD

Adolescents with ADHD whose caregiver never attended their events, had significant amounts of increased screen time in both unadjusted (β = 89.2 min/day [19.5-158.9]) and adjusted models (β = 86.7 min/day [5.7-167.6]) (Table 4.2). Adolescents whose households had more days where they shared meals had decreased screen time of around 5 minutes per day (β = -5.3 min/day [-10.6--0.1]) in the unadjusted model, with a similar non-significant association in the adjusted model. Sport social engagement among adolescents with ADHD was associated with significant decreases in screen time of ~39 minutes (β = -38.6 min/day [-63.7--13.4];) and 32 minutes (β = -32.0 min/day [-55.8--8.1]) respectively in unadjusted and adjusted models. The unadjusted any social engagement (β = -42.7 min/day [-75.0--10.4]) and other social engagement (β = -43.1 min/day [-76.6--9.5]) findings were associated with significantly decreased screen time, with similar non-significant trends in adjusted models.

4.5 Discussion

There is a growing body of literature that has identified the high rates of obesity and screen time among youth with ADHD.[4,59,79,109,115] The purpose of this study was to examine the potentially modifiable risk factors of family and social engagement on the screen time of youth with ADHD. Youth with ADHD, due to their challenges with impulsivity, inattention, and behavioral regulation[115] are at particular risk of exclusion from their peers which may results in higher screen time. Few studies[79,109] have moved past investigating the association between television and ADHD[110,111], and none of them have included both engagement with the family and social engagement outside of the youth's household, this is the first study to do so.

Children are not as independent as adolescents, and so caregivers are more likely to engage at higher levels with them regularly than adolescents. A greater proportion of caregivers of children with ADHD in this study always attended the child's events, spent more days sharing a meal, knew all the child's friends, and could talk/share with the child than caregivers of adolescents with ADHD. On the other hand, a higher proportion of adolescents with ADHD participated in other social engagement activities than children with ADHD. Perhaps adolescents are more sensitive to issues of engagement outside of the home, as they likely have more opportunities for this type of social interaction. Adolescence is a developmental stage where their behaviors are greatly influenced by their peers and external social influences rather than their families. Adolescents who have fewer opportunities to engage with others may default engaging in solitary activities, such as screen time.

Despite being less common than among children, family engagement factors were associated with screen time among adolescents. Adolescents with ADHD whose caregivers never attended their events had nearly 90 minutes more screen time per day than their peers whose caregivers always attended events. Still, it is important to bear in mind that a lack of attendance may also be due to a lack of participation in these events. Similarly, adolescents with ADHD whose households spent more days in a week sharing at least one meal daily were found to have a 5 minute decrease in screen time. These findings are consistent with that of previous work by Ray and Roos[116] that found that positive family involvement led to better health behaviors among 10-11 year old Finnish children. This prospective study found that families having meals together decreased screen time and increased consumption of fruit and vegetables. This study also found that one aspect of family involvement, the more time the child spent alone, the higher the screen time the child engaged in.[116] These findings imply that lack of family engagement has a direct effect on screen time. The more engaged a family, specifically the caregiver, is with youth with ADHD, the lower the amount of screen time that the youth with engage in.

The association of family engagement factors with screen time among children was less clear. More positive family involvement has been associated with decreases in screen time and more favorable health behaviors in typically developing youth.[12,96,116,117] Surprisingly, a caregiver having no knowledge of the child's friends was associated with a decrease in screen time of nearly an hour daily. A possible explanation may be that a caregiver who has no knowledge of a child's friends would be unable to accurately report

screen time, which could contribute to the ~6 hours of screen time found in these youth with no friends. Alternatively, caregivers who are more involved may make up most of the social engagement for a youth, and they would thus have fewer peers and friends. Additionally, this question may be confusing to caregivers and their responses may be so inaccurate that it is difficult to reach a definitive conclusion. This group was also only 3.5% of children, a small proportion, so problems with sample size issues may have arisen. Overall, the findings suggest that there is a higher level of engagement in children with their caregivers than adolescents with ADHD, which is consistent when the growing independence of adolescents is taken into account.

Social engagement outside of the home was associated with decreased screen time among both children and adolescents. These findings are consistent with the time-displacement hypothesis articulated by Williams[31] and then Neuman[32]. They posit that time children spend engaging in front of screens is time that can otherwise be spent in more active pursuits. In this study, type of social engagement that was associated with screen time differed by age group. Children's engagement in other social engagement activities, such as special interest clubs, church groups, Boy and Girl Scouts, musical pursuits, and other organized activities decreased screen time by 37 minutes. This association was not observed in the multivariate adolescent model. A possible explanation may be that children with ADHD have more opportunities for these other types of social engagement than adolescents, or they may have more of a preference for these types of activities. Typically during childhood, parents will provide the opportunity for their child to engage in some of these groups and activities, as children age, these

opportunities increasingly fall on them to join and adolescents may choose not to. Among adolescents with ADHD, sport social engagement decreased screen time by 32 minutes, but there was only a trend toward decreased screen time in the adjusted multivariate regression models, suggesting that the sport social engagement is highly influential in this group, as other covariates were taken into account already.

Overall, study findings suggests that an effective strategy to reduce screen time in children and adolescents with ADHD is to involve them in social engagement activities, including sports. Sports, especially during adolescence, are more competitive and consume a lot more discretionary time than they may during middle childhood, therefore the impact on screen time behavior may be larger than for younger children.

There are several limitations to this study that must be taken into account. Caregiver's reported on diagnosis of ADHD, screen time, and all of the engagement items, and may be inaccurate due to recall bias and under-reporting or social response bias. However, other work that has used caregiver report of a child's diagnosis has been shown reliable and accurate.[4,61,81-84] Screen time may be inaccurate since youth, particularly among adolescents, may be engaging in screen time in places outside of the home. Additionally, recency effects may lead to recall bias and under-reporting of actual screen time rates. Moreover, screen time rates are likely underestimates due to the lack of weekend screen time, as the NSCH only asks about week day screen time activity. In terms of engagement factors, parent report may also be inaccurate due to social desirability bias, with caregivers wanting to appear more engaged with the youth than they actually are. On the other hand, caregivers of youth with ADHD may in fact be more

aware of the need for opportunities/experiences for their child to engage with others because these youth are typically more socially isolated then their peers. Lastly, the screen time that is captured in this study failed to account for other types of screen time, such as tablets, hand-held entertainment devices, and smart phones. The availability and accessibility to these mini-computer devices is quite high now and likely accounts for a large proportion of incidental screen time that often goes unmeasured. Despite these limitations, there are several strengths to this study. The large, nationally representative sample size of youth with ADHD offers more support to the validity of these findings. This study also examined several aspects of engagement. Previous work in this area has only looked at one or two engagement items, or focused on the family or the external social environment in typically developing youth.[12,45,96,117,118]

This study furthers the research on screen time among youth with ADHD by examining the age-group specific associations of family and social engagement opportunities and screen time. It elucidates intervenable areas that could potentially decrease screen time and strengthen social networks among this population of youth that engage in screen time at high levels and may have limited social networks.

Table 4.1 Participant characteristics by age group (n = 7,024)[†]		
	Middle Childhood n = 2,471 %	Adolescence n = 4,553 %
Characteristics of Youth		
Age (mean [SE])	9.0 (±0.07)	14.6 (±0.1)
Sex		
Male	74.0	68.8
Race/Ethnicity		
White, Non-Latino	61.1	63.8
Black, Non-Latino	16.7	15.6
Other, Non-Latino	6.8	8.3
Latino	12.9	10.9
# Days in Past Week in Physical Activity (mean [SE])	6.1 (±0.6)	5.8 (±1.0)
BMI[‡]		
Underweight	-	3.6
Normal weight	-	61.0
Overweight	-	16.1
Obese	-	19.4
ADHD Medication		
Unmedicated ADHD	23.9	25.5
Medicated ADHD	58.3	45.7
Unknown	17.8	28.9
Family Characteristics		
Respondent Relationship to Child		
Mother	75.8	76.0
Father	14.7	14.0
Other	9.5	10.0
Family Structure		
2 Parent	59.9	59.6
Single Mother	30.1	30.2
Other	10.0	10.3
# Siblings Living in Household		
0	18.6	33.4
1	39.2	38.5
2	30.3	20.8
3+	11.9	7.3
Family SES: Derived Poverty Level		
At or below 100%	25.5	18.8
Above 100% to at or below 200%	23.0	22.0
Above 200% to at or below 400%	28.6	30.9
Above 400%	22.9	28.2

Table 4.1 Participant characteristics by age group (n = 7,024)†		
	Middle Childhood n = 2,471 %	Adolescence n = 4,553 %
Family Television Environment		
Television Program Rules in the Household	93.6	81.8
Television in Child's Bedroom	56.1	61.0
Screen Time (minutes/day)	172.4 (±7.2)	225.0 (±6.4)
Engagement Factors		
Frequency caregiver attends S.C.'s events		
Always	67.0	55.6
Usually	20.7	23.0
Sometimes	10.0	16.0
Never	2.2	5.4
# meals household share/week (mean[SE])	5.13 (±0.10)	4.55 (± 0.08)
Caregiver knows S.C.'s friends		
All	33.2	24.4
Most	40.3	51.6
Some	21.3	21.9
None	3.7	1.2
Has no friends	1.6	0.8
S.C. can talk/share with caregiver		
Very Well	56.0	52.0
Somewhat Well	36.1	39.9
Not Well	7.9	8.1
Any Social Engagement	73.5	77.1
Other Social Engagement	68.7	72.1
Sport Social Engagement	46.7	49.8

†Sample weights were applied to estimates.
‡BMI data unavailable for this age group.

Table 4.2 Screen time in relation to family characteristics, among children and adolescents with ADHD

	Daily screen time (minutes/day), Mean [SE]	Unadjusted		Adjusted*	
		R 95%CI	p-value	R 95%CI	p-value
Middle Childhood (6-11 years) (n=2471)					
Frequency caregiver attends S.C.'s events					
Always	162.6 [9.1]	Ref.		Ref.	
Usually	155.2 [14.4]	-7.4 (-40.7-26.0)	0.665	0.3 (-25.3-25.8)	0.984
Sometimes	178.0 [19.4]	15.4 (-26.5-57.3)	0.471	-7.4 (-45.0-30.3)	0.701
Never	141.9 [28.6]	-20.7 (-79.6-38.2)	0.490	-45.4 (-103.9-13.1)	0.128
# Meals household members share in a week					
0	168.5 [25.8]				
1	222.0 [42.8]				
2	191.1 [33.2]				
3	199.8 [32.8]	-4.0 (-10.9-3.0)	0.263	-4.0 (-10.0-1.9)	0.179
4	186.6 [12.6]				
5	155.4 [11.0]				
6	124.4 [14.4]				
7	169.6 [11.8]				
Caregiver knows S.C.'s friends					
All	158.9 [8.7]	Ref.		Ref.	
Most	183.0 [11.1	24.1 (-3.5-51.7)	0.087	23.8 (-1.1-48.8)	0.061
Some	183.4 [21.5]	24.6 (-20.8-70.0)	0.289	4.6 (-39.9-49.1)	0.840
None	110.6 [17.8]	-39.3 (-78.0--0.5)	0.047	-60.6 (-97.7--23.6)	0.001
Has no friends	158.6 [62.9]	-0.3 (-124.7-124.1)	0.996	57.2 (-48.0-162.4)	0.286
S.C. can talk/share with caregiver					
Very Well	165.8 [7.5]	Ref.		Ref.	
Somewhat Well	186.4 [15.2]	20.6 (-12.6-53.9)	0.224	23.8 (-6.8-54.3)	0.127
Not Well	155.5 [24.2]	-10.3 (-59.9-39.4)	0.685	-0.1 (-47.5-47.4)	0.998
Any Social Engagement	162.2 [7.1]	-39.1 (-78.2--0.1)	0.049	-35.1 (-65.2--4.9)	0.023
Sport Social Engagement	163.2 [8.1]	-17.3 (-45.0-10.4)	0.220	-12.1 (-35.3-11.2)	0.310
Other Social Engagement	157.2 [8.4]	-44.1 (-84.1--4.0)	0.031	-37.1 (-68.1--6.2)	0.019
Adolescence (12-17 years) (n=4553)					
Frequency caregiver attends S.C.'s events					
Always	206.2 [10.2]	Ref.		Ref.	
Usually	204.5 [12.1]	-1.7 (-32.8-29.5)	0.917	4.3 (-26.2-34.7)	0.784

Table 4.2 Screen time in relation to family characteristics, among children and adolescents with ADHD

	Daily screen time (minutes/day), Mean [SE]	Unadjusted		Adjusted*	
		R 95%CI	p-value	R 95%CI	p-value
Sometimes	236.4 [14.0]	30.3 (-3.8-64.3)	0.081	31.0 (-3.4-65.3)	0.077
Never	295.3 [34.0]	89.2 (19.5-158.9)	0.012	86.7 (5.7-167.6)	0.036
# Meals household members share in a week					
0	274.0 [19.6]				
1	260.0 [33.8]				
2	232.3 [21.1]				
3	239.6 [19.6]	-5.3 (-10.6--0.1)	0.048	-4.7 (-9.8-0.4)	0.070
4	194.0 [15.4]				
5	219.0 [20.4]				
6	195.4 [15.9]				
7	224.6 [9.6]				
Caregiver knows S.C.'s friends					
All	214.1 [11.8]	Ref.		Ref.	
Most	223.5 [9.5]	9.5 (-20.1-39.1)	0.530	4.6 (-22.9-32.2)	0.741
Some	235.9 [11.7]	21.8 (-10.8-54.4)	0.189	16.2 (-20.6-53.0)	0.387
None	215.9 [26.8]	1.9 (-55.5-59.2)	0.950	-9.6 (-80.9-61.7)	0.791
Has no friends	379.7 [142.4]	165.6 (-114.7-445.9)	0.247	184.6 (-144.1-513.3)	0.271
S.C. can talk/share with caregiver					
Very Well	220.6 [9.4]	Ref.		Ref.	
Somewhat Well	226.6 [8.7]	6.0 (-19.2-31.2)	0.640	12.0 (-10.7-34.8)	0.299
Not Well	246.3 [29.2]	25.7 (-34.4-85.8)	0.402	30.8 (-14.4-76.0)	0.182
Any Social Engagement	215.3 [7.0]	-42.7 (-75.0--10.4)	0.010	-27.4 (-57.1-2.2)	0.070
Sport Social Engagement	205.7 [9.2]	-38.6 (-63.7--13.4)	0.003	-32.0 (-55.8--8.1)	0.009
Other Social Engagement	214.9 [8.4]	-43.1 (-76.6--9.5)	0.012	-24.7 (-56.3-6.9)	0.125

*Adjusted for: gender, race and ethnicity, child physical activity level, ADHD medication, respondent relationship to child, family structure, number of siblings living in the household, derived poverty level; adolescent models also adjusted for weight status.

Chapter V

Discussion & Conclusion

5.1 Summary

This dissertation addresses a growing issue that is understudied in a vulnerable population, youth with DEVDIS, particularly ADHD. Experts cite an increase in the amount of time children spend watching television and in other screen-related activities as a potential risk factor for obesity among youth with DEVDIS. However, prevalence estimates of screen time have not previously been established for youth with DEVDIS until this work.

The purpose of the first aim was to establish estimates of screen time among children and adolescents with DEVDIS, and compare these rates to their peers without SHCN. This dissertation also explored the effects of the family television environment on the television screen time of youth with DEVDIS, a topic that has not been studied previously and has identified that the presence of television in a child's bedroom is an influential risk factor for increased screen time in this population. Lastly, it has the identified potential factors of family and social engagement among children and adolescents with ADHD that can influence screen time.

Overall, adolescents had higher screen time (199.8 min/day) than children (142.3 min/day), and youth with DEVDIS had higher screen time rates compared to their peers without SHCN (156.9-225.0 min/day vs. 137.8-195.6 min/day). After controlling for potential confounders, children with ADHD had significantly more screen time than those without SHCN, a similar non-significant association was found for adolescents with ADHD. While unadjusted findings indicate that youth with developmental disabilities engage in higher rates of screen time than youth without SHCN, these associations were

largely attenuated by medicated ADHD in the multivariate regression models. Thus ADHD symptoms, a common comorbidity across developmental disabilities, drove associations between the other developmental disabilities and screen time. These findings suggest that ADHD is the primary developmental disability risk factor for high screen time rates and that medication to control/treat this condition will attenuate these associations. As ADHD is co-morbid with the other DEVDIS explored in this work, treating ADHD as a method to reduce screen time and sedentary behavior thereby decreasing the risk for obesity, may be one approach but must be placed in the context of the other factors that influence screen time (e.g. social isolation, family engagement, etc.) and what the child and family perceive as appropriate and beneficial.

Establishing screen-time as a problem for youth with DEVDIS and obtaining baseline measures of screen-time are important because screen time is a behavior that can be targeted and modified with intervention strategies. In exploratory analyses using the data of this dissertation, we investigated the association of BMI and screen time. This association was statistically significant for youth without SHCN but was not statistically significant for youth with DEVDIS, perhaps because of power issues related to the limited sample size of youth with DEVDIS.

The second aim assessed how the family television environment, comprised of household television rules and presence of a television in the youth's bedroom, affects screen time among youth with DEVDIS and without SHCN. While the household television rules findings were not robust in youth with DEVDIS and without SHCN, presence of television in the youth's bedroom was found to be associated with increased

screen time. Given the higher proportion of youth with a DEVDIS having a television in their bedroom than youth without SHCN, prevention of the placement of a television in the youth's bedroom or removal of a present television could likely effectively reduce screen time in these populations.

In the third aim, we examined the potentially modifiable risk factors of family and social engagement effects on the screen time of youth with ADHD. Our findings suggest that a potential approach to reducing screen time in children with ADHD is to involve them in other types of social engagement activities (e.g., Boys & Girls clubs, specialized interest clubs, etc.) while among adolescents with ADHD, sport social engagement may be a more effective strategy. In regards to family engagement, these findings indicate that a lack of family engagement has a direct effect of higher screen time rates. Thus, the more engaged a family, the lower the amount of screen time that the youth will engage in. Taken as a whole, this aim suggests that increased awareness of how social networks influence screen time may potentially have an effect on the social networks of these youth.

5.2 Limitations & Strengths

This dissertation has several limitations that must be acknowledged. The 2007 NSCH is a cross-sectional study that covers a broad range of topics. Thus, it is hampered by the fact that the questions do not provide information about the quality of responses or allow for the assessment changes over time or the assessment of temporal associations. This limitation also greatly affects the item regarding household television rules, of which we have no specific information about the types (i.e., duration, co-viewing, quality

of programming, etc.). Another concern is the level of disability will also affect how much time youth are on the computer, but may not affect how much time is spent watching TV. The survey is also unable to provide information regarding the existence of inclusive programs in the community of these participants. Therefore, children and adolescents with DEVDIS may in fact desire increased participation in more social engagement opportunities but because of the lack of programs available in their communities, they may experience significant barriers to participation. This isolation could potentially encourage their engagement in screen-related activities. Further limitations related to the cross-sectional design of this study are that causality is unable to be determined and potentially there exists recall bias from respondents. The social engagement items in which respondents are asked to report on the participation of the child over the course of a year are vulnerable to this type of bias. It is also important to note the low response rate of 46.7% of this survey. Possible reasons for this include the long duration of the interview, which could deter potential participants who have limited availability and the increased popularity of telemarketing, which has led many households to screen their phone calls. The NSCH employed a conservative approach to estimate eligibility, contact rates, interview rates, and thus overall response rates with survey participants, in accordance with the American Association for Public Opinion Research's standards.[50] Additionally, the sample weighting procedures endeavor to control for this low response rate.

Another example of the limitations related to the incomplete context of the questions is parent/guardian knowledge of friends. As children age, parents know fewer

of their children's friends. In addition, as children age, they gain more independence and autonomy, so responses to the family engagement items may be very different for a child at 16 years and at 6 years. However, this issue can be resolved by stratifying the results by age. The NSCH does ask a wide breadth of questions related to family functioning that are not necessarily related to family engagement such as a description of the relationship between respondent and child, level of affection with child, making life decisions together, and trusting relationship, etc. However, because these questions are not necessarily reflective of family engagement or are inappropriate for families who have a child with a DD, they were excluded in the working concept of family engagement in this study. Additionally, information about how involved the parent/guardian is in the education of their child or how supportive a parent/guardian is of the child's decisions is not provided in this dataset. Definitions of family engagement used in other studies have had more of a focus on interventions to improve educational outcomes, and not on screen time. Therefore, research into discerning how family engagement is associated with screen time is both novel and significant, as families provide the first opportunities for children to engage socially and are likely the first to provide exposure to screen-based entertainments.

An additional limitation is that screen time, which is comprised of TV time and computer time, is not a homogenous grouping. Time spent on the computer is extremely variable and requires a level of sophisticated cognitive functioning in order to operate and navigate successfully. Some children with DD are able to operate the computer and engage in this form of screen time independently. However, other children, who may

have many co-morbidities or more severe conditions, may only be able to access the computer with the assistance of an adult, sibling, caregiver, or friend. The relationship with this person is important because if their interaction is high quality (i.e. open communication, established relationship, free discourse) then computer use may be encouraged and as a result, an increase in these instances will occur, resulting in screen time in excess of the American Academy of Pediatrics guidelines.

It is important that screen time in this context not be viewed as a negative activity. Youth engaging in screen-related activities may be involved in imaginative play or creative pursuits. The NSCH does not reflect the quality of screen time, only the amount. It is possible that use of computers is a form of social engagement, which allows children to interact with their peers and is not solely a form of "vegging out". Social network media websites and gaming systems may provide an opportunity for youth with DEVDIS to connect with others. Increasingly more youth are online and bonding on these social media networks as well as through many types of gaming systems (e.g., Nintendo Wii, Xbox, and other online multi-player games). So while total screen time may increase due to these activities, so does social interaction. Finally in regards to screen time measurement, the data in this dissertation are from 2007, and at present, screen time is now much more developed due to the accessibility of smart phones, tablet devices, and computers. Even the school environment has shifted to a more screen-based method of teaching, which is more interactive and alters the traditional concept that screen time is passive TV viewing.

The social engagement items in the 2007 NSCH provide limited information about the sampled child's participation in activities, but no data as to the quality, frequency of activities, or whether the sampled child participates in multiple activities per item (i.e., baseball and soccer, dance class and Girl Scouts, etc.). Additionally, the question focuses on the sampled child's participation in that activity over the course of the year, and so seasonal effects are unable to be determined but any seasonal differences that may be present will be equal among youth with a DD and those w/o SHCN.

Lastly, the incomplete information regarding ADHD medication is problematic. It is reasonable to assume that if a caregiver is unable to answer whether or not their youth is taking medication for their ADHD, then the youth is not likely to be, as caregivers will usually have to be in charge of filling the prescription and administering the medication. However, being unable to provide an answer to this item does call into question the accuracy of their other responses to the rest of the items asked in the NSCH. The considerable attenuating effect, that ADHD medication had on screen time points to the importance of having this information to achieve a true understanding of this complex relationship with screen time.

Despite these limitations, this study has several important strengths. The external validity of this project is improved due to the sampling strategy, large sample size, and great diversity of participants in the total sample. The NSCH also asks participants a wide breadth of questions pertaining to the health of children, covering many factors of social and family engagement. The data were also relatively recently collected, making these

findings more easily comparable to current work in this area. Because the NSCH samples all children and adolescents, we are able to compare youth with DEVDIS to those without special health care needs, potentially further strengthening our findings. We are also able to control for many confounders, especially those related to the family such as family structure, which many past studies have not been able to do. Most importantly, this study was able to examine potential areas of intervention, such as family and social engagement factors, to reduce screen time among youth with DEVDIS, notably youth with ADHD.

5.3 Implications

This research contributes to furthering the information available about factors that influence screen time among youth with DEVDIS. Better understanding of these considerations can aide parents, school teachers, healthcare workers, disability advocacy groups, and researchers in developing strategies to reduce screen time and encourage social engagement. This population of youth is at particular risk for peer rejection and social isolation, which has been cause for concern for many of these stakeholders. Thus, greater understanding of what may be effective in reducing screen time, and thus the risk for obesity, as well as ways in which they can modify their own external environments and interactions with youth to foster opportunities for greater social interaction is desirable. For instance, offering caregivers of these youth training programs that focus on engaging youth with DEVDIS and how to provide the types of support that these youth need, may be an effective strategy to modify the immediate external environment.

At present and to our knowledge, there are few programs geared towards engaging youth with DEVDIS and ADHD, much less those that focus on reducing screen time. High screen time is a growing concern for parents, school teachers, and disability advocacy groups, because many of them worry about addiction to these devices and long-term health consequences resulting from sedentary behavior, which would further socially isolate these youth from their peers without these disorders. Awareness of the consequences of high screen time and how to combat it must be disseminated to these stakeholders via existing channels such as Special Education Parent Advisory Councils (SPED-PAC) and online forums where caregivers of youth with DEVDIS often get their information. Informing concerned parents and families of youth with DEVDIS to remove televisions from bedrooms, to be more mindful about the amount of television viewed by youth, and helping them, through parent training programs, develop strategies within the home to provide the supports necessary for their child, may be powerful first steps to reduce screen time among children with DEVDIS.

As a result of reducing screen time, youth with DEVDIS may have more leisure time available which can be spent pursuing social opportunities with peers, engaging in physical activities and other forms of organized social engagement, and/or strengthening relationships with families. Incorporating the findings of this research into existing interventions that promote healthy behaviors and teaching social interaction may have far-reaching effects on not only the physical health of youth with DEVDIS but their emotional and psycho-social health as well. Limiting exposure to screen time in the household and by extension the classroom, while encouraging social opportunities with

peers and within the family, can contribute to long term changes and eventually better health outcomes. By establishing a foundation of evidence-based interventions, parents and teachers of these youth can determine acceptable ways to encourage engagement and relay that information to each other. These outcomes will help in closing the gap of quality of life and health between youth with DEVDIS and their typically developing peers.

5.4 Conclusions

The findings of this dissertation foster current knowledge of the screen time behaviors of youth with DEVDIS, in particular, youth with ADHD. This work contributes to the ongoing efforts to promote physical activity and positive health behaviors among youth with DEVDIS, by providing greater insight into the family and social engagement factors that may be influencing the high rates of screen time in this population. Determination of intervenable areas in reducing screen time can potentially reduce rates of sedentary behavior and subsequent risk of obesity, among youth who are already at increased risk for overweight. While this work is an important first step to shrinking the disparities that those with disabilities experience, dissemination of the findings about the influential factors of social engagement on screen time and more targeted health promotion interventions that encourage various types of social engagement in order to prevent progression of obesity and other chronic conditions are needed. This research establishes a base of information that can inform future work towards these health promotion efforts.

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Appendix A. 2007 National Survey of Children's Health Disability Items

Item Number	Question	Response Options
K2Q31A	Has a doctor or other health care provider ever told you that [S.C.] had Attention Deficit Disorder or Attention Deficit Hyperactive Disorder, that is, ADD or ADHD?	• No • Yes • Don't Know • Refused
K2Q35A	Has a doctor or other health care provider ever told you that [S.C.] had Autism, Asperger's Disorder, Pervasive Developmental Disorder, or other Autism Spectrum Disorder?	• No • Yes • Don't Know • Refused
K2Q36A	Has a doctor or other health care provider ever told you that [S.C.] had any developmental delay that affects [his/her] ability to learn	• No • Yes • Don't Know • Refused
K2Q30A	Has a doctor, health care provider, teacher, or school official ever told you [S.C.] had a learning disability?	• No • Yes • Don't Know • Refused
CSHCN	Child with special health care need.	• Child does not have a special health care need/s • Child has special health care need/s

Appendix B. 2007 National Survey of Children's Health Screen Time Items

Item Number	Question	Response Options
K7Q60	On an average weekday, about how much time does [S.C.] usually watch TV, watch videos, or play video games?	• Open-ended
K7Q51	On an average weekday, about how much time does [S.C.] use a computer for purposes other than schoolwork?	• Open-ended

Appendix C. 2007 National Survey of Children's Health Family Television Environment Items

Item Number	Question	Response Options
K7Q61	Are there family rules about what television programs [he/she] is allowed to watch	• No • Yes • Don't Know • Refused
K7Q62	Is there a television in [S.C.]'s bedroom?	• No • Yes • Don't Know • Refused

Appendix D. 2007 National Survey of Children's Health Family Engagement Items

Item Number	Question	Response Options
K7Q33	During the past 12 months, how often did you attend events or activities that [S.C.] participated in?	• Never • Sometimes • Usually • Always • Don't Know • Refused
K8Q11	During the past week, on how many days did all the family members who live in the household eat a meal together?	• 0 • 1 • 2 • 3 • 4 • 5 • 6 • 7 • Don't Know • Refused
K7Q34	Regarding [S.C.]'s friends, would you say that you have met all of [his/her] friends, most of [his/her] friends, some of [his/her] friends, or none of [his/her] friends?	• All • Most • Some • None • Child has no friends • Don't Know • Refused
K8Q21	How well can you and [S.C.] share ideas or talk about things that really matter?	• Very Well • Somewhat Well • Not Very Well • Not Well at All • Don't Know • Refused

Appendix E. 2007 National Survey of Children's Health Social Engagement Items

Item Number	Question	Response Options
K7Q30	During the past 12 months, was [S.C.] on a sports team or did [he/she] take sports lessons after school or on weekends?	• No • Yes • Don't Know • Refused
K7Q31	During the past 12 months, did [he/she] participate in any clubs or organizations after school or on weekends?	• No • Yes • Don't Know • Refused
K7Q32	During the past 12 months, did [he/she] participate in any other organized events or activities?	• No • Yes • Don't Know • Refused