

PEDIATRICS®

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

Video Game Use in Boys With Autism Spectrum Disorder, ADHD, or Typical Development

Micah O. Mazurek and Christopher R. Engelhardt

Pediatrics 2013;132;260; originally published online July 29, 2013;

DOI: 10.1542/peds.2012-3956

The online version of this article, along with updated information and services, is located on the World Wide Web at:

<http://pediatrics.aappublications.org/content/132/2/260.full.html>

PEDIATRICS is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. PEDIATRICS is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2013 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 0031-4005. Online ISSN: 1098-4275.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™



Video Game Use in Boys With Autism Spectrum Disorder, ADHD, or Typical Development



WHAT'S KNOWN ON THIS SUBJECT: Children with autism spectrum disorder (ASD) and those with ADHD are at risk for problematic video game use. However, group differences in media use or in the factors associated with problematic video game use have not been studied.



WHAT THIS STUDY ADDS: Boys with ASD and ADHD demonstrated greater problematic video game use than did boys with typical development. Inattention was uniquely associated with problematic use for both groups, and role-playing game genre was associated with problematic use among the ASD group only.

AUTHORS: Micah O. Mazurek, PhD,^{a,b} and Christopher R. Engelhardt, PhD^c

Departments of ^aHealth Psychology, and ^cPsychological Sciences, University of Missouri, Columbia, Missouri; and ^bThompson Center for Autism and Neurodevelopmental Disorders, Columbia, Missouri

KEY WORDS

video game, video game addiction, autism, autism spectrum disorder, attention-deficit/hyperactivity disorder, ADHD

ABBREVIATIONS

ANOVA—analysis of variance

ADHD—attention-deficit/hyperactivity disorder

ASD—autism spectrum disorder

PVGT—Problem Video Game Playing Test

SCQ—Social Communication Questionnaire

TD—typical development

VADPRS—Vanderbilt Attention Deficit/Hyperactivity Disorder Parent Rating Scale

Dr Mazurek conceptualized and designed the study, coordinated and supervised data collection, carried out the initial analyses, and drafted the initial manuscript; Dr Engelhardt contributed to the analysis plan and reviewed and revised the manuscript; and both authors approved the final manuscript as submitted.

www.pediatrics.org/cgi/doi/10.1542/peds.2012-3956

doi:10.1542/peds.2012-3956

Accepted for publication May 2, 2013

Address correspondence to: Micah Mazurek, PhD, Department of Health Psychology, University of Missouri, Thompson Center for Autism and Neurodevelopmental Disorders, 205 Portland St, Columbia, MO 65211. E-mail: mazurekm@missouri.edu

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

Copyright © 2013 by the American Academy of Pediatrics

FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: All phases of this study were supported by a grant from the University of Missouri Research Board.

abstract

FREE

OBJECTIVES: The study objectives were to examine video game use in boys with autism spectrum disorder (ASD) compared with those with ADHD or typical development (TD) and to examine how specific symptoms and game features relate to problematic video game use across groups.

METHODS: Participants included parents of boys (aged 8–18) with ASD ($n = 56$), ADHD ($n = 44$), or TD ($n = 41$). Questionnaires assessed daily hours of video game use, in-room video game access, video game genres, problematic video game use, ASD symptoms, and ADHD symptoms.

RESULTS: Boys with ASD spent more time than did boys with TD playing video games (2.1 vs 1.2 h/d). Both the ASD and ADHD groups had greater in-room video game access and greater problematic video game use than the TD group. Multivariate models showed that inattentive symptoms predicted problematic game use for both the ASD and ADHD groups; and preferences for role-playing games predicted problematic game use in the ASD group only.

CONCLUSIONS: Boys with ASD spend much more time playing video games than do boys with TD, and boys with ASD and ADHD are at greater risk for problematic video game use than are boys with TD. Inattentive symptoms, in particular, were strongly associated with problematic video game use for both groups, and role-playing game preferences may be an additional risk factor for problematic video game use among children with ASD. These findings suggest a need for longitudinal research to better understand predictors and outcomes of video game use in children with ASD and ADHD. *Pediatrics* 2013;132:260–266

Children with autism spectrum disorder (ASD) and those with ADHD are at risk for preoccupation with video games. Studies have shown that children with ASD spend substantial amounts of time playing video games,^{1–3} have difficulty disengaging from them,⁴ and show higher levels of problematic (addictive) video game use than do children with typical development.⁵ Similarly, children with ADHD exhibit greater problematic video game use than do children with TD,⁶ and ADHD symptoms are associated with greater time spent on video games^{7,8} and with greater problematic game use.⁸ Han et al⁹ also found a reduction in problematic video game use among children with ADHD after an 8-week trial of methylphenidate. This line of research suggests that the behavioral and neurobiological mechanisms of ADHD may be closely related to problematic video game use, as discussed in 2 recent reviews on the relationship between ADHD symptoms and video game addiction.^{10,11} Although video game addiction is not a formal diagnosis, studies have found that it is characterized by the same features as other behavioral addictions, including salience, tolerance, withdrawal, relapse, mood modification, and conflict.^{12–14} Additionally, the problematic video game use construct can be reliably assessed,^{15,16} has good construct validity,¹⁷ and is associated with negative functional outcomes.¹⁸

The primary diagnostic features of ASD include impairment in social and communication skills and engagement in restricted/repetitive behaviors.¹⁹ These core symptoms may be directly related to the development of problematic video game play patterns. Specifically, a tendency to develop encompassing pre-occupations or intense interests may lead to difficulty disengaging from video games. The audiovisual and structural features of video games, coupled with their relative lack of social demands, may

also make them particularly reinforcing for children with ASD. However, symptoms of inattention and hyperactivity are also common co-occurring problems for children with ASD,^{20–22} which may also relate to problematic game use. Given that children with ASD and ADHD have distinct diagnostic features, yet share common symptoms and are at risk for problematic video game use, a better understanding of the relations among these variables across diagnostic groups is important. Surprisingly, studies have not yet examined how these groups compare in video game play or whether the correlates of problematic game use are similar across groups.

The current study investigated these issues by (1) comparing video game use in boys with ASD, ADHD, or TD and (2) examining the relative contribution of specific symptom types and game features in predicting problematic video game use. Due to the significant gender differences in ASD and ADHD prevalence and phenotypes^{23–26} and the increased risk for problematic game use among boys,^{12,18} the current study examined video game use among boys only.

This was the first study to examine these issues, so competing hypotheses were tested. Specifically, if inattention and hyperactivity largely account for variability in problematic video game use across groups, no differences in video game use would be expected when comparing ASD and ADHD groups, but significant differences would be expected (for both groups) compared with TD children. Alternatively, if problematic video game use is more closely related to core ASD symptoms, differences would be expected when comparing ASD and ADHD groups.

METHODS

Participants

The sample included parents of 56 boys with ASD, 44 boys with ADHD, and 41 boys with TD, ranging in age from 8 to 18

(mean 11.7 years, SD 2.5 years). See Table 1 for demographic information.

Participants with ASD were recruited through an academic medical center specializing in ASD diagnosis and treatment and had been previously diagnosed with an ASD, including autistic disorder (46.4%), Asperger's disorder (25.0%), or pervasive developmental disorder not otherwise specified (PDD NOS) (28.6%), according to the center's clinical care model. The standard diagnostic battery generally includes evaluations by a physician and/or psychologist and the use of standardized tools, including the Autism Diagnostic Observation Schedule²⁷ and/or Autism Diagnostic Interview–Revised.²⁸ Only 4 participants had an IQ of ≤ 70 , and only 2 were reported by parents to have no current use of phrase speech. Participants with ADHD were recruited through a university-affiliated developmental and behavioral pediatrics clinic, and they all had been previously diagnosed with ADHD. See Table 2 for a list of current medications.

Participants in the TD group were recruited through the community with the use of fliers and word-of-mouth recruitment and had no previous diagnosis of ASD, ADHD, or other developmental disorder as reported by parents. TD group participants fell below clinical cutoffs on diagnostic screening measures (described later) and were not taking medications for behavioral or developmental concerns.

Measures

Video game use was assessed by using a questionnaire designed for the current study. Parents reported the number of hours per day their child spent “playing video or computer games” during out-of-school hours (data were collected during months in which school was in session). Parents provided separate estimates for “typical” weekday and weekend days. An average

TABLE 1 Sample Characteristics

	ASD (<i>n</i> = 56)	ADHD (<i>n</i> = 44)	TD (<i>n</i> = 41)	<i>P</i>
Age, y, mean (SD)	11.7 (2.6)	11.1 (2.4)	12.2 (2.4)	.14
No. of siblings, mean (SD)	2.2 (1.6)	1.8 (1.2)	1.9 (1.3)	.37
Race, %				.23
White	80.4	86.4	92.7	
Nonwhite	19.6	13.6	7.3	
Household income, %				<.001
<\$10 000	15.1	7.0	2.4	
\$10 000–\$20 000	7.5	18.6	0	
\$21 000–\$30 000	11.3	25.6	0	
\$31 000–\$40 000	7.5	16.3	0	
\$41 000–\$80 000	32.1	20.9	17.1	
>\$80 000	26.4	11.6	80.5	
Parent marital status, %				.001
Married	55.4	61.4	90.2	
Separated	1.8	2.3	0	
Divorced	30.4	11.4	7.3	
Never married	12.5	25.0	2.4	

Group comparisons for continuous variables were conducted by using ANOVA; group comparisons for categorical variables were conducted by using χ^2 tests.

TABLE 2 Psychotropic Medication Use Across Groups

	ASD (<i>n</i> = 56)	ADHD (<i>n</i> = 44)	TD (<i>n</i> = 41)
Anticonvulsant	10.7%	4.5%	0%
α -Agonist	23.2%	29.5%	0%
Antipsychotic	28.6%	11.4%	0%
Stimulant	33.9%	70.5%	0%
SSRI	16.1%	6.8%	2.4%
SNRI	3.6%	6.8%	0%

SSRI, selective serotonin reuptake inhibitor; SNRI, serotonin-norepinephrine reuptake inhibitor.

daily use variable was created by multiplying the weekday value by 5 and the weekend value by 2, and dividing the sum of these values by 7, consistent with previous research.^{1,5} Parents were also asked: “Does your child have a video game system in his room?”

Parents also listed their child's 3 most commonly played video games during the past month. Game titles were coded into mutually exclusive genre categories based on descriptions from the Entertainment Software Rating Board website and were cross-referenced with descriptions from 2 popular gaming websites (Gamespot and IGN). Genre categories included (1) action/action-adventure, (2) adventure, (3) role-playing, (4) strategy, (5) puzzle/mini-game, (6) educational, (7) fighting, (8) first-person shooter, (9) music, (10) platform, (11)

racing, (12) simulation, (13) sports simulation, and (14) fitness.

Problematic video game use was assessed by using a modified version of the Problem Video Game Playing Test (PVGT).¹⁵ The original PVGT was developed as a self-report measure of problematic video game use based on the behavioral addiction model¹³ but was modified in a previous study for use with children.⁵ This parent-report version includes 19 items rated on a 4-point scale ranging from 1 (Never) to 4 (Always); total PVGT scores represent a sum of all items. Cronbach's α ranged from 0.90 to 0.94 across groups.

Inattention and hyperactivity/impulsivity symptoms were assessed by using the Vanderbilt Attention Deficit/Hyperactivity Disorder Parent Rating Scale (VADPRS).²⁹ Items are rated on a 4-point scale ranging from 0 (Never) to 3 (Very Often), and the Inattention (9 items), Hyperactivity (9 items), and ADHD Total scale scores were examined. The VADPRS has good internal consistency, validity, and reliability³⁰ and has been used in ASD studies.³¹ Cronbach's α ranged from 0.87 to 0.94 across groups.

Current ASD symptoms were assessed by using the Social Communication Questionnaire–Current (SCQ).³² The

SCQ is a parent-report questionnaire with strong reliability and validity.^{32–34} The Current form was used, focusing on behavior over the most recent 3-month period. Items are rated as “Yes” or “No” (total possible scores range from 0 to 39). Cronbach's α ranged from 0.62 to 0.83 across groups.

RESULTS

Sample Characteristics

Groups did not differ by age, race, or number of siblings. Group differences in parent marital status and household income were observed (see Table 1). A 1-way analysis of variance (ANOVA) revealed that SCQ scores differed significantly across groups, $F(2, 138) = 45.5$, $P < .001$. Tukey post-hoc comparisons showed that the ASD group had higher SCQ scores (mean 13.7, SD 5.6) than both ADHD (mean 8.1, SD 5.4, $P < .001$) and TD groups (mean 4.4, SD 2.4, $P < .001$). The ADHD group also had higher scores than the TD group ($P = .001$). A 1-way ANOVA also showed group differences on the ADHD Total score: $F(2, 138) = 60.2$, $P < .001$. Tukey post-hoc comparisons showed that the ADHD group exhibited higher ADHD Total scores (mean 30.3, SD 12.1) than the TD group (mean 7.5, SD 5.9, $P < .001$). However, the ADHD and ASD (mean 28.0, SD 12.0) groups did not differ.

Video Game Use

We examined diagnostic group differences in daily video game hours using the general linear model while controlling for household income (dichotomous variable, 1 = income \leq \$80 000, and 2 = income $>$ \$80 000) and parent marital status (dichotomous variable, 1 = married, and 2 = not married). The results revealed significant diagnostic group differences in daily video game hours (Table 3). Bonferroni post-hoc comparisons revealed that boys with ASD spent more time playing video games than did boys with TD ($P = .01$,

$d = .80$), whereas boys with ADHD did not differ significantly from either group.

In-Room Video Game Access

The χ^2 tests revealed significant group differences for in-room video game access (Table 4). Post-hoc bivariate χ^2 tests showed that a greater percentage of both the ASD and ADHD groups had in-room video game systems compared with the TD group, ($P = .001$ and $P = .002$, respectively), whereas the ASD and ADHD groups did not differ.

Video Game Genre

Dichotomous variables (coded 0 = no, 1 = yes) were created to indicate whether each game genre was 1 of the top 3 most frequently played. To reduce the possibility of Type I error, a Bonferroni correction was applied by dividing the α level ($\alpha = .05$) by the number of total comparisons (14), yielding an adjusted significance level ($\alpha = .004$). Two-tailed Fisher exact tests comparing all 3 groups revealed significant differences in the shooter and sports genres (see Table 4). Post-hoc bivariate Fisher exact tests showed that a greater percentage of the TD ($P = .002$) group preferred shooter games compared with the ASD group. Also, a greater percentage of the TD group preferred sports games compared with the ADHD group ($P = .001$).

Problematic Video Game Use

Diagnostic group differences in PVGT score were examined by using the general linear model, controlling for

household income (dichotomous), parental marital status (dichotomous), and daily video game hours (a correlate of problematic game use in previous research¹² and $r = 0.51$, $P < .001$ in the current study). The results indicated diagnostic group differences in PVGT score ($P = .001$). Bonferroni post-hoc comparisons indicated that the ASD and ADHD groups had higher PVGT scores than the TD group ($P = .001$, $d = 1.12$, and $P = .03$, $d = .98$, respectively). However, the ASD and ADHD groups did not differ (see Table 3).

Regarding video game genre preference, 1-way ANOVA revealed that boys who played role-playing games had higher PVGT scores (mean 45.0, SD 11.9) than those who did not (mean 35.6, SD 10.7): $F(1, 142) = 11.2$, $P = .001$. A factorial ANOVA showed that the diagnostic group \times role-playing game interaction was nonsignificant, $F(2, 135) = 1.7$, $P = .18$, suggesting a similar relationship between role-playing preferences and PVGT scores across groups.

Associations Between Symptoms and Problematic Video Game Use

Subsequent analyses were conducted separately by group to examine the relative contribution of particular symptoms in predicting problematic video game use.

ASD Group

PVGT score was correlated with daily video game hours ($r = 0.36$, $P = .008$), inattention ($r = 0.48$, $P < .001$), and hyperactivity ($r = 0.38$, $P = .004$) but not with SCQ ($r = -0.01$, $P = .97$). To

determine the relative contribution of these variables to PVGT score, a simultaneous linear regression was conducted with PVGT score as the dependent variable and daily video game hours, role-playing genre, inattention, and hyperactivity as independent variables. The results indicated that daily video game hours ($\beta = .29$, $t = 2.6$, $P = .01$), role-playing genre ($\beta = .25$, $t = 2.2$, $P = .03$), and inattention ($\beta = .43$, $t = 2.8$, $P = .01$) remained significant predictors of PVGT, whereas hyperactivity was not a significant predictor ($P = .54$) when controlling for the other variables in the model.

ADHD Group

PVGT score was correlated with daily video game hours ($r = 0.47$, $P = .002$) and inattention ($r = 0.37$, $P = .01$) but not with hyperactivity ($r = 0.20$, $P = .19$). Linear regression results indicated that daily video game hours ($\beta = .49$, $t = 3.7$, $P = .001$) and inattention ($\beta = .36$, $t = 2.1$, $P = .04$) remained significant predictors of PVGT, whereas hyperactivity and role-playing genre ($P = .97$ and $P = .70$, respectively) were not.

TD Group

PVGT score was correlated with daily video game hours ($r = 0.70$, $P < .001$), inattention ($r = 0.55$, $P < .001$), and hyperactivity ($r = 0.50$, $P = .001$). Linear regression results showed that daily video game hours ($\beta = .59$, $t = 5.9$, $P < .001$) and hyperactivity ($\beta = .32$, $t = 2.9$, $P = .006$) remained significant predictors of PVGT, whereas inattention and role-playing genre ($P = .07$ and $P = .87$, respectively) were not.

DISCUSSION

This is the first study to examine video game use among boys with ASD compared with those with ADHD or TD. Consistent with previous findings,⁵ boys with ASD spent significantly more time than did boys with TD playing video games, and this alone (2.1 h/d)

TABLE 3 Group Differences in Video Game Use

	ASD ($n = 56$)	ADHD ($n = 44$)	TD ($n = 41$)	P	η^2_p
Video game, h/d, mean (SD)	2.1 (1.3) ^a	1.7 (1.1)	1.2 (0.9) ^a	.01	.070
PVGT, mean (SD)	41.2 (12.7) ^a	37.7 (9.2) ^b	29.6 (7.1) ^{ab}	.001	.107

Group comparisons were conducted by using the general linear model, controlling for household income, parent marital status, and video game hours per day (for the PVGT model). Groups with matching superscripts within rows differed at the $P < .05$ level in Bonferroni post-hoc comparisons. Unadjusted means and standard deviations are reported. Partial η squared (η^2_p) is reported for effect sizes.

TABLE 4 Group Differences in Video Game Access and Genres

	ASD, % (<i>n</i> = 56)	ADHD, % (<i>n</i> = 44)	TD, % (<i>n</i> = 41)	χ^2	<i>P</i>	Effect Size
In-room video game system, %	42.9 ^a	43.2 ^b	12.2 ^{ab}	12.3	.002	0.295
Genre reported in top 3 games, %						
Action	30.4	38.6	17.1		.08	
Adventure	3.6	4.5	2.4		1.000	
Educational	3.6	11.4	0		.06	
Fighting	1.8	0	0		1.000	
Fitness	1.8	0	0		1.000	
Music	0	2.3	4.9		.19	
Platform	21.4	25.0	9.8		.17	
Puzzle/mini-games	25.0	20.5	34.1		.37	
Racing	17.9	20.5	26.8		.57	
Role-playing	16.1	13.6	4.9		.21	
Shooter	14.3 ^a	34.1	43.9 ^a		.003	
Simulation	7.1	13.6	14.6		.45	
Sports	16.1	9.1 ^a	41.5 ^a		.001	
Strategy	5.4	6.8	7.3		.92	

Group comparisons were conducted by using χ^2 test when possible. Effect size is described by Cramer's *V*. Fisher's exact test (2-sided) was used in cases in which cell counts were <5. Post hoc bivariate analyses were performed by using Fisher's exact tests; groups with matching superscripts within rows differed at the *P* < .004 level.

exceeded the American Academy of Pediatrics' recommendation for *combined* screen-based media exposure.³⁵ The estimates of daily video game time for both ASD and TD groups were highly consistent with those from another recent study of similarly aged children⁵ and extend those findings by including a comparison group of boys with ADHD. Estimates of video game hours per day in children with ADHD have not been previously reported, yet our findings were also consistent with a small study showing that children with ADHD and TD did not differ on broader measures of game play frequency or duration.⁶

Importantly, the current study extends previous findings with regard to problematic patterns of video game play. Boys with ASD and boys with ADHD demonstrated significantly greater problematic video game use than did boys with TD, whereas the ASD and ADHD groups did not differ from one another. These findings replicate and extend previous research that has found differences in problematic video game use when separately comparing ASD and TD groups⁵ and ADHD and TD groups.⁶ To further explore this issue, we examined the role of particular symptoms in

relation to problematic video game use. Among boys with ASD, problematic video game use was positively correlated with inattention and hyperactivity but not with overall ASD symptoms. Furthermore, in multivariate models, hyperactivity was not a significant predictor of problematic video game use beyond the effects of game play variables, whereas inattention was significantly associated with problematic video game use across the ASD and ADHD groups.

These results shed light into potential associated features of problematic game use and are consistent with previous studies linking impulsivity and inattention with problematic video game use.^{6,8,18} Children with ASD and those with ADHD experience difficulties with impulse control and response inhibition,³⁶ and these problems appear to be closely related to video game preoccupation. In contrast, core ASD symptoms were not associated with either hours of video game play or problematic video game use. Longitudinal studies among children with ASD will be essential to determine whether attention problems contribute to maladaptive video game use, whether

problematic video game use leads to attention problems, and whether there are bidirectional influences (as in general population studies).⁷

This was also the first study to examine game genre preferences among children with ASD compared with other children. A somewhat greater, though not significantly different, percentage of boys with ASD preferred role-playing games (eg, the *Pokémon* series) compared with boys with TD. This finding is noteworthy, because role-playing games have been associated with problematic video game use in previous studies.^{37–39} In fact, boys who preferred role-playing games had higher problematic video game use than did those who did not. This relationship remained significant even when controlling for additional game- and symptom-level variables in multivariate regression models. These results suggest that game genre may provide its own unique contribution in the prediction of problematic game use, above and beyond the effects of other well-known correlates of problematic game use. Moreover, boys with ASD who prefer this genre may be at even greater risk for negative game-related sequelae.

Interestingly, boys with ASD were much less likely than boys with TD to play first-person shooter games. Because we did not assess the reasons for game choice, we can only hypothesize the reasons for this difference. First-person shooter games are fast-paced, audiovisually intense, and violent, and game play often results in increased physiologic arousal.^{40,41} Given that individuals with ASD are at increased risk for anxiety⁴² and sensory reactivity,^{43,44} these types of games may be less appealing for many individuals with ASD.

Finally, the results showed that boys with ASD or ADHD had greater in-room access to video games than did boys with TD. It is possible that their preoccupation with games results in

increased access. Alternatively, greater access may lead to more problematic use or preoccupation. Another possibility is that parents of children with ASD or ADHD may offer increased access to these media as a means of managing difficult behavior. This idea has been discussed in other studies of families of children with ASD⁴ and disruptive behavior disorders.⁴⁵

LIMITATIONS AND FUTURE DIRECTIONS

Primary limitations of the current study included reliance on parent-report measures and a lack of comprehensive measures for diagnostic confirmation. Future studies should include a multimethod, multi-informant approach, including gold standard diagnostic tools, to evaluate the impact of particular symptoms on screen-based media use. Although overall ASD symptoms, as measured by the SCQ, were not related to problematic game use, the use of multidimensional measures of core symptoms may yield different results. In particular, specific difficulties

with restricted interests and preoccupations may be most closely related to the tendency to develop problematic patterns of video game use. Additionally, the relatively small sample size may have limited our ability to detect meaningful group differences in correlates of problematic video game play patterns.

Standardized measures of intellectual and language functioning would also be helpful to determine whether media use differs as a function of cognitive or language level. Also, the cross-sectional study design provides information about associations between variables and suggests areas for further study. However, causal conclusions cannot be drawn from the current findings. Longitudinal studies are needed to extend this research and to examine the long-term effects of screen-based media use in children with ASD.

CONCLUSIONS

These results suggest that children with ASD and those with ADHD may be at particularly high risk for significant

problems related to video game play, including excessive and problematic video game use. Attention problems, in particular, are associated with problematic video game play for children with ASD and ADHD, and role-playing games appear to be related to problematic game use particularly among children with ASD. Although longitudinal research is needed to examine the outcomes of problematic video game use in these special populations, general population studies have shown that problematic game use can have significant detrimental effects.¹⁹ Thus, the current findings indicate a need for heightened awareness and assessment of problematic video game use in clinical care settings for children with ASD and ADHD.

ACKNOWLEDGMENTS

We gratefully acknowledge all the families who participated in this study. Thanks are also due to Dr Kristin Sohl, Colleen Wenstrup, and Megan Ellingsworth for their help with recruitment and data collection.

REFERENCES

- Orsmond GI, Kuo H-Y. The daily lives of adolescents with an autism spectrum disorder: discretionary time use and activity partners. *Autism*. 2011;15(5):579–599
- Mazurek MO, Shattuck PT, Wagner M, Cooper BP. Prevalence and correlates of screen-based media use among youths with autism spectrum disorders. *J Autism Dev Disord*. 2012;42(8):1757–1767
- Shane HC, Albert PD. Electronic screen media for persons with autism spectrum disorders: results of a survey. *J Autism Dev Disord*. 2008;38(8):1499–1508
- Nally B, Houlton B, Ralph S. Researches in brief: The management of television and video by parents of children with autism. *Autism*. 2000;4(3):331–337
- Mazurek MO, Wenstrup C. Television, video game and social media use among children with ASD and typically developing siblings. *J Autism Dev Disord*. 2013;43(6):1258–1271
- Bioulac S, Arfi L, Bouvard MP. Attention deficit/hyperactivity disorder and video games: a comparative study of hyperactive and control children. *Eur Psychiatry*. 2008;23(2):134–141
- Gentile DA, Swing EL, Lim CG, Khoo A. Video game playing, attention problems, and impulsiveness: Evidence of bidirectional causality. *Psychology of Popular Media Culture*. 2012;1(1):62–70
- Chan PA, Rabinowitz T. A cross-sectional analysis of video games and attention deficit hyperactivity disorder symptoms in adolescents. *Ann Gen Psychiatry*. 2006;5:16
- Han DH, Lee YS, Na C, et al. The effect of methylphenidate on Internet video game play in children with attention-deficit/hyperactivity disorder. *Compr Psychiatry*. 2009;50(3):251–256
- Weiss MD, Baer S, Allan BA, Saran K, Schibuk H. The screens culture: impact on ADHD. *Atten Defic Hyperact Disord*. 2011;3(4):327–334
- Weinstein A, Weizman A. Emerging association between addictive gaming and attention-deficit/hyperactivity disorder. *Curr Psychiatry Rep*. 2012;14(5):590–597
- Gentile DA. Pathological video-game use among youth ages 8 to 18: a national study. *Psychol Sci*. 2009;20(5):594–602
- Griffiths MD. A components model of addiction within a biopsychosocial framework. *J Subst Use*. 2005;10:191–197
- King D, Delfabbro P, Griffiths M. The role of structural characteristics in problematic video game play: An empirical study. *Int J Ment Health Addict*. 2011;9(3):320–333
- King D, Delfabbro P, Zajac I. Preliminary validation of a new clinical tool for identifying problem video game playing. *Int J Ment Health Addict*. 2011;9(1):72–87
- Tejeiro Salguero RA, Morán RMB. Measuring problem video game playing in adolescents. *Addiction*. 2002;97(12):1601–1606

17. Choo H, Gentile DA, Sim T, Li D, Khoo A, Liau AK. Pathological video-gaming among Singaporean youth. *Ann Acad Med Singapore*. 2010;39(11):822–829
18. Gentile DA, Choo H, Liau A, et al. Pathological video game use among youths: a two-year longitudinal study. *Pediatrics*. 2011; 127(2):e319–e329
19. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*, Fourth Edition, Text Revision. Washington, DC: American Psychiatric Association; 2000
20. Frazier JA, Biederman J, Bellordre CA, et al. Should the diagnosis of attention-deficit/hyperactivity disorder be considered in children with pervasive developmental disorder? *J Atten Disord*. 2001;4(4):203–211
21. Gadow KD, Devincent CJ, Pomeroy J, Azizian A. Comparison of DSM-IV symptoms in elementary school-age children with PDD versus clinic and community samples. *Autism*. 2005;9(4):392–415
22. Mayes SD, Calhoun SL, Mayes RD, Molitoris S. Autism and ADHD: overlapping and discriminating symptoms. *Res Autism Spectr Disord*. 2012;6(1):277–285
23. Gershon J. A meta-analytic review of gender differences in ADHD. *J Atten Disord*. 2002;5(3):143–154
24. Mandy W, Chilvers R, Chowdhury U, Salter G, Seigal A, Skuse D. Sex differences in autism spectrum disorder: evidence from a large sample of children and adolescents. *J Autism Dev Disord*. 2012;42(7):1304–1313
25. Rucklidge JJ. Gender differences in attention-deficit/hyperactivity disorder. *Psychiatr Clin North Am*. 2010;33(2):357–373
26. Volkmar FR, Szatmari P, Sparrow SS. Sex differences in pervasive developmental disorders. *J Autism Dev Disord*. 1993;23(4): 579–591
27. Lord C, DiLavorne PC, Risi S. *Autism Diagnostic Observation Schedule*. Los Angeles, CA: Western Psychological Services; 2002
28. Lord C, Rutter M, Le Couteur A. Autism Diagnostic Interview-Revised: a revised version of a diagnostic interview for caregivers of individuals with possible pervasive developmental disorders. *J Autism Dev Disord*. 1994;24(5):659–685
29. Wolraich ML, Hannah JN, Baumgaertel A, Feurer ID. Examination of DSM-IV criteria for attention deficit/hyperactivity disorder in a county-wide sample. *J Dev Behav Pediatr*. 1998;19(3):162–168
30. Wolraich ML, Lambert W, Doffing MA, Bickman L, Simmons T, Worley K. Psychometric properties of the Vanderbilt ADHD diagnostic parent rating scale in a referred population. *J Pediatr Psychol*. 2003;28(8):559–567
31. Mazurek MO, Engelhardt CR. Video game use and problem behaviors in boys with autism spectrum disorders. *Res Autism Spectr Disord*. 2013;7(2):316–324
32. Berument SK, Rutter M, Lord C, Pickles A, Bailey A. Autism screening questionnaire: diagnostic validity. *Br J Psychiatry*. 1999; 175(5):444–451
33. Rutter M, Bailey A, Lord C. *The Social Communication Questionnaire (SCQ) Manual*. Los Angeles, CA: Western Psychological Services; 2003
34. Chandler S, Charman T, Baird G, et al. Validation of the social communication questionnaire in a population cohort of children with autism spectrum disorders. *J Am Acad Child Adolesc Psychiatry*. 2007;46(10): 1324–1332
35. American Academy of Pediatrics. Committee on Public Education. American Academy of Pediatrics: Children, adolescents, and television. *Pediatrics*. 2001;107(2): 423–426
36. Corbett BA, Constantine LJ, Hendren R, Rocke D, Ozonoff S. Examining executive functioning in children with autism spectrum disorder, attention deficit hyperactivity disorder and typical development. *Psychiatry Res*. 2009;166(2-3):210–222
37. Lee M-S, Ko Y-H, Song H-S, et al. Characteristics of Internet use in relation to game genre in Korean adolescents. *Cyberpsychol Behav*. 2007;10(2):278–285
38. Smyth JM. Beyond self-selection in video game play: an experimental examination of the consequences of massively multiplayer online role-playing game play. *Cyberpsychol Behav*. 2007;10(5):717–721
39. Rehbein F, Kleimann M, Mössle T. Prevalence and risk factors of video game dependency in adolescence: results of a German nationwide survey. *Cyberpsychol Behav Soc Netw*. 2010;13(3):269–277
40. Barlett CP, Harris RJ, Baldassaro R. Longer you play, the more hostile you feel: examination of first person shooter video games and aggression during video game play. *Aggress Behav*. 2007;33(6): 486–497
41. Ivory JD, Kalyanaraman S. The effects of technological advancement and violent content in video games on players' feelings of presence, involvement, physiological arousal, and aggression. *J Commun*. 2007; 57(3):532–555
42. White SW, Oswald D, Ollendick T, Scahill L. Anxiety in children and adolescents with autism spectrum disorders. *Clin Psychol Rev*. 2009;29(3):216–229
43. Baranek GT, David FJ, Poe MD, Stone WL, Watson LR. Sensory Experiences Questionnaire: discriminating sensory features in young children with autism, developmental delays, and typical development. *J Child Psychol Psychiatry*. 2006;47(6):591–601
44. Ben-Sasson A, Cermak SA, Orsmond GI, et al. Extreme sensory modulation behaviors in toddlers with autism spectrum disorders. *Am J Occup Ther*. 2007;61(5): 584–592
45. Gadow KD, Sprafkin J. Television 'violence' and children with emotional and behavioral disorders. *J Emot Behav Disord*. 1993;1(1): 54–63

Video Game Use in Boys With Autism Spectrum Disorder, ADHD, or Typical Development

Micah O. Mazurek and Christopher R. Engelhardt
Pediatrics 2013;132;260; originally published online July 29, 2013;
DOI: 10.1542/peds.2012-3956

Updated Information & Services

including high resolution figures, can be found at:
<http://pediatrics.aappublications.org/content/132/2/260.full.html>

References

This article cites 42 articles, 10 of which can be accessed free at:
<http://pediatrics.aappublications.org/content/132/2/260.full.html#ref-list-1>

Citations

This article has been cited by 2 HighWire-hosted articles:
<http://pediatrics.aappublications.org/content/132/2/260.full.html#related-urls>

Subspecialty Collections

This article, along with others on similar topics, appears in the following collection(s):
Development/Behavioral Issues
http://pediatrics.aappublications.org/cgi/collection/development:behavioral_issues_sub
Autism/ASD
http://pediatrics.aappublications.org/cgi/collection/autism:asd_sub
Media
http://pediatrics.aappublications.org/cgi/collection/media_sub

Permissions & Licensing

Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at:
<http://pediatrics.aappublications.org/site/misc/Permissions.xhtml>

Reprints

Information about ordering reprints can be found online:
<http://pediatrics.aappublications.org/site/misc/reprints.xhtml>

PEDIATRICS is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. PEDIATRICS is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2013 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 0031-4005. Online ISSN: 1098-4275.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

