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Prevalence and Correlates of Screen-Based Media Use among Youths with Autism Spectrum Disorders

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Abstract

Anecdotal reports indicate that individuals with autism spectrum disorders (ASD) are often preoccupied with television, computers, and video games (screen-based media). However, few studies have examined this issue. The current study examined screen-based media use among a large, nationally representative sample of youths participating in the National Longitudinal Transition Study – 2 (NLTS2). The majority of youths with ASD (64.2%) spent most of their free time using non-social media (television, video games), while only 13.2% spent time on social media (email, internet chatting). Compared with other disability groups (speech/language impairment, learning disabilities, intellectual disabilities), rates of non-social media use were higher among the ASD group, and rates of social media use were lower. Demographic and symptom-specific correlates were also examined.

Keywords

autism; autism spectrum disorder; video game; television; internet

Autism spectrum disorders (ASD) are characterized by significant impairment in communication and social interaction, and the presence of unusual or repetitive behaviors (American Psychiatric Association, 1994). In addition to these core symptoms, ASD are often associated with a variety of other difficulties, including cognitive impairment, poor adaptive function, and psychiatric comorbidities (Simonoff, Pickles, Charman, Chandler, Loucas, & Baird, 2008). Although still relatively limited, there is a growing body of literature examining youth and adult outcomes among individuals with ASD. Global outcomes, based generally on ratings in the areas of occupational functioning, social functioning, and level of independence, are typically poor. Estimates from previous studies have found that from 42% to 78% of adults with ASD obtain poor to very poor overall outcomes (Billstedt, Gillberg, & Gillberg, 2005; Eaves & Ho, 2008; Howlin, Goode, Hutton, & Rutter, 2004). However, other research has shown that the core symptoms of autism can improve gradually over time for many adults with ASD, highlighting the importance of identifying factors that influence long-term success (Shattuck, Seltzer, Greenberg, Orsmond, Bolt, Kring, Lounds, & Lord, 2007). Thus, it is particularly important to identify factors that promote adaptive and social engagement, both of which represent core areas of difficulty for individuals with ASD (American Psychiatric Association, 1994).

Anecdotal and clinical reports indicate that for many youths with ASD, use of television and video games can be a clinically significant problem to the extent these behaviors interfere with adaptive functioning and social engagement. However, this phenomenon has not been examined thoroughly in published research. Thus, the purpose of the current study was to examine the use of screen-based media among a large, nationally representative sample of youths with ASD. The general term “screen-based media,” as used by Marshall, Gorely, and Biddle, 2006, refers to television, computer, and video games.

Screen-Based Media Use among Youths with ASD

Engagement in restricted and repetitive interests is a hallmark diagnostic feature of ASD in the Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition) (*DSM-IV*) (American Psychiatric Association, 1994). Within this cluster of symptoms, criterion A refers specifically to the intensity of a particular interest, an “encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or in focus” (American Psychiatric Association, 1994). Although other types of repetitive behaviors (e.g., stereotyped motor mannerisms) appear to differ as a function of cognitive ability (Turner, 1999), there is some evidence to suggest that circumscribed interests and preoccupations appear to be independent of cognitive ability or developmental level and may increase in severity over time (Bartak & Rutter, 1976; Schultz & Berkson, 1995; South, Ozonoff, & McMahon, 2005). Furthermore, there is considerable evidence that circumscribed interests contribute to marked functional impairment and interference with social relationships and family functioning (South et al., 2005).

In studies of restricted interest among individuals with ASD, interests in playing video games and watching television are often specifically excluded from analysis because these interests are considered to commonly occur among typically developing children (Klin, Danovitch, Merz, & Volkmar, 2007). Thus, we do not yet know whether these interests are similar in nature to other preoccupations that occur among individuals with ASD. In addition, we do not yet know whether the amount or nature of screen-based media use is different among youths with ASD than among typically developing youths or those with other types of disabilities.

Although anecdotal reports of children and adolescents with ASD frequently describe their fascination with technology, including screen-based media, few studies have actually examined this issue directly. To our knowledge, there have been only two relevant studies among children with ASD. In a qualitative study, Nally and colleagues (2000) used a focus-group design to assess parent perceptions of television/video use and management in their children with ASD. Several themes emerged, including the use of television to distract and minimize behavioral outbursts, as well as family difficulties and stress associated with managing television and video use (Nally, Houlton, & Ralph, 2000).

Among a sample of 89 children with ASD, Shane and Albert (2008) examined usage patterns of screen-based media and related parenting strategies. The results indicated that children with ASD participate in screen-based activities (including television, video, and computer games) more often than any other leisure activities (both on weekdays and weekends). For children who engaged in the most use of this media, they did so to the exclusion of other activities (Shane & Albert, 2008). Although this study provided a first look at usage patterns among youths with ASD, it did not compare those patterns with those of children without ASD. Clearly, more research is needed in this area.

Screen-Based Media Use among Typically Developing Youths

Despite the paucity of research on media use in ASD, this topic has received broad attention from researchers interested in typical development. Screen-based media are increasingly used by children and adolescents as a primary and preferred activity. In the United States, estimates of media use from the Kaiser Family Foundation indicate that 68% of 8-18 year olds have television sets in their bedrooms, and 49% have video game systems in their bedrooms (Roberts & Foehr, 2008). This highlights the widespread availability of screen-based media, and the relative ease with which youth may access them. In a systematic review of 90 studies of screen-based media use, Marshall reports that children and adolescents view an average of 134 minutes per day of television. Video and computer game use was estimated to average 40 and 34 minutes per day, respectively (Marshall, Gorely, & Biddle, 2006). In addition, 28% of youths were found to be “high users” of TV (watching more than 4 hours per day). Marshall also reports that high users of both TV and video games are more likely to be male (Marshall et al., 2006).

These high rates of use are alarming given that excessive screen-based media use has been associated with a range of negative outcomes among typically developing children and adolescents. A large body of research has shown that excessive use of screen-based media has detrimental effects on academic performance, attitudes toward school, and long-term educational outcomes in adulthood (Hancox, Milne, & Poulton, 2005; Johnson, Cohen, Kasen, & Brook, 2007; Sharif, Wills, & Sargent, 2009).

Time spent engaged in screen-based media has also been shown to be negatively related to engagement in other activities, including reading, homework, and time spent with family and friends (Cummings & Vandewater, 2007) and has been associated with obesity among children and adolescents (Marshall, Biddle, Gorely, Cameron, & Murdey, 2004; Vandewater, Shim, & Caplovitz, 2004). These and other findings highlight the importance of examining this construct among youths with ASD, who are already at heightened risk for problems in these areas of functioning.

Correlates of Screen-Based Media Use

Among typically developing youths, screen-based media use has been associated with a number of different personal and environmental predictors. In terms of family characteristics, studies have found that low parental education (Anand & Krosnick, 2005; Certain & Kahn, 2002) and low family income (Gentile & Walsh, 2002) are associated with increased screen-based media use among children and adolescents. Additionally, children and adolescents living in single-parent households have been found to spend more time watching television, playing video games, and using computers than those from two-parent households (Anand et al., 2005; Gentile et al., 2002). At the individual level, there is strong consensus that boys spend more time engaged with television, video games, and computers, than girls (Wright, Huston, Vandewater, Bickham, Scantlin, Kotler, Caplovitz, Lee, Hofferth, & Finkelstein, 2001). In addition, African American youths have been found to spend more time watching television and playing video games than youths from other racial and ethnic backgrounds (Andersen, Crespo, Bartlett, Cheskin, & Pratt, 1998; Bickham, Vandewater, Huston, Lee, Caplovitz, & Wright, 2003; Certain et al., 2002), but less time using the computer for internet or email (Cleary, Pierce, & Trauth, 2006; Hoffman & Novak, 1998). Despite this information from the general population, nothing is known about the specific demographic and individual characteristics that are associated with media use among children with ASD.

Relevance to ASD

There is substantial evidence showing that screen-based media use can have detrimental effects on outcomes among typically developing youths, particularly in the areas of academic performance, social engagement, behavioral regulation, and health (Andersen et al., 1998; Anderson, Sakamoto, Gentile, Ichori, Shibuya, Yukawa, Naito, & Kobayashi, 2008; Sharif & Sargent, 2006). This is an important area of inquiry in the field of ASD research because of the importance of these particular areas of functioning as they relate to overall outcome. Although these youths appear to be at risk for excessive use of screen-based media due to the nature of their core symptoms, we know very little about actual patterns of screen-based media use among youths with ASD.

Current Study

The purpose of this study was to examine the prevalence and correlates of screen-based media use among a large nationally representative sample of youths with ASD. The following research questions were addressed:

1. What is the prevalence of use of various types of screen-based media among youths with ASD?

We predicted that youths with ASD would demonstrate high rates of use of solitary screen-based media (including television and video games), with relatively lower rates of use of socially interactive media (including email or chat room participation).

2. How does screen-based media use among youths with ASD compare with that among youths with other disabilities?

Our data source did not include a typically developing comparison group. However, we wanted to contextualize the rates of screen-based media use by comparing youths with ASD to groups of youths who may exhibit impairments in some, but not all, of the three areas affected by the core symptoms of autism. Thus, our comparison groups of interest included youths with 1) intellectual disability (who often exhibit similar levels of adaptive impairment, but not necessarily impairments in the social domain), 2) speech impairment (who exhibit impairments in some aspect of communication, but not necessarily in social or behavioral domains), and 3) learning disabilities (who have academic impairment, but not necessarily problems with social interaction, communication, or behavior).

3. Among youths with ASD, what are the correlates of screen-based media use?

Because there have been no studies on this topic, to date, we have no reason to suspect that correlates of media use among youths with ASD would be different from those that have been found among typically developing youths. Thus, we expect that particular youth characteristics (including gender, ethnicity, and comorbid ADHD) will be significantly related to amount of media use. We also expect that family variables (including parental marital status and family income) will be related to media use. Finally, we were interested in examining whether severity of communication, social, or adaptive impairment has any relationship to type and/or rate of media use.

Methods

This study was approved by the Washington University IRB. All unweighted N's have been rounded to the nearest 10 in compliance with data security regulations from the U.S. Department of Education's Institute for Education Sciences.

Sampling & Data Collection Procedures

Data for this study were taken from the National Longitudinal Transition Study-2 (NLTS2), a 10-year prospective study conducted by SRI International for the U.S. Department of Education, which followed a sample of more than 11,000 students who were ages 13 through 16 and receiving special education services in grade 7 or above in December, 2000. The study's two-stage sampling strategy involved first recruiting a stratified random sample of more than 500 school districts. Special education students were then randomly sampled from district rosters and weighted to be nationally representative of students receiving special education services in the target age range as a whole and of students in each of 12 special education disability categories. The present study includes students who received special education services under the primary disability category of autism, as determined by district-established eligibility criteria. These criteria vary from district to district and can differ from DSM-IV diagnostic criteria. Further details of the sampling and weighting strategies for NLTS2 were published previously (Wagner, Kutash, Duchnowski, & Epstein, 2005).

Data were taken from the first wave of data collection, conducted in 2001, when virtually all sample members were ages 13 through 17 and in middle or high school. Computer Assisted Telephone Interviewing was used to collect data from parents or designated care givers of sample members. An abbreviated mailed questionnaire was sent to parents who could not be reached by telephone. The number of sample-eligible students in the autism category was 1,100. There were 920 participants with parent interview data at wave 1, for a response rate of 84%.

Groups

Prior research indicates that the special education autism category is moderately sensitive and highly specific (Bertrand, Mars, Boyle, Bove, Yeargin-Allsopp, & Decoufle, 2001; Yeargin-Allsopp, Rice, Karapurkar, Doernberg, Boyle, & Murphy, 2003). Not all students with ASD who receive special education services are enrolled in the autism category, and it is possible that some students enrolled in this category do not meet full DSM-IV criteria for an ASD. Unfortunately, we have no way of identifying these youths in our data. We do not have benchmark reference data to accurately characterize the differences between young people with ASD who are served in the autism category and those served in other special education categories or who are not enrolled in special education. Thus, our findings generalize to youths with ASD who were enrolled in the autism category rather than to the entire population of youths with ASD.

We compared youths from the autism category to those from three other enrollment categories: speech/language impairment (SL), learning disability (LD), and mental retardation (MR). Current terminology guidelines urge against the use of the term "mental retardation." However, we use it here in order to be consistent with legislative definitions of the special education categories and the way the data were collected. Parents were asked an open-ended question about other conditions their child might have. We dropped 30 cases from the comparison groups where parents indicated their child also had a diagnosis of ASD, leaving unweighted group totals of 860 youths with SL, 880 youths with LD, and 850 youths with MR.

Measures

Screen-based media use—We examined five dependent measures of screen-based media use. A measure of e-mail or chat room use was derived from a question with ordinal response categories: "How frequently does [YOUTH] interact with others using e-mail or taking part in chat rooms?" Response categories were: several times a day, once a day,

several times a week, and less often. Later in the interview, parents were asked an open-ended question about how their son or daughter spent most of his/her free time: "During the past few weeks, how has [YOUTH] spent most of [his/her] time when [she/he] wasn't working or going to school?" Responses were coded into several categories that were not mutually exclusive. We used three of these for this study: 1) uses electronic or computer games; 2) uses computer for Internet, e-mail, or chat; and 3) watches TV or videos. We also created a variable indicating whether a youth spent most of his/her time using nonsocial screen-based media ("yes" to either "uses electronic or computer games" or "watches TV or videos," AND "no" to "uses computer for Internet, e-mail, or chat").

Youth and family characteristics—Demographic variables of interest included age, gender, ethnicity, race, household income (reported in categories), and an indicator for single-parent households. Respondents were asked if their youth had a diagnosis of attention deficit disorder (ADD) or attention-deficit/hyperactivity disorder (ADHD). An additional variable (having access to a computer in one's home) was included to control for home access to this technology in analyses examining factors related to computer and internet use.

Youth communication, social and adaptive impairment—Conversational ability was assessed using a single item in which respondents were asked, "How well does [YOUTH] carry on a conversation?" and responded on a 4-point ordinal scale (has no trouble carrying on a conversation, has a little trouble, has a lot of trouble, doesn't carry on a conversation at all). Social competence was assessed using a scale (Cronbach's alpha = 0.75 across these 4 groups) that was constructed by summing responses to four questions, each with a 3-category ordinal response scale (never, sometimes, very often), about how often youth: joins groups without being told to; makes friends easily; seems confident in social situations; and starts conversations rather than waiting for others to initiate. Functional cognitive skills were assessed using a scale (Cronbach's alpha = 0.85 for these 4 groups) that was constructed by summing responses to four questions about how well a youth could do the following tasks without help: tell time on an analog clock, read and understand common signs, count change, look up telephone numbers and use a telephone.

Data Analysis

Our three research questions were addressed as follows. First, we examined the prevalence of screen-based media use among youths with ASD by calculating percentages and 95% confidence intervals for each of the five screen-based media use variables of interest (Research Question 1). Second, we compared the prevalence of each type of media use across the four disability groups. Group differences were tested using logistic regressions with dummy indicators (Research Question 2). Finally, we used multivariate logistic regression to model correlates of the four dependent variables for the ASD group (Research Question 3).

Regarding missing data, income was missing for 17% of cases. The remaining variables had missing rates under 8%. We used multiple imputation by chained equations to fill missing values with IVEware to create 50 data sets with no missing values ("IVEware: Imputation and variance estimation software"; Raghunathan, Lepkowski, Van Hoewyk, & Solenberger, 2001). The multiply imputed data were analyzed using Stata 11 which combines estimates using well established procedures (Rubin, 1987). All reported estimates were weighted and variances adjusted to account for the complex sampling using the "mi svy" procedures available in Stata.

Results

Prevalence

Regarding prevalence of screen-based media use among youths with ASD, non-social media use was high. Specifically, the majority of youths with ASD (64.2%) spent most of their time using non-social media (e.g., TV, videos, and electronic or computer games) and did not use email or chat rooms at all (Table 1). The lowest prevalence was for use of computers for email or chat (13.2%).

Group Differences

With regard to group differences in screen-based media use, several significant findings emerged. Among youths with ASD, 64.4% did not use e-mail or chat rooms, about twice as high as the rates for the SL (33.5%) and LD (34.9%) groups (see Table 1). At 41.4%, youths with ASD had a significantly higher prevalence of electronic game use compared with the other groups. They also had the highest rate of TV watching (60.3%), with the SL (50.9%) and LD (47.3%) youths having significantly lower rates. In contrast, youths with ASD had the second lowest rate of using computers for Internet, e-mail, or chat (13.2%). For the combined indicator of spending most of their time with nonsocial electronic media (TV or electronic games), the proportion of youths with ASD (64.2%) was significantly higher than all other groups.

There were several notable differences across groups in demographics and correlates (see Table 2). Consistent with the gender differential in the prevalence of autism spectrum disorders, the proportion who were female (15.4%) was the lowest among all the groups. Relative to youths from the MR group, youths with ASD were more likely to be from affluent families (22.8% vs. 6.5%) and less likely to be from poorer families (22.2% vs. 51.0%). Consistent with the centrality of language impairment as a core feature of autism, 17.3% of youths with ASD had no conversation ability – significantly higher than any other group. Similarly, youths with ASD had the lowest mean score on the social competence scale. The prevalence of having a computer in the home was highest among youths with ASD (81.4%) – significantly higher than the LD (71.1%) and MR (53.4%) groups. The prevalence of attention deficit-hyperactivity disorder was highest among youths with ASD (33.9%), significantly higher compared to youths in the SL group (19.3%).

Correlates of Screen-Based Media Use among Youths with ASD

In a logistic regression model using just the cases with ASD and controlling for other covariates, the odds of no e-mail or chat were significantly lower among older youths (odds ratios of 0.4 for 16- and 17-year olds), those with higher functional cognitive skills (odds ratio 0.7), and among youths with a computer in the home (odds ratio 0.3) (see Table 3). The odds of no email or chat room use were higher among African-American (odds ratio 2.3) and other non-white (odds ratio 2.8) youths, and those with significant impairments in conversation ability (odds ratio 8.1 for those with no conversation ability). The odds of using electronic or computer games during free time were significantly higher among those with higher functional cognitive skills (odds ratio 1.1) and who had a computer in the home (odds ratio 3.2). Females (odds ratio 2.6), Hispanic youths (odds ratio of 0.3), those with higher functional cognitive skills (odds ratio 1.3), and those with a computer in the home (odds ratio 14.2) all had significantly higher odds of using a computer for Internet browsing, e-mail, or chat, whereas the odds were lower for those with no conversation ability (odds ratio 0.1). There were no significant predictors of variability in TV watching. The odds of nonsocial media use was lower among females (odds ratio 0.4) and those with higher functional cognitive skills (odds ratio 0.9), where the odds were higher among those with “a little trouble” conversing (odds ratio 2.1) compared to those with no trouble conversing.

Discussion

The current study is the first to examine the prevalence and correlates of screen-based media use among a large nationally representative sample of youths with ASD. Consistent with our expectations, we found a very high rate of use of solitary screen-based media (i.e., television and video games) among youths with ASD, with markedly lower rates of use of socially interactive media (i.e., email and chat room participation).

Television Use

Nearly two-thirds (60.3%) of the youths with ASD were reported to spend “most of his/her time” watching television or videos. This rate appears to be high, given that among typically developing adolescents, only 28% have been shown to be “high users” of television (Marshall et al., 2006). Although the current study did not use a typically developing comparison group, comparisons among youths with ASD and those with other disabilities were possible. Television use was significantly higher among those with ASD than those with either speech/language impairment or learning disabilities.

Interestingly, the percentage of youths with ASD who spent the majority of their free time watching television was approximately equal to that among youths with intellectual disabilities. This finding may be consistent with previous research examining activity participation among those with disabilities. For example, studies have found that individuals with intellectual disabilities participate in fewer adaptive leisure activities than both typically developing individuals *and* those with other disabilities (e.g., cerebral palsy, hearing loss, seizure disorder) (Van Naarden Braun, Yeargin-Allsopp, & Lollar, 2006). In addition, children with intellectual disabilities participate in fewer physical activities than their typically developing peers beginning in childhood (Foley, Bryan, & McCubbin, 2008), and these rates of participation further decline during adolescence (Kozub, 2003).

Further analysis of television use among youths with ASD in the current study revealed that none of the variables we examined significantly contributed to the prediction of television use. This is surprising given that research among typically developing children has consistently found that male gender and sociodemographic factors (such as low family income) are associated with greater time spent watching television. Furthermore, given that individuals with intellectual disability in the current sample were also highly likely to spend the majority of their free time watching television, it is surprising that functional abilities were not significant predictors of TV use among youths with ASD.

Among the current sample, television viewing is clearly a preferred activity for youths with ASD regardless of symptom profile, functional level, or family status. Although this is the first study to examine these issues quantitatively, the findings of Nally and colleagues (2000) may provide additional insight. In their study, parents of children with autism reported in focus groups that television and videos are often used as a distraction technique, to prevent tantrums, and to control behavior (Nally et al., 2000). This would be consistent with earlier arguments of Gadow and Sprafkin (1993). In their discussion of television use among children with disruptive behavior disorder, they also observed that parents may use television as an opportunity for “peace and quiet” (Gadow & Sprafkin, 1993).

In the absence of other productive activities, it is possible that television may be a particularly convenient and accessible activity (from both the family and youth perspectives). Because watching television requires little effort (either physical or cognitive), it may represent a “mental break” for youths who have trouble engaging in cognitively or socially demanding tasks due to the nature of their impairments. If this is the case, it is not surprising that those with ASD and intellectual disability make the most use of

television, as they are likely to experience more significant difficulties in the social and cognitive domains than are youths with speech impairment or learning disabilities.

Video Game Use

The current results indicate that nearly half the sample (41.4%) of youths with ASD spent most of their free time playing video games. Again, this rate is very high, and was significantly higher than among the other three disability groups examined. Given that only 18% of youths in the general population are considered to be high users of video games (Marshall et al., 2006), it seems reasonable to infer, based on the current results, that youths with ASD are at significantly greater risk of high use of this media than are youths without ASD.

In examining potential predictors of video game use among those with ASD, the current results indicate that access to technology in the home (i.e., having a personal computer) and having higher functional cognitive skills were the only significant predictors in the logistic regression model. Contrary to findings among other groups, family income, gender, or other demographic factors did not significantly predict video game use among youths with ASD. In addition, level of ASD-specific impairment (e.g., difficulties with either social interactions or communication) did not differentiate between those who spent most of their time playing video games and those who did not. Thus, it appears that use of video games is highly prevalent among youths with ASD, and that their use is largely independent of individual or sociodemographic factors. Future work is needed in this area to better characterize the nature and intensity of video game use among those with ASD, as well as examining the types and content of preferred games.

Email and Chat Room Use

In contrast to the high rates of use of non-social screen-based media, the current results reveal strikingly lower rates of use of email and social media among youths with ASD. Specifically, we found that over half of youths with ASD (64.4%) did not use email or chat at all; and that youths with speech impairment and learning disabilities were about 2 times more likely to use email or chat rooms than those with ASD. This finding is not surprising given that the purpose of email and chat room participation is to engage in social interactions (albeit electronically), and that youths with ASD have significant impairment in social reciprocity. Youths with ASD have also been shown to have fewer dyadic friendships or other peer relationships than do youths without ASD (Bauminger & Shulman, 2003; Orsmond, Krauss, & Seltzer, 2004). Thus, these youths may be limited by both social and communicative competence, and opportunities to interact with others. In short, if they have fewer peers with whom to exchange email, their rates of use of this media would be understandably reduced.

In examining individual predictors of email or chat room use among those with ASD, our results were somewhat consistent with this idea. Specifically, we found that youths with ASD who had poorer overall functional cognitive abilities and poorer conversational skills were less likely to use email or participate in chat rooms than those with no conversational or cognitive difficulties. Given that email and chat room participation is largely communicative; it is not surprising that difficulties in social communication would be associated with less use of this technology. It is interesting, but not necessarily surprising, that difficulties in face-to-face verbal communication (e.g., conversation) are associated with difficulties in written communication (e.g., email).

With regard to the influence of cognitive abilities on email and chat room use, previous studies have also shown that individuals with intellectual disabilities are likely to have

weaknesses in basic computer skills (including knowing how to operate the keyboard and mouse). For example, among a large sample of adults with intellectual abilities, Li-Tsang and colleagues (2005) found that only 9% of the sample knew how to access the internet, and only 33% could actually operate the computer independently (Li-Tsang, Yeung, Chan, & Hui-Chan, 2005). Others have found that individuals with intellectual disability have problems using typical computer interfaces, including web browsers and other technologies required for internet use (Davies, Stock, & Wehmeyer, 2001). The current study provides additional information about technology use among youths with ASD with varying levels of cognitive ability, and is largely consistent with previous findings in that greater levels of cognitive impairment were associated with less electronic media use (including both email and video game use).

Racial background was an additional significant predictor in the model focusing on email or chat room participation. Specifically, African American youths and those with other non-white racial backgrounds were less likely to use email or internet chatting than white youths. Interestingly, this was true even after controlling for socioeconomic factors (including income and household composition) and access to having a personal computer in the home. Some cross-cultural studies have found differences in computer and internet use when comparing children from Eastern and Western cultures (Jackson, Zhao, Qiu, Kolenic Iii, Fitzgerald, Harold, & von Eye, 2008; Li & Kirkup, 2007). For example, children and adolescents from the US and UK have been found to be more likely to use computers, internet, and video games than those from China. However, many of these differences were attributable to access to computers at home (Jackson et al., 2008). In contrast, among US samples, previous research has shown that African American individuals are less likely to own personal computers, even after controlling for income and education (Hoffman et al., 1998). Some have argued that underlying socio-cultural processes have a role in explaining cultural differences in computer use, including lower rates of internet and email use among African American individuals; however, these processes have yet to be sufficiently investigated (Cleary et al., 2006; Jackson, Ervin, Gardner, & Schmitt, 2001; Ono & Tsai, 2008).

Limitations and Strengths

The current study has several limitations that should be noted. First, our sample was comprised of youths who met eligibility criteria for special education services under the autism category. As noted, this designation is highly specific and moderately sensitive. We cannot say with confidence that our results generalize to all youths with ASD, but only to those with ASD who were also enrolled in special education. An additional limitation of the study was that our sample did not include a typically developing comparison group. In addition, our survey methodology relied on parent-report for key constructs of interest, which may be subject to bias. Because our data did not include standardized measures of cognitive ability, communication skills or social interactions, we cannot be certain of the validity of our parent-reported measures of these constructs. Another limitation has to do with the wording of the questions about the youths' use of time when not at work or school. The open-ended question structure meant that we are not able to rank each activity relative to others. If a respondent noted that his/her child engaged in all three, we do not know if the total amount of time spent with screen-based media was evenly distributed. Furthermore, we do not know how many hours were spent with each type of screen-based media. Thus, the use of multiple methods and multiple raters, including self-report, direct observation, and standardized assessment would be helpful in future studies.

Our study had several notable strengths. First, the use of a large and socioeconomically diverse sample allowed us to test hypotheses about demographic correlates with adequate power. Second, the nationally-based sampling strategy increases the generalizability of our

findings relative to studies based on clinic or community sampling strategies. Third, the availability of comparison groups enabled us to contextualize the findings among the youths with ASD.

Summary and Future Directions

In summary, the results provide a first look at the prevalence and correlates of television, video game, and computer use among youths with ASD. Although anecdotal reports have long indicated that youths with ASD are fascinated by technology and computers, there has been almost no empirical research on the topic. The current results provide support for these previous assumptions, specifically, that solitary screen-based media use represents a primary and preferred activity for a large percentage of youths with ASD. This is an important issue in the ASD field due to the substantial evidence showing that excessive use of such media has detrimental effects on youth outcomes in the general population, particularly with regard to academic performance, social engagement, behavioral regulation, attention, and health (Andersen et al., 1998; Anderson et al., 2008; Sharif et al., 2006).

Future studies should include large, well-characterized samples of youths with confirmed ASD diagnoses, as well as comparison groups of youths with no diagnoses as well as youths with other diagnoses. More sophisticated measurement strategies are also needed in order to more carefully characterize the nature and intensity of screen-based media use among those with ASD. In particular, it will be important to fully investigate both amount of use (in hours per day) and the qualitative intensity of use (in terms of self- and other-reported preoccupation). As noted in the introduction, it is possible that preoccupation with TV and video games represents a specific type of restricted interest for individuals with ASD. The relations among these constructs were not specifically examined in the current study; however, this topic clearly warrants further exploration in future research. Finally, longitudinal approaches examining social, adaptive, and educational outcomes of screen-based media use among youths with ASD will offer important information that would be highly relevant to clinical care.

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Table 1

Prevalence of screen-based media use compared among groups (percentages and 95% confidence intervals).

	ASD	SL	LD	MR	Test vs. ASD
No email or chat	64.4% [57.7, 70.6]	33.5% [26.2, 41.5]	34.9% [30.6, 39.5]	64.4% [59.3, 69.3]	SL ^{***} , LD ^{***}
How youth spends most of his/her time when not at school or work:					
- Uses electronic or computer games	41.4% [36.9, 46.0]	31.9% [28.7, 35.3]	31.5% [28.1, 35.2]	24.5% [21.2, 28.1]	SL ^{**} , LD ^{**} , MR ^{**}
- Uses computer for Internet, email, chat	13.2% [10.1, 17.0]	19.0% [16.2, 22.1]	17.0% [14.2, 20.2]	6.0% [4.3, 8.3]	SL [*] , MR ^{***}
- Watches TV or videos	60.3% [55.5, 64.9]	50.9% [46.9, 54.9]	47.3% [43.2, 51.5]	56.1% [51.8, 60.2]	SL ^{**} , LD ^{***}
- Spends most of his/her time using nonsocial media	64.2% [59.6, 68.6]	47.3% [42.8, 51.8]	44.8% [40.8, 49.0]	58.1% [53.9, 62.2]	SL ^{***} , LD ^{***} , MR [*]

Source: National Longitudinal Transition Study 2, Wave 1, 2001.

Notes: Number of multiply imputed data sets = 50. Weighted to population levels. Variances adjusted for sampling method.

* $p < .05$

** $p < .01$

*** $p < .001$

Table 2

Demographics and correlates across groups.

	ASD	SL	LD	MR
Age				
13 & 14	33.0% [28.7, 37.6]	44.2% [39.7, 48.9]	31.3% [28.0, 34.9]	27.0% [23.4, 30.8]
15	22.9% [19.7, 26.4]	22.8% [20.1, 25.8]	24.0% [21.0, 27.4]	23.4% [20.1, 27.0]
16	26.4% [22.8, 30.4]	20.1% [16.4, 24.5]	26.3% [22.7, 30.3]	28.3% [24.9, 31.9]
17	17.7% [14.6, 21.2]	12.8% [10.4, 15.7]	18.3% [15.2, 21.9]	21.4% [18.2, 24.9]
Female	15.4% [12.9, 18.3]	37.9% [33.7, 42.4]	32.9% [29.2, 36.7]	43.1% [39.5, 46.7]
Hispanic	11.0% [7.2, 16.6]	19.1% [9.9, 33.6]	20.9% [16.1, 26.8]	10.9% [7.7, 15.2]
Race				
White	65.2% [59.5, 70.5]	65.3% [56.0, 73.5]	66.6% [59.3, 73.2]	57.2% [51.5, 62.8]
African-American	22.6% [17.9, 28.2]	16.4% [12.4, 21.5]	16.8% [12.7, 21.9]	32.4% [27.3, 38.0]
Other	12.2% [9.4, 15.6]	18.3% [12.0, 26.8]	16.6% [13.0, 20.9]	10.3% [8.2, 13.0]
Income				
< \$25,000	22.2% [18.2, 26.7]	26.4% [20.3, 33.7]	31.0% [26.3, 36.1]	51.0% [46.3, 55.7]
\$25,001-50,000	31.5% [27.1, 36.1]	34.5% [30.0, 39.3]	33.3% [29.7, 37.1]	31.0% [26.9, 35.4]
\$50,001-75,000	23.6% [20.2, 27.5]	23.6% [18.9, 28.9]	24.4% [20.2, 29.2]	11.5% [9.1, 14.3]
> \$75,000	22.8% [18.5, 27.6]	15.6% [11.2, 21.1]	11.3% [8.6, 14.5]	6.5% [4.6, 9.2]
Single parent	27.4% [22.8, 32.4]	24.7% [19.2, 31.3]	30.5% [25.6, 35.8]	34.0% [30.2, 38.0]
Conversation ability				
No trouble	13.1% [10.4, 16.5]	60.9% [54.8, 66.7]	75.8% [71.5, 79.6]	44.0% [40.2, 47.9]
A little trouble	31.0% [26.9, 35.4]	29.9% [25.9, 34.2]	21.0% [17.7, 24.8]	34.3% [30.8, 37.8]
A lot of trouble	38.6% [34.5, 42.8]	8.9% [6.3, 12.4]	3.2% ^a	17.0% [14.0, 20.6]
None	17.3% [12.6, 23.2]	0.3% [0.1, 1.0]	[2.2, 4.7]	4.7% [3.2, 6.8]
Social competence	2.9 [2.7, 3.1]	5.1 [4.8, 5.3]	5.3 [5.1, 5.5]	4.6 [4.5, 4.8]
Functional cognitive skills	10.8 [10.3, 11.4]	14.3 [14.0, 14.7]	14.1 [13.8, 14.3]	11.3 [11.0, 11.6]
Computer in the home	81.4% [77.4, 84.9]	74.6% [69.3, 79.3]	71.1% [66.8, 75.1]	53.4% [48.7, 58.0]
ADHD	33.9% [29.4, 38.6]	19.3% [15.9, 23.3]	33.5% [29.3, 38.0]	30.3% [26.5, 34.2]

Source: National Longitudinal Transition Study 2, Wave 1, 2001.

Number of multiply imputed data sets = 50. Weighted to population levels. Variances adjusted for sampling method.

^aThis point estimate pools the values for "A lot of trouble" and "None" in order to comply with the data use agreement rules about table cells based on small underlying counts.

Table 3
Logistic regression models predicting screen-based media use among youths with ASD

	How youth spends most of his/her time when not at school or work:					
	No email or chat Odds ratio [95% CI]	Uses electronic or computer games Odds ratio [95% CI]	Uses computer for Internet, email, chat Odds ratio [95% CI]	Watches TV or videos Odds ratio [95% CI]	Uses nonsocial media Odds ratio [95% CI]	
Age						
(13 & 14) ^a						
15	0.6 [0.3,1.1]	0.8 [0.5,1.3]	1.3 [0.6,2.7]	1 [0.6,1.6]	0.7 [0.4,1.2]	
16	0.4 ^{**} [0.2,0.8]	0.9 [0.6,1.4]	1.5 [0.7,3.3]	0.8 [0.5,1.2]	0.7 [0.5,1.2]	
17	0.4 ^{**} [0.2,0.8]	0.7 [0.4,1.3]	1.8 [0.7,4.6]	1.1 [0.6,2.1]	0.6 [0.3,1.1]	
Female	0.9 [0.5,1.6]	0.9 [0.5,1.5]	2.6 [*] [1.1,6.2]	0.6 [0.4,1.0]	0.4 ^{***} [0.2,0.6]	
Hispanic	0.7 [0.3,1.7]	1.3 [0.8,2.2]	0.3 [*] [0.1,0.9]	0.7 [0.4,1.3]	1.2 [0.6,2.3]	
Race (White)						
African-American	2.3 ^{**} [1.3,4.2]	1.2 [0.8,2.0]	0.6 [0.3,1.6]	0.9 [0.6,1.4]	1.1 [0.7,1.8]	
Other	2.8 ^{**} [1.3,6.1]	1.1 [0.6,2.2]	1 [0.3,3.1]	0.8 [0.4,1.4]	0.7 [0.4,1.4]	
Income						
< \$25,000	1.2 [0.5,2.7]	0.9 [0.5,1.8]	0.8 [0.2,2.9]	1.2 [0.7,2.3]	1 [0.5,2.0]	
\$25,001-\$50,000	0.8 [0.5,1.5]	1 [0.6,1.7]	1.5 [0.6,3.3]	1.1 [0.6,1.8]	0.8 [0.5,1.4]	
\$50,001-\$75,000	1.1 [0.6,2.1]	1.3 [0.7,2.2]	0.8 [0.4,1.7]	0.8 [0.5,1.4]	0.9 [0.5,1.5]	
(> \$75,000)						
Single parent	1.1 [0.6,2.0]	1.1 [0.7,1.7]	0.9 [0.4,1.9]	0.9 [0.6,1.3]	1.1 [0.8,1.7]	
Conversation ability						
(No trouble)						
A little trouble	0.9 [0.4,1.8]	1.3 [0.7,2.2]	0.8 [0.4,1.7]	1.5 [0.9,2.6]	2.1 ^{**} [1.3,3.6]	
A lot of trouble	2.2 [1.0,4.9]	1 [0.5,2.1]	0.6 [0.2,1.5]	1 [0.6,1.9]	1.5 [0.8,2.8]	
None	8.1 ^{***} [2.4,27.1]	0.6 [0.3,1.5]	0.1 [*] [0.0,0.8]	0.7 [0.3,1.6]	0.8 [0.3,1.9]	
Social competence	0.9 [0.8,1.0]	1.1 [1.0,1.2]	1 [0.8,1.2]	0.9 [0.9,1.0]	1 [0.9,1.1]	
Functional cognitive skills	0.7 ^{***} [0.7,0.8]	1.1 ^{***} [1.1,1.2]	1.3 ^{***} [1.2,1.5]	1 [0.9,1.0]	0.9 [*] [0.9,1.0]	

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	How youth spends most of his/her time when not at school or work:					
	No email or chat	Uses electronic or computer games	Uses computer for Internet, email, chat	Watches TV or videos	Uses nonsocial media	
	Odds ratio [95% CI]	Odds ratio [95% CI]	Odds ratio [95% CI]	Odds ratio [95% CI]	Odds ratio [95% CI]	
Computer in the home	0.3 [*] [0.1,0.7]	3.2 ^{***} [1.7,6.0]	14.2 [*] [2.1,95.2]	0.7 [0.4,1.2]	0.9 [0.5,1.4]	
ADHD	0.9 [0.5,1.4]	1.2 [0.8,1.8]	1.2 [0.7,2.2]	0.8 [0.6,1.1]	0.9 [0.6,1.2]	

Source: National Longitudinal Transition Study 2, Wave 1, 2001.

Number of multiply imputed data sets = 50. Weighted to population levels. Variances adjusted for sampling method.

^{*} $p < .05$
^{**} $p < .01$
^{***} $p < .001$

^aReference categories in parentheses.