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Media use among adolescents with autism spectrum disorder

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Abstract

This study explores how adolescents with autism spectrum disorder (ASD) use media, and the factors associated with their media use. A total of 91 adolescents with ASD and their parents completed mail-based surveys. In all, 78% of the adolescents with ASD watched television (approximately 2 h/day), and 98% used computers (approximately 5 h/day) on any given day. They most frequently watched cartoons, played computer or video games that involved shooting, and visited websites that contained information on video games. Adolescents with ASD who watched television with parents reported more positive parent–child relationships. Adolescents with ASD who visited social networking websites or received emails from friends reported more positive friendships. The findings help us understand media-use habits of adolescents with ASD and suggest areas for future research.

Keywords

adolescent, autism spectrum disorder, media use, personal relationships

Adolescents with autism spectrum disorder (ASD) have been reported to have difficulties with peer relationships and participation in social and recreational activities, spending much of their free time engaging in solitary activities and less time doing social activities (Orsmond et al., 2004; Orsmond and Kuo, 2011). Previous research found that watching television and using a computer were the two most frequent free-time activities of adolescents with ASD (Orsmond and Kuo, 2011). Researchers also found that adolescents with ASD had a significantly high prevalence of television viewing and computer usage compared with adolescents with speech/language impairment and confirmed those with learning disabilities (Mazurek et al., 2012). Given the frequency with which adolescents with ASD engage in television viewing and use computers, and the lack of research in this area, it is important to understand the factors associated with engagement in these activities. Media-use patterns and their developmental consequences have been well documented for typically developing adolescents (e.g. Blais et al., 2008; Rideout et al., 2010; Roberts et al., 2004). The first step to understanding the developmental sequelae of media use in adolescents with ASD is to better describe their patterns, and to begin to understand the concurrent associations between media use and characteristics of the adolescent. In this study, we examined how adolescents with ASD spent time using media, and the factors associated with their media use. Specifically, we examined the television shows they watched and what they were doing when using a computer.

Research shows that television can be educational and can positively change attitudes and perceptions of individuals (Larson and Verma, 1999). Moreover, the increased variety of communication features available through the Internet (e.g. instant messaging programs, emails, social networking websites, and chat rooms) and the interaction possibilities within computer games provide enriched learning opportunities for children and adolescents. These same features can also pose risks, such as violent behaviors and social isolation (Anderson et al., 2001). Thus, engaging in various forms of media use could have both positive and negative consequences.

A relatively large body of research has documented the associations between media usage, behavioral outcomes, and social competences of typically developing youth. For

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example, watching violent programs is associated with increased aggression, viewing educational programs is associated with higher grades and less aggressive behavior, and viewing sports television is associated with higher athletic participation (Anderson et al., 2001; Shields and Behrman, 2000). Individuals who engage in high levels of violent first-person shooter video game (a video game centered on gun and weapon-based combat through a first-person perspective) have been reported to have more aggressive behavior (Barlett et al., 2007). Similarly, adolescents who use video games that are suitable for ages over 17 years show more aggressive behavior (Olson et al., 2009). We know very little about the types of television programs and computer activities in which adolescents with ASD engage. Given the fact that engaging in different contents of media may have different influences on development, it is important to begin to understand what content and types of media they are engaging in.

The social context of media use is important in adolescents. Children who watch television with their parents tend to report more enjoyment of programs than those who do not watch television with their parents (Nathanson, 1999). Youth who watch television with their parents tend to have similar viewing habits as their parents (Nathanson, 2002). Watching television with a parent may have a negative effect, however, if aggressive content is viewed together and parents do not appropriately discuss the content (Nathanson, 1999).

Research also suggests that the effects of computer use on the development of social relationships depend partly on whether the online social contacts are with family members and friends, or with strangers and acquaintances (Blais et al., 2008; Valkenburg and Peter, 2007). Adolescents who interact with family members and friends on the Internet develop better social relationships than those interacting with strangers and acquaintances because offline relationships with family and friends provide more social support than strangers and acquaintances. Therefore, in this study, we also examined the companions with whom adolescents with ASD use media.

Research with typically developing adolescents indicates that media usage can impact personal relationships. Using instant messaging is positively associated with positive friendships, whereas visiting chat rooms and playing video game are associated with less positive friendships (Blais et al., 2008). Higher frequency of Internet use has been reported to be associated with less positive parent–child relationships (Willoughby, 2008) and a decrease in adolescents' size of social networks (Kraut et al., 1998). Given that adolescents with ASD have difficulties with social skills and communication (American Psychological Association (APA), 2000), it is important to examine the associations between autism symptoms and media usage. If we find an association between social and/or communication skills and media use, we might be able to use media to positively impact these skills. Thus, understanding the associations between media use and ASD will add to our knowledge about which youth might be vulnerable to engaging in excessive or negative types of media use, and will have implications for intervention, either through monitoring of children's behavior or through using media to improve social and communication skills.

The emerging literature on media use by youth with ASD indicates that these youth spend more time engaging in television and movie viewing than any other leisure activity, and animated programs were highly preferred by those who engaged in those activities (Shane and Albert, 2005). These findings were based on parents' or caregivers' reports. However, parents or caregivers who are not viewing media together with their children may not be able to accurately account for their children's media use. Furthermore, Shane and Albert's (2005) sample included a wide age range of both children and adolescents with ASD, which may not represent the media-use patterns in different developmental stages. Thus, the present study focused on adolescents with ASD and gathered information directly from adolescents.

In view of the lack of knowledge of how adolescents with ASD use media in terms of patterns and companions, and the need to understand the possible associations between media usage and the factors such as social skills, behavior problems, and personal relationships, the aims of the current study were to (a) describe how adolescents with ASD use media, in terms of the frequency, amount of time, and media content; (b) identify the companions with whom they spent time using media; (c) examine the factors (e.g. demographics and severity of autism symptoms) associated with their media use; and (d) examine the associations between media use and parent–child relationships and friendships.

Methods

Procedures

Participants were recruited through local practitioners or private school teachers working with adolescents with ASD, and advertisements posted on autism-related Web pages, forums, or through e-newsletters. Participants were also recruited with the assistance of the Interactive Autism Network (IAN) Research Database at the Kennedy Krieger Institute and Johns Hopkins Medicine—Baltimore, sponsored by the Autism Speaks Foundation.

Prior to participation in the study, a short phone interview with parents was conducted to assure that the adolescents: (1) had a reading level at the 5th grade or higher, so that the adolescents could complete the measures independently; (2) had been previously diagnosed with ASD by a licensed professional; and (3) had a score of 15 or higher on the Lifetime Form of the Social Communication Questionnaire (SCQ; Rutter et al., 2003), which was

Table 1. Demographic characteristics of adolescents with ASD (N = 91).

Variable	Adolescents with ASD
Age (in years)	
Mean ± SD	14.8 ± 1.9
Range	12.0 − 18.0
Gender (n, %)	
Male	74 (81%)
Female	17 (19%)
Education level (n, %)	
Grade 6–Grade 9	58 (64%)
Grade 10–Grade 12	25 (28%)
High school graduate	7 (7%)
Ungraded special education	1 (1%)
Reading level	
> Grade level	39 (43%)
< Grade level	30 (33%)
= Grade level	22 (24%)
Primary diagnosis (n, %)	
Asperger syndrome	58 (64%)
Autistic disorder	17 (19%)
PDD-NOS	16 (18%)
Comorbidity (n, %)	
ADHD	44 (48%)
Anxiety	27 (30%)
Obsessive-compulsive disorder	19 (21%)
Depression	15 (17%)
Intellectual disability	6 (7%)
Other	28 (31%)
Speaking skills (n, %)	
Speaks in full sentences	86 (95%)
Speaks in phrases of several words	5 (5%)
US regions (n, %)	
Northeast	45 (49.5%)
South	18 (19.8%)
Midwest	15 (16.5%)
West	13 (14.3%)

Note: PDD-NOS: pervasive developmental disorder–not otherwise specified; ADHD: attention deficit hyperactivity disorder.

Table 2. Demographic characteristics of parents (N = 91).

Variable	Parent
Age (in years)	
Mean ± SD	46.7 ± 6.0
Range	31.4 − 59.9
Relationship to adolescent (n, %)	
Biological mother	80 (88%)
Biological father	7 (8%)
Adoptive mother	3 (3%)
Stepmother	1 (1%)
Ethnicity (n, %)	
White non-Hispanic	90 (99%)
African American	1 (1%)
Marital status (n, %)	
Married	75%
Divorced	18%
Other	7%
Number of children in family	
Mean ± SD	2.5 ± 1.26
Range	1 − 7
Education status (n, %)	
High school graduate	3 (3%)
1–3 years of college or associate degree	23 (25%)
Bachelor's degree	21 (23%)
Post BA/BS but no graduate degree	18 (20%)
Graduate degree (master's or doctoral degree)	26 (29%)
Employment status (n, %)	
Unemployed	22 (24%)
Full-time	40 (30%)
Part-time	57 (44%))
Seasonally/temporarily	2 (2%)
Household income in 2008	
$10,000–$49,999	22%
$50,000–$89,999	30%
$90,000–$159,999	32%
⩾ $160,000	17%
Median	$85,000

administered during the screening phone interview. After the adolescents and their parents completed the questionnaires and returned them to the research office, the adolescents were sent a gift card as a token of appreciation for their participation.

Participants

Screening phone interviews were conducted with 119 parents, and 113 adolescents qualified for the study. A total of 91 adolescents and their parents completed and returned mailed surveys. The data were collected during the summer months in the United States (May 2009 to August 2009). Tables 1 and 2 show the demographic characteristics of the adolescents with ASD and their parents, respectively.

Measures

Data were collected from adolescents and their parents through mailed questionnaires.

Background information. During the phone screen, parents reported their child's age, gender, and primary ASD diagnosis. By filling out the questionnaires, parents provided information on adolescent characteristics, such as current autism symptoms, speaking skills, and comorbidity of intellectual disability. They were also asked about family characteristics, such as household income, parental education level, and parental employment status.

Past and present autism symptoms. Parents completed the Lifetime Form and Current Forms of the Social Communication Questionnaire (SCQ; Rutter et al., 2003). The SCQ

contains 40 items in three domains (social interaction, communication, and repetitive, stereotyped patterns of behavior). A score of 1 is given for the presence of an abnormal behavior. A cutoff score of 15 on the Lifetime Form indicates likely ASD. Good reliability and convergent validity have been reported (Chandler et al., 2007; Witwer and Lecavalier, 2008). In the present study, alpha reliability of the Lifetime Form and the Current Form were .77 and .80, respectively.

Parent–child relationships. Adolescents completed the Inventory of Parent and Peer Attachment–Revised (IPPA-R; Gullone and Robinson, 2005). The IPPA-R has 28 items for mother–child relationships and 28 items for father–child relationships rated on a 3-point scale from 1 (never true) to 3 (always true), with a higher total score indicating more positive parent–child relationships. The IPPA-R has good internal consistency reliability and convergent validity (Gullone and Robinson, 2005). Alpha reliabilities were .76 and .87 for mother–child relationships and father–child relationships, respectively.

Friendship qualities. Adolescents completed the Friendship Qualities Scale (FQS; Bukowski et al., 1994), which measures the adolescents' friendship qualities with their best friend. The FQS has 23 items rated on a 5-point scale from 1 (strongly disagree) to 5 (strongly agree), and it contains five dimensions of friendships, namely, companionship, conflict, helpfulness, security, and closeness, which are measured. The total scores are calculated using the mean score in each dimension, with high scores reflecting friendships perceived to be high in the named dimension. Good psychometric properties have been reported (Bukowski et al., 1994). In this study, alpha reliability was .87.

Media use. Adolescents completed activity reports for one weekday and one weekend day at the end of the day. Adolescents reported on time spent watching television and engaging in computer activities, which included playing video games on the computer as well as on a video game console. Other computer activities queried included browsing websites, receiving/sending emails, visiting chat rooms, using social networking programs, and using instant messaging programs.

If the adolescent indicated that he or she used media on a given day, they were asked to indicate the total amount of time they spent using each type of media, such as "How much time did you spend watching TV today?" They were also asked to write in the name of the television programs watched, games played, and websites visited. For video games, adolescents did not need to specify the format (computer, console, or tablet), but rather reported on the total number of hours spent playing video games, and the specific games that they played. For each activity, they also reported whether they engaged in the activity alone or with their mother, father, sibling(s), other relative, peer(s) or friend(s), professional staff, or someone else. Adolescents who used instant messaging programs or emails were asked to report the companions with whom they exchanged instant messages or emails. Adolescents were allowed to choose more than one companion.

Results

Frequency and amount of time

Table 3 shows the frequency and the amount of time that adolescents watched television and used a computer. We present the frequency of adolescents who watched television or used a computer on either the weekday or weekend day or on both days. We calculated the average daily hours spent watching television and using a computer over one week by multiplying the weekday hours of each activity by 5 and multiplying the weekend hours of each activity by 2, and then dividing the sum of these two calculations by 7. Thus, the average time shown in Table 3 is not merely an average of the weekday and weekend hours but is weighted to reflect more weekday than weekend days in a week.

On any given day, 78% of adolescents watched television for an average of 2.3 h. Almost all adolescents (98%) used a computer on any given day for an average of 4.9 h. To examine weekday and weekend differences in media use, we used matched-pairs *t*-tests for continuous data and McNemar tests (the matched-pairs equivalent of a chi-square test) for categorical data (Sheskin, 2007). We report the McNemar test statistic (z) because of small cell sizes. The frequency of weekday and weekend television viewing was not significantly different (66% versus 73%; $z = 1.5$, $p = .210$). Similarly, the amount of time spent watching television between weekdays and weekend days was not significantly different (2.6 h vs 2.7 h; $t(70) = -1.24$, $p = .221$). Similar to television viewing, there were no significant differences between weekday and weekend use in the frequency of computer use (92% vs 91%; $z = 0.30$, $p = 1.000$), or the amount of time spent using a computer (4.8 h vs 5.0 h; $t(90) = -.45$, $p = .651$).

Regarding specific computer activities (video gaming, visiting websites, emailing, visiting chat rooms, using social networking programs, or using instant messaging programs), exploring websites and playing video games (including both video games on personal computers and on video-game consoles) were the most common (see Table 3). On average, adolescents spent over 2 h surfing websites and 2 h playing video games per day. A small number of adolescents used computers for emailing, social networking, chatting, instant messaging, and doing other activities (instrumental use, e.g. working on a school project or downloading software). Although they less frequently used instant messaging programs or visited chat rooms, they

Table 3. Amount of time spent watching television and engaging in computer activities on any given day.

Variable	*N*	% of all adolescents	Mean[a] (h)	SD (h)	Range (h)	Mean[b] (h)
Television	71	78%	2.25	1.94	0.12–11.02	1.76
Computer	89	98%	4.91	3.91	0.10–18.76	4.88
Types of Computer Activities						
Website	76	84%	2.15	1.83	0.01–8.36	1.80
Video game[c]	71	78%	2.40	2.51	0.14–16.14	1.88
Instrumental use[d]	41	45%	1.05	1.12	0.04–4.07	1.29
Email	27	30%	0.39	0.61	0.02–2.86	0.11
Social networking program	21	23%	0.81	0.67	0.06–2.14	0.19
Instant messaging program	20	22%	1.00	1.01	0.05–3.07	0.22
Chat room	12	13%	1.03	1.53	0.02–5.71	0.14

[a]Mean value represents average time for adolescents who engaged in that specific activity, excluding the zero values for those who did not engage in the activity. The mean values were weighted for weekday and weekend values.
[b]Mean value represents average time for all adolescents, including the zero values if no time was spent engaged in that specific activity. The mean values were weighted for weekday and weekend values.
[c]Video games include games played on computers, consoles, and any other formats such as tablets and smart phones.
[d]Examples of instrumental use include doing homework, downloading, and using software.

spent a relatively long duration of time when they engaged in these two activities. The range of time spent in these activities was large, which suggests that some adolescents with ASD spent large amounts of time on these activities, and many did not do these activities. No significant differences were found in the frequency and the amount of time spent on each of the computer activities between weekdays and weekend days.

Content preferences

We further examined the contents of television programs, video games, and websites that adolescents with ASD most frequently reported. A total of 359 television programs (including movies played on television), 240 video games, and 439 websites were listed by adolescents. All reported media content was coded by the first author and a graduate student (who was blind to the study purpose). The genres of television programs and video games were adapted from Roberts et al.'s (2004) media activity coding scheme, and the definitions of the genres were based on Newcomb (2004) and Adams (2009), respectively. The genres of websites were created by the first author. The genres of television programs, video games, and websites are available from the author upon request.

Inter-rater reliability analysis using the Kappa statistic was performed to determine consistency between the two coders. The inter-rater reliability Kappa was .925 ($p < .001$) for television program, .918 ($p < .001$) for video games, and .765 ($p < .001$) for websites. For discrepancies, the first and the second authors made a consensus decision about which genre was the most appropriate.

Television programs. Cartoons were the most popular television genre, and accounted for 37% of television programs reported by adolescents (see Figure 1). Frequently listed cartoons included *SpongeBob SquarePants, Fairly Odd Parents, Total Drama Action, The Penguins of Madagascar, Family Guy*, and *The Simpsons*. Comedy (including situational comedy) was the second most popular television genre, accounting for 15%. Each of the remainder of the television genres accounted for less than 10% of reported television programs.

Video games. Action games accounted for slightly less than half of reported video games (46%) (see Figure 2). Action games typically challenge the player's physical skills and coordination. As shown in Figure 2, shooting games were the most frequently reported games in the action genre. Simulation games and role-playing games represented about 10%–20% of reported games. Adolescents less frequently played classic games (including board games, card games, puzzles, gambling, word games, and game shows), racing games, and adventure games, with each of them accounting for less than 5% of reported games.

Websites. Websites used for information and research accounted for the majority of reported websites, with those containing information on video games as the most common sites and those containing information on anime as the second most frequently reported sites (see Figure 3). Adolescents also visited sites for entertainment (e.g. watching online anime, reading online comics, and sharing and viewing video clips), sites for either maintaining or establishing relationships (e.g. friendships and intimate relationships), and sites for playing games. The remainder of the reported websites accounted for less than 10%, and included search

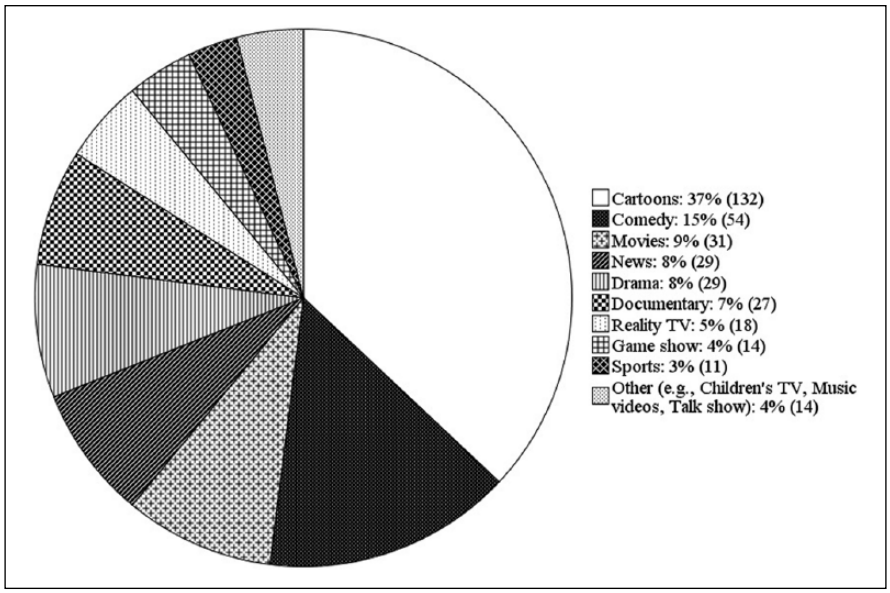

Figure 1. Percentage and number of television program types (N = 359).

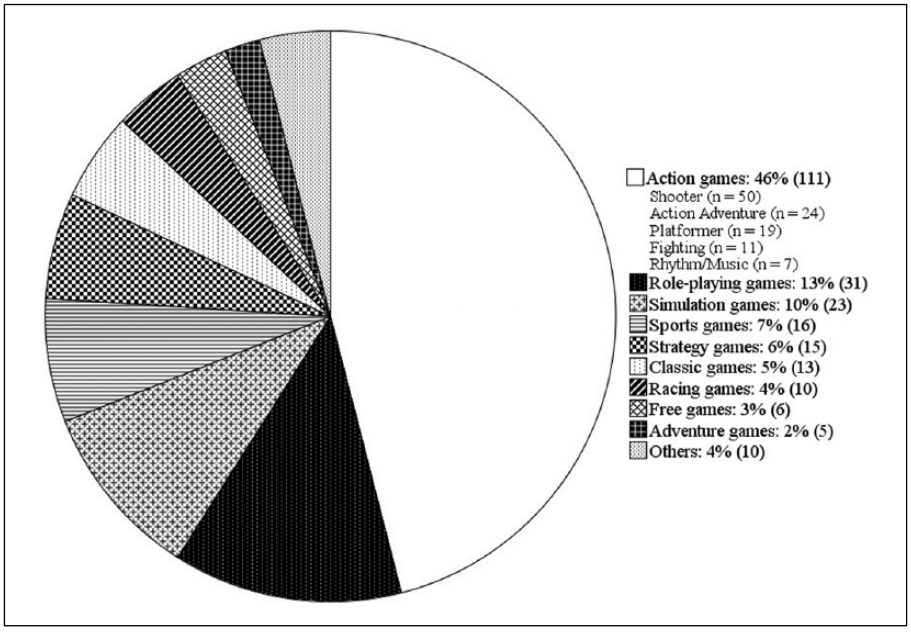

Figure 2. Percentage and number of video game categories (N = 240).

engine websites, shopping sites, online news, and family/children sites.

Companions

Table 4 shows the frequency with which adolescents with ASD used various media with different companions. About half of adolescents who watched television did it either alone or with family members on any given day. Adolescents most frequently watched television with their mothers, followed by siblings and then fathers. They less frequently watched television with peers and other companions. Companions for television viewing did not differ significantly between weekdays and weekend days.

Regarding video games, more than a half of adolescents played video games alone, and about one-fourth with peers. Peers were the companions with whom adolescents most frequently used instant messaging programs, and either sent or received emails.

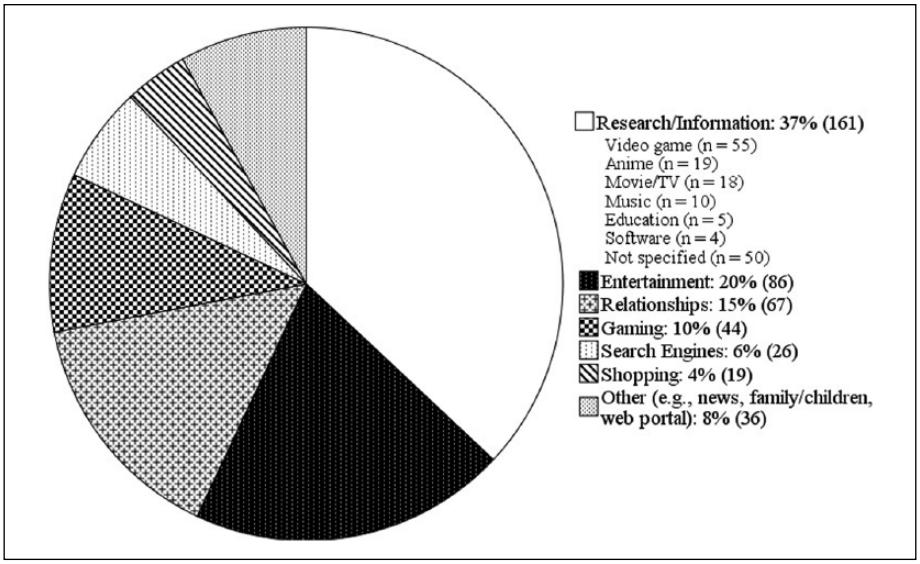

Figure 3. Percentage and number of types of websites (*N* = 493).

Table 4. Companions with whom adolescents with ASD used media on any given day (*N*, % of all adolescents[a]).

Companion	Watching television	Playing video games	Sending emails to	Receiving emails from	Using instant messaging programs
Alone	38 (42%)	59 (65%)	N/A	N/A	N/A
Mother	34 (37%)	1 (1%)	4 (4%)	6 (7%)	2 (2%)
Father	27 (30%)	2 (2%)	5 (5%)	4 (4%)	0 (0%)
Sibling(s)	32 (35%)	13 (14%)	3 (3%)	2 (2%)	3 (3%)
Peer(s)	12 (13%)	22 (24%)	13 (14%)	16 (18%)	18 (20%)
Professional staff	0 (0%)	1 (1%)	4 (4%)	5 (5%)	0 (0%)
Relatives	6 (7%)	4 (4%)	6 (7%)	5 (5%)	3 (3%)
Other	2 (2%)	6 (7%)	4 (4%)	11 (12%)	1 (1%)

[a]The values were based on adolescents' activity reports on both weekday and weekend day. The percentiles represented the number of adolescents who did it on either weekday or weekend day.

Factors associated with media use

We used chi-square and *t*-tests to examine factors associated with how adolescents with ASD used media. Because of the non-normal distribution of variables, and the many adolescents who did not engage in specific computer activities (e.g. instant messaging and using chat rooms), we used a dichotomous variable to indicate whether adolescents participated in each discretionary activity on any given day (0 = no, 1 = yes). Dichotomous factors examined included gender, comorbidity of intellectual disability (0 = without ID, 1 = with ID), parental education level (1 = lower than bachelor's degree and 2 = bachelor's degree or higher), and parental employment status (1 = unemployed and 2 = employed). Other factors were continuous (e.g. age and autism symptoms).

None of the factors were significantly associated with whether adolescents watched television or not, but gender and the severity of autism symptoms (current total SCQ score) were associated with the types of television programs they watched. Females were more likely to watch reality TV shows than males (30% vs 7%; $\chi^2(1) = 7.25$, $p = .007$). Adolescents with more autism symptoms were more likely to watch news programs ($t(89) = 2.32$, $p = .023$) than those with fewer autism symptoms.

Age, gender, and household income were significantly associated with adolescents' computer use. Adolescents who used social networking programs were older than those who did not (15.6 years old vs 14.6 years old; $t(89) = -2.21$, $p = .030$). Males were more likely to play video games than females (68% vs 11%; χ^2 (1) = 4.49, $p = .034$). More males than females played action games (53% vs 12%; $\chi^2(1) = 9.36$, $p = .002$) and sport or competitive games (24% vs 0%; $\chi^2(1) = 5.16$, $p = .023$). More females than males visited websites devoted to shopping (29% vs 11%; $\chi^2(1) = 3.91$, $p = .048$). Adolescents in families with higher household incomes were more likely to spend time using a computer than those in families with lower household incomes ($t(89) = -2.05$, $p = .043$).

Associations between media use and important personal relationships

Adolescents who watched television with their mothers or fathers reported more positive mother–child relationships ($t(89) = 2.11$, $p = .039$) and more positive father–child relationships ($t(89) = 2.22$, $p = .029$), than those who did not watch television with mothers or fathers.

In terms of friendships, adolescents who received email from friends reported greater security in their friendships ($t(89) = 2.14$, $p = .036$). Similarly, adolescents who used social networking programs reported greater security in their friendships ($t(89) = 2.11$, $p = .039$). Adolescents who visited websites for establishing or maintaining relationships reported more positive overall friendships than those who did not ($t(89) = 2.19$, $p = .031$).

Discussion

This study helps us understand how adolescents with ASD use media. A large number of adolescents with ASD in this sample engaged in media activities. Cartoons were the television programs that they watched most frequently. When using a computer, they tended to visit websites that contained information about video games and anime, and play video games that involved killing and shooting. Age, gender, and severity of autism symptoms were associated with whether adolescents with ASD engaged in media activities and their media content preferences. Engaging in specific activities with specific companions was associated with adolescents' relationships with those companions.

Because our study did not include typically developing comparison, we can only compare our findings to those of previous published studies on typically developing adolescents (Rideout et al., 2010; Roberts et al., 2004). This provides us with some indication of the possible differences of the media-use patterns between adolescents with ASD and typically developing adolescents. In comparison to the research on typically developing adolescents who spent an average of 4.7 h watching television on a typical day (Rideout et al., 2010), adolescents with ASD in our sample spent half the amount of time watching television and twice the amount of time using computers (including playing games). This finding also differs from Shane and Albert's (2008) in which youth with ASD spent considerable time watching television. Because Shane and Albert's sample included both children and adolescents with ASD, their findings may not represent the media use patterns in adolescence. One key difference in our study was that adolescents with ASD frequently watched television with their mothers, whereas typically developing adolescents tend to watch television with friends rather than parents (Roberts et al., 2004). Watching television, videos, or movies with peers could be one method through which typically developing adolescents socialize (Roberts et al., 2004). For adolescents with ASD, watching television may not be the method they utilize to socialize with peers or friends. Future research directly comparing the media use between adolescents with ASD and typically developing adolescents is needed to verify our indirect comparison.

Adolescents with ASD most frequently watched cartoons, some of which are targeted toward younger children. These types of television programs usually contain less suggestive dialog, humor, and coarse language, and might be easier for adolescents with ASD to comprehend.

Regarding video games, adolescents with ASD frequently played video games that involved shooting or killing. Shooting games require the player to focus attention on and identify specific targets within a complex background (Adams, 2009). Individuals with ASD often show unusual attention to details and preoccupation with parts of objects instead of the whole object (O'Riordan et al., 2001). They have strengths in visual search tasks and feature discrimination, which require the ability to pick out a small stimulus from a surrounding background (O'Riordan and Plaisted, 2001). Adolescents with ASD may have the capacity to perform well in shooting games, and at the same time, they might be able to have successful experiences in these kinds of games. Although we did not find associations between shooting games and stereotyped, restricted behaviors in our sample, prior research has found that playing shooting games is associated with aggressive behavior in young adults (Barlett et al., 2007). Given that a large number of the adolescents in our sample frequently played shooting game, it is important for future researchers to explore whether there is a similar association between shooting games and problem behaviors in adolescents with ASD.

In terms of website preferences, adolescents with ASD most frequently explored websites containing information about video games and anime. One of the autism symptoms, stereotyped interests, may explain the website preferences of adolescents with ASD (APA, 2000). Winter-Messiers (2007) interviewed children and adolescents with Asperger's syndrome about their special interests and found that video games and arts (including anime) were two of the main interest themes. Our data support this finding.

It was interesting to find that autism symptoms were associated with adolescents' media content preferences. Adolescents with ASD with more autism symptoms were more likely to watch news programs than those with fewer autism symptoms. News programs primarily report current events. The content is usually straightforward, rarely requiring viewers to interpret the emotions and intentions or others, or to understand meanings of metaphors. Therefore, news programs may be relatively easy to understand. It is also possible that teens were passively watching the television programs that their parents preferred.

We found that adolescents with ASD who used computers for social purposes reported more positive friendships than those who used computers for other purposes. Notably, peers were the companions with whom adolescents with ASD most frequently engaged in these computer activities.

Research on typically developing adolescents suggests that adolescents may have better social relationships if they spend more time communicating online with family and friends than with strangers or acquaintances because offline relationships with family and friends may provide more social support than strangers and acquaintances. Our data support this assertion.

We also found that adolescents with ASD who watched television with their parents reported more positive parent–child relationships than those who did not watch television with their parents. Watching television with children not only provides opportunities for parents to gain knowledge of their children's preferences and reactions to the television content but also allows parents to clarify, explain, or discuss the television content (Dorr et al., 1989). When watching television together, parents and adolescents share the same experience, and the television content may provide a concrete subject for conversation (Sang et al., 1993). Moreover, watching television with parents may also provide children a sense of security (Dorr et al., 1989). However, we do not know the causal relationship between watching television together and parent–child relationships. Longitudinal research is needed.

Our study had several limitations, which should be noted in interpreting the findings. First, the findings from our study should be generalized with caution. All participating families were from the United States. Adolescent participants were almost exclusively Caucasian, and almost all had at least phrase speech. Two-thirds had a parent-reported diagnosis of Asperger's syndrome. Through conducting a mail-based survey, we were able to gain regional representativeness across the United States, but most participant families were well educated and many came from middle to upper socio-economic status. Thus, this sample may represent adolescents who are more skilled and have greater access to media than the broader population of adolescents with ASD.

Second, we did not know whether parents set rules on adolescents' use of media, such as what types of television programs adolescents could watch, how long adolescents were allowed to play video games, and whether adolescents were allowed to have an account on the social networking websites. Rates of use may be influenced by household rules. Moreover, adolescents might have engaged in more than one activity simultaneously. For example, they may have surfed websites and sent instant messages to friends at the same time. Thus, our findings my represent an underreporting of media use by these adolescents.

Third, most measures were self-report by the adolescents with ASD. Although we view this as a methodological strength, it also comes with some limitations. The data we gathered represents the adolescents' perceptions and memories. We do not know the accuracy of their reported media use, and we do not know whether the days on which adolescents completed the activity reports were representative of their typical days. Moreover, completing the activity reports at the end of the day may have resulted in recall bias. To solve these limitations, future studies could collect data in real time via an electronic device (e.g. PDA) to record the start and end time of each media activity. These methods, however, may be burdensome to adolescents.

Fourth, we conducted a number of bivariate comparisons to examine the factors that may be associated with the adolescents' media use, which could have increased the possibility of a Type 1 error. Due to the small sample size, we did not adopt a more stringent p level. Readers should interpret our findings with caution, and replication of our findings with larger samples is warranted.

Another limitation of this study was that all data were collected during the summer months. It is possible that adolescents with ASD were more likely to spend time using media during the summer months than during the school year because they have more free time. We do not know how adolescents with ASD use media during the academic year, and we do not know if adolescents' use of media is similar between summer months and other months.

Finally, we did not collect data from typically developing adolescents for direct comparison. There is considerable data on patterns of media use by typically developing adolescents, but this information also becomes outdated fairly quickly. Future studies that collect data from both populations will facilitate a better understanding of the use of media by adolescents with ASD compared with their peers without ASD.

The present study is the first study investigating how adolescents with ASD use media, focusing on watching television and using a computer. In addition to describing media use patterns in adolescents with ASD, we identified factors that are associated with adolescents' media use. We collected data directly from adolescents rather than proxies (e.g., parents, caregivers, and teachers), which provided the adolescents an active role in research, and also yielded detailed media use information. Although we cannot compare adolescents' media use between summer months and academic years, one advantage of collecting data during summer months is that adolescents had more free time in summer months and thus they had more opportunities to engage in these activities. Therefore, we were able to gain more information on their television viewing and computer use.

Management of media use has been reported to be a major issue for parents of children and adolescents with ASD and has caused stress within their family (Nally et al., 2000). A better understanding of how adolescents with ASD use media may help parents be less worried about their adolescents' frequent media use and help them monitor their adolescents' exposure to media. Additional research is needed to better understand if the social skills applied to or learned from online interactions as well as the relationships established online could be generalized to real lives. Moreover, longitudinal studies are needed to investigate the developmental consequences of media use for this population.

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