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Is time spent playing video games associated with mental health, cognitive and social skills in young children?

Viviane Kovess-Masfety[1,9], **Katherine Keyes**[2], **Ava Hamilton**[2], **Gregory Hanson**[2], **Adina Bitfoi**[3], **Dietmar Golitz**[4], **Ceren Koç**[5], **Rowella Kuijpers**[6], **Sigita Lesinskiene**[7], **Zlatka Mihova**[8], **Roy Otten**[6], **Christophe Fermanian**[1], and **Ondine Pez**[1]

[1]EHESP, Paris Descartes University, EA 4057 Paris, France [2]Mailman School of Public Health, Columbia University, New York, NY, USA [3]The Romanian League for Mental Health, Bucharest, Romania [4]Institute of Psychology, University of Koblenz-Landau (Campus Koblenz), Koblenz, Germany [5]Yeniden Health and Education Society, Istanbul, Turkey [6]Behavioural Science Institute, Radboud University, Nijmegen, The Netherlands [7]Clinic of Psychiatry, Faculty of Medicine, University of Vilnius, Vilnius, Lithuania [8]New Bulgarian University, Sophia, Bulgaria [9]EHESP, rue du Pr Leon Bernard, 35043 Rennes, France

Abstract

Background—Video games are one of the favourite leisure activities of children; the influence on child health is usually perceived to be negative. The present study assessed the association between the amount of time spent playing video games and children mental health as well as cognitive and social skills.

Methods—Data were drawn from the School Children Mental Health Europe project conducted in six European Union countries (youth ages 6–11, $n = 3195$). Child mental health was assessed by parents and teachers using the Strengths and Difficulties Questionnaire and by children themselves with the Dominic Interactive. Child video game usage was reported by the parents. Teachers evaluated academic functioning. Multivariable logistic regressions were used.

Results—20 % of the children played video games more than 5 h per week. Factors associated with time spent playing video games included being a boy, being older, and belonging to a

Viviane Kovess-Masfety, vkovess@gmail.com; viviane.kovess@ehesp.fr.
Katherine Keyes, kmk2104@columbia.edu
Ava Hamilton, ah3108@columbia.edu
Gregory Hanson, gshanson1988@gmail.com
Adina Bitfoi, adinapetricamd@yahoo.com
Dietmar Golitz, goelitz@uni-koblenz.de
Ceren Koç, kocceren@gmail.com
Rowella Kuijpers, rowellakuijpers@gmail.com
Sigita Lesinskiene, sigita.lesinskiene@mf.vu.lt
Zlatka Mihova, zmihova@doctor.bg
Roy Otten, R.Otten@trimbos.nl
Christophe Fermanian, christophe.fermanian@ehesp.fr
Ondine Pez, pez_ondine@hotmail.com

[1]http://www.sf-36.org.

Compliance with ethical standards

Conflict of interest The authors have declared that no competing interests exist.

medium size family. Having a less educated, single, inactive, or psychologically distressed mother decreased time spent playing video games. Children living in Western European countries were significantly less likely to have high video game usage (9.66 vs 20.49 %) though this was not homogenous. Once adjusted for child age and gender, number of children, mothers age, marital status, education, employment status, psychological distress, and region, high usage was associated with 1.75 times the odds of high intellectual functioning (95 % CI 1.31–2.33), and 1.88 times the odds of high overall school competence (95 % CI 1.44–2.47). Once controlled for high usage predictors, there were no significant associations with any child self-reported or mother- or teacher-reported mental health problems. High usage was associated with decreases in peer relationship problems [OR 0.41 (0.2–0.86) and in prosocial deficits (0.23 (0.07, 0.81)].

Conclusions—Playing video games may have positive effects on young children. Understanding the mechanisms through which video game use may stimulate children should be further investigated.

Keywords

Mental health; Children; Epidemiology; Gambling

Background

According to the APA Council on Communications and Media Executive Committee, “Children and teenagers spend more time engaged in various media than they do in any other activity except for sleeping”. This assessment was based on a 2010 Kaiser Family Foundation survey of more than 2000 youths 8–18 years old which revealed that children and teenagers in the US spend an average of 7 h per day with a variety of media. The survey further indicated that 70 % of American teenagers have a TV in their bedroom, and half have a video game console. The Council recommended limiting media time to 2 h per day for children and suggested that pediatrician or family practitioners inquire about media exposure during visits to educate parents on recommended guidelines and on health risks associated with exaggerated exposure.

In the European Union (EU), video games are very popular across age groups and socio-economic categories. An EU council resolution is in place to rate video games and provide warning labels regarding violence or adult content, allowing parents to decide which games are appropriate for their child. This resolution has since been extended to 20 Member States. However, this rating system is not in place in four Member States including Cyprus, Luxembourg, Romania and Slovenia. Furthermore, 15 EU States have legislation concerning the sale of video games with adult content to minors in stores, although the scope of this legislation varies greatly between Member States. For instance, Germany, Ireland, Italy and the UK have banned certain violent video games, while other countries have not. Despite these efforts to control access to violent or inappropriate games in the EU, no recommendations have been issued towards physicians to provide guidelines on how media exposure should be addressed with the parents during routine health examinations.

The effect of video games on child mental health has been researched relatively thoroughly over the past few decades with regard to the time spent playing video games, and the effects

of sometimes violent, ultra-realistic video games. High media usage (including TV, videos, computer/internet use and more specifically video games) has been linked to an increased risk of suicidality and depression in adolescents [1, 2] and in adults [3] in the US and in Norway. However, this elevated risk was not replicated in other countries. A large Canadian study showed non-significant or even inverse associations between video game use and depression or binge drinking, while it was significantly associated with increased risk of obesity [4]. Violent video games were also reported to desensitize children towards violence and to decrease morality and empathy [5]. Finally, other studies reported addictive behavior associated with video games comparable to substance dependence [6, 7] along with its negative consequences.

A 1997 meta-analysis [8] indicated that video games might not lead to aggressive behavior, and suggested that playing video games may even help children to express their aggression, suggesting that they could even be used for health education. However, data from this meta analysis were limited to adolescents and young adults, yet children as young as 8 or younger have access to those games and have not been thoroughly studied and more recent data has shown that the influence of media such as video games and TV on children is not uniformly negative [9-12]. This is an important gap in the literature given that patterns of media use may be established during this developmental window, and it is also a critical window for the onset of childhood mental health problems.

To our knowledge, the present study is the first ever to utilize survey data on more than 3000 European schoolchildren aged 6–11, across six countries representing very diverse cultural contexts to investigate the association between video game use and mental health. The objectives are (1) to determine the amount of time spent on video games by primary school children in diverse European countries, and to examine the determinants of video game use; (2) to determine whether high video game use is associated with decrease academic performance; and (3) to investigate whether high video game use is associated with mental health problems.

Methods

The School Children Mental Health Europe (SCHME) study is a cross-sectional survey of European schoolchildren aged 6–11 conducted in 2010. The present study included data collected in Germany, The Netherlands, Lithuania, Romania, Bulgaria, and Turkey. Details on country-specific sampling are provided elsewhere [13]. Briefly, approximately 45–50 schools were approached per country (a greater number of schools were approached in Germany and The Netherlands), with varying participation rates from 6.5 % in The Netherlands and 95.6 % in Romania. Schools were selected randomly though they were not selected to be representative of the country. Classes were then randomly selected within each participating school. Approximately 48 children were then randomly selected in each school. One exception is in The Netherlands, where a smaller number of schools participated and complete classes were included. Parents received a letter describing the study and a consent form to be returned to the school. Children were included if they were present on the day of the assessment, unless their parent actively refused. Among participating schools, between 50.5 % (Turkey) and 90.5 % (The Netherlands) of eligible children participated in the study,

and between 45.5 % (The Netherlands) and 90.9 % (Lithuania) of the child informants (parents and teachers) participated. The total sample size was 4911 for teacher-reported outcomes and 5115 for mother-reported outcomes. Among those with both informants, we restricted the dataset to include only mother respondents 4079 (81.61 % of sample) to maintain comparability since proportion of fathers largely varies across countries and gender differences influence most of the mental heath evaluations and we excluded few kids aged 5 or 12/13 to concentrate on the 6–11 range. Respondents for whom data on video games were not available ($n = 884$, 21.67 %) were excluded. The final sample included in the present study is 3195.

Measures

In each country, data were collected from the child, the teacher and the mother. The mothers completed self-reports documenting socio-demographic variables such as household composition (including age, gender and parental status for each member), parental education (highest level completed), marital status, occupational level (professionally active vs inactive), as well as the MH5 a subscale of the SF36[1] [14] assessing psychological distress. In The Netherlands the same questions were completed electronically using a secured website, though paper questionnaires were made available upon request.

Video game use—Parents were asked how long their child spends playing video games on average during the week. We used tertiles of reported time spent for analyses based on distributions in the data and preliminary analyses. Low video game use was defined as 0–60 min per week; moderate use was defined as 61–300 min, and high use was >300 min.

Mother-reported and teacher-reported mental health status—Child psychopathology was assessed using the Strengths and Difficulties Questionnaire (SDQ) [15, 16]. The SDQ has been validated in a number of languages and has been used extensively in Europe [17-20]. The parent and teacher versions of the SDQ include a brief questionnaire divided into five subscales for which the author provided cuts points in order to define normal, doubtful and probable cases of emotional problems, hyperactivity and inattention, conduct problems, peer relationship difficulties, and pro-social behaviors. A total difficulties score was computed, excluding pro-social behaviors and peer relationship difficulties with cut points for parent and teacher evaluations. In addition, parents and teachers were asked to rate the level of impairment caused by the child's mental health issues. These responses were scored as recommended [15]. The present study also considers probable cases combining parents and teachers answers plus impairment [21] for three diagnoses as for a pooled "any diagnosis" Subjects were then excluded if they did not include a mother and teacher response. Of the 4342 subjects with a maternal response, 4079 also had a full teacher report.

Child-self-reported mental health status—Self-reported mental health was evaluated using a computerized cartoon-like assessment tool known as the "Dominic Interactive". The Dominic Interactive (DI) was designed for young children (6 years old and older), and consists of 91 cartoons depicting a child named Dominic/Dominique experiencing a feeling, a thought or an action. A voice-over asks the child if she or he acts, feels or thinks similarly.

Children completed the DI individually on a computer station at school under the supervision of a research assistant. A series of yes/no questions provides greater scope for self-expression [22, 23]. The DI has been validated in several studies and has been found to be more reliable than structured interviews in the assessment of mental health in young children. A recent study established the construct validity of the DI among the seven participating countries [24].

Data on suicidal thoughts were directly drawn from two of the 91 cartoons [25] included in the DI: "Do you often think about death or about killing yourself" and "Do you often think about death or dying?".

Academic performance—Academic performance was evaluated by teachers who answered questions regarding the child's school performance and learning behavior observed in the classroom. It was formulated as "compared to the other children in the class, how does he or she fare in the following areas: school performance, reading, mathematics, spelling and intellectual functioning?" to be classified into five levels from [5] marked difficulties to [1] very good. An additional question evaluated the child motivation to succeed at school.

Ethics statement—A personal letter allowing for a written refusal informed parents. Surveys were completed in anonymity and no names were available on the questionnaires sent to the research team.

Each country received the support of their government, and minister of education and obtained the support of relevant ethical committees. In Bulgaria: The Deputy Minister of Education, Youth and Science of the Republic of Bulgaria; in Germany approval was obtained through landers: (a) Ministry of Education, Science and Culture, Mecklenburg-Vorpommern (b) State school authority, Luneburg (c) Ministry of Education and Culture of Schleswig–Holstein country; in Lithuania: the Ministry of Education and Science of the Republic of Lithuania; in The Netherlands: the Commission of Faculty Ethical Behavior Research (ECG); in Romania the Bucharest School Inspectorate General Municipal, and in Turkey: the Istanbul-directorate of National Education.

In addition, ethical committees were given their approval in each of the countries except Germany where the school authorization clearly mentioned in its text the ethical conditions for the authorization and Turkey where such committee does not exist but a parental signed consent form was mandatory.

No child was obliged to participate; any refusal to participate will have stopped his or her participation.

Statistical analyses

Statistical analyses were performed using SAS V9.3. Multivariable logistic regressions were performed to assess the association between mental health outcomes and video game use adjusting for the child's sex and age, the number of children in household, region (Eastern vs Western Europe), mother's age, socio-economic status, marital status, mother's

psychological distress. Statistical significance was evaluated using 0.05-level. Odds ratios are shown with the corresponding 95 % confidence interval. Data were weighted to correct for size of schools and probability of child selection.

Results

Sample characteristics

A table available online presents the demographic characteristics of the final sample. There were significant differences with regard to age with a higher mean age in Eastern Europe (8.72 years). Differences were also observed regarding gender and number of children in the family with Eastern Europe having a higher percentage of families with four or more children. In addition, the Western European sample had a significantly lower percentage of mothers living apart from the father when compared to Eastern Europe. Mothers in the sample were also significantly more educated in Western Europe as well as significantly older with an average age of 40.52 years.

Video game use

Overall, 20 % of the children were in the high usage group defined as spending more than 5 h a week playing video games, 39 % spent less than 1 h a week using video games and 40 % between 1 and 5 h a week. Among the high usage category, very few children played more than 20 h (0.69 %), 4.32 % played 10–20 h, 6.89 % 7–10 h, and 8.11 % between 5 and 7 h. The remaining, 59.47 % played more than 7 h and 20 % more than 10 h.

Table 1 shows that most demographic characteristics were associated with video-game usage. Factors associated with increased usage included being a boy, being older, belonging to a medium size family. Conversely, a less educated, single, inactive, or psychologically distressed mother decreases the probability of high usage. Children living in Western European countries were significantly less likely to be high users as compared to their Eastern European peers (9.66 vs 20.49 %),though this pattern was not homogenous.

Video game usage, academic performance and motivation to succeed

High usage was associated with good intellectual functioning and academic achievement (Table 2). The positive associations included competence in reading ($p = 0.05$), mathematics ($p = 0.0031$), and spelling ($p = 0.002$). Motivation to succeed at school did not vary as a function of usage (data not shown).

Once adjusted for child age and gender, number of children, mother's age, marital status, education, employment status, psychological distress, and European Region (West/East), high usage was associated with increased odds of elevated intellectual functioning (aOR 1.58 (1.22, 2.05) [0.001]), and high overall competence (aOR 1.67 (1.31, 2.12) [<0.001]) (Table 2), moderate usage as well but to a lesser extend.

Video games and child mental health

Table 3 shows that in univariate analyses, playing video games was associated with a lower prevalence of self-reported internalizing disorders and fewer reports of thoughts of death.

However, once adjusted for child age and gender, number of children, mother's age, marital status, education, employment status, psychological distress, and European Region (West/East), these differences were no longer significant.

There were no significant associations with any SDQ dimension: emotional, ADHD, conduct, peer relationship, total difficulties as reported separately by the mother or the teacher (tables on request).

Children whose mother and teacher both reported as having problems with peer relationships or with an elevated total difficulties score were less likely to be in the high usage group (Table 4). Once adjusted for child age and sex, number of children, mother's age, marital status, education, employment status, psychological distress and regions, the association between combined mother and teacher evaluations of peer relationship problems and odds of high video game usage remained (aOR 0.41, 95 % CI 0.2–0.86) as well as the one with total difficulties (aOR 0.41, 95 % CI 0.2–0.86). Prosocial deficits were also milder among those with moderate video game usage (OR 0.23, 95 % CI 0.07–0.81).

Discussion

In a sample of over 3000 young children across six European countries, high video game usage (playing video games more than 5 h per week) was significantly associated with higher intellectual functioning, increased academic achievement, a lower prevalence of peer relationship problems and a lower prevalence of mental health difficulties. High video game usage was not associated with an increase of conduct disorder or any externalizing disorder nor was it associated with suicidal thoughts or thoughts of death. Controlling for demographic and other risk factors explained part of the association between video game use and protective associations in mental health and cognitive function, nevertheless all these relations particularly cognitive functioning persisted despite control.

These findings are in line with several studies. Dorman [8] reviewed several studies conducted on children which reported that video gaming seemed to increase prosocial skills. For example, in a free play setting, young children (ages 4–6) displayed an increase in violent behavior as well as in prosocial behaviors after playing violent games. A Japanese study of kindergarten children found that those who played video games had more friends and were more willing to talk to others [26].

More recently, a literature review [27] described the "social benefits of gaming". The authors concluded that playing video games is today, even more so than in the past two decades, a highly social activity for most children as the vast majority of children play their video games with a friend. Some games explicitly reward effective cooperation, supporting and helping behavior [28]. In addition, playing prosocial video games increased prosocial behaviors: children who frequently played prosocial video games were more inclined to engage in helpful behavior later in the year [29]. Children who engaged in social interactions while playing video games were also more likely to take an interest in civic engagement once adults. Violent and nonviolent games appear to be equally predictive of such involvement. The same review [27] reported cognitive benefits of video games as children

developed problem-solving skills and enhanced creativity. In addition, children seemed to develop beliefs about their intelligence and abilities that affected their level of achievement, which extended beyond their performance on video games and applied to school activities. An important future direction of this work is to determine whether there are differential associations between video game playing and childhood health outcomes depending on the content of the game; for example, whether violent content specifically vs more complex cognitive problems solving tasks differently predict health outcomes.

Several limitations should be considered when interpreting the findings. First, due to the cross-sectional nature of the SCMHE study, we cannot establish temporality between video game usage and mental health outcomes. Second, video game usage was reported by the mother, which may have led to an overestimation or underestimation of the time spent playing video games. We did not assess children's own perception of their time spent. While this information would be useful as corroborative evidence, children may not be accurate reporters of time spent playing, compared with parents who most likely manage children's schedules. Third, mental health symptoms were assessed via self report of the mother, teacher, and children themselves, but not by trained clinicians. While clinician assessments would be informative, assessments by multiple reporters increase the reliability and validity of the information we obtain in the present study. Finally, the overall participation rate is a concern as only 21.67 % of eligible families did not respond to the video game question. Missing data are mainly due to data collected in Turkey, where only 55.67 % responded to video game-related questions, whereas in the remaining countries the response rate was between 70 and 80 %. That being said, the analyses controlled for the main socio-demographics variables, which differentiated respondents from non-respondents, correcting much of the potential bias.

Conclusion

The results of the present study suggest that video game use is not associated with an increased risk of mental health problems. On the contrary, the data presented here suggest that video games are a protective factor, especially regarding peer relationship problems for the children who are the most involved in video games. Finally, video games seem to be linked to better intellectual functioning and academic achievement.

According to our data, video gaming is entirely beneficial for cognitive functioning as well as for some aspects of mental health. However, the cross-sectional nature of the survey precludes us from drawing conclusions on the long-term effects of high video game usage. Longitudinal studies are needed to monitor mental health, cognitive and social functioning through adolescence and into early adulthood to ensure that the positive effects observed in children are maintained later in life.

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cooperation in contributing to the survey. Special thanks for Jean-Pierre Valla, for making the Dominic Interactive available in the participating countries languages.

Abbreviations

SDQ	Strengths Difficulties Questionnaire
DI	Dominic Interactive
SCHME	School Children Mental Health Europe

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Table 1

Demographics by Video Game use category

Demographic characteristic	Subcategory	Less than 1 h or 1 h/ week	Greater than 1–5 h/ week	Greater than 5 h/ week	*p* value
	Total sample size	**(*n* = 1254)**	**(*n* = 1294)**	**(*n* = 636)**	
Age of child	Mean age	8.5	8.83	9	<0.01
	6	55.65	28.87	15.47	
	7	51.92	36.66	11.43	
	8	44.61	35.12	20.27	
	9	41.16	38.79	20.05	
	10	34.03	42.16	23.8	
	11	26.29	46.52	27.19	

Demographic characteristic	Subcategory	Less than 1 h or 1 h/week	Greater than 1–5 h/ week	Greater than 5 h/ week	*p* value
	Total sample size	**(*n* = 1258)**	**(*n* = 1298)**	**(*n* = 639)**	
Sex of child	Girl	47.43	35.73	16.84	<0.01
	Boy	35.97	41.41	22.62	

Demographic characteristic	Subcategory	Less than 1 h or 1 h/ week	Greater than 1–5 h/ week	Greater than 5 h/ week	*p* value
	Total sample size	**(*n* = 1258)**	**(*n* = 1298)**	**(*n* = 639)**	
Number of children in family	1	39.89	41.5	18.61	<0.01
	2 or 3	39.32	39.86	20.82	
	≥4	51.65	29.89	18.46	

Demographic characteristic	Subcategory	Less than 1 h or 1 h/ week	Greater than 1–5 h/ week	Greater than 5 h/ week	*p* value
	Total sample size	**(*n* = 1161)**	**(*n* = 1223)**	**(*n* = 601)**	
Mother's highest level of education	College completed	66.07	25.64	8.28	<0.01
	Secondary completed	51.19	31.15	17.65	
	Some secondary	39.09	39.06	21.86	
	None/primary	33.81	44.38	21.8	
	Other	50.26	34.71	15.03	

Demographic characteristic	Subcategory	Less than 1 h or 1 h/ week	Greater than 1–5 h/ week	Greater than 5 h/ week	*p* value
	Total sample size	**(*n* = 1253)**	**(*n* = 1298)**	**(*n* = 635)**	
Age of mother	Mean age	35.73	35.83	35.79	<0.01
	≤35	42.68	38.31	19.01	
	>35, ≤40	38.74	39.02	22.24	
	>40	41.79	40.19	18.01	

Demographic characteristic	Subcategory	Less than 1 h or 1 h/ week	Greater than 1–5 h/ week	Greater than 5 h/ week	*p* value
	Total sample size	**(*n* = 1253)**	**(*n* = 1298)**	**(*n* = 635)**	
Maternal psychological distress	Psych distress	40.36	39.41	20.23	<0.01
	No psych distress	44.15	36.65	19.2	

Demographic characteristic	Subcategory	Less than 1 h or 1 h/week	Greater than 1–5 h/ week	Greater than 5 h/ week	*p* value
	Total sample size	**(*n* = 1210)**	**(*n* = 1256)**	**(*n* = 622)**	
Maternal activity	Active	37.99	41.39	20.63	<0.01
	Inactive	46.21	35.74	18.05	

Demographic characteristic	Subcategory	Less than 1 h or 1 h/week	Greater than 1-5 h/ week	Greater than 5 h/ week	*p* value
	Total sample size	**(*n* = 1205)**	**(*n* = 1270)**	**(*n* = 620)**	
Mother's marital status	In couple	39.85	39.69	20.46	<0.01
	Single	46.32	36.4	17.27	

Demographic characteristic	Subcategory	Less than 1 h or 1 h/ week	Greater than 1-5 h/ week	Greater than 5 h/ week	*p* value
	Total sample size	**(*n* = 1258)**	**(*n* = 1298)**	**(*n* = 639)**	
Country	Bulgaria	39.82	36.27	23.91	<0.01
	East Germany	53.7	40.38	5.92	
	West Germany	59.4	37.05	3.55	
	Lithuania	47.37	30.45	22.18	
	The Netherlands	38.43	47.54	14.03	
	Romania	31.03	48.87	20.1	
	Turkey	45.11	43.34	11.55	

Demographic characteristic	Subcategory	Less than 1 h or 1 h/ week	Greater than 1-5 h/ week	Greater than 5 h/ week	*p* value
	Total sample size	**(*n* = 1258)**	**(*n* = 1298)**	**(*n* = 639)**	
Region	East	41.11	38.4	20.49	<0.01
	West	47.17	43.17	9.66	
Intellectual functioning	High	64.03	69.96	77.35	0.000
	Low/average	35.97	30.04	22.65	
School achievement	High	53.15	60.28	68.72	0.000
	Low/average	46.85	39.72	31.28	

Table 2

Intellectual functioning and school competences and video games

Teacher	Unadjusted	Adjusted[a]
High intellectual functioning vs low or average		
1–5 h of usage	1.34 (1.13, 1.59) [0.001]	1.25 (1.03, 1.53) [0.028]
>5 h of usage	1.82 (1.46, 2.28) [<0.001]	1.58 (1.22, 2.05) [0.001]
School competence high vs low or average		
1–5 h of usage	1.36 (1.16, 1.60) [<0.001]	1.38 (1.14, 1.67) [0.001]
>5 h of usage	1.83 (1.49, 2.25) [<0.001]	1.67 (1.31, 2.12) [<0.001]

[a]Adjusted child age and gender, number of children, mothers age, marital status, maternal education, activity status, psychological distress, European Region (West/East)

Table 3

Child Mental health self evaluation (DI) in relation to video game playing (1–5, and 5+ vs 1 or less h)

Children DI	Unadjusted	Adjusted[a]
External dx		
1–5 h of usage	0.95 (0.64, 1.42)	0.93 (0.6, 1.44)
>5 h of usage	0.86 (0.52, 1.44)	0.74 (0.42, 1.33)
Internal dx		
1–5 h of usage	**0.75 (0.59, 0.97) [0.03]**	0.88 (0.66, 1.17)
>5 h of usage	**0.72 (0.53, 0.99) [0.05]**	0.85 (0.59, 1.22)
Specific phobia		
1–5 h of usage	0.8 (0.53, 1.22)	1.11 (0.68, 1.81)
>5 h of usage	0.67 (0.39, 1.13)	0.99 (0.54, 1.8)
Separation anxiety		
1–5 h of usage	0.76 (0.57, 1.03)	0.87 (0.63, 1.21)
>5 h of usage	0.68 (0.45, 1.01)	0.73 (0.45, 1.17)
GAD		
1–5 h of usage	1.08 (0.69, 1.7)	1.21 (0.73, 1.99)
>5 h of usage	0.95 (0.53, 1.69)	1.15 (0.6, 2.18)
Depression		
1–5 h of usage	1.35 (0.82, 2.2)	1.42 (0.82, 2.45)
>5 h of usage	1.04 (0.56, 1.96)	1.05 (0.52, 2.12)
Oppositional dx		
1–5 h of usage	1.39 (0.78, 2.47)	1.24 (0.7, 2.18)
>5 h of usage	1.35 (0.69, 2.67)	1.08 (0.5, 2.31)
ADHD		
1–5 h of usage	1.14 (0.63, 2.05)	1.12 (0.61, 2.06)
>5 h of usage	1.04 (0.48, 2.23)	1.12 (0.51, 2.44)
Conduct Dx		
1–5 h of usage	0.76 (0.42, 1.37)	0.78 (0.4, 1.51)
>5 h of usage	0.6 (0.28, 1.29)	0.43 (0.18, 1.05)
Think about suicide		
1–5 h of usage	0.83 (0.64, 1.07)	1.11 (0.88, 1.39
>5 h of usage	0.87 (0.63, 1.18)	1.15 (0.86, 1.51
Thoughts of death		
1–5 h of usage	1.01 (0.80, 1.28)	1.06 (0.81, 1.4)
>5 h of usage	**0.68 (0.50, 0.92) [0.01]**	0.76 (0.54, 1.06)

Bold indicates significance at 0.05 and above

[a]Adjusted child age and gender, number of children, mothers age, marital status, maternal education, activity status, psychological distress, European Region (West/East)

Table 4

Parent and teacher combined SDQ variables in relation to video game playing

Parent and teacher	Unadjusted	Adjusted[a]
Emotional		
1–5 h of usage	0.87 (0.41, 1.84)	1.14 (0.42, 3.1)
>5 h of usage	0.7 (0.3, 1.63)	0.79 (0.26, 2.42)
ADHD		
1–5 h of usage	1.05 (0.66, 1.67)	1.03 (0.59, 1.8)
>5 h of usage	0.67 (0.37, 1.21)	0.61 (0.31, 1.19)
Conduct		
1–5 h of usage	0.82 (0.52, 1.29)	0.97 (0.54, 1.73)
>5 h of usage	0.73 (0.43, 1.25)	0.66 (0.33, 1.3)
Any pb with impact		
1–5 h of usage	0.89 (0.41, 1.95)	1.29 (0.47, 3.53)
>5 h of usage	0.43 (0.17, 1.07)	0.67 (0.2, 2.21)
Prosocial		
1–5 h of usage	0.43 (0.14, 1.37)	**0.23 (0.07, 0.81) [0.02]**
>5 h of usage	0.81 (0.26, 2.51)	1.09 (0.31, 3.9)
Peer relationship		
1–5 h of usage	0.68 (0.41, 1.11)	0.83 (0.44, 1.57)
>5 h of usage	**0.35 (0.18, 0.7) [<0.01]**	**0.43 (0.19, 0.99) [0.05]**
Total difficulties		
1–5 h of usage	0.75 (0.46, 1.23)	0.97 (0.5, 1.88)
>5 h of usage	**0.5 (0.27, 0.92) [0.03]**	**0.41 (0.2, 0.86) [0.02]**

Bold indicates significance at 0.05 and above

[a]Adjusted child age and gender, number of children, mothers age, marital status, maternal education, activity status, psychological distress, European Region (West/East)