Plugged in: Electronics use in youth and young adults with Autism Spectrum Disorder

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Abstract

Although electronic technology currently plays an integral role for most youth, there are growing concerns of its excessive and compulsive use. The current study documents patterns and impact of electronics use in individuals with Autism Spectrum Disorder (ASD) compared to typically developing peers. Participants included 172 parents of typically developing individuals and 139 parents of individuals with an ASD diagnosis, ranging in age from 6 to 21 years. Parents completed an online survey of demographics and the frequency, duration, and problematic patterns of electronics use in their youth and young adults. Individuals with ASD were reported to use certain electronics more often in the last month and on an average day, and had greater compulsive Internet and video game use than individuals without ASD. Across both samples, males used video games more often than females. Compared to parents of individuals without ASD, parents of individuals with ASD were significantly more likely to report that electronics use was currently having a negative impact. The implications of problematic electronics use for individuals with ASD are discussed.

Keywords
Autism spectrum disorder, Youth, Video games, Internet, Electronics

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Electronic technology currently plays an integral role in the lives of youth around the world (Durkin, Whitehouse, Jaquet, Ziatas, & Walker, 2010; Madell & Muncer, 2004). The vast majority of youth spend a considerable amount of time engaged in electronics use, playing video games, using computer applications, and carrying cell phones (Madell & Muncer, 2004; Willoughby, 2008; Witt, Massman, & Jackson, 2011), and there is research on positive and negative characteristics associated with these activities (Green & Bavelier, 2007). There has also been an increasing emphasis on electronics use in youth with Autism Spectrum Disorder (ASD; Mazurek, 2013; Mazurek & Engelhardt, 2013a,2013b; Mazurek & Wenstrup, 2013). Understanding the frequency, type, and impacts of electronics use on individuals with ASD is important for ensuring that policies and programs are in place to maximize the benefits and address any problems associated with its use.

Frequency of electronic use

Many individuals with ASD are particularly drawn to video games and other screen-based entertainment, and spend a considerable amount of time engaged in these activities (Mineo, Ziegler, Gill, & Salkin, 2009; Shane & Albert, 2008). Parents and caregivers report that individuals with ASD spend more time on electronic screen media (which

includes video game use) compared to any other leisure activity (Shane & Albert, 2008). Approximately 41% of parents participating in the U.S. National Longitudinal Transition Study-2 reported that their child with ASD (aged 13-17) spent most of his or her free time playing video games (Mazurek, Shattuck, Wagner, & Cooper, 2012), and parents of boys with ASD reported that their sons spent more time playing video games per day (on average 2.1 hrs/day) than typically developing boys (on average 1.2 hrs/day) (Mazurek & Engelhardt, 2013a). In the general population, gender differences are observed in the use of video games, with males spending more time on video game playing (16.4hrs/week) than females (9.2hrs/week) (Gentile, 2009; Witt et al., 2011; Willoughby, 2008).

There may be some key differences in the type of electronics use between those with and without ASD. In a survey of 91 adolescents with ASD and their parents, 98% of youth reported that they used a computer on any given day for an average of 4.9 hours (Kuo, Orsmond, Coster, & Cohn, 2013). With regard to social electronics use though, children with ASD spend significantly less time using email, Facebook, or texting than their typically developing siblings (Mazurek & Wenstrup, 2013). In a small sample of 35 adolescents with Asperger Syndrome, Durkin and colleagues (2010) reported that 60% used a cell phone, compared to 94% of a matched typically developing sample. Compared

to the comparison group, individuals with ASD were less likely to value calling peers and were more likely to use mobile phones for games than their peers.

Impact of electronic use

There is growing concern about the impact prolonged electronics use may have on youth both with and without ASD. Studies have highlighted addictive characteristics associated with Internet use, such as withdrawal when Internet use is impossible, inability to manage time spent online, and conflicts about Internet use (Chou, Condron, & Belland, 2005; Kerkhof et al., 2011; Meerkerk, van den Eijnden, Vermulst, & Garretsen, 2009). Problematic Internet use (Also known as Compulsive Internet Use) is characterized "by continued use of the Internet despite the intention to stop, Internet use dominating a person's cognitions and behaviors, unpleasant emotions when Internet is impossible, the use of Internet to escape from negative feelings, and Internet use which results in conflict with others or with oneself" (Meerkerk et al., 2009, p. 3). In adults, problematic Internet use is associated with feelings of loneliness (Morahan-Martin & Schumacher, 2000), depressive feelings (van den Eijnden et al., 2008), and diminished relationship quality (Kerkhof et al., 2011). The addictive potential of Internet applications, combined with the impulsive and premature adolescent brain, means that adolescents may be particularly susceptible to problematic Internet use (van den Eijnden et al., 2010).

Problematic video game use has also emerged as a major concern for adolescents, with characteristics similar to other forms of dependency. Youth have been found to steal money to play or buy games, skip school to play, ignore academic tasks and social activities to play games, become irritable if unable to play, and report playing for longer than intended (Griffiths & Hunt, 1998; Griffiths & Meredith, 2009). Online gaming in particular may be even more problematic than games that are offline, combining the issues surrounding both video game use and Internet use (Griffiths, Davies, & Chappell, 2004). Grüsser, Thalemann, and Griffiths (2006) found that in a sample of 7,069 game players (M = 21.11 year, SD = 6.35), one out of nine met at least three diagnostic criteria of gaming addiction based on the dependence syndrome outlined by the World Health Organization: "craving, tolerance, withdrawal symptoms, loss of control, neglect of other activities, and other negative consequences" (Griffiths & Meredith, 2009, p. 248).

Individuals with ASD may be particularly susceptible to problematic electronics use (including both problematic Internet and video game use), and research and anecdotal evidence suggest that problematic electronics use is associated with social, behavioral, and academic challenges in families of children with ASD. Like many typically developing individuals with problematic Internet use (Caplan, 2003), individuals with ASD are noted to prefer online communication over face-to-face interaction (Benford, 2008; Mazurek &

Wenstrup, 2013) and have a propensity toward computer-mediated communication (Burke, Kraut, and Williams, 2010). One recent study found an association between ASD symptoms and compulsive Internet use in a non-clinical adult sample (Finkenauer, Pollmann, Begeer, & Kerkhof, 2012). A second study found that boys with ASD (n = 56) had more problematic video game use compared to typically developing boys (n = 41) (Mazurek & Engelhardt, 2013a). Individuals with ASD are more likely to report having difficulty disengaging from playing video games, feeling upset when not able to play, getting angry when interrupted from games, and playing longer than intended compared to their typically developing siblings (Mazurek & Wenstrup, 2013). Further, problematic video game use was predictive of oppositional behavior in boys with ASD (Engelhardt & Mazurek, 2013).

Current Study

We are just beginning to understand the phenomenon of electronics use for individuals with ASD. The existing research indicates that individuals with ASD are actively engaging in electronics; however, most studies have examined general electronics use, so we know little about the pattern of electronics use across the electronic devices (e.g., tablets) and electronic activities (e.g., video games, Internet, social activities, and general computing) now available. Few studies have included male and female participants

with ASD, along with a typically developing comparison group, so we do not know how this electronics use differs by gender in individuals with ASD, compared to same age peers. Further, research has yet to explore the issue of problematic Internet use along with problematic videogame use in youth with ASD and the impact of such use on youth and their families. The current study explores the experience of electronics use (age of use, duration and frequency, interference or compulsion) across a host of different electronics types, by gender and compared to a typically developing comparison group. This is also the first study to examine the reported impact of electronics use for individuals with ASD and their families.

Based on previous research that examined rates of electronics use (Mazurek & Engelhardt, 2013b), we hypothesized that individuals with ASD would begin using electronics at a younger age and have higher rates of electronics use (both frequency and duration) than same-aged individuals without ASD, with non social activities being more common than social ones. We also hypothesized that individuals with ASD would have higher rates of problematic Internet and video game use than individuals without ASD. Finally, we predicted that parents of individuals with ASD would be more likely to report that electronics use negatively impacted their child's life and their family life compared to parents of individuals without ASD.

Method

Participants

Participants originally included 195 parents of typically developing youth and 149 parents of youth diagnosed with ASD between 6 and 21 years of age. All parents completed the Social Communication Questionnaire about their son or daughter to determine eligibility for the study (SCQ; Berument et al., 1999), which has strong diagnostic validity (Berument, Rutter, Lord, Pickles, & Bailey, 1999). Based on previous research and recommendations from the developers, the current study used the clinical cutoff of 12 to increase sensitivity (Corsello et al., 2007; Zablotsky, Bradshaw, Anderson, & Law, 2012); individuals in the comparison group were included if they had an SCQ score lower than 12 (23 participants were excluded out of the 195), and individuals in the ASD sample had to have a score of 12 or greater (10 were excluded out of the 149). Previous research has validated the use of parent reports of professional ASD diagnoses in Internet-based research, especially when combined with reliable screening measures (Daniels et al., 2012).

The final sample included 172 parents of typically developing children (M = 11.72; SD = 3.61) and 139 parents of children with an ASD diagnosis (M = 12.25; SD = 3.97). There was no difference in the age of youth in the two samples, $t(309) = -1.22$, $p = .22$, or in levels of family income between groups, U= 11701, $z = -.11$, $p = .92$ (See Table 1). As

shown in Table 1, there were also no significant differences between the two samples on gender, nationality, marital status, and minority status. Reported DSM-IV-TR diagnoses for the ASD group included Autism (51.8%, n = 72), Asperger Syndrome (36.0%, n = 50), and Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS; 10.8% n = 10), with one individual who had a pending diagnosis but had an SCQ score above the clinical cutoff. The vast majority of individuals in both groups were reported by parents to be able to talk using short phrases or sentences, although fewer in the ASD group compared to the comparison group (92.1% vs. 99.1%, respectively), $\chi^2 = 11.14$, $p = .001$.

Procedure

Convenience and snowball sampling were employed to recruit parents of children with an ASD diagnosis using several Canadian and U.S. Asperger Syndrome and ASD organizations. Emails were sent to these organizations asking if our recruitment flyer could be emailed to individuals on their listserve, posted on their website, and/or displayed onsite. Our recruitment flyer explained that we knew that electronics use was associated with advantages and possible concerns, and that we wanted to understand the benefits and the problems of electronics use. The recruitment flyer also included a link to the consent form and survey. Qualtrics panel management, whose panel is for research purposes only, was employed to email parents of children without an ASD diagnosis. Qualtrics emailed

invitations to their participant lists, ensuring a representative sample of new and old members, until the comparison group reflected the distribution of our ASD sample in terms of age, gender, and country (Canada and the United States). After giving informed consent, parents completed online measures of demographics, electronics use, and social interaction. The survey took approximately 20 minutes to complete. Surveys were completed between October 2012 and May 2013. The survey was approved by the university research ethics board.

Measures

Electronic use. Parents were asked whether their child knew how to use a number of electronic *devices* (lap top computer, desk top computer, iphone or other smart phone, and ipad/ipod/table) and electronic *activities* (play videogames on a computer, play video games on a console, play video games on a portable gaming system, surf the web, use a search engine, watch videos, create a web page, download music files, create documents for school, save or edit images/graphics, use a photo editing program, use social networking sites, talk on a cell phone, text message on a cell phone, instant message with friends, visit a chat room, send and receive emails), similar to Witt et al. (2011). Activity items were totaled to create four subscales: Video games (i.e., play videogames on a computer, play video games on a console, play video games on a portable gaming system); Internet (i.e.,

surf the web, use a search engine, watch videos, create a web page, download music files); Social (i.e., use social networking sites, talk on a cell phone, text message on a cell phone, instant message with friends, visit a chat room, send and receive emails); and General computing (i.e., create documents for school, save or edit images/graphics, use a photo editing program). Parents were then asked, using a 12-point Likert scale ranging from 1 (*less than 4 years old*) to 12 (*older than 14 years old*), the age at which their child started using each of the electronic devices and activities that were endorsed (that the youth knew how to use or do). Parents were also asked how *often in the last month* (i.e, frequency) their child used the electronic devices and activities on a 7-point Likert scale, ranging from 1 (*less than once a month)* to 7 (*daily)* and about the *amount of time on an average day* (i.e., duration) that their child used the electronic devices and activities on a 6-point Likert scale ranging from 1 (*less than 30 minutes)* to 6 (*more than 3 hours)*. Since parents of youth and young adults are unlikely to know the precise number of hours their child uses electronics, Likert scales were used to better capture the general trends of electronics use.

Impacts of electronics use. Parents were asked whether their child's electronics use was currently causing problems for them or their child in any way (yes/no). If the parents responded yes, they were asked to select all of the relevant ways in which electronics use was currently causing programs (i.e., significantly impacting child's social life in a negative

way, significantly impacting child's education in a negative way, and/or significantly impacting their family life in a negative way), with higher total scores reflecting more negative impact. Parents were also asked whether their child's electronics use caused problems for them or their child *in the past*, which were not currently causing problems (yes/no). If parents responded yes, they were asked to select all the relevant ways that electronics use caused problems for them or their child in the past, which were not currently causing problems (i.e., significantly impacted child's social life in a negative way, significantly impacted child's education in a negative way, significantly impacted family life in a negative way), with total scores reflecting greater past impact.

Problematic Internet use. Problematic Internet use was assessed using the Compulsive Internet Use Scale (CIUS; Meerkerk et al., 2009). The CIUS consisted of 14 items that assess compulsive Internet use (e.g, "I find it difficult to stop using the Internet"). The items were adapted for caregiver reporting, and rated on a 5-point Likert scale ranging from 0 (*never)* to 4 (*very often*). The scale has shown good factorial stability over time and across different samples. The CIUS was reported to have high internal reliability ($\alpha = .88$)

and good validity (Meerkerk et al., 2009). In the current study, the internal consistency for the CIUS was α = .94.

Problematic video game use. Problematic video game use was measured by replacing "Internet" with "video game" in the CIUS. In research, problematic video game is considered a specific problem, separate from problematic Internet use (e.g., Mazurek & Engelhardt, 2013b; Meerkerk et al., 2009). In the current study, the internal consistency for problematic video game use was α = .96.

Results

Two-way ANOVAs were conducted with Diagnosis and Gender as between-subject factors to examine potential differences in ability to use electronics, age at which youth began using electronics, frequency and duration of electronics use, as well as impacts of electronics use. All statistical analyses were carried out with SPSS 21.0 software, using two-tailed tests with $\alpha = 0.05$. Missing data were handled using pairwise deletion.

Ability to Use Electronics

As shown in Table 2, two-way ANOVAs indicated no diagnosis by gender interactions for the total number of electronic devices or activities. Individuals with ASD were reported to be able to use significantly more electronic devices ($M = 3.70$; $SD = .14$) than the comparison group ($M = 3.35$; $SD = .10$), although the effect size was small. There

were significant main effects of both diagnosis and gender for the ability to play video games, with the comparison group having the ability to play significantly more video game type activities (M = 2.69; SD = .08) compared to individuals with ASD (M = 2.06; SD = .09) and males having the ability to play significantly more videogame activities (M = 2.58; SD = .05) than females (M = 2.17; SD = .10), with a small effect size. The main effect of diagnosis, but not gender, was significant for social activities, with individuals with ASD using electronics for fewer social activities (M = 2.21; SD = .23) than the comparison group (M = 3.42; SD = .20). No main effects were significant for Internet activities and general computing activities. Among individuals with ASD, SCQ symptom severity was significantly correlated with the number of electronic activities that they knew how to use, r = -.19, p = .03, although the size of the correlation was small.

Age at which Youth Began Using Electronics

As shown in Table 3, there were no significant interactions and no main effects for age at which individuals began using electronic devices, video games, Internet, or general computing activities. Individuals with ASD were significantly older (M = 9.25; SD = .45) when they began using electronics for social activities compared to the comparison group (M = 8.11; SD = .30).

Frequency and Duration of Electronics Use

As shown in Table 4, there were no diagnosis by gender interactions for the frequency or duration of electronics use. Individuals with ASD were reported to spend significantly more time using electronic devices (M = 5.72, SD = .15) than individuals without ASD (M = 5.28, SD = .11) in the previous month, with no gender differences observed. Similarly, individuals with ASD spent more time using Internet and general computing activities (M = 6.09, SD = .16; M = 5.23, SD = .22, respectively) compared to the individuals without ASD (M = 5.53, SD = .12; M = 4.58, SD = .19). There was a significant gender effect for video game use, with males spending significantly more time playing videogames (M = 5.73, SD = .08) than females (M = 5.16, SD = .19) in the last month, and no main effect for diagnosis. No differences emerged with regard to the frequency of social activity use.

As shown in Table 4, none of the diagnosis by gender interactions were significant for the duration of electronics use on an average day. Males were found to spend more time playing video games (M = 2.87, SD = .06) than females (M = 2.48, SD = .15), and individuals with ASD spent more time on the Internet (M = 2.86, SD = .13) compared to individuals without ASD (M = 2.46, SD = .10). No differences emerged for the duration of social activities and general computing.

Impacts of Electronics Use

As shown in Table 5, there were significant main effects of diagnosis for CIUS video game use and Internet use, and no interactions. Individuals with ASD had higher levels of compulsive videogame and Internet use (M = 6.09, SD = .16; M = 5.23, SD = .22, respectively) compared to the individuals without ASD (M = 5.53, SD = .12; M = 4.58, SD = .19). Males had higher levels of compulsive videogame use (M = 2.22, SD = .06) compared to females (M = 1.93, SD = .12). As shown in table 6, parents of individuals with ASD were significantly more likely to report that electronics use was currently impacting their son or daughter's life in a negative way than parents of the comparison group. They were also more likely to report that electronics use had impacted their life in the past (but not currently) than parents of the comparison group. No gender differences or interactions emerged with regard to impact.

Discussion

While other studies have examined problematic video game use in youth with ASD, the current study is the first to examine the frequency and duration of a number of different categories of electronic devices and activities with a comparison group of individuals without ASD, and taking into account potential differences in gender. This is also the first paper to investigate both problematic Internet and video game use and its impact on the lives of North American children with ASD and their families compared to a comparison

group. Parents of individuals with ASD reported that their youth and young adults were able to use a greater number of electronic devices, however did not engage in as many video game and social activities, as the comparison sample. Symptoms of ASD, based on the SCQ, were related to the number of electronic activities that individuals knew how to use; higher ASD symptoms corresponded with lower numbers of electronic activities that individuals knew how to use. Individuals with ASD were significantly older when they began using electronics for social activities, and spent more time using the Internet and on general computing activities, than the comparison sample. Parents of individuals with ASD were significantly more likely to report that electronics use was currently impacting their son or daughter's life (currently and in the past) in a negative way.

These results are consistent in many respects with previous research. In a large, representative sample of youth from the U.S., youth with ASD had higher rates of non-social media use (i.e., television and video games) and lower rates of social media use (i.e., email and chat room participation) than other disability groups (learning disabilities, speech/language impairments, and intellectual disabilities) (Mazurek et al., 2012). Similarly, Mazurek and Wenstrup (2013) found that compared to typically developing siblings, children with ASD spent more time watching television and playing video games and less time using social media or socially interactive video games. Television and

electronic use may be an attractive activity because it requires little effort, and provides a break for individuals who, because of the nature of their difficulties, have trouble engaging in activities that are cognitively or socially demanding (Mazurek et al., 2012). Given that individuals with ASD have difficulty with social interaction and have fewer friendships compared to individuals without ASD, the finding that individuals spend more time on non-social electronics use may not be surprising, but is particularly problematic, as it creates yet another context where individuals with ASD fail to experience practice and competence with social contexts.

Our work extends what is known about problematic electronics use in individuals with ASD. Mazurek and Englehardt (2013b) found that boys with ASD had higher rates of problematic video game use compared to boys without ASD, while another study found that children with ASD had higher levels of problematic video game use compared to their typically developing siblings (Mazurek & Wenstrup, 2013). The results from our study indicate that the compulsive behavior appears to be present with other electronics beyond video game use, suggesting a broader concern. Mazurek and Englehardt (2013a) found that core ASD symptoms were not related to hours of video game play or problematic video game use; however, another study found a connection between symptoms of ASD and compulsive Internet use in a non-clinical adult sample (Finkenauer et al., 2012), making it

unclear how deficits in social communication and restricted patterns of behavior influence risk. Individuals with ASD may be more prone to problematic electronics use because of other characteristics associated with the disorder. For instance, deficits in impulse control and response inhibition are connected with a diagnosis of ASD (Corbett, Constantine, Hendren, Rocke, & Ozonoff, 2009) as well as with problematic video game play (Mazurek & Englehardt, 2013a). A link has also been found between inattention and playing video games for more than one hour a day (Chan & Rabinowitz, 2006). More research is needed to examine the connection between these executive functioning deficits and problematic electronics use for individuals with ASD.

Parents of individuals with ASD were significantly more likely to report that electronics use negatively impacted their child's life compared to parents of individuals without ASD. For typically developing individuals, problematic video game use has been associated with poorer school performance (Gentile, 2009) and high Internet use has been linked with poorer relationships with mothers and peers (Sanders, Field, Diego, & Kaplan, 2000). For individuals with ASD, the negative impacts of playing electronics may be compounded by the social and academic difficulties they already face due to the nature of their difficulties. When individuals with ASD are engaging in problematic electronic use, they have even fewer opportunities to develop social, academic, and occupational skills,

which may be associated with more negative impacts for their families, who are already multiply stressed (Lecavalier, Leone, & Wiltz, 2006). While a number of positive experiences have been noted about electronics use in individuals with ASD, particularly as a teaching or communication device (e.g., Burton, Anderson, Prater, & Dyches, 2013), the current research also suggests that caregivers and clinicians should be aware of early signs of interference or compulsions related to these activities, particularly because parents are reporting negative impacts.

The pattern of differences based on diagnosis was found regardless of gender. A clear pattern of gender differences was found for video game involvement, but not for any other type of electronics activity. Across groups, males had the ability to play significantly more video game activities and spent more time on video games in the last month and on an average day compared to females. Males also had higher rates of problematic video game use than females. These findings are consistent with the gender differences that are found in the general population (Gentile, 2009; Witt et al., 2011; Willoughby, 2008). These findings suggest that boys with ASD are particularly vulnerable to problematic electronics use.

Limitations and Future Directions

One of the main limitations of the current study was that it relied on parent reports, similar to other research on electronics use and ASD (e.g., Mazurek et al., 2012, Mazurek

& Engelhardt, 2013b). Another limitation of the study was the lack of a standardized diagnostic tool to determine an autism diagnosis. Although not a gold standard assessment, we did use the SCQ, which has strong diagnostic validity, to confirm the ASD diagnosis reported by parents, similar to other survey studies (e.g., Zablotsky et al., 2012). Further, parent report of a child's ASD diagnosis has been shown to be valid indicator of child diagnosis (Daniels et al., 2012). Convenience sampling also presents with the possibility of a sample bias, as parents of individuals with ASD were recruited through ASD organizations in Canada and the U.S., and these parents may have children with higher levels of support needs compared to parents of children with ASD who are not involved in these organizations. Parents of both typically developing children and those with ASD who were concerned about problematic computer use may also have been more likely to participate in our study. Our use of online surveys may have excluded parents who did not have access to computers or the Internet, who had less free time due to high parenting demands, or who had lower literacy levels. While our two samples were matched on certain characteristics (e.g., age and geographic location), they were not matched on verbal or cognitive ability.

Certainly, a major strength of the study was its comprehensive nature and the use of a typically developing comparison group to contextualize the pattern of ASD use and

provide a broader understanding of what might be expected in the general population. We examined frequency and duration of electronics use across a broad array of activities and types, problematic use in both video game, Internet, and other electronics, and are the first to explore the potential negative impacts on the child and the family. Future research can build on this work by making use of multiple sources of information about electronics use, including both parent-report and self-report, direct observation, and diaries. Having a comparison group that is matched on developmental level would be helpful. It would also be useful to examine both the predictors and outcomes of problematic electronics use employing longitudinal design, to understand the trajectories over time.

Conclusions

The results confirm the central role that electronics play in the lives of youth with and without ASD, although for youth with ASD, it is less likely used for social reasons. Given the propensity for electronics among individuals with ASD, incorporating electronics into interventions may help to increase engagement, motivation, and reinforcement (Mazurek & Wenstrup, 2013), if done in a strategic way that enhances engagement rather than serving an isolating role. These results also suggest that individuals with ASD may be at a particularly high risk for problems related to electronics use, including excessive and problematic video game and Internet use, calling for further attention into ways of helping

individuals use electronics in a healthy way. Given that electronics use has a significant negative impact on families of individuals with ASD, more research is needed to examine how families can make informed decisions about introducing electronics and how they can implement strategies for monitoring its use. Research should also investigate how to support families when they are facing problematic electronics use. The current findings highlight the need for increased awareness and assessment of problematic electronics use for individuals with ASD.

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Table 1

ASD Sample Compared to Comparison Sample on Key Demographic Variables

Variable		ASD		Comparison % (n)		Test Statistic
		% (N)	Mean (SD)	% (N)	Mean (SD)	
Age			11.72 (3.61)		12.25 (3.97)	$t(309)= -1.22$, $p = .22$
Gender	Male	83.9 (115)		77.9 (134)		$\chi^2 =1.78$, $p = .12$
Nationality	Canadian	90.6 (125)		84.3 (145)		$\chi^2 =2.69$, $p = .07$
	American	9.4 (13)		15.7 (27)		
Marital Status	Divorced, separated, single	18.1 (25)		12.4 (21)		$\chi^2 =3.33$, $p = .19$
	Living with someone or married	81.2 (112)		87.6 (149)		
Minority Status	Self-identify as a member of a visible minority/racialized group	11.5 (16)		14.5 (25)		$\chi^2 =1.04$, $p = .59$
Income			Mean rank = 155.59		Mean rank = 154.53	U= 11701, $z = -.11$, $p = .92$

Table 2

Total electronic devices and total electronic activities use for ASD group and Comparison group

Electronics	ASD		Comparison		Effect of diagnosis	Effect of gender	Diagnosis x gender
	Male M (SD)	Female M (SD)	Male M (SD)	Female M (SD)	*F*, *p*-value & partial eta squared	*F*, *p*-value & partial eta squared	*F*, *p*-value & partial eta squared
Total Devices	3.88 (.98)	3.52 (1.31)	3.49 (1.12)	3.21 (1.14)	$F(1, 285) = 4.36$, $p = .04$, eta =.02	n.s.	n.s.
Total Videogames	2.38 (.97)	1.75 (1.38)	2.79 (9.53)	2.59 (.76)	$F(1, 303) = 28.55$, $p < .001$, eta =.09	$F(1, 303) = 12.19$, $p < .01$, eta =.04	*n.s.*
Total Internet	3.04 (1.12)	2.82 (1.67)	3.17 (1.37)	3.08 (1.62)	n.s.	n.s.	n.s.
Total Social	1.99 (1.95)	2.43 (2.36)	3.34 (2.19)	3.51 (2.16)	$F(1, 303) = 16.54$, $p < .001$, eta =.05	n.s.	n.s.
Total General Computing	1.22 (1.21)	1.41 (1.28)	1.39 (1.22)	1.41 (1.28)	n.s.	n.s.	n.s.

Table 3

Mean age (using an ordinal scale) and standard deviations for ASD group and Comparison group

Electronics	ASD		Comparison		Effect of diagnosis	Effect of gender	Diagnosis x gender
	Male M (SD)	Female M (SD)	Male M (SD)	Female M (SD)	*F*, *p*-value & partial eta squared	*F*, *p*-value & partial eta squared	*F*, *p*-value & partial eta squared
Devices	6.26 (2.50)	6.97 (2.79)	6.79 (2.56)	7.29 (3.05)	n.s.	n.s.	n.s.
Video games	5.53 (2.02)	6.18 (2.09)	6.25 (2.06)	6.04 (2.39)	n.s.	n.s.	n.s.
Internet	7.44 (2.54)	8.24 (2.34)	7.96 (2.11)	8.34 (1.85)	n.s.	n.s.	n.s.
Social	8.52 (3.18)	9.99 (2.30)	8.04 (2.91)	8.18 (2.77)	$F(1, 225) = 4.59$, $p = .03$, eta =.02	n.s.	n.s.
General Computing	8.09 (2.56)	7.58 (2.06)	8.03 (2.91)	9.28 (2.33)	n.s.	n.s.	n.s.

Table 4

Mean frequency and duration of electronics use for ASD group and Comparison group

Electronics		ASD		Control		Effect of diagnosis	Effect of gender	Diagnosis x gender
		Male M (SD)	Female M (SD)	Male M (SD)	Female M (SD)	*F*, *p*-value & partial eta squared	*F*, *p*-value & partial eta squared	*F*, *p*-value & partial eta squared
Frequency (in the last month)	Devices	5.64 (1.12)	5.80 (1.17)	5.36 (1.21)	5.20 (1.28)	$F(1, 285) = 5.66$, $p = .02$, eta = .02	n.s.	n.s.
	Video games	5.68 (1.21)	5.42 (1.21)	5.77 (1.07)	4.89 (1.25)	n.s.	$F(1, 253) = 7.86$, $p = .01$, eta = .03	n.s.
	Internet	6.17 (1.07)	6.02 (.72)	5.54 (1.31)	5.52 (1.21)	$F(1, 259) = 8.13$, $p = .01$, eta = .03	n.s.	n.s.
	Social	5.19 (1.48)	5.78 (1.00)	5.37 (1.52)	5.75 (1.40)	n.s.	n.s.	n.s.
	General Computing	5.34 (1.32)	5.13 (1.14)	4.71 (1.62)	4.44 (1.32)	$F(1, 143) = 4.89$, $p = .03$, eta = .03	n.s.	n.s.
Duration (on an average day)	Devices	3.35 (1.04)	3.18 (1.06)	3.11 (1.00)	3.07 (.79)	n.s.	n.s.	n.s.
	Video games	2.82 (.94)	2.67 (.88)	2.92 (.99)	2.30 (.69)	n.s.	$F(1, 267) = 5.80$, $p = .02$, eta = .02	n.s.
	Internet	2.99 (1.14)	2.74 (.78)	2.52 (.96)	2.41 (.97)	$F(1, 267) = 5.71$, $p = .02$, eta = .02	n.s.	n.s.
	Social	2.17 (.74)	2.39 (.82)	2.27 (.94)	2.24 (.76)	n.s.	n.s.	n.s.
	General Computing	2.32 (.85)	2.36 (.55)	2.16 (.98)	1.99 (.78)	n.s.	n.s.	n.s.

Table 5

Mean of the CIUS for ASD group and Comparison group

CIUS	ASD		Control		Effect of diagnosis	Effect of gender	Diagnosis x gender
	Male M (SD)	Female M (SD)	Male M (SD)	Female M (SD)	*F*, *p*-value & partial eta squared	*F*, *p*-value & partial eta squared	*F*, *p*-value & partial eta squared
Video game	2.51 (1.09)	2.47 (078)	1.92 (.75)	1.40 (.52)	*F*(1, 278) = 37.10, *p* <.001, eta = .12	*F*(1, 278) = 4.45, *p* = .04, eta = .02	*n.s.*
Internet	2.41 (.94)	2.78 (.70)	1.88 (.73)	1.77 (.65)	*F*(1, 282) = 38.47, *p* <.001, eta = .12	*n.s.*	*n.s.*

Table 6

Mean impact of electronics use for ASD group and Comparison group

Impact	ASD		Control		Effect of diagnosis	Effect of gender	Diagnosis x gender
	Male	Female	Male	Female	*F*, *p*-value & partial eta squared	*F*, *p*-value & partial eta squared	*F*, *p*-value & partial eta squared
Currently Impact	.95 (1.21)	.64 (.99)	.20 (.54)	.05 (.23)	$F(1, 300) = 31.52$, $p < .001$, eta = .10	*n.s.*	*n.s.*
Impacted in the Past but Not Currently	.44 (.85)	.31 (.60)	.15 (.48)	.11 (.39)	$F(1, 302) = 7.91$, $p = .01$, eta = .03	*n.s.*	*n.s.*