RESEARCH ARTICLE

Stuck on Screens: Patterns of Computer and Gaming Station Use in Youth Seen in a Psychiatric Clinic

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Abstract

Objective: Computer and gaming-station use has become entrenched in the culture of our youth. Parents of children with psychiatric disorders report concerns about overuse, but research in this area is limited. The goal of this study is to evaluate computer/gaming-station use in adolescents in a psychiatric clinic population and to examine the relationship between use and functional impairment. **Method:** 102 adolescents, ages 11-17, from out-patient psychiatric clinics participated. Amount of computer/gaming-station use, type of use (gaming or non-gaming), and presence of addictive features were ascertained along with emotional/functional impairment. Multivariate linear regression was used to examine correlations between patterns of use and impairment. **Results:** Mean screen time was 6.7±4.2 hrs/day. Presence of addictive features was positively correlated with emotional/functional impairment. Time spent on computer/gaming-station use was not correlated overall with impairment after controlling for addictive features, but non-gaming time was positively correlated with risky behavior in boys. **Conclusions:** Youth with psychiatric disorders are spending much of their leisure time on the computer/gaming-station and a substantial subset show addictive features of use which is associated with impairment. Further research to develop measures and to evaluate risk is needed to identify the impact of this problem.

Key words: computer addiction, internet addiction, adolescence, video games

Résumé

Objectif: l'ordinateur et la console de jeux font partie intégrante de la culture des adolescents canadiens. Les parents d'enfants qui souffrent de troubles psychiatriques s'inquiètent de l'utilisation excessive de ces appareils et constatent que ce sujet n'a pas été suffisamment étudié. Les auteurs évaluent le temps passé à l'ordinateur ou à la console de jeux par des adolescents suivis dans une clinique psychiatrique et analysent la relation qui existe entre cette utilisation et le déficit fonctionnel de ces derniers. **Méthodologie:** cent-deux adolescents, âgés de 11 à 17 ans, suivis dans une clinique externe de psychiatrie ont participé à cette étude. Le temps passé à l'ordinateur ou à la console de jeux, l'usage fait de l'appareil (jeu ou autre) et la présence de traits de personnalité spécifiques à l'addiction ont été évalués parallèlement au déficit émotionnel ou fonctionnel. Les corrélations entre les schémas d'utilisation et les déficits ont été analysées par régression linéaire multivariable. **Résultats:** le temps moyen passé devant l'écran était de 6,7 ± 4,2 h/jour. La présence de traits d'addiction était en corrélation avec le déficit émotionnel ou fonctionnel. Le temps passé à l'ordinateur ou à la console de jeux n'était pas en corrélation directe avec ce déficit lorsque les traits d'addiction étaient contrôlés ; en revanche, le temps qui n'était pas consacré au jeu était associé à un comportement à risque. **Conclusion:** les adolescents souffrant de troubles psychiatriques passent une grande partie de leur temps libre à l'ordinateur ou à la console de jeux. Un sous-ensemble non négligeable de sujets présente des traits de personnalité spécifiques à l'addiction qui sont associés à une déficience émotionnelle ou fonctionnelle. Les futurs travaux de recherche devront proposer des unités de mesure et évaluer le risque afin de déterminer l'impact de ce problème.

Mots clés: addiction à l'ordinateur, addiction à l'internet, adolescence, jeux vidéos

Introduction

Over the past 20 years, computer and gaming-station use in children's and adolescents' daily lives has greatly increased (Media Awareness Network, 2005; Smith, et al., 2009). New forms of social communication including instant messaging and web-based social interactions are now important daily components of many teens' lives. Electronic gaming has exploded in popularity and for some children has become their primary recreational activity (Olson, et al., 2007). As computer/gaming-station use is a relatively new phenomenon, our understanding about the effects of use on general child development as well as social and academic functioning is limited. This study is a first step in examining computer and gaming-station use in children with psychiatric disorders, a vulnerable population about which even less is known.

Children and youth frequently identify positive features of use including social and intellectual stimulation (Campbell, et al., 2006) and there is research suggesting videogaming may build attentional and visual spatial skills (Green & Bavelier, 2003). However, concerns have been raised about the effects of use on school work and social development, particularly where high levels of use limit involvement in direct social engagement, sports, imaginative play, music, and other types of skill-building extracurricular activities (Allison, et al., 2006; Jordan, 2006).

Overuse of computer/gaming-station activities has led to proposals that this be considered a type of behavioral addiction (Young, 1998b). Different addiction models have been proposed including those based on impulse control disorders, pathological gambling and substance dependence (Beard, 2005; Byun, et al., 2009; Shapira, et al., 2003; Young, 1998b). Internet addiction is not included in the DSM-IV-TR, (APA, 2000) but some have proposed that it be included as part of the DSM-V (Block, 2008). Studies of populations of high school and university students have identified rates of problematic or "addictive" use ranging from 2.4%-20% (Cao & Su, 2006; Grusser, et al., 2005; Ha, et al., 2006; Mythily, et al., 2008; Niemz, et al., 2005), although inter-study comparisons are difficult as no standardized definition of internet addiction exists (Byun, et al., 2009; Weinstein & Lejoyeux, 2010).

Terminology in this area is evolving. Various terms are used including "internet addiction" (Byun, et al., 2009), "problematic internet use" (Ceyhan, 2008), "compulsive internet use" (van Rooij, et al., 2010) and "cyberaddiction" (Vaugeois, 2006). Most studies focus on internet use exclusively (Byun, et al., 2009), whereas others look at videogaming (whether on- or off-line) (Gentile, 2009; Rehbein, et al., 2010; Tejeiro Salguero & Bersabe Moran, 2002). This exclusive focus on

one electronic activity or another is not consistent with the behavior of most youth who, in our experience, do a variety of on-line and off-line activities, sometimes simultaneously. In this study, we use the term "computer/gaming-station activity" to include all recreational (i.e. non-school or work related) activities on computers and gaming-stations (including hand-held gaming devices). We define "screen time" to include time spent on the computer/gaming-station plus time spent watching television. The term "overuse" will be used when the activity implies excessive time, but not necessarily addictive features. We use the term "addiction" to refer to studies where there is a measure addressing qualitative features of addiction as described above.

Correlations between heavy use and presence of psychiatric symptoms such as depression, ADHD, and social anxiety in general population samples have been identified (Cao & Su, 2006; Chan & Rabinowitz, 2006; Jang, et al., 2008; Kim, et al., 2006; Ko, et al., 2008; Niemz, et al., 2005; Rehbein, et al., 2010; Weinstein & Lejoyeux, 2010; Weinstein, 2010; Yang, et al., 2005; Yoo, et al., 2004). Other studies have looked at psychiatric features of heavy internet users and found variable results mostly suggesting that heavy users have higher rates of psychiatric symptoms including social anxiety and mood symptoms (Cao, et al., 2007; Chak & Leung, 2004; Lo, et al., 2005; Shapira, et al., 2000; Yen, et al., 2008), as well as cognitive deficits (Sun, et al., 2009; Sun, et al., 2008).

These correlations between heavy use and psychiatric symptoms are consistent with anecdotal reports from clinicians and parents involved with children and youth with mental health concerns. While the labeling of computer/gaming-station use as "addictive" remains controversial in the research world (Shaffer, et al., 2000), in clinical practice many parents report significant concerns about "addictive" use in their children, and treatment centers for "internet addiction" are increasing (Ahn, 2007; Khaleej Times Online, 2009). It is unclear whether high amounts of computer/gaming-station use are contributing to emotional difficulties, whether use is a result of difficulties (e.g. social isolation), or a combination of both factors. Currently, little information about patterns of computer/gaming-station use in youth with psychiatric disorders exists.

This study is the first to look specifically at computer/gaming-station use in youth in a psychiatric clinic population. Objectives were to determine how much time youth with psychiatric disorders are spending in front of "screens" (television, computers, and gaming-stations) and how they are dividing their time between videogaming and non-gaming recreational computer activities (e.g., Facebook). Further objectives were to determine whether there was a relationship between the extent of computer/gaming-station use, and the extent of emotional as well as functional impairment. Finally,

although "internet addiction" as a disorder remains controversial, we wanted to determine whether the presence of features of addictive use based on proposed models for internet addiction could be identified in our clinical population and whether they had any predictive value on how the youth was functioning.

Method

Participants

Children and their families being seen in out-patient psychiatric clinics at a provincial children's hospital in Canada as well as 2 community sites over a 4 month period in 2008 were approached and asked to participate in the study. They were a heterogeneous group and included patients attending general psychiatry clinics as well as subspecialty clinics and were a mixture of secondary and tertiary cases. We had no data on socioeconomic status of participants. Inclusion criteria were age between 11-17, fluency in English, and ability to read English. We distributed ~160 surveys of which 112 were completed by both the child and their parent. We omitted 8 participants because of incomplete consent and/or assent forms, one participant as he was below the age cutoff, and one participant because of incorrect interpretation of the questionnaires. The final sample therefore consisted of 102 subjects. This study was approved by the University of British Columbia Research Ethics Board and all subjects signed consent or assent forms.

Demographics

Demographic information including age, gender, number of computers, and internet access was ascertained via parent and child questionnaires. Child and parent estimates of time spent on gaming, non-gaming computer-based recreational activities, and TV on weekdays (school days) and weekends (non school days) were obtained, allowing a weighted daily average to be calculated for each activity. The questionnaire did not assess texting, and did not distinguish between on-line or off-line gaming. The presence of rules, time limits and computer/gaming system location were ascertained.

Measures

There are no existing measures looking at addictive features of computer and gaming-station activities appropriate for youth. Multiple measures have been developed to look specifically at internet-based activities (Beard, 2005; Beranuy Fargues, et al., 2009; Ko, et al., 2005a; Nichols & Nicki, 2004; Park, 2005; Young, 1998a, 1998b) and several have been developed to look exclusively at videogaming (Gentile, 2009; Tejeiro Salguero & Bersabe Moran, 2002). Much of the research on internet addiction has taken place in Asia with one of the most widely used measures being the Chen Internet

Addiction Scale (Ko, et al., 2005a), which is not available in English. One of the most widely used English language measures looking at internet activities, the Internet Addiction Test (IAT) (Young, 1998a, 1998b) has only been validated in adults (Chang & Law, 2008; Widyanto & McMurran, 2004) and includes some questions that are inappropriate for children, (e.g. "How often do you prefer the internet to intimacy with your partner?"). One validation study included some youth but mean age of the sample was over 25 (Widyanto & McMurran, 2004). No English language scales assessing internet addiction in children have been validated. Furthermore, all existing measures rely exclusively on self-report and don't include collateral information from a parent, thereby risking under-reporting of problems.

Computer/Gaming-station Addiction Scale (CGAS).

In the absence of an appropriate and validated measure for children and youth, as described above, we developed a questionnaire which would capture both child and parent report, multiple modalities of computer and gaming-station activities, and identify those children who qualify for proposed criteria for Internet Addiction for adolescents (Ko, et al., 2005b). Criteria in the Ko paper were derived from candidate diagnostic criteria based on impulse control disorder and substance use disorder in the DSM-IV TR as well as proposed diagnostic criteria from other studies and were empirically validated in a community sample of adolescents. The self report CGAS is an 8-item Likert scale on a 1-5 range assessing 1) preoccupation with computer/gaming-station activities; 2) failure to resist the impulse to use; 3) tolerance (increased use needed to feel satisfied); 4) withdrawal (distress when not using, resolving with use); 5) longer than intended use; 6) unsuccessful efforts to cut down; 7) excessive efforts put into trying to use; and 8) continued use despite knowledge of it causing problems. Responses on the 8 questions were summed to create an Addiction Score which ranged between 8 (no addictive features) to 40 (maximum addictive features). In order to minimize the negative halo effect of the scale, questions about addictive features were embedded within 16 other questions focusing on the youth's perceptions of positive and negative aspects of computer/gaming-station use.

As many of these proposed addictive features were based on the adolescent's subjective experience of use, they were not asked of parents. Instead, parents responded to 4 questions of proposed warning signs for addiction, including: 1) child has neglected other interests since using computer/gaming-station; 2) child seems distressed when not allowed to use; 3) child only seems happy when using; and 4) child puts a lot of effort into getting to use. Parental score for warning signs of

addiction was summed from the four questions and therefore score ranged from 4 - 20.

Analyses of the CGAS included exploratory factor analysis and internal consistency. Construct validity was assessed through correlations with time spent on the computer/gaming-station and general psychopathology symptoms using the Strengths and Difficulties Questionnaire, as well as through correlation with parent-reported warning signs of addiction.

Strengths and Difficulties Questionnaire (SDQ)

The SDQ is a 25 item, widely used validated scale of child and adolescent psychopathology, available at www.sdqinfo.org. It has been normed on more than 10,000 children and translated into over 50 languages with excellent psychometrics (Goodman, 1997, 2001; Goodman, et al., 2000). We evaluated both the self-report SDQ (child SDQ) and the parent SDQ for ages 11-17, looking at the total score, and the five subscales (emotional problems, conduct problems, hyperactivity, peer problems, and prosocial behavior).

Weiss Functional Impairment
Rating Scale-parent (WFIRS-P)

The WFIRS-P is a validated parent questionnaire which assesses functional impairment in children with emotional problems, available at www.caddra.ca. It is comprised of 50 Likert scale questions assessing child's functional impairment in 6 domains: family, learning and school, life skills, child self-concept, social activity, and risky activity, with higher scores reflecting higher levels of functional impairment (Weiss, 2008). The WFIRS has excellent psychometric properties with Cronbach's alpha >0.9 overall, and subscale domain Cronbach's alphas ranging from 0.75– 0.93, and validation in pediatric, psychiatric, and community samples (Weiss, 2008). The life skills section includes a question on excessive computer and TV use which was excluded from the statistical analysis.

Statistical Analysis

Descriptive statistics were performed on all variables. Multivariate linear regressions were performed with total and subscale scores of the WFIRS-P, child SDQ, and parent SDQ, as the dependent variables. Independent variables included gender, gaming time, non-gaming time and addiction score. Missing values on the SDQ were handled as per SDQ scoring protocol (www.sdqinfo.com). Missing WFIRS and addiction score values were handled the same way. Subjects were dropped for a specific regression if they were missing > 2 subscale items, except for the WFIRS "self" subscale which contained only 3 items and therefore all responses were required. This protocol resulted in dropping 1 subject each for the child and parent SDQ regressions, and 2 subjects for the WFIRS. Statistical significance was defined as $p<0.05$.

Statistical analysis was calculated using STATA software (version 9.1, Statacorp, 2005).

Results

Descriptives

The total sample size was 102, including 41 females (40.2%) and 61 males (59.8%). Mean age was 13.7 ± 1.9. Almost all households (99.0%) had a computer in the home and the vast majority had internet access (94.1%). The mean number of computers in the home was 2.3 ± 1.3. One quarter (24.5%) of the children had a computer in their bedroom. Half of the households (50.0%) had rules limiting computer/gaming-station use. Parents reported their children obeyed the rules 67 ($\pm$ 31) % of the time.

Children reported spending 2.3 ($\pm$ 2.2) hrs/day on gaming, 2.0 ($\pm$ 2.1) hrs/day on non-gaming computer-based activities, and 2.4 ($\pm$ 2.0) hrs/day watching television. Mean child-reported screen time was 6.7 ± 4.2 hrs/day. Boys were statistically more likely to engage in gaming than girls: 2.8 vs.1.4 hrs/day (p=0.002). Contrary to our hypothesis that children would underestimate time, parents reported less use of all media compared with their children. These differences were statistically significant for non-gaming time and TV time using a paired t-test (mean differences = 0.35 ± 0.14 hrs and 0.33 ± 0.15 hrs, t = 2.5 and 2.2, p = 0.02 and 0.03, respectively), although none of the differences were clinically substantial relative to mean use. For the regression analysis, child estimates of times were used, as children were felt to be more accurate in describing how they divided their time between gaming and non-gaming activities.

Distribution between various media activities is shown in Table 1. Although amounts of time spent on each media activity were roughly the same, gaming was more likely to take up large amounts of time, with twice as many children reporting spending over 6 hr/day on gaming compared to non-gaming or television.

Mean value of the Addiction Score was 17.2 ± 7.7. Addiction score did not vary significantly by gender, and did not depend on whether time was predominantly spent on gaming or non-gaming activities, i.e. children who were predominantly gamers were equally likely to show addictive features of use to those predominantly engaged in other activities, such as social networking.

Psychometric properties of the CGAS

The internal consistency was excellent with Cronbach α = 0.89. Principal components exploratory factor analysis of the CGAS was consistent with a unidimensional solution based on both the Scree test (Cattell, 1978) and the Kaiser criterion. One factor explained 56% of the variance and all 8 questions
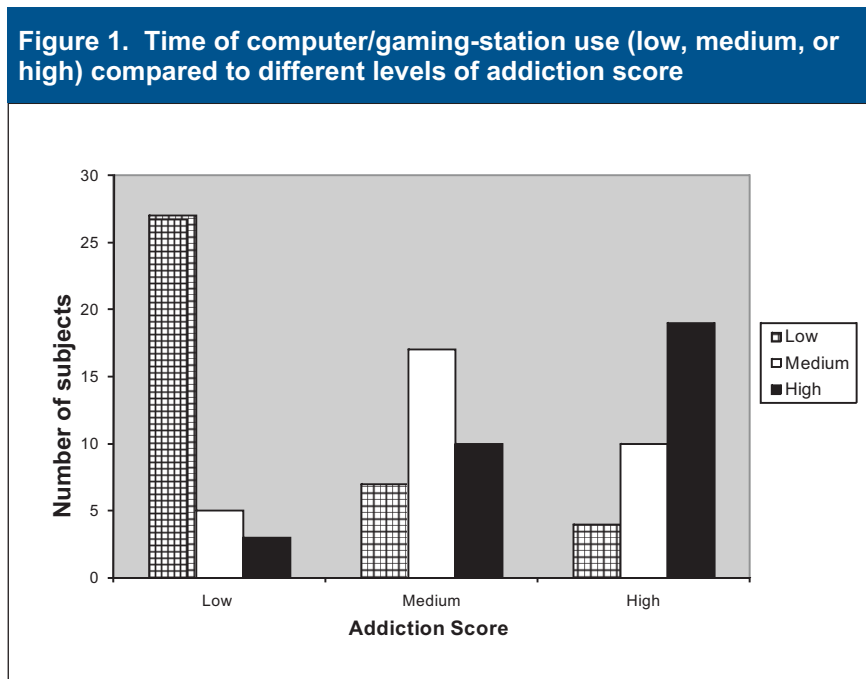
Figure 1. Time of computer/gaming-station use (low, medium, or high) compared to different levels of addiction score

Table 1. Distribution of average daily time spent on media activities (child report). N = 102

	0-2 hours		2-4 hours		4-6 hours		>6 hours	
	Count	Row %	Count	Row %	Count	Row %	Count	Row %
Gaming time	60	59%	16	16%	18	18%	8	8%
Non-gaming time	66	65%	17	17%	15	15%	4	4%
TV time	53	52%	35	34%	10	10%	4	4%
Total Media time	6	6%	28	27%	21	21%	47	46%

loaded with roughly equal weights (0.66-0.80). The correlation between the addiction score and daily time spent on the computer was moderate (r=0.42, p<0.001) consistent with the hypothesis that time of use and addiction are overlapping, yet distinct entities. The correlations between addiction score and SDQ scores were also in the moderate range (r=0.55, p<0.001 and 0.41, p<0.001 for Child and Parent SDQ's, respectively) again consistent with addiction overlapping with general psychopathology symptoms. Addiction score was moderately correlated with parental warning signs of addiction (r = 0.47, p<0.001).

Although most subjects with high addiction score were heavy computer/gaming-station users, a subset were not. Figure 1 shows the relationship between addiction score and time, where the top, middle and lower thirds of addiction scores are compared to the high, medium, and low users. The majority of subjects fall into expected categories (e.g. high addiction/high use), however many subjects fall outside of these categories. Roughly 30% of subjects with low addiction score are using medium to high amounts of time and roughly 10%

of subjects with high addiction score are using low amounts of time. Thus although the scale has high internal consistency, it is able to distinguish between time spent and addictive features.

Regression Results

Mean Child SDQ score for the sample was 14.6 ± 6.4, which is at the 82nd percentile compared to normed data (Meltzer, et al., 2000). Subscale percentiles on the child SDQ were similarly elevated and ranged from the 77th to 85th percentiles. Mean Parent SDQ score was 15.4 ± 6.5, which is at the 89th percentile compared to population normed data. Subscale percentiles on the parent SDQ were similarly elevated and ranged from the 83rd to 92nd percentiles. These values are well within the clinical range as would be anticipated given recruitment from a clinical population. Mean WFIRS score was 40.3 ± 24.2, which is at the 27th percentile compared with a clinical population of 200 children with untreated ADHD, ages 6-11 (Weiss, 2008). Subscales percentiles ranged from the 20th to the 60th percentile compared to the same ADHD sample.

Table 2. Standardized multiple regression coefficients (t scores) for Child SDQ subscales and total score. Statistically significant correlations shown in bold (*p<0.05, **p<0.01). N = 101

	Emotional problems	Conduct problems	Hyperactivity	Peer Problems	Prosocial behavior	Total score
Gender	**0.35****	0.07	0.11	0.09	0.08	**0.23***
	(3.7)	(0.74)	(1.1)	(0.89)	(0.75)	**(2.6)**
Gaming time	-0.11	0.06	0.10	0.12	-0.04	0.04
	(-1.10)	(0.55)	(0.95)	(1.1)	(-0.35)	(0.46)
Non-gaming time	0.04	**0.20***	0.15	**-0.22***	0.03	0.07
	(0.43)	**(2.2)**	(1.58)	**(-2.3)**	(0.27)	(0.78)
Addiction score	**0.39****	**0.40****	**0.29****	**0.40****	**-0.29****	**0.51****
	(4.0)	**(4.1)**	**(2.8)**	**(4.0)**	**(-2.7)**	**(5.6)**
R square	0.29	0.27	0.18	0.21	0.10	0.36

Table 3. Standardized multiple regression coefficients (t-scores) for Parent SDQ subscales and total score. Statistically significant correlations shown in bold (*p<0.05, **p<0.01). N = 101

	Emotional problems	Conduct problems	Hyperactivity	Peer Problems	Prosocial behavior	Total score
Gender	0.16	-0.06	-0.03	-0.002	0.03	0.03
	(1.5)	(-0.58)	(-0.32)	(-0.02)	(0.26)	(0.28)
Gaming time	-0.11	-0.09	0.08	0.21	0.04	0.04
	(-0.95)	(-0.85)	(0.73)	(1.9)	(0.35)	(0.32)
Non-gaming time	-0.01	0.11	-0.01	**-0.25***	-0.08	-0.06
	(-0.11)	(1.1)	(-0.13)	**(-2.5)**	(-0.76)	(-0.63)
Addiction score	0.15	**0.38****	**0.27***	**0.24***	**-0.30****	**0.39****
	(1.3)	**(3.6)**	**(2.51)**	**(2.3)**	**(-2.7)**	**(3.7)**
R square	0.06	0.15	0.10	0.15	0.10	0.15

The relationships between time spent on the computer/gaming-station, presence of addictive features and overall emotional and behavioral functioning as measured by the parent SDQ, child SDQ, and the WFIRS were evaluated using multivariate linear regressions. TV time was checked to see if it had any impact on results, but was dropped as it did not contribute to the analysis of any of the three regressions. Gender effects on the relationships between time, addictive features, and functioning were examined.

Table 2 shows the results of a multivariate linear regression looking at how child SDQ scores vary with gender, gaming time, non-gaming time, and addiction score. Of note, addiction score is significantly correlated with total SDQ score as well as all subscale scores, i.e. subjects with high addiction score report higher difficulties and less prosocial behavior. In contrast, gaming time is not correlated with any SDQ subscale and in fact, the regression coefficient for total child SDQ is close to zero (0.04) suggesting no relationship between the two. Similarly, non-gaming time is not correlated

with SDQ total score or subscale scores, with the exceptions of positive correlation with conduct problems and negative correlation with peer problems. No significant differences were found between boys and girls in the effects of gaming time, non-gaming time and addiction score on child SDQ scores.

Table 3 shows the results of a multivariate linear regression looking at how parent SDQ scores vary with gender, gaming time, non-gaming time, and addiction score. Again, addiction score is significantly correlated with parent SDQ scores. As with the child SDQ, gaming time is not significantly correlated with any parent SDQ subscale or total score. Similarly, non-gaming time is not significantly correlated with parent SDQ with the exception of a negative correlation with parent-reported peer problems. No significant differences were found between boys and girls in the effects of gaming time, non-gaming time and addiction score on parent SDQ scores.

Table 4. Standardized multiple regression coefficients (t scores) for WFIRS subscales and total score. Statistically significant correlations shown in bold (*p<0.05, **p<0.01). N = 100

	Family	Learning/ school	Life skills	Self-Concept	Social activity	Risky activity	Total WFIRS
Gender	-0.11	-0.04	0.05	0.09	0.02	-0.10	-0.04
	(-1.1)	(-0.41)	(0.46)	(0.83)	(0.17)	(-0.95)	(-0.38)
Gaming time	-0.19	0.05	-0.04	-0.14	0.05	-0.06	-0.07
	(-1.7)	(0.42)	(-0.37)	(-1.21)	(0.47)	(-0.56)	(-0.67)
Non-gaming time	0.09	0.13	0.17	0.11	-0.08	**0.33****	0.17
	(0.91)	(1.3)	(1.7)	(1.13)	(-0.81)	**(3.3)**	(1.68)
Addiction score	**0.28***	**0.30****	**0.27***	**0.26***	**0.37****	0.08	**0.35****
	(2.6)	**(2.8)**	**(2.5)**	**(2.3)**	**(3.5)**	(0.75)	**(3.3)**
R square	0.090	0.14	0.12	0.10	0.15	0.12	0.16

Table 4 shows the results of a multivariate linear regression looking at how WFIRS scores vary with gender, gaming time, non-gaming time, and addiction score. Similar to the results for both SDQ's, addiction score is significantly correlated with total WFIRS score and subscale scores (with the exception of risky behavior); i.e., subjects with high addiction score have increased functional impairment across most domains. Gaming time, as in both SDQ measures, is not significantly correlated with any WFIRS subscale or total score. Similarly, non gaming time, is not significantly correlated with WFIRS total score or subscale scores (with the exception of risky behavior). No significant differences were found between boys and girls in the effects of gaming time, non-gaming time and addiction score on WFIRS, with the exception of risky behavior, where gender analysis showed non-gaming time to be significantly correlated with risky behavior for boys but not girls (regression coefficient =0.46, p=0.001 and regression coefficient =0.02, p=0.93, respectively). Therefore the significant correlation between risky behavior and non-gaming time shown in Table 4 is largely accounted for by boys.

Discussion

Youth in our clinical sample are spending many hours per day in front of screens with 94% spending over the 2 hour time limit recommended by the American Academy of Pediatrics (AAP, 2001). Their screen time (mean = 6.7 hrs/day) is more than twice that reported in two large epidemiologic surveys of Canadian adolescents during the same period (Mark & Janssen, 2008; Smith, et al., 2009), suggesting that youth with psychiatric disorders are spending significantly more time on the computer/gaming-station than the general population.

This study developed and validated a child and parent report to measure addictive features of computer and gaming station use based on the Ko model of internet addiction (Ko, et al.,

2005b). The CGAS proved to be a reliable scale for assessing proposed addictive features of computer/gaming-station with excellent internal consistency. Patterns of correlations with time spent on the computer, SDQ scores, and parental warning signs of addiction supported its construct validity. Although the concept of computer addiction remains controversial, using this measure, we have been able to identify a subset of youth with psychiatric disorders who show features of addictive patterns of use.

The most striking result is the strong positive correlation between the presence of addictive features and the reported problems in all realms of the child's life. This result is clinically and statistically significant and robust enough to be consistent across parent and child informants as well as measures of psychopathology and functional impairment.

Although one might also hypothesize that increasing time spent on the computer/gaming-station would also be correlated with increasing problems, this is not the case in our data once one controls for addictive features. For all three outcome measures, time spent on the computer/gaming-station is generally not correlated with problems (with the exception of risky behavior discussed below) and, particularly for gaming time, the regression coefficients are close to zero (i.e. change in gaming time leads to almost no change in reported difficulties).

This result implies there is a qualitative difference between youth who "fill" large amounts of free time with computer/gaming-station use and youth whose use is more driven and problematic. This apparent paradox is explained graphically in Figure 1 where the "time fillers" are shown by the high use/low addiction score group. One can hypothesize that the low use/high addiction score group may be youth whose parents have placed external control on their use, for example, one father we met who took the computer to work every day to

keep it away from his child. Although, the existence of "computer addiction" remains controversial, this clear differentiation between time and addictive features suggests that addictive patterns of use are distinct and qualitatively different from non-addictive patterns.

Although time spent on the computer/gaming-station was not generally associated with problems, the exception was the association between time spent on non-gaming recreational activities and risky behavior (on the WFIRS) and conduct problems (on the SDQ). Gender analysis showed this to be statistically significant for boys, but not girls on the WFIRS, and for the total group (boys and girls) on the SDQ. Both the SDQ conduct subscale and the WFIRS risky behavior subscale tap into similar problems (e.g. lying, stealing and aggression on the SDQ; legal difficulties, substance use, and risky sexual behavior on the WFIRS). Non-gaming recreational computer use encompasses a wide variety of activities including web-based social networking groups, as well as other riskier activities such as gambling or pornography. Increased time spent on these riskier activities may account for this observed association. It is important to remember that our data is correlational only, and cannot differentiate between computer use leading to risky behavior, or youth with conduct problems being drawn more towards these computer activities.

This study has several clinical implications. First, youth with psychiatric disorders spend many hours per day on computer/gaming-station use and inquiry into the amount and type of use as part of routine psychiatric assessment is recommended. When concerns about excessive use are present, parents and clinicians need to differentiate between children who are simply filling their free time with computer use and children whose use is more driven and problematic. Parental warning signs for addictive features of use (described above) were correlated with youth reports of addictive features and should trigger further investigation. A further implication is that parents need to monitor what their child is doing on the computer, as certain activities may be associated with increased problems. This is particularly relevant given the high percentage of youth who had their own computers in their bedrooms, where much of their use is presumably unsupervised.

This study has significant limitations, but begins to pilot an area which is deserving of considerably more research given its impact on our youth. These results in children with existing psychopathology cannot be generalized to the population at large. No diagnostic information was available in this study and therefore no associations between computer/gaming-station use and specific psychiatric disorders could be made. No socioeconomic data was available and therefore no demographic associations could be made. This study is cross-sectional in nature and looks only at correlations between computer use and functioning and therefore cannot answer causal questions.

Although the concept of whether it is possible to be "addicted" to the computer remains controversial, our findings demonstrate a significant subgroup of children for whom the use of the computer/gaming-station is more driven and difficult to control which appears to be associated with both increased psychopathology and functional impairment. Further studies to develop the methodology to evaluate the impact of computer and gaming station use on our youth is imperative.

Acknowledgements / Conflicts of Interest

References

Ahn, D. H. (2007). *Korean policy on treatment and rehabilitation for adolescents' Internet addiction*. Seoul, Korea: National Youth Commission.

Allison, S. E., von Wahide, L., Shockley, T., & Gabbard, G. O. (2006). The development of the self in the era of the internet and role-playing fantasy games. *American Journal of Psychiatry, 163*(3), 381-385.

American Academy of Pediatrics (2001). *American Academy of Pediatrics: Children, Adolescents, and Television. Pediatrics, 107*(2), 423-426.

American Psychiatric Association (2000). *Diagnostic and Statistical Manual of Mental Disorders, 4th edition, revised*. Washington, DC: American Psychiatric Association.

Beard, K. W. (2005). Internet addiction: A review of current assessment techniques and potential assessment questions. *Cyberpsychology and Behavior, 8*(1), 7-14.

Beranuy Fargues, M., Chamarro Lusar, A., Graner Jordania, C., & Carbonell Sanchez, X. (2009). [Validation of two brief scales for Internet addiction and mobile phone problem use]. *Psicothema, 21*(3), 480-485.

Block, J. J. (2008). Issues for DSM-V: Internet Addiction. *American Journal of Psychiatry*, 165, 306-307.

Byun, S., Ruffini, C., Mills, J. E., Douglas, A. C., Niang, M., Stepchenkova, S., et al. (2009). Internet addiction: Metasynthesis of 1996-2006 quantitative research. *Cyberpsychology and Behavior, 12*(2), 203-207.

Campbell, A. J., Cumming, S. R., & Hughes, I. (2006). Internet use by the socially fearful: Addiction or therapy? *Cyberpsychology and Behavior, 9*(1), 69-81.

Cao, F., & Su, L. (2006). Internet addiction among Chinese adolescents: Prevalence and psychological features. *Child: Care, Health and Development, 33*(3), 275-278.

Cao, F., Su, L., Liu, T., & Gao, X. (2007). The relationship between impulsivity and Internet addiction in a sample of Chinese adolescents. *European Psychiatry, 22*, 466-471.

Cattell, R. B. (1978). *The Scientific Use of Factor Analysis in Behavioral and Life Science*. New York: Plenum.

Ceyhan, A. A. (2008). Predictors of problematic Internet use on Turkish university students. *Cyberpsychology and Behavior, 11*(3), 363-366.

Chak, K., & Leung, L. (2004). Shyness and locus of control as predictors of internet addiction and internet use. *Cyberpsychology and Behavior, 7*(5), 559-570.

Chan, P. A., & Rabinowitz, T. (2006). A cross-sectional analysis of video games and attention deficit hyperactivity disorder symptoms in adolescents. *Annals of General Psychiatry, 5*(16).

Chang, M. K., & Law, S. P. M. (2008). Factor Structure for Young's Internet Addiction Test: A confimatory study. *Computers in Human Behavior, 24*(6), 2597-2619.

Gentile, D. (2009). Pathological Video-game use amoung youth ages 8 to 18. *Psychological Science, 20*(5), 594-602.

Goodman, R. (1997). The Strengths and Difficulties Questionnaire: A Research Note. *Journal of Child Psychology and Psychiatry, 38*, 581-586.

Goodman, R. (2001). Psychometric properties of the Strengths and Difficulties Questionnaire (SDQ). *Journal of the American Academy of Child and Adolescent Psychiatry, 40,* 1337-1345.

Goodman, R., Ford, T., Simmons, H., Gatward, R., & Meltzer, H. (2000). Using the Strengths and Difficulties Questionnaire to screen for child psychiatric disorders in a community sample. *British Journal of Psychiatry, 177,* 534-539.

Green, C. S., & Bavelier, D. (2003). Action video game modifies visual selective attention. *Nature, 423*, 534-537.

Grusser, S. M., Thalemann, R., Albrecht, U., & Thalemann, C. N. (2005). Excessive computer usage in adolescents—results of a psychometric evaluation. *Wiener Klinische Wochenschrift, 117,* 188-195.

Ha, J. H., Yoo, H. J., Cho, I. H., Chin, B., Shin, D., & Kim, J. H. (2006). Psychiatric comorbidity assessed in Korean children and adolescents who screen positive for internet addiction. *Journal of Clinical Psychiatry, 67*(5), 821-826.

Jang, K. S., Hwang, S. Y., & Choi, J. Y. (2008). Internet Addiction and Psychiatric Symptoms Among Korean Adolescents. *Journal of School Health, 78*(3), 165-171.

Jordan, A. B. (2006). Exploring the impact of media on children. *Archives of Pediatrics and Adolescent Medicine, 160*(4), 446-448.

Khaleej Times Online (2009). Internet addiction center opens in US http://www.khaleejtimes.com/Displayarticle08.asp?section=technology&xfile=data/technology/2009/September/technology_September21.xml Retrieved April 16, 2010

Kim, K., Ryu, E., Chon, M. Y., Yeun, E. J., Choi, S. Y., Seo, J. S., et al. (2006). Internet addiction in Korean adolescents and its relation to depression and suicidal ideation: A questionnaire survey. *International Journal of Nursing Studies, 43*, 185-192.

Ko, C. H., Yen, J. Y., Yen, C. F., Chen, C. C., Yen, C. N., & Chen, S. H. (2005a). Screening for internet addiction: An empirical study on cut-off points for the Chen Internet Addiction Scale. *Kaohsiung Journal of Medical Sciences, 21*(12), 545-551.

Ko, C. H., Yen, J. Y., Chen, C. C., Chen, S. H., & Yen, C. F. (2005b). Proposed diagnostic criteria of Internet addiction for adolescents. *Journal of Nervous and Mental Disease, 193*(11), 728-733.

Ko, C. H., Yen, J. Y., Chen, C. S., Chen, C. C., & Yen, C. F. (2008). Psychiatric comorbidity of Internet addiction in college students: An interview study. *CNS Spectrums, 13*(2), 147-153.

Lo, S. K., Wang, C. C., & Fang, W. (2005). Physical interpersonal relationships and social anxiety among online game players. *Cyberpsychology and Behavior, 8*(1), 15-20.

Mark, A. E., & Janssen, I. (2008). Relationship between screen time and metabolic syndrome in adolescents. *Journal of Public Health, 30*(2), 153-160.

Media Awareness Network (2005). Media Awareness Network: Young Canadians in a Wired World—Phase II <http://www.media-awareness.ca/english/research/YCWW/phaseII/upload/YCWWII_trends_recomm.pdf> Retrieved April 9, 2010.

Meltzer, H., Gatward, R., Goodman, R., & Ford, F. (2000). *Mental health of children and adolescents in Great Britain*. London: The Stationary Office.

Mythily, S., Qiu, S., & Winslow, M. (2008). Prevalence and correlates of excessive Internet use among youth in Singapore. *Annals, Academy of Medicine, Singapore, 37*, 9-14.

Nichols, L. A., & Nicki, R. (2004). Development of a psychometrically sound internet addiction scale: A preliminary step. *Psychology of Addictive Behaviors, 18*(4), 381-384.

Niemz, K., Griffiths, M., & Banyard, P. (2005). Prevalence of pathological internet use among university students and correlations

with self-esteem, the General Health Questionnaire (GHQ), and disinhibition. *Cyberpsychology and Behavior, 8*(6), 562-570.

Olson, C. K., Kutner, L. A., Warner, D. E., Almerigi, J. B., Baer, L., & Nicholi, A. M. (2007). Factors correlated with violent video game use by adolescent boys and girls. *Journal of Adolescent Health, 41*(1), 77-83.

Park, J. S. (2005). [Development of internet addiction measurement scales and Korean internet addiction index]. *Journal of Preventative Medicine and Public Health, 38*(3), 298-306.

Rehbein, F., Kleimann, M., & Mossle, T. (2010). Prevalence and risk factors of video game dependency in adolescence: Results of a German nationwide survey. *Cyberpsychology and Behavior,13*(3), 269-277.

Shaffer, H. J., Hall, M. N., & Vander Bilt, J. (2000). "Computer Addiction": A critical consideration. *American Journal of Orthopsychiatry, 70*(2), 162-168.

Shapira, N. A., Goldsmith, T. D., Keck, P. E., Kholsa, U. M., & McElroy, S. L. (2000). Psychiatric features of individuals with problematic internet use. *Journal of Affective Disorders, 57*, 267-272.

Shapira, N. A., Lessig, M. C., Goldsmith, T. D., Szabo, S. T., Martin, L., Gold, M. S., et al. (2003). Problematic internet use: Proposed classification and diagnostic criteria. *Depression and Anxiety, 17*(4), 207-216.

Smith, A., Stewart, D., Peled, M., Poon, C., & Saewyc, E. (2009). *A Picture of Health: Highlights from the 2008 BC Adolescent Health Survey*. Vancouver, BC: McCreary Centre Society.

Sun, D. L., Chen, Z. J., Ma, N., Zhang, X. C., Fu, X. M., & Zhang, D. R. (2009). Decision-making and prepotent response inhibition functions in excessive internet users. *CNS Spectrums, 14*(2), 75-81.

Sun, D. L., Ma, N., Bao, M., Chen, X. C., & Zhang, D. R. (2008). Computer games: A double-edged sword? *Cyberpsychology and Behavior, 11*(5), 545-548.

Tejeiro Salguero, R. A., & Bersabe Moran, R. M. (2002). Measuring problem video game playing in adolescents. *Addiction, 97*, 1601-1606.

van Rooij, A. J., Schoenmakers, T. M., van de Eijnden, R. J., & van de Mheen, D. (2010). Compulsive Internet use: The role of online gaming and other internet applications. Journal of Adolescent Health, 47(1), 51-57.

Vaugeois, P. (2006). *Cyber Addiction: Fundamentals and Perspectives*. In Montreal: Centre quebecois de lutte aux dependances (Ed.). Montreal, Quebec.

Weinstein, A., & Lejoyeux, M. (2010). Internet Addiction or Excessive Internet Use. *American Journal of Drug and Alcohol Abuse*, *36*(5), 248-253.

Weinstein, A. M. (2010). Computer and video game addiction-a comparison between game users and non-game users. *American Journal of Drug and Alcohol Abuse, 36*(5), 268-276.

Weiss, M. (2008). *Beyond Core Symptoms: Implications of Effectiveness Research for Clinical Practice*. Paper presented at the American Academy of Child and Adolescent Psychiatry Annual Meeting.

Widyanto, L., & McMurran, M. (2004). The Psychometric Properties of the Internet Addiction Test. C*yberpsychology and Behavior, 7*(4), 443-450.

Yang, C. K., Choe, B. M., Baity, M., Lee, J. H., & Cho, J. S. (2005). SCL-90-R and 16PF profiles of high school students with excessive internet use. *Canadian Journal of Psychiatry, 50*(7), 407-414.

Yen, J. Y., Ko, C. H., Yen, C. F., Chen, S. H., Chung, W. L., & Chen, C. C. (2008). Psychiatric symptoms in adolescents with Internet addiction: Comparison with substance use. *Psychiatry and Clinical Neurosciences, 62*, 9-16.

Yoo, H. J., Cho, S. C., Ha, J., Yune, S. K., Kim, S. J., Hwang, J., et al. (2004). Attention deficit hyperactivity symptoms and internet addiction. *Psychiatry and Clinical Neurosciences, 58*(5), 487-494.

Young, K. S. (1998a). *Caught in the Net: How to Recognize Signs of Internet Addiction—and a Winning Strategy for Recovery*. New York: John Wiley & Sons.

Young, K. S. (1998b). Internet Addiction: The emergence of a new clinical disorder. *Cyberpsychology and Behavior, 1*(3), 237-244.