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ORIGINAL RESEARCH

A descriptive pilot survey of behavioural addictions in an adolescent secondary school population in Ireland

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Objectives: The aim of the present study was to evaluate the levels of possible internet addiction, gaming addiction, gambling addiction and associated mental health difficulties in a secondary school population in Ireland.

Methods: An online survey containing questions related to internet addiction, gaming addiction, gambling addiction and associated mental health difficulties was administered to secondary school adolescents in Ireland. Participants were self-selecting and answered questions on the characteristics of each topic and screening questionnaires for addiction to each behaviour, as well as their respective effects on mental health.

Results: A total of 234 children participated in the survey (156 males; aged 12–18 years; average age of 14.2 years; S.D. 1.60). Internet addiction as assessed using the Chen Internet Addiction Scale was present for between 11.5% and 22.6% and levels of gaming addiction as assessed using by the Internet Gaming Disorder Scale–Short Form was present for between 0.5% and 1.6%. Weak positive correlations were found between time spent on the internet and time spent gaming with internet addiction and gaming addiction, respectively. There were weak positive correlations between higher internet addiction scores, higher gaming addiction scores, and increased depression and anxiety scores. Using the South Oaks Gambling Screen–Revised for Adolescents, two participants were classed as 'at-risk' for gambling addiction and one participant was classed as a problem gambler.

Conclusions: The present study examined behavioural addictions and their effects on mental health on a self-selecting sample of schoolchildren at two schools in Ireland. A low number were identified as being at risk or problem gamblers.

Keywords: internet addiction, gaming addiction, gambling addiction, behavioural addiction, children and adolescents, Ireland

Introduction

Behavioural addictions among adolescent populations are becoming an increasing concern given the risk of their development in this population (Villella *et al.*, 2011). Behavioural addictions are syndromes with similar features to dependency seen in traditional substance-related addiction but do not involve the ingestion of a psychoactive agent (Grant *et al.*, 2010). In the *International Classification of Diseases* (ICD-11), both gaming disorder and gambling disorder have been included under the category of 'Disorders due to substance use or addictive behaviours' (World Health Organization, 2018). Behaviours that conform to six core

components of addiction (salience, mood modification, tolerance, withdrawal symptoms, conflict and relapse) have been defined as addictive behaviour and this model has been investigated in behaviours such as exercise, shopping, internet use, work and social networking (Griffiths, 2013).

With increasing access to the internet and ease of accessibility, internet addiction is becoming a growing concern in the adolescent population (Kuss *et al.*, 2013b). Internet addiction among adolescents can range from anywhere between 0.9% to 37.9% in Asian studies and between 2.0% - 18.3% in European studies (Alimoradi *et al.*, 2019) and is associated with depression, anxiety (Kuss and Lopez-Fernandez, 2016), fatigue, and sleep disturbance (Bener *et al.*, 2019). It is important to note that internet addiction does not conceptually encompass addictions to activities such as online gambling or online gaming. These use the medium of the internet for interaction but are independently addictive (Pontes and Griffiths, 2014). Internet addiction is generally considered an addiction to the internet itself (e.g., an individual spending of all of their time on the internet), rather than addiction to specific activities that take place on the internet (Pontes and Griffiths, 2014). Internet addicted individuals spend more time on the internet compared to their non-addicted peers (Kuss *et al.*, 2013a) and adolescents are an at-risk population for internet addiction due to variable development of cognitive control and boundary setting skills (Kuss *et al.*, 2013b). The current adolescent population can be considered to be 'digital natives' – individuals who have spent the majority of their lives integrated with the internet and technology and thrive on the instant gratification and feedback that can be obtained on the internet (Prensky, 2001). Social media sites are very popular among adolescents and applications involving online video-sharing such as *TikTok* or *YouTube* have the highest interactive level of all these sites (Balakrishnan and Griffiths, 2017). Social networking sites (SNSs) are very popular among adolescents, and excessive use is associated with increased rates of maladaptive cognitions which can lead to addictive use (Kuss and

Griffiths, 2017). Irish adolescents have been shown to engage in higher levels of prolonged social media use (greater than four hours per day) on non-school days compared to their European counterparts (ESPAD Group, 2020), with over one-third of Irish adolescents spending greater than three hours per day on social media sites (Dooley et al., 2019). It is important to state that, despite the possible mental health consequences, social media use is an important part of child and adolescent socialisation and children should be supported to use social media appropriately (Kaess, 2020).

Another hugely popular use of the internet for adolescents is online gaming, with an estimated 60% of children in the US engaging in gaming via a console (WePC, 2020). For the majority, videogame playing is a harmless and enjoyable pastime. Gaming can confer a number of positive benefits including educational (Griffiths, 2002), cognitive, social, and emotional benefits (Granic *et al.*, 2014). Gaming can improve adherence to medical treatment (Kato *et al.*, 2008) and improve mood (Russoniello *et al.*, 2009). For a minority of individuals engaging in gaming, there is a risk of developing gaming disorder. In one meta-analysis of the prevalence of internet gaming disorder among adolescents, the pooled prevalence rate was 4.6% with higher rates noted in male adolescents (Fam, 2018). Gaming disorder has been associated with a number of mental health symptoms (González-Bueso *et al.*, 2018) and increased substance misuse (Van Rooij *et al.*, 2014). The reasons why individuals engage in online gaming are also important, with a recent study of adult gamers in Ireland showing that non-disordered gamers used gaming as a recreational and social pursuit whereas disordered gamers used gaming as a coping mechanism or an escape strategy (Columb *et al.*, 2020a), concurrent with other studies in this area (Király *et al.*, 2015, Kim *et al.*, 2016). Gaming micro-transactions (e.g. in-game purchases that unlock specific features or give players special abilities, characters, or content) are also a concern in online gaming for adolescents. Loot boxes, a type of micro-transaction defined as "in-game purchases consisting of a virtual container that awards players with items

and modifications based on chance" (Rouse, 2018), have been described as "virtual games of chance" (Griffiths, 2018). A recent study of 12-16 year olds in Finland showed that 45.6% of the participants had been used loot boxes during gaming in the past year (Kristiansen and Severin, 2020). Their connection with gambling is such that the Belgian government has banned loot boxes as they are viewed as gambling and encourage children to gamble (MacDonald, 2018).

Online gambling in more traditional formats are a concern for adolescents. A systematic review of gambling disorder prevalence in adolescents in Europe found the prevalence of gambling disorder to be between 0.2% and 12.3% in this population (Calado *et al.*, 2017). There are concerns about the advertising of gambling to children and the effect this may have (Monaghan *et al.*, 2008). Children have been shown to give detailed accounts of betting products and advertisements (Pitt *et al.*, 2017) and there is a general lack of restrictions on gambling advertisements before the 9pm television watershed (Lopez-Gonzalez *et al.*, 2017). Previous research has shown that adolescent gamblers are at an increased risk of becoming problem gamblers as adults (Griffiths and Wood, 2000). Irish adolescents have an increased risk of lifetime substance misuse compared to their European counterparts (ESPAD Group, 2020).

Currently there are little data pertaining to the levels of internet addiction, gaming addiction, and gambling addiction among adolescents in Ireland, as well as the possible mental health difficulties associated with these addictions. Consequently, the aim of this pilot study was to evaluate the levels of internet addiction, gaming addiction, gambling addiction, and their associated mental health difficulties in a secondary school population in Ireland.

Methods

Participants

A convenience sample of participants was recruited from two Irish secondary schools (one publicly-funded and one fee-paying school) between November 2019 to May 2020. Parents were approached to obtain informed consent for their child to participate in the study via email of a participant information pack, in addition to in-person discussion relating to the study with parents at parent-teaching meetings. Of the eligible population, 21.9% of parents returned completed consent forms. All adolescents (100%) with parental consent gave permission for their children to participate in the study. Each participant was asked to complete a 20-minute online survey within their school setting. The survey comprised questions related to internet use, involvement in gaming, engagement in gambling, and questions related to mental health. The survey consisted of questions related to internet use, involvement in gaming, engagement in gambling, and questions related to mental health. Each participant and their parent(s) provided informed consent for their child to participate in the survey. Each parent and participant were given information on the study, the reasons behind the study, how the participant's data would be used, the risks and benefits of the study, and the relevant *General Data Protection Regulation* (GDPR) information. The present study was approved by the Research Ethics Committee of University College Dublin.

Survey design

The survey contained 31 questions and seven psychometric questionnaires comprising five sections – demographic questions, internet use questions, gaming questions, gambling questions and questions related to mental health. Demographic questions consisted of age, gender, and nationality. Participants were informed that they were not required to answer any questions they felt uncomfortable answering, leading to some participants omitting specific questions.

Internet use and internet addiction

Internet use questions enquired about the age when internet use started, the hours spent on the internet during the weekdays and weekends, and how much parents had limited their time on the internet. Use of popular social media apps and websites were surveyed in terms of frequency of use and time spent per day on each of these apps and websites. To screen for internet addiction, the Chen Internet Addiction Scale (CIAS) was included. The CIAS has been used worldwide to screen for internet addiction and has demonstrated good internal consistency in previous studies (Kuss *et al.*, 2014). The CIAS is a 26-item self-report scale screening for internet addiction across five domains: compulsive use, withdrawal, tolerance, interpersonal relationships, and time management (Poli, 2017) and answered on a four-point scale ranging from *"Does not match my experience at all"* to *"Definitely matches my experience".* The scoring ranges from 26 (lowest score) to 104 (highest score). In previous studies of adolescents and internet addiction, a CIAS score of 57/58 was used a screening cut-off, given the high sensitivity (85.6%) for internet addiction at this score (Ko *et al.*, 2005). A diagnostic cut-off point of 63/64 was used in the same study given the high specificity (87.6%) for the diagnosis of internet addiction (Ko *et al.*, 2005). By using both the screening and diagnostic cut-off points in the study, a more accurate assessment range of possible internet addiction is obtained. The Cronbach's alpha for the CIAS in the present study was 0.92, demonstrating excellent internal consistency.

Gaming use and gaming addiction

Gaming questions focused on the age participants started playing videogames both online and offline, the hours spent gaming during the weekend and weekdays, any limits that parents had placed on their gaming time and devices they used for gaming. Participants selected the games they engaged with online from a list of 27 of the most popular online games used in a previous study of Irish adults gamers (Columb *et al.*, 2020a). Mobile game frequency was assessed using popular mobile games such as *Candy Crush Saga, Fortnite, Pokemon Go!, Toon Blast, Candy*

Crush Soda Saga, Clash of Clans, ROBLOX, Guns of Glory, Dragon Ball Z and *Dokkan Battle*. Questions concerning micro-transactions focused on the participants use of micro-transactions, the type of micro-transaction used (in-game currencies, random chance purchases/loot boxes, in-game advantages, expiration [purchases to continue playing when a time-limit expires]) and the estimated amount of money spent on micro-transactions over the past year. The nine-item Internet Gaming Disorder Scale–Short Form (IGDS9-SF) was included in the present study to screen for possible gaming addiction (Pontes and Griffiths, 2015). The nine questions are based on the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) criteria for Internet Gaming Disorder (American Psychiatric Association, 2013) and are responded to on a five-point scale ranging from 1 (*"never"*) to 5 (*"very often"*). The scoring ranges from 9 (lowest score) to 45 (highest score). Endorsing five or more items out of nine in the most severe range (i.e., 5) indicates possible gaming disorder. A score of 36 out of 45 on the IGDS9-SF has also been suggested as a cut-off point for disordered gaming in previous studies (Pontes and Griffiths, 2015) and was also be used in the present study. This is a research cut-off point and not part of the DSM-5 Internet Gaming Disorder criteria as IGD in the DSM-5 can only be diagnosed via clinical interview. The Cronbach's alpha for the IGDS9-SF in the present study was 0.88, demonstrating very good internal consistency. The Motives for Online Gaming Questionnaire (MOGQ) was included in the present study to assess participants reasons for engaging in online gaming across seven main motives (social, escape, competition, coping, skill development, fantasy, and recreation) (Demetrovics *et al.*, 2011). The questionnaire comprises 27 items answered on a five-point scale ranging from 1 (*"almost never"*) to 5 (*"almost always/always"*) with a minimum score of 4 for each factor (3 for Recreation) and a maximum of 20 for each factor (15 for Recreation). The Cronbach's alpha for the MOGQ in the present study was 0.95, demonstrating excellent internal consistency.

Gambling use and gambling addiction

Participants were asked about their participation in gambling of any form, the frequency of their gambling, the time spent per gambling session, and the age at which they first commenced gambling. Participants were also asked about the method by which they gambled (online, in-person, or both), the use of their own money, parents' money and/or friends' money to gamble, if they had their own gambling account or used a different account (parents/friends) and how often they engaged in different forms of gambling such as sports betting, buying scratchcards, and playing poker. Gambling addiction was screened for using the South Oaks Gambling Screen–Revised for Adolescents (SOGS-RA) scale (Winters *et al.*, 1993). The SOGS-RA is a 12-item scale based on features of gambling disorder such as loss of control and the effect gambling has on their social and school functioning (Buja *et al.*, 2017). The questions are delivered in a 'yes/no' format apart from one question related to attempting to win money back lost on the previous day, which is answered on a four-point scale. The scoring for the scale ranges from 0 (lowest score) to 12 (highest score), with a score of 0-1 indicating non-problem gamblers, a score of 2-3 indicating 'at-risk' gamblers, and a score of 4 or higher indicating problem gamblers (Buja *et al.*, 2017). The Cronbach's alpha for the SOGS-RA in the present study was 0.73, demonstrating good internal consistency.

Mental health questions

The presence of mental disorder (depression, generalised anxiety, and somatic anxiety) in this population was assessed using three psychometric scales. The nine-item Patient Health Questionnaire (PHQ-9) is a brief screening instrument for depression severity based on the PRIME-MD diagnostic instrument for mental disorders (Kroenke *et al.*, 2001). Each of the nine questions is answered on a scale ranging from 0 (*"not at all"*) to 3 (*"nearly every day"*) giving a total score of between 0 (lowest) and 27 (highest). A cut-off point of 11 out of 27 in adolescents has been found to have a sensitivity of 89.5% and specificity of 77.5% based on criteria in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-

IV) for major depression (Richardson *et al.*, 2010). The Cronbach's alpha for the PHQ-9 in the present study was 0.87, demonstrating very good internal consistency. The seven-item Generalised Anxiety Disorder scale (GAD-7) was used to screen for generalised anxiety symptoms (Spitzer *et al.*, 2006). The scale comprises seven questions answered on a four-point scale ranging from 0 (*"not at all"*) to 3 (*"nearly every day"*) with a total score of 21 (highest score). Cut-off points of 11 or greater (moderate anxiety) and 17 or greater (severe anxiety) have been shown to have optimum sensitivity and specificity for generalised anxiety in adolescents (Mossman *et al.*, 2017). The Cronbach's alpha for the GAD-7 in the present study was 0.91, demonstrating excellent internal consistency. The 15-item Patient Health Questionnaire (PHQ-15) comprises 15 questions answered on a three-item scale ranging from 0 (*"not at all"*) to 2 (*"bothered a lot"*) assessing severity of somatic symptoms that may be related to somatic anxiety (Kroenke *et al.*, 2010). The total score ranges from 0 (lowest) to 30 (highest) with cut-off points of 5 (mild somatic symptom severity), 10 (moderate) and 15 (severe) respectively (Kroenke *et al.*, 2010). The Cronbach's alpha for the PHQ-15 in the present study was 0.86, demonstrating very good internal consistency.

Data analysis

Descriptive statistics were performed on each of the 31 questions. Independent *t*-tests were performed to analyse differences between male and female participants for continuous data and Mann-Whitney U-tests were used when ordinal variables were compared. Correlation analyses between variables were performed using Pearson's correlation coefficients (r) for continuous variables and Spearman's correlation coefficients (r_s) for ordinal variables.

Results

Participants

A total of 235 participants completed the online survey between November 2019 to May 2020. One participant's responses were excluded due to inappropriate answers given to some questions (such as stating 25 hours per day usage of the internet). Of the remaining 234 participants, males accounted for 156 participants (66.7%) and females accounted for 78 participants (33.3%). The participants ranged in age from 12 years to 18 years with a mean average age of 14.2 years (SD=1.6 years). Female participants had an average age of 14.4 years (SD=1.5 years) and male participants had an average age of 14.1 years (SD=1.6 years). In terms of nationality, 203 participants were Irish (86.8%) with 31 participants listing their nationality as "other" (13.2%).

Internet use behaviours

Every participant engaged in internet use. The most common age for participants to begin using the internet was between 8-11 years (48.3%), followed by 6-8 years (29.1%), 12-14 years (11.1%) and less than 6-years (8.5%). Seven responses were excluded because the participants' age of first use the internet was reported as being older than the participant's current age. There was a statistically significant difference (p<0.05) between male and female age to begin to use the internet, with females being older when beginning to use the internet. The most common time spent on the internet during weekdays was 2-5 hours per day (36.6%) and the most common time spent on the internet during the weekend was 2-5 hours per day (40.0%). The time spent on the internet during the weekdays and weekend are shown in Figure 1.

Figure 1 about here

There was a significant difference between the time males and females used the internet during weekdays (p<0.05), with females using the internet for significantly longer than males. There was no difference between male and female time spent on the internet on the weekend (p=.626). Parents limited their children's time on the internet for 96 participants (41.0%). Of the

participants whose parents limited time on the internet, the most common time limit was 1-2 hours per day (42.7%), followed by 30-60 minutes per day (18.8%), between 2-5 hours per day (7.3%), between 15-30 minutes per day (6.3%) and less than 15 minutes per day (2.1%). Other than set time restrictions, eight participants stated that they had been given an internet curfew at night and six participants stated that their parents would ask them to stop using the internet if they felt they had been on the internet too long. Five participants were only allowed the internet on weekends or had their internet limited at weekends and two participants were allowed to access the internet on condition of going outside first or completing their chores. One participant was not allowed the internet at all at home. The most commonly used apps by participants were *YouTube* (97.0%), followed by *Instagram* (78.6%), *Snapchat* (73.9%) and *TikTok* (43.2%). Other apps used by participants were *Reddit* (18.8%), *Twitter* (17.9%), *Facebook* (15.0%), and *Skype* (8.1%).

Internet addiction

Using the screening cut-off point (57/58 on CIAS) for internet addiction, 53 participants (22.6%) met criteria for internet addiction. Using the diagnostic cut-off point (63/64 on CIAS) for internet addiction, 27 participants (11.5%) met criteria for internet addiction. There was no statistically significant difference between male and female participants in relation to CIAS scores (p=.170). There were weak positive correlations between internet addiction scores and time spent on the internet during weekdays (r=.418, p<.01) and weekends (r=.441, p<.01).

Gaming behaviours

When asked about playing videogames of any description (PC gaming, mobile gaming or console gaming), 184 participants (78.6%) stated that they engaged in these forms of gaming. Of these 184 participants, 147 participants (79.9%) were male and 37 participants (20.1%) were female. The most common age to commence gaming was between 8-11 years (36.8%),

followed by 6-8 years (32.4%), less than 6 years (16.5%), between 12-14 years (12.6%), and between 15-16 years (1.1%). Two participants did not answer. The most common age to commence playing videogames was between 8-11 years (52.0%), followed by between 12-14 years (32.2%) and 6-8 years (12.3%). Between 15-16 years and less than 6 years were both uncommon, with 1.8% of participants commencing online gaming at this age. The time spent engaging in videogame playing on weekends and weekdays is shown in Figure 2. The most common time spent engaging in gaming on weekdays was between 30-60 minutes per day (23.5%) and the most common time spent engaging in gaming on the weekend was 1-2 hours per day (30.6%).

Figure 2 about here

Parental restrictions on videogame playing time were in place for 88 participants (48.1% of gaming participants). Of the participants that had time restrictions, the most common time restriction was 1-2 hours of gaming per day (51.1%), followed by 30-60 minutes per day (13.6%), 2-5 hours per day (10.2%), 15-30 minutes per day (6.8%), less than 15 minutes per day (5.7%) and 5-8 hours per day (1.1%). Some participants stated that they had a set time at which videogame playing had to stop by (4.5%), limitations in gaming time on weekdays only (2.3%) and only allowed to play on specific days of the week (2.3%). However, these options were given as a free text option and the actual percentages may be higher. Seven participants did not answer.

Online gaming

Three-quarters of participants stated that they engaged in online gaming (77.2%). From a list of 27 popular online games, each participant selected the online game they mainly played. The main games participants played were *FIFA* (30.3%), *Minecraft* (21.1%), *Fortnite Battle Royale* (14.1%), *GTA V* (7.7%) and *Call of Duty* (6.3%). In terms of all games played by participants,

Minecraft (79.6%) was the most commonly played, followed by *FIFA* (68.3%), *Fortnite Battle Royale* (49.3%), *GTA V* (43.0%) and *Call of Duty* (39.4%). In terms of the genre of video game, sandbox role-playing games (RPGs) were the most popular (*Minecraft*), followed by online sports games (*FIFA*), Online Multiplayer Battle Royale (*Fortnite*), action-adventure videogames (*GTA V*), and First-Person Shooter (FPS) games (*Call of Duty*).

Devices used for gaming

A total of 148 participants (80.4%) used mobile devices for gaming, with the same number of participants (80.4%) also using console devices for gaming. PC gaming was only used by 59 participants (32.1%). Mobile phone gaming was the most frequent form of gaming with 72 participants (39.1%) using this device for gaming either most days (18.5%) or every day (20.6%) of the week. Console gaming was the next most frequently used, with 54 participants (29.4%) using this device for gaming either most days (19.1%) or every day (10.3%). The least utilised device for gaming was a PC, with 17 participants (9.3%) endorsing most day (3.3%) or every day (6.0%) use. In terms of frequency of use per device, the most common frequency for mobile gaming was everyday use (20.6%), for console gaming was 2-4 times per week (27.2%), and for PC gaming was less than once per month (17.8%). The most frequent time spent on mobile gaming during the week was less than 15 minutes per day (34.5%) and between 15-30 minutes per day during the weekend (29.1%). The results of the time spent on mobile gaming are shown in Table 1. Participants given a list of the most popular mobile games selected *Clash of Clans* (28.4%) as the most played game, followed by *Fortnite* (25.0%) and *Roblox* (18.2%). All other games listed were played by 12 participants or fewer.

Table 1 about here

Micro-transactions

Micro-transactions were used by 118 participants (64.1%). Of the participants using micro-transactions, the most common form used was in-game currencies (83.5%). Loot boxes were the next most common micro-transaction (24.6%), followed by in-game advantage items (11.0%) and expiration (8.5%) micro-transactions. The most common amount of money spent on micro-transactions was between €1-€20 per year (41.5%), followed by €20-50 per year (25.4%), and €50-€100 per year (14.4%). Seven participants spent between €50-€100 per year on micro-transactions, with a further six participants spending between €200-€500 per year and three participants (2.5%) stated that they spent over €1000 per year on micro-transactions. Six participants did not answer.

Disordered gamers

Based on the criteria for disordered gaming, one participant met the IGDS9-SF criteria for disordered gaming. A total of three participants met the proposed points cut-off (36 out of 45) for gaming disorder. In terms of the separate questions asked on the IGDS9-SF, the highest scoring factor related to using gaming as a method to escape or relieve a negative mood, with an average score of 2.78 out of 5 (SD=1.4). Aside from feeling preoccupied by your gaming behaviour (2.30 out of 5, SD=1.1), all other factors had an average score of less than 2 out of 5. There was a weak positive correlation between time spent on the gaming during weekdays (r_s=.383, p<.01) and IGD scores. There was a moderate positive correlation (r_s=.602, p<.01) between increased time spent on gaming during the weekend and higher IGD scores. There was a moderate positive association between higher internet addiction scores on the CIAS (r_s=.524, p<.01) and higher gaming disorder scores.

Motives for online gaming

The main motive for online gaming ranked by participants was recreation (42.9%), followed by competition (27.2%), skill (15.8%), coping (14.1%), escape (13.0%), social (10.9%), and

fantasy (9.8%). When looking at mean gaming disorder scores and endorsed motive for online gaming, fantasy (21.8, SD=10.1) had the highest associated IGD score, followed by escape (20.6, SD=8.3), skill (20.4, SD= 7.8) and coping (19.7, SD=8.7). Gaming for social reasons (17.8, SD=8.9), competition (17.3, SD=6.5) and recreation (14.6, SD=4.6) had the lowest associated IGD scores.

Gambling behaviours

Only 12 participants engaged in some form of gambling (5.1%) and all were male. The average age of gambling participants was 14.7 years (SD=1.3 years). In terms of frequency of gambling, one participant gambled every day, three participants gambled between 1-4 times per month and six participants gambled less than one day per month. Two participants did not answer. Nine participants stated that they gambled in person (75.0%), one participant gambled solely online and two participants gambled both online and in person. Two participants had their own account with a bookmaker, three participants had used their parents account, and the remaining seven participants did not have any type of account for gambling. When gambling, five participants used their own money to gamble, six participants used their parents' money, and one participant did not answer. Ten participants spent less than 15 minutes on a typical gambling session, with one participant spending between 2-5 hours on a typical gambling session. Sports betting was the most popular form of gambling (n=7), followed by horserace betting (n=6), scratchcards (n=3), blackjack (n=3), poker (n=2), lottery (n=1), bingo (n=1) and fruit machines (n=1). No participants engaged in roulette. Utilizing the SOGS-RA, two participants were classed as being 'at-risk' of problem gambling and one participant was classed as a problem gambler.

Mental health symptoms

Utilising the PHQ-9, 47 participants were classed as having major depression (20.1%). Looking at individual PHQ-9 factors, 50 participants endorsed having thoughts that they would be better off dead or hurting themselves in some way (21.4%). Utilising the GAD-7, 32 participants scored in the moderate anxiety range (13.7%) and 11 participants scored in the severe anxiety range (4.7%). Somatic symptoms of anxiety (utilising the PHQ-15) were endorsed by 69 participants in the mild range (29.5%), 27 participants in the moderate range (11.5%), and 21 participants in the severe range (9.0%). There was moderate positive correlation between high scores on the anxiety symptom scale and high scores somatic symptom scale (r=.657, p<.01). There were strong positive correlations between high scores on the depressive symptom scale and high scores on the somatic symptom scale (r=.774, p<.01) and high scores on the anxiety symptom scale (r=.747, p<.01).

There were weak positive correlations with increased IGD scores and higher scores for screening depressive symptoms (r_s=.293, p<.01), screening somatic symptoms (r_s=.254, p<.01) and screening anxiety symptoms (r_s=.259, p<.01). There were weak positive correlations between higher internet addiction scores and depression scores (r=.493, p<.01) and somatic symptom scores (r=.454, p<.01). There was a weak positive correlation between high internet addiction scores and anxiety scores (r=.326, p<.01).

Discussion

The aim of the present study was to evaluate the levels of internet addiction, gaming addiction, gambling addiction and associated mental disorder among a secondary school population in Ireland. One of the main findings of the present study was the levels of possible internet addiction ranged from 11.5% to 22.6% among the study population. The range of internet addiction in the present study would represent a higher prevalence range at the upper limit compared to previous studies (between 2.0%-18.3%) in European adolescents (Alimoradi *et*

al., 2019) although some of the data were collected during the COVID-19 pandemic where internet use is likely to have been higher given online schooling at home and the level of home quarantining. Using the diagnostic cut-off point of 63/64 on the CIAS, which classified 11.5% of the study population as addicted to the internet, other studies in Asian populations found that between 10.8% and 21.0% met criteria for internet addiction (Kuss *et al.*, 2014). It is important to note that the papers cited in these studies are over a decade old and internet addiction rates are likely higher currently given increased internet usage over the past decade. A recent study of Portuguese adolescents estimated an internet addiction prevalence of 16.5%, in line with the prevalence reference range for our study participants (Martins *et al.*, 2019). However, it is important to note that the prevalence rates for internet addiction in surveys is likely to be much higher than those diagnosed via clinical interviews.

There was no difference between gender and internet addiction scores in the present study, concurrent with other European studies in Finland (Sinkkonen *et al.*, 2014) and Germany (Wartberg *et al.*, 2016) but other international studies have shown male adolescents to have a higher incidence of internet addiction compared to female adolescents (Ha and Hwang, 2014). There were weak positive correlations between increased time spent on the internet during both the weekdays and weekends and increased internet addiction scores, echoing previous findings (Kuss *et al.*, 2013b). Females were shown to have greater use of the internet during the week but no gender differences in internet addiction scores in the present study. Female adolescents have been shown in other studies to have higher levels of mild internet use compared to their male counterparts (Sinkkonen *et al.*, 2014), which could explain the increased use seen in females in the present study. There were weak positive correlations found between higher internet addiction scores and higher depression, somatic symptom, and anxiety scores. These findings concur with previous studies showing increased symptoms of depression and anxiety seen among internet-addicted adolescents (Kuss and Lopez-Fernandez, 2016). A recent

systematic review also highlighted the positive associations between depressive symptoms and amount of time spent on social media sites (Piteo and Ward, 2020).

Parental controls on internet use were reported by 41.0% of the study population, in line with a recent study finding that 41.6% of adolescents had parental controls on internet use (Brighi *et al.*, 2019) but slightly higher than previous studies that reported parental control on internet use of between 36% and 38% of adolescents (Wang *et al.*, 2005, Rosen *et al.*, 2008). Parental control of internet usage has been shown to decrease the likelihood of internet addiction and lead to healthier internet use among adolescents (Martins *et al.*, 2019). In relation to apps used by the study population, these were in keeping with trends seen in other European countries, with *YouTube* being the most commonly used app (Koptyug, 2020). In terms of social media sites, the increasing popularity of Instagram and Snapchat seen worldwide was also found in the current cohort (Clement, 2020).

Gaming was more common among male participants in the present study (79.9%), showing similar ratios to previous studies among adolescents (Desai *et al.*, 2010). The prevalence of gaming disorder was between 0.5%-1.6% based on the two sets of criteria used in the study to identify gaming disorder, slightly below the levels of gaming disorder of 1.6% for European populations (Müller *et al.*, 2015) and 4.6% for worldwide populations (Fam, 2018). Larger studies examining the prevalence of gaming disorder in Ireland may find an increased prevalence of gaming disorder comparable to their European counterparts.

More than half of gamers (56.3%) in the study spent between 1-5 hours per day on gaming on the weekends, in line with other studies on excessive gaming (Grüsser *et al.*, 2006) and studies on adult Irish gamers (Columb *et al.*, 2020a). The amount of time spent on gaming correlated with higher gaming addiction scores, which is an identified risk factor for the development of gaming addiction (Mihara and Higuchi, 2017) although the amount of time spent gaming is not

necessarily associated with problem gaming (Griffiths, 2010b). Parental time limits were in place for just under half of the participants in the present study, which is recommended in order to minimise the risk of gaming addiction (Griffiths, 2010a, Martins *et al.*, 2019) but may be less useful than other parental control options such as shared family rooms instead of the adolescents' own room for gaming and discussing cybersafety with their children (Smith *et al.*, 2015).

There were weakly positive correlations with increased gaming addiction scores and increased scores on scales assessing mental health disorder symptoms (depression, anxiety), which have been found in previous studies on gaming addiction (González-Bueso *et al.*, 2018). The use of recreation as the main motive for gaming was associated with lower gaming addiction scores, concurrent with previous studies on adult gamers in Ireland (Columb *et al.*, 2020a). The use of gaming for fantasy, escape, and coping purposes were associated with higher gaming addiction scores in the study and paralleled with previous study findings among Irish adults (Columb *et al.*, 2020a). This finding could be of importance in early identification of possible gaming disordered adolescents by enquiring about the reasons for their engagement in gaming.

Participants in the present study used either mobile gaming or console gaming to access their games, unlike adult gamers in Ireland who utilised PC gaming as the most common form of gaming (Columb *et al.*, 2020a). This is in keeping with the global rise of mobile gaming and the decline of PC gaming (Dujmovic, 2019). Videogame genres endorsed by the study population here mirrored other studies examining game genre preferences, with RPGs positively associated with gaming addiction (Lee and Kim, 2017). FPS games were also popular among the cohort here and are associated with an increased problematic gaming (Elliott *et al.*, 2012). The other popular gaming genres of Online Multiplayer Battle Royale games (Mc Caffrey, 2019) and online sports games (MacDonald, 2018) have been associated with micro-transaction use. The majority of gamers in the present study had utilised micro-

transactions, with the most common type being in-game currencies. Using in-game currencies can hide the true value of purchases made in games (Duverge, 2016) and has also been demonstrated among players using chips instead of cash payments in poker (Lapuz and Griffiths, 2010), potentially resulting in more money spent on games. Loot boxes were used by under one-quarter of the gamers in the present study, which have associations with problem gambling given their structural characteristics (Zendle and Cairns, 2018).

Gambling engagement in the present study (5.1%) was much lower compared to larger studies in Europe examining gambling engagement, where 44% of Finnish adolescents (Raisamo *et al.*, 2013) and 73% of British adolescents had engaged in gambling in their lifetime (Griffiths, 2008). Irish adolescents, compared to their European peers, reported higher rates of gambling engagement in a recent large-scale study (ESPAD Group, 2020). The study here found a much lower level of gambling engagement compared to a survey conducted by the Department of Health in Ireland between 2014 and 2015, which reported approximately 10% of adolescents having engaged in lottery ticket or scratchcard buying, and 9.4% having placed a bet on horse/dog racing meetings (Department of Health, 2019). The rate of problem gambling in the present study was 0.4% overall, which is at the lower end of the range of problem gambling addiction among adolescents (Calado *et al.*, 2017) and lower than the 1% of problem adolescent gamblers identified in a recent national survey of older adolescents (Senior Cycle) in Ireland (Dooley *et al.*, 2019). Gambling is a popular activity among Irish adults, with two-thirds of Irish individuals engaging in gambling over a 12-month period (Department of Health, 2019) and gambling is commonly advertised during some sporting events in Ireland (Columb *et al.*, 2020b). This exposure to gambling advertising has been raised as a concern for young children in previous studies (Monaghan *et al.*, 2008, Lopez-Gonzalez *et al.*, 2017) and could lead to higher rates of gambling engagement in the future.

Rates of mental disorder in the study population were found to be higher similar to other studies examining Irish adolescents. Depressive symptom rates in the present study population (20.1%) were largely similar to the 19.3% of adolescents found to have moderate to very severe depression in a national Irish survey (Dooley *et al.*, 2015). Similarly, the rates of moderate anxiety (13.7%) and severe anxiety (4.7%) tallied with the levels of moderate anxiety (13.8%) and severe anxiety (4.4%) in the same national survey (Dooley *et al.*, 2015). The prevalence of passive death wish and self-harm thoughts among one-fifth of the study population (21.4% as endorsed on the PHQ-9) falls between the range of reported thoughts of self-harm and suicidal ideation in 13-15 year olds (15.0%) (Rowley *et al.*, 2001) and the range of suicidal ideation experiences by first-year college students (28.5%) in Ireland (Horgan *et al.*, 2018). Somatic symptoms of anxiety were in line with other studies with 50% of the population in the present endorsing some form of somatic symptom (Crawley *et al.*, 2014).

There are a number of limitations to the present study. The main limitation is the relatively small total number of participants in the study, with further large population-based studies required to investigate rates of internet, gaming, and gambling addiction in this population. No information was obtained in relation to the low return of parental consent forms. Given the authors' largely positive experiences of discussions at parent-teacher meetings, this is possibly due to the delay between information received about the study and the return of consent forms to the research team (given the minimum one-week period required for informed consent to be obtained). The study also used self-report measures rather than clinician-based diagnosis, which may lead to greater inaccuracy and higher prevalence of individuals operationally defined as being addicted. The parents of participants and the participants in the study were also self-selecting, increasing selection bias in the present study. There was a higher participation rate from the fee-paying school compared to the publically-funded school, potentially skewing some of the results obtained towards the fee-paying school population.

In conclusion, this is one of the first studies to identify prevalence rates of different behavioural addictions among a convenience sample of adolescents in Ireland. The study also identified the characteristics of this group and the mental health associations among these behaviours. The present study highlights the need for large-scale epidemiological studies in this area in order to aid detection and early treatment among this vulnerable group. Given the low number of participants in the study, a jointly co-ordinated national effort between schools and researchers would be required to provide this information on a nationwide scale.

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Conflicts of Interest

David Columb, Eoghan Keegan and Colin O'Gara have no conflicts of interest to disclose. Mark D. Griffiths' (MDG) university currently receives research funding from *Norsk Tipping* (the gambling operator owned by the Norwegian Government). MDG has also received funding for a number of research projects in the area of gambling education for young people, social responsibility in gambling and gambling treatment from Gamble Aware (formerly the Responsible Gambling Trust), a charitable body which funds its research program based on donations from the gambling industry. MDG regularly undertakes consultancy for various gaming companies in the area of social responsibility in gambling.

Ethical Standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committee on human experimentation with the Helsinki Declaration of 1975, as revised in 2008. The study protocol was approved by the ethics committee of University College Dublin.

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Figures

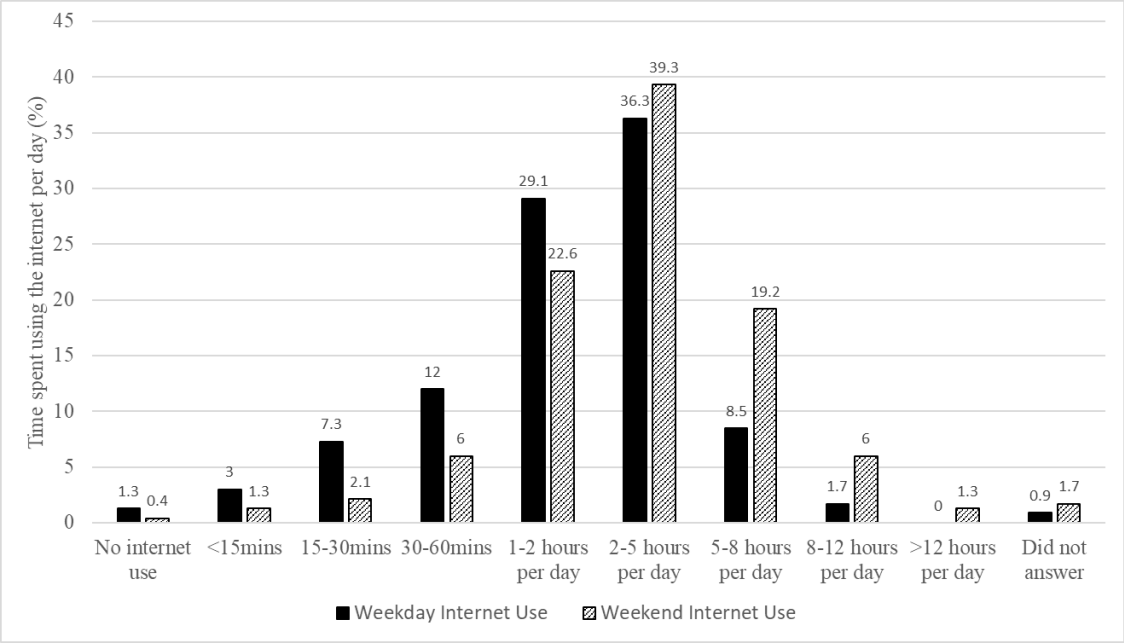

Fig. 1. Comparison of time spent daily on the internet on weekdays and weekends

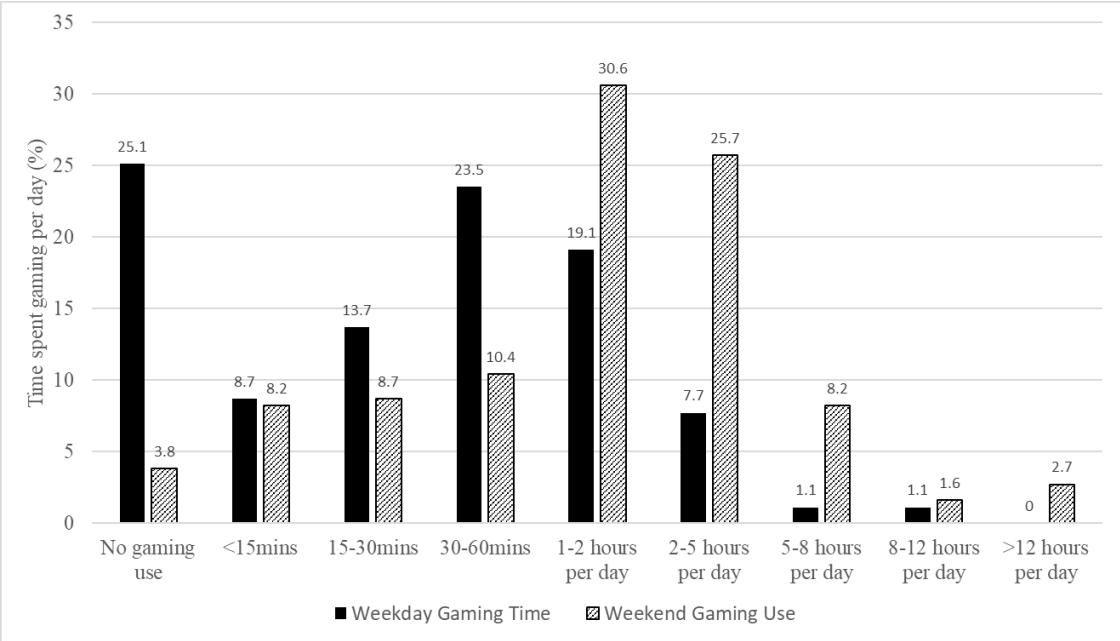

Fig. 2. Comparison of time spent daily on gaming on weekdays and weekends

Tables

Table 1: *Time spent mobile gaming per day on weekdays and weekends*

Weekdays	*n*	*%*	*Weekends*	*n*	*%*
No play during weekdays	13	8.8	No play during weekends	17	11.5
<15mins	51	34.5	<15mins	38	25.7
15-30mins	37	25.0	15-30mins	43	29.1
30-60mins	30	20.3	30-60mins	22	14.9
1-2 hours per day	9	6.1	1-2 hours per day	14	9.5
2-5 hours per day	3	2.0	2-5 hours per day	7	4.7
5-8 hours per day	2	1.4	5-8 hours per day	5	3.4
8-12 hours per day	0	0.0	8-12 hours per day	0	0.0
>12 hours per day	0	0.0	>12 hours per day	0	0.0
Did not answer	3	2.0	Did not answer	2	1.4
Total	148	100	*Total*	148	100