# Internet gaming disorder, harm, and loot box involvement

[redacted]

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**DECLARATION**

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For the purpose of anonymous submission, acknowledgements have been deleted from this copy of the thesis.

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LITERATURE REVIEW

# Harm, Internet gaming disorder, and loot box engagement: A literature review

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**Abstract**

The specific nature of harm and functional impairment in the context of Internet gaming disorder (IGD) has received limited attention. Assessing for widespread taxonomic harms is now commonplace in the study of problem gambling and other addictions. Given key risks in engaging in video gaming (namely, the acquisition of Internet Gaming Disorder and engaging in gambling-like activities), it is reasonable to suggest that a study of widespread gaming-related harms should be conducted. The review will propose that gambling-related harm measurement could be adapted for the measurement of gaming-related harm, to specifically a) identify and classify the harms differing between gamers with and without IGD, and b) identify financial harms associated with gambling-like gaming activities.

*Keywords:* Video Games, Internet Gaming Disorder, Loot Boxes, Gambling-Related Harm

## Harm, Internet gaming disorder, and loot box engagement: A literature review

Video gaming is a recreational activity known to have many benefits. Gaming can be enjoyable (McGonigal, 2011); provide catharsis (Eastin, 2007; Schmierbach, 2010; Velez, Mahood, Ewoldsen, & Moyer-Gusé, 2012); a sense of achievement or goal attainment (Sweetser & Wyeth, 2005); improve visuo-spatial skills, among other cognitive benefits (Uttal et al., 2013); provide virtual opportunities for socialising with others (Granic, Lobel, & Engles, 2014); and, foster social connections, friendship, and a sense of self-worth (Kain, 2016). In support of these views, many gamers report that gaming helps them develop their social confidence, improve their mood, and make new friends (Grohol, 2016; Tateno et al., 2016).

Most research, however, has focused on the negative consequences of gaming engagement. While gaming is not inherently harmful, studies report a positive association between gaming time and related problems. In adolescent studies, a positive association has been observed between gaming hours and musculoskeletal problems (Hakala et al., 2010), vision problems (Green & Bravelier, 2006), obesity (Carvalhal, Padex, Moreira, & Rosado, 2006; Chaput et al., 2011) and psychological issues including depression, anxiety, rule-breaking behaviours, aggression, poor coping behaviours, and attention deficits (Shokouhi-Moqhaddam et al., 2013; von der Heiden, Braun, Müller, & Egloff, 2019). Other studies have shown curvilinear relationships with gaming where low or moderate adolescent players displayed greater psychological benefits than non-gamers and excessive gamers alike (Allahverdipour, Bazargan, Farhandinasab, & Moeini, 2010). Adult studies have also shown gaming volume is positively related with sleep problems (Exelmans & van den Bulck, 2015), anxiety and aggression (Mehroof & Griffiths, 2010), lowered self-efficacy (Jeong & Kim, 2011), and mood and anxiety disorders (Wang et al., 2018).

Excessive gaming can have particularly negative consequences. In 2013, the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5) established Internet Gaming Disorder (IGD) as a condition warranting more clinical research (American Psychiatric Association [APA], 2013). IGD criteria include a number of problem cognitions, emotions, and behaviours associated with video gaming, many of which do not necessarily require Internet use. This was followed by the World Health Organization's ICD-11 definition of Gaming Disorder (World Health Organization [WHO], 2018a). The WHO also recognise 'hazardous gaming', which refers to gaming that has the potential to be harmful and increase the risk of developing IGD.

IGD is known to correlate with a number of other conditions and harms. These include: depression, anxiety, and heightened suicide risk (Kim et al., 2016; Gonález-Bueso et al., 2018; Cheng et al., 2018; Wu, Lee, Liao, & Chang, 2015); poor diet and general health (King and Delfabbro, 2019a; Tetik et al., 2018); worsened sleep cycles and quality, as well as higher prevalence of sleep disorder (Männikkö, Billieux, & Kääriäinen, 2015; Satghare et al., 2016); heightened risk of other addictive issues (Burleigh et al., 2019; Spekman et al., 2013); numerous social problems, including relational conflict and loss (Northrup & Shumway, 2014; King & Delfabbro, 2019a); and occupational problems, including disruption to study and work (King & Delfabbro, 2019a).

Despite these convergent findings, the validity of IGD as a behavioural addiction has been questioned. Przybylski, Weinstein, and Murayama (2016), for example, have drawn attention to the low prevalence rates (0.3 to 1.0% in the general population) when assessed in more methodologically robust studies, or using stricter criteria. A more recent meta-analysis by Stevens, Dorstyn, Delfabbro, and King (2020) reported that the worldwide prevalence of IGD

was 3.05%, but this figure reduced to 1.96% when excluding studies based on more stringent sampling criteria. Others have argued that IGD, or pathological gaming, may only be a set of maladaptive behaviours associated with an underlying mood or anxiety disorder (Kardefeldt-Winther, 2014; Wood, 2007).

For excessive gaming to be considered a clinical condition (such as IGD), it is important to show it is instrumental in producing harm. Consistent with this view, the ICD-11 refers to the process by which gamers change their priorities to put gaming ahead of important non-gaming-related responsibilities, people, and events. Gamers, it is argued, increasingly neglect the 'real world' and their part in it, and this leads to problems in health and other areas of functioning (King & Delfabbro, 2018a). The gamer begins to neglect basic activities (e.g., sleep, eating), real-world social interaction, and important responsibilities including work, study, and childcare (King & Delfabbro, 2018a). Subsequent mental consequences can include an aversion to addressing life outside of gaming (Wu, Lee, Liao, and Chang, 2015); and distress, depression, or anxiety (King & Delfabbro, 2018a). As a consequence, important social, occupational, or academic communities may be affected (Northrup & Shumway, 2014; King & Delfabbro, 2019a). They may also experience financial harm if they come to overspend on in-game purchases that are increasingly common in modern games (Soroush, Hancock, & Bonns, 2014; Zendle & Cairns, 2018; 2019), as will be discussed in this review.

The purpose of this review is to discuss how widespread harm could be best measured in gaming research, and the current shortcomings in understanding taxonomic gaming-related harms. The review will, in particular, examine recent developments in the related field of gambling research, and how these can be used to capture harm within populations of gamers. This will then be followed by a summary of loot box-associated risks, so as to provide insights into

why these newly developed features have given rise to concern about their potential financial impact and whether they encourage or are associated with higher risk gambling behaviour.

**Pathological versus non-pathological gaming: Unexplored differences in harm**

Much of the focus on gaming-associated harm has related to problems that are likely to have clinical significance, as informed by the DSM criteria. However, as King and Delfabbro (2018a) have argued, relatively little attention has been directed towards understanding how reported harms (e.g. financial, psychological, occupational) are distributed across various IGD populations (e.g., adolescent, adult, those with comorbid mental health issues), and test how these harms manifest between IGD and non-IGD gaming populations. The issue of sub-clinical harm has been addressed in studies of other health behaviours. For example, studies of intermittent tobacco smoking (Schane, Ling, & Glantz, 2010), low-risk gambling (Canale, Vieno, & Griffiths, 2016), sugar consumption in non-diabetics (Stanhope, 2016), and low-risk alcohol consumption (Sherk, Thomas, Churchill, & Stockwell, 2020) have found that those in the population not meeting clinical criteria may still acquire problems and risks associated with certain health behaviours.

It is unclear whether gaming gives rise to harm in the same way, despite consistent analogies drawn between IGD and substance use and/or gambling disorders. Despite the specific harms associated with increased gaming time, it is unclear how IGD gives rise to harm, what kinds of harms are reported, or what factors predispose gamers to gaming-related harm. Further, there has not yet been a dedicated study of widespread, taxonomic gaming harms to compare the negative experiences between gamers with and without IGD. Such research would compare the harms between IGD statuses (i.e., gamers with IGD versus regular gamers without IGD) to

understand the differential harms associated with gaming addiction, as opposed to regular but non-pathological gaming.

While there have been many studies presenting associations between IGD and aforementioned problems, a study of harms across a variety of health and wellbeing categories is yet to be performed, such that the literature's understanding of gaming-related harm is largely piecemeal. Studies measuring a single harm, or limited range of associated harms, will often differentiate between IGD and non-IGD gamers as their central hypothesis. However, rarely will the single harm measured (e.g. psychological) be compared with other gaming-related harms. For example, it has been demonstrated repeatedly that IGD is associated with depression and anxiety (Kim et al., 2016; Gonàlez-Bueso et al., 2018). However, it has not been demonstrated how relatively significant and widespread these psychological harms are compared to associated social problems, such as relational conflict and loss (Northrup & Shumway, 2014; King & Delfabbro, 2019a). Assessing for widespread taxonomic harm within single samples would not only test for the differential harm acquired by IGD gamers, but also examine the relative significance of different harm types within an IGD gamer group. Relevantly, potential financial harms originating from gambling-like gaming activities (Zendle & Cairns, 2018; 2019) could be specified.

In this review, the focus is principally on widespread and taxonomic harm assessment approaches in gambling research. Problem gambling is often categorized as a behavioural addiction (Yau & Potenza, 2015) and there has been interest in studying the harms associated with it. However, common screening measures, such as the Problem Gambling Severity Index (PGSI) (Ferris & Wynne, 2001) are principally designed to capture problem gambling in terms of behaviours and consequences known to be more common in those with a gambling disorder. Such

measures are, therefore, not consistent with modern public health approaches to gambling, where a stronger focus has now developed on measuring the associated harms rising from gambling (Abbott et al., 2015; Delfabbro & King, 2017; Delfabbro & King, 2019; Korn & Shaffer, 1999; Schaffer & Korn, 2002; Wardle et al., 2018).

**Harm measurement in gambling research**

Gambling-related harm has been defined as "any negative consequence associated with gambling that can be considered as having a significant detrimental interference on the functioning of an individual or societal domain" (Blaszcysnki et al., 2015). It has been argued that a better understanding of the potential harms associated with gambling would be obtained by examining a broader range of harms and in populations that extend beyond just problem gamblers (i.e., the most severe or clinical) (Browne & Rockloff, 2018). Most previous problem gambling surveys include items to capture whether participants report certain harms. These typically relate to whether people have lost jobs, become bankrupt, or suffered a severe psychological disorder. However, these very severe harms tend be relevant only for clinical cases (Delfabbro & King, 2019). For this reason, attempts to measure harm between clinical and non-clinical samples have been undertaken. For example, a study by Browne et al. (2016) involved a survey of over 2000 regular gamblers who completed a 72-item checklist measuring harm across six dimensions: financial, work/study, health, psychological, social, and other. Each item was binary in scoring, and varied in severity within each domain (e.g., financial harm items ranged from reduced recreational spending, to declarations of bankruptcy). When scores were compared to traditional PGSI responses (Ferris & Wynne, 2001), it was found that PGSI-classified problem gamblers

reported the greatest harm, followed in volume by moderate-risk gamblers, and then low-risk gamblers.

Burden of disease methodologies were also used by Brown et al. (2016), with gamblers asked to compare gambling harm with other physical and psychological conditions (the Visual Analogue Method) and years of quality of life lost to gambling harm (the Time Trade-Off Method). Gambling experts also completed similar measures, with responses compared to known disability weights obtained from the Global Burden of Disease (Rawat et al., 2018). These subjective comparisons found that "low-risk" gambling posed as much burden of disease as chronic obstructive pulmonary disease (COPD), and more than chronic illnesses including diabetes (Brown et al., 2016). The volume of harm attributed to low-risk gamblers also resembled the prevention paradox observed by Raisamo et al. (2015) and Canale et al. (2016), who argued that low-risk gambling contributed a greater burden of total harm in the community *en masse* due to the larger number of low-risk gamblers.

This methodology was criticised by Delfabbro and King (2017, 2018) who raised a number of conceptual concerns. They argued that a number of the harm items in the Browne et al. (2016) study (e.g., reductions in savings, changes in leisure choices) were not really forms of harm, but rather were substitution effects. They also questioned whether it made sense to consider an individual scoring 10/10 on a harm domain (e.g., a person with a suicide attempt might score 10/10 on psychological harm) less important than 20 people who each scored 1/10 on a harm domain for possibly trivial harm experiences. Another criticism was the manner of scoring. The items were all binary, and did not ask the respondent to what extent the harm (e.g., feeling depressed) was due to gambling as opposed to other causes. Similar criticisms were made by

Blaszcysnki et al. (2015) who argued that participants should self-report how attributable their harm was to gambling.

Using the updated Gambling Effects Scale, Shannon, Anjoul, & Blaszczynski (2017) administered two Likert-type questions derived from each of Browne et al.'s (2016) harm items. The first question of each item asked participants about harm severity (on a five-point scale from Not a Problem to a Very Serious Problem) and then, if the harm was identified as anything other than Not a Problem, the participant was asked to what degree this harm was attributable to gambling (on a five-point scale from Not at All to Totally). If a participant responded to "*During the past 6 months, drugs (including street drugs and prescription drugs) have*:" with "*Been a moderate problem in my life*", they would then be prompted to answer the question, "*My problem with drugs was*:" with the second five-point scale. If they initially responded, "*Not been a problem in my life*", they would be prompted to skip the attribution question. Blaszczynski et al. (2015) then used a scoring matrix to measure the level of gambling-harm elicited by the participant, with no harm and/or harm unrelated to gambling as 0, and gambling-attributed harm scored higher for its a) self-reported severity and b) self-reported gambling attribution. Identified individual harms could range from a score of 1 (a minor problem, not caused by gambling) to 7 (a serious problem, totally caused by gambling).

This method has addressed some concerns of misattribution and was adopted (albeit in a modified form) by Delfabbro, Georgiou, and King (2020) who divided the severity of harm into three categories: General, Any, and Moderate Harm. General Harm refers to all levels of harms endorsed on an item, regardless of attribution to gambling (i.e., any non-zero endorsement of harm on the first question of an item, and any score on the second). Any Harm refers to all level of harm endorsed on an item, with any non-zero attribution to gambling on the second item (i.e.,

at least some level of harm, at least somewhat attributable to gambling). Finally, Moderate Harm refers to at least moderate endorsements of both severity and gambling attribution (i.e., answers of ‘A moderate problem’ or more on the first question, and ‘Moderately caused by my gambling' or more on the second). For each item on the questionnaire, participants were given a score of “1” on any of these three categories if their response passed the criteria described above.

Delfabbro, Georgiou, and King’s (2020) study mapped participants’ harm scores against traditional risk categories on the DSM-informed PGSI. The purpose of this study was to examine whether instances of harm were mapped across PGSI risk categories, much like the studies of Browne et al. (2016) and Brown and Rockloff (2018), with this new scoring methodology. Largely, this was the case. Higher risk gamblers reported more instances of gambling-attributed harm, but lower risk gamblers still reported genuine harms that were a) of significant concern to them and b) attributed to their gambling. However, it was found that the moderate risk and problem gamblers reported the majority of harm when the stricter (Moderate Harm) scoring method was used. The most significant harm categories endorsed by all gamblers (across the General, Any, and Moderate severities) were Financial and Psychological. The Social, Health, Work and Study, and Other harm categories were not as widely endorsed, relatively. However, problem gamblers were much more likely to endorse Moderate Harms in the Health category (64.4% of problem gamblers’ Health item responses were graded as Moderate Harm, versus 23.7% for moderate-risk gamblers and 11.5% for low-risk gamblers).

The gambling harm questionnaire used by Browne et al. (2016), along with the scoring methodology used by Delfabbro et al. (2020), could prove useful for the novel assessment of gaming-related harm. By replacing “gambling” with “gaming”, it may be possible to adapt the methodology to conduct a similarly detailed measurement of harm in regular gamers.

Adapting this measure to gaming could answer key research questions pertaining to a) the types and severity of harm reported between IGD statuses, and the perceived role of gaming in experiencing harms, and b) the severity of financial harm in regular gamers, and its relationship with expenditure on particular higher risk activities. One of these higher risk activities is loot box playing, summarised in the following section.

**Loot boxes: Parallels to traditional gambling media and the potential for problematic use**

Until the 2000s, the gaming industry's business model was largely based around selling game copies, usually as physical discs or cartridges (Lizardi, 2012). However, by the 2010s, virtual gaming products could be bought within video games (Lehdonvirta, 2009). The availability of these "microtransactions" has increased rapidly in the last ten years. Between 2010 and 2019, microtransactions went from appearing in 8.34% to 85.9% of the world's 474 most popular Steam games (Zendle, Ballou, & Meyer, 2020a). These microtransactions enable players to spend money to obtain either gameplay assets (e.g. an upgraded weapon or avatar) or cosmetic features (colloquially, "skins") (King & Delfabbro, 2019b; Lawrence, 2018). One particular microtransaction is a "loot box", a mystery item that, once obtained or purchased, will reveal its value or set of values. Outcomes of loot boxes are based on "randomized rewards with potential real-world value" such that the purchaser receives outcomes based on a chance-based algorithm. Some of the items obtained in loot boxes can also be traded for real currency via third party platforms (McCaffrey, 2019). Zendle et al. (2020a) have observed the rise of loot boxes in desktop gaming and noted that their prevalence in popular Steam games has risen from 4.27% to 71.28% between 2010 and 2019. This trend has also been observed in mobile and tablet gaming,

with loot boxes available in 58 of the top 100 games in the Google Play store, and 59 of the top 100 in the Apple App Store (Zendle et al., 2020b).

Since their arrival, loot boxes have been under scrutiny, with attention directed towards their similarity to gambling. Not only do loot boxes facilitate rewards on a variable ratio reinforcement schedule, many also meet Griffiths' (1995) five criteria that differentiate gambling from other risk-taking activities. Loot boxes mirror gambling by: 1) involving a monetary exchange; 2) including an exchange of assets relating to an unknown future event; 3) containing outcomes are at least partially determined by chance; 4) having non-participating customers potentially avoid losses; and 5) asset winners gaining at the sole expense of losers (i.e., asset-gaining loot box "winners" have a competitive online advantage against non-gaining "losers"). However, some regulatory bodies consider a sixth criterion essential; that winnings can be converted by some method into genuine currency to be utilised outside the game (Drummond & Sauer, 2018).

An analysis of twenty-two games featuring loot boxes (Drummond & Sauer, 2018) found that ten met Griffiths's five criteria. Four of these ten games had a third-party trading platform where players could trade their winnings for cash, conceptually meeting the sixth criterion. In recognition of these similarities, an *Addiction* editorial from King and Delfabbro (2018b) labeled loot boxes as "predatory" and capable of leading to a form of entrapment (Brocker, Shaw, & Rubin, 1979; Rubin & Brockner, 1975). By this, they were referring to the possibility of players attempting to attain desirable (but elusive) virtual rewards that could motivate ongoing investment in loot box purchasing, to justify their existing investments (the sunk cost effect). They also argued entrapment could occur because a) costs are less salient in digitised media

(King, Russell, Gainsbury, & Delfabbro, 2016) and b) pursuing a desired item is somewhat akin to "chasing losses" in gambling (Soroush et al., 2014).

Loot boxes are available in a significant proportion of mobile-based games deemed suitable for minors, raising concerns about the effects of gambling media exposure on children and adolescents (Fisher, 1993; Griffiths, 1999). Six of the ten games that met criteria in the Drummond and Sauer (2018) study were rated as suitable for audiences 13 years and over. Furthermore, 93.1% of Android games and 94.9% of Apple games in the Zendle et al. (2020b) study featuring loot boxes were available to consumers aged 12 and older. Kristiansen and Severin (2020) found that, in a sample of over one thousand Danish 12-16 year olds, nearly half (45.6%) engaged in loot box purchasing in the past year, and that engagement was particularly high in males (93%), compared to females (15%). In the Kristiansen and Severin (2020) study, loot box purchasing was positively correlated with problem gambling severity, and adolescent consumers who had not engaged with a loot box in the past year were significantly less likely to be classified as an at-risk or problem gambler compared to those who had engaged at least once. Zendle, Meyer, and Over (2019) also noted a significant link between loot box spending and problem gambling ($\eta^2 = 0.054$) in an online international survey of 16-18 year olds. Non-problem adolescent gamblers have also been shown to spend an average of US$24.94 on loot boxes per month, whereas low to moderate gamblers spent US$43.75, while problem gamblers spent US$84.72, with a statistically significant association between loot box expenditure and problem gambling severity ($p < .001$) (Zendle et al., 2020a).

This association has been examined in adult populations. Zendle and Cairns (2018; 2019), in two large-scale cross-national surveys of regular gamblers, found loot box spending was significantly linked to problem gambling severity ($\eta^2 = 0.054$ and $\eta^2 = 0.051$, respectively).

In both studies there was a significant difference in loot box spending between problem gamblers and low-risk and/or moderate-risk gamblers. Drummond, Sauer, Ferguson, and Hall (2020) also found associations between variables relating to the intensity of loot box use, problem gambling, excessive gaming, and psychological distress. Li, Mills, and Nower (2019) also found an association between loot box expenditure and problem video gaming, problem gambling severity, and psychological distress.

This research has raised concerns that loot box involvement could provide another way in which people might develop problems with gambling. Loot boxes, it is argued, could provide a 'gateway' to gambling, with the term derived from a similar metaphor in substance use research. Specifically, it has been reasoned that gambling-like video games activities could increase gamers' propensity to engage in traditional gambling media and increase their risk of developing gambling disorder via loot box media or elsewhere (Hayer et al., 2018; Molde et al., 2019).

A review of the literature found that seven studies, all previously mentioned in this review, tested for loot box spending's relationship with problem gambling (Delfabbro & King, 2020). Delfabbro and King (2020) concluded that, in line with the findings of Zendle and Cairns (2019), problem gamblers appear to spend more money on loot boxes than non-problem gamblers. However, rather than encourage non-gamblers to start gambling, loot boxes may be another avenue for predisposed problem gamblers to engage in tasks involving financial risk. Overall, Delfabbro and King (2020) argued evidence for a gateway hypothesis was "weak", and that this argument could only be supported using longitudinal research designs where clear evidence linking loot box activity and gambling could be provided (e.g., using skins from loot boxes to gamble, when one had not gambled before). While problem gambling severity is

repeatedly associated with loot box engagement, it does not establish whether loot box engagement is instrumental in the development of pathological gambling.

It would be of value, therefore, to examine whether loot box use is associated with cross-sectional financial harm, particularly if this harm can be attributed via self-report to gaming. Browne et al.'s (2016) recently developed taxonomy of gambling harm included a financial domain, which could be adapted to measure the harm associated with gaming purchases. The scoring method used by Delfabbro, Georgiou, and King (2020) could also test for gamers' perceived relationship between gaming behaviour and financial consequences.

Furthermore, the financial harms associated with loot box expenditure versus non-loot box gaming expenditure (e.g., money spent on gaming software and hardware) could be compared, testing for the relative harm associated with gaming purchases that do not resemble gambling as per Griffiths' (1995) criteria. While loot boxes do present a novel risk of gambling-like financial loss, they are one of several commercial avenues present in contemporary video gaming.

## Conclusion

This review argued that widespread, taxonomic, and graded harm measures could be adapted from gambling research to determine harm's relationship with key gaming variables of IGD status and loot box expenditure. Currently, no research has been conducted to measure widespread harm estimates between clinical and sub-clinical cases of regular gamers. Such research would not only test for the differential harms acquired by gamers meeting IGD criteria, but also examine the relative significance of different harm categories. Moreover, given concerns about the potential harms associated with loot boxes, it would be important to examine whether

gamers who purchase loot boxes report greater financial harm than those who do not. Crucially, use of the Browne et al. (2016) items with the Delfabbro, Georgiou, and King (2020) scoring method could test for both a) harm associated with independent variables of IGD status and loot box expenditure, and b) gamers' graded attribution of gaming's role in the development of reported harms.

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RESEARCH REPORT

FOR SUBMISSION TO *JOURNAL OF GAMBLING STUDIES*

# Internet gaming disorder, harm and loot box involvement

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**Abstract**

The specific nature of harm and functional impairment in the context of Internet gaming disorder (IGD) has received limited attention. Previous research has often employed screening measures that use a single item to assess each of the IGD criteria, which provides imprecise information about the actual problems arising from excessive gaming. The present study was guided by measurement approaches used in problem gambling research to examine the relative proportions of various types of harm, including financial, psychological, physical, social and study/occupational, and other forms, that arise in problem gaming. Harm items were also designed to assess the degree to which each type of harm was directly attributed to gaming. In addition, this study aimed to determine whether these harms were predicted by measures of gaming involvement, including loot box spending. A sample of 471 regular gamers (M = 380, F = 73), recruited through the online platform Prolific, completed a survey where IGD was identified using Petry et al.'s (2014) IGD measure. Individuals with IGD scored higher than the non-problem group on most dimensions of harm, with physical and psychological types being the most common issues. Loot box expenditure was low (for the 10.8% of participants engaging loot boxes, M = $25 in 3 months), but significantly positively associated with the degree of gaming-related financial harm. The study shows that excessive gaming is most strongly associated with physical or psychological harm, but that financial harms may manifest from gaming activities that facilitate continuous spending options.

## Introduction

In 2013, Internet Gaming Disorder (IGD) was recognised in the DSM-5 as a condition warranting further study (American Psychiatric Association, 2013). The IGD criteria refer to the conventional symptoms of an addictive disorder, including: impaired control; tolerance and withdrawal; continued engagement in gaming despite harm; and functional impairment due to gaming. IGD has been found to be associated with comorbid problems, including: depression and anxiety (Kim et al., 2016; Gonález-Bueso et al., 2018; Cheng et al., 2018; Wu, Lee, Liao, & Chang, 2015); poor diet and general health (King & Delfabbro, 2019; Tetik, Kayhan, Sertkaya, & Sandikci, 2018); and poorer sleep, including sleep disorders (Männikkö, Billieux, & Kääriäinen, 2015; Satghare et al., 2016). Other correlates identified have included: a heightened risk of other addictive issues (Burleigh et al., 2019; Spekman, Konijn, Roelofsma, & Griffiths, 2013); social problems, including relational conflict and loss (Northrup and Shumway, 2014; King & Delfabbro, 2019); and, disruption to study and work (King & Delfabbro, 2019).

Despite these convergent findings, the validity of IGD as a behavioural addiction has been questioned. Przybylski, Weinstein, and Murayama (2016), for example, have drawn attention to the low prevalence rates (0.3 to 1.0% in the general population) when assessed in more methodologically robust studies, or using more stringent criteria. Others have argued that IGD may only be a set of maladaptive behaviours associated with an underlying mood or anxiety disorder (Kardefeldt-Winther, 2014; Wood, 2007). Similarly, a meta-analysis by Stevens, Dorstyn, Delfabbro, and King (2020) reported that the worldwide prevalence of IGD was 3.05%, but this figure reduced to 1.96% when excluding studies based on more stringent sampling criteria. For excessive gaming to be considered a genuine clinical condition, it is important to

show that the behaviour gives rise to genuine harm and that this can be attributed to the activity itself.

Such harm-based research has, for example, been undertaken in the related field of gambling studies, in which a number of studies have shown that problem gambling can be distinguished from lower risk gambling on a range of harm dimensions (e.g., Browne et al., 2016; Browne, & Rockloff, 2018; Delfabbro, Georgiou, & King, 2020; Rawat et al., 2018). Browne et al. (2016) showed that problem gamblers score significantly higher on measures of financial harm (e.g., reports of significant financial distress); report greater psychological distress; declines in physical health; disruption to social relationships; and, difficulties in work or study. So far, no systematic measurement of harm has been undertaken for gaming to determine whether individuals who meet the IGD criteria on screening measures differ significantly from other gamers using an extensive range of harm measures. Instead, as shown above, current understanding of the impacts of gaming have been based on a more piecemeal approach that combines separate self-report measures and assumes a degree of causality (e.g., between IGD symptoms and depression). Therefore, it is usually not possible to examine which categories of harm tend to differentiate problem gamers from the general gamer population.

A further reason for interest in harm is that an increasing body of research shows that gaming may be becoming more similar to gambling through a gradual process of convergence (Delfabbro & King, 2020; Gainsbury, 2019; King, Delfabbro & Griffiths, 2010; Macey & Hamari, 2019), with excessive gambling an adjunct behaviour known to cause significant harm (Browne et al., 2016). Gambling-like features, including those that allow for greater financial expenditure, are increasingly included in gaming (King et al., 2019; King & Delfabbro, 2020; McCaffrey, 2019). Such features raise the possibility that excessive gaming may not only

contribute to harm through high levels of involvement (e.g., 30+ hours of play per week), but also because it is more expensive and can encourage players to spend money to gain advancement in games (Zendle, Ballou, & Meyer, 2020a; Zendle, et al., 2020) through a process sometimes termed 'predatory monetization' (King & Delfabbro, 2018). A particular kind of online microtransaction is a "loot box"; a mystery item that, once purchased, will reveal its values or set of values (Drummond, Sauer, Hall, Zendle, & Loudon, 2020; Griffiths, 2018). Since their arrival, loot boxes have been under scrutiny, with particular attention directed towards their similarity to gambling (Drummond, Sauer, & Hall, 2019; King & Delfabbro, 2020). Not only do loot boxes facilitate rewards on a variable ratio reinforcement schedule, many meet Griffiths' (1995) five criteria that differentiate gambling from other risk-taking activities. Some regulatory bodies consider a sixth criterion essential; that winnings can be converted by some method into genuine currency to be utilised outside the game. Drummond an Sauer (2018) detailed that, for some games featuring loot boxes, unofficial third party sides can indeed allow players to trade winnings for "real world" currency.

Due to these conceptual similarities, concerns have been raised as to whether loot boxes may increase the harm associated with gambling, and also be a risk factor for more vulnerable gamers including children and adolescents. In line with this view, King and Delfabbro (2018) highlighted examples of microtransactions as "predatory" and capable of leading to forms of entrapment and excessive expenditure (Brocker, Shaw, & Rubin, 1979; Rubin & Brockner, 1975). Studies of adolescents have shown that loot box engagement is positively correlated with problem gambling severity. Adolescent consumers engaging with loot boxes are more likely to be classified as a problem gambler than non-engaging peers, and adolescent problem gamblers spend more on loot boxes than non-problem gambler peers (Kristiansen & Severin, 2020;

Zendle, Meyer, & Over, 2019). Such results also emerge in adult studies, with Zendle and Cairns (2018, 2019) showing that loot box expenditure was significantly linked to problem gambling severity, and that there was a significant difference in loot box expenditure between problem gamblers and low-risk, moderate-risk gamblers. Studies have also demonstrated significant associations between loot box expenditure and problem gambling severity, excessive/problem video gaming, and psychological distress (Drummond, Sauer, Ferguson, & Hall, 2020; Li, Mills, & Nower, 2019). These results may indicate that loot boxes are attractive features for people already involved with gambling (see Delfabbro & King, 2020) and raise questions about whether the products of loot boxes (e.g., skins) might be used as a currency to gamble on adjacent online sites.

**The Present Study**

There is currently no literature assessing for graded harm in regular gamers and those meeting IGD criteria. Further, little is known about whether newer features of games, such as loot boxes, are increasing the harms (particularly the financial ones) associated with excessive gaming. For these reasons, the aim of the present study was to survey for harm in regular gamers, and specifically test the relationship between a) IGD status and harm, and b) loot box expenditure and financial harm. Items from Browne et al.'s (2016) taxonomy of gambling harms were adapted to gaming, and administered using a method developed by Blaszczynski et al. (2016) and applied by Delfabbro, Georgiou, and King. (2020). This method requires respondents to endorse harms, but also rate the extent to which any endorsed harm was attributable to gaming. It was hypothesised that problem gamers with IGD would score higher on the different measures of gaming harm and that loot box expenditure would be positively associated with the

level of financial harm reported. The study also examined whether IGD would be associated with harm after controlling for a range of other variables (e.g., problem gambling severity, overall psychological distress) that the literature has a) identified as known correlates of IGD, and b) are potential factors related to harm.

## Method

The study was approved by the Human Research Ethics Subcommittee in the School of Psychology at the University of Adelaide (Approval 20/08).

### Participants

The final sample comprised 471 adult regular gamers recruited from an online panel provider (Prolific). Participants were required to play games at least 3 days in a typical week and to be over 18 years of age. A total of 215 participants resided in mainland Europe (45.6%); 147 resided in North America (31.2%); 65 resided in the UK or Ireland (13.8%); 25 resided in Australia or New Zealand (5.3%); and, the remaining 19 participants resided in either Asia, Africa, or South America (4.0%). A total of 380 participants identified as male (80.7%), 73 as female (15.5%), and 18 as neither (3.8%). Full demographic characteristics can be found in Table 1, with separate groupings for IGD status.

As shown in Table 1, the sample was predominantly male (81%) and aged 18-30 years (80%). The sample included people with a mixture of relationship, employment and living arrangements. The sample generally reported a low prevalence of health-related behaviours such as smoking and other substance use. Around one third appeared to be living in financially

precarious circumstances. Chi-squared tests revealed no significant demographic and lifestyle differences between IGD statuses.

Table 1. Demographic characteristics of groups classified by IGD status. ($N = 471$)

| Variable | Overall (N = 471) | IGD (N = 84) | No IGD (N = 387) | |
|---|---|---|---|---|
| | N (%) | N (%) | N (%) | $\chi^2$ |
| *Gender* | | | | |
| Male | 380 (80.7) | 65 (77.4) | 315 (81.4) | |
| Female | 73 (15.5) | 14 (16.7) | 59 (15.2) | |
| Other | 18 (3.8) | 5 (6.0) | 13 (3.4) | Ns |
| *Age* | | | | |
| 18-30 | 375 (79.6) | 70 (83.3) | 305 (78.8) | |
| 31-40 | 73 (15.5) | 11 (13.1) | 62 (16.0) | |
| 41-50 | 16 (3.4) | 2 (2.4) | 14 (3.6) | |
| 51-60 | 3 (0.6) | 0 (0.0) | 3 (0.8) | |
| 61+ | 4 (0.8) | 1 (1.2) | 3 (0.8) | Ns |
| *Employment* | | | | |
| Full-time | 162 (34.4) | 25 (29.8) | 137 (35.4) | |
| Part-time | 52 (11.0) | 10 (11.9) | 42 (10.9) | |

| Variable | Overall (N = 471) | IGD (N = 84) | No IGD (N = 387) | |
|---|---|---|---|---|
| | N (%) | N (%) | N (%) | $\chi^2$ |
| Student | 141 (29.9) | 25 (29.8) | 116 (30.0) | |
| Other | 116 (24.6) | 24 (28.6) | 92 (23.8) | Ns |
| *Relationship status* | | | | |
| Single | 270 (57.3) | 42 (50.0) | 228 (58.9) | |
| In relationship/married | 196 (41.6) | 41 (48.8) | 155 (40.1) | |
| Divorced/separated | 5 (1.1) | 1 (1.2) | 4 (1.0) | Ns |
| *Living situation* | | | | |
| With parents | 267 (56.7) | 49 (58.3) | 218 (56.3) | |
| Renting | 124 (26.3) | 23 (27.4) | 101 (26.1) | |
| Owning and occupying | 80 (17.0) | 12 (14.3) | 68 (17.6) | Ns |
| *Raising US$2000 in emergency* | | | | |
| Easily | 128 (27.2) | 20 (23.8) | 108 (27.9) | |
| With sacrifices | 177 (37.6) | 27 (32.1) | 150 (38.8) | |
| Drastic measures | 113 (24.0) | 27 (32.1) | 86 (22.2) | |
| Unable to do it | 53 (11.3) | 10 (11.9) | 43 (11.1) | Ns |

| Variable | Overall (N = 471) | IGD (N = 84) | No IGD (N = 387) | |
|---|---|---|---|---|
| | N (%) | N (%) | N (%) | $\chi^2$ |
| *Health behaviour* | | | | |
| Smokes (weekly or more) | 54 (11.5) | 8 (9.5) | 46 (11.9) | Ns |
| Vapes (weekly or more) | 52 (11.0) | 12 (14.3) | 40 (10.3) | Ns |
| Recreational drugs (weekly or more) | 27 (5.7) | 4 (4.8) | 23 (5.9) | Ns |
| Gambling (weekly or more) | 60 (12.7) | 14 (16.7) | 46 (11.9) | Ns |

*Note.* Participants were classified as IGD if meeting IGD criteria as per Petry et al.'s (2014) measure. Participants were classified as No IGD if not meeting this criteria. $\chi^2$ = *p*-value of a Chi-squared test of independence. Ns = Not significant, $p > .05$.

**Procedure**

The study, advertised as *The Benefits and Harms of Gaming,* was made available on Prolific on two occasions in March and May of 2020. (Appendix A contains the Participant Information Sheet used to debrief potential participants about the study). On both occasions, the active participant load allowed (350 and 150, respectively) was filled within twenty minutes. Once accepting a place, participants were presented with an online consent form with researcher contact information (see Appendix B). The survey took on average 24 minutes to complete, and participants were paid for their time via Prolific. While 540 participants began the study, 4 were disqualified for completing the study too quickly; 15 were disqualified for gaming less than three days per week; and 12 surveys were left incomplete.

Of the 509 remaining, a further 38 were eliminated because of unrealistic, aberrant, or inconsistent responding. For example, 11 participants were removed for endorsing gaming more than 84 hours of gaming time per week (i.e., more than 12 hours every day), as this figure was considered too extreme to be reliable. Other validity checks were based on cross-tabulations to identify illogical responses (e.g., participants were excluded for endorsing experiences of "extreme distress" in the past 12 months, but not previously endorsing any experiences of "distress"). Participants were also excluded for meeting PGSI criteria for problem gambling, but not endorsing participating in any gambling activities during the PGSI's time frame of reference (the last 12 months).

## Measures

**Demographics.** Participants indicated their gender, age range, work status, living status, and financial vulnerability (based on whether they could raise the equivalent of US$2000 in an emergency).

**Gaming Behaviour.** Participants were asked to indicate their favourite gaming genre; their gaming platform of choice (e.g. desktop computer, home gaming console); their gaming days per week; and, the hours per day. Participants who indicated they gamed less than 3 days per week, contradicting selection criteria, were excluded from the survey. Participants were then asked how many times in the past three months they had spent money on: gaming in general; gaming software; loot boxes; and other microtransactions. Following this, after selecting the currency of their choice, participants reported how much they spent on each occasion within the previous four domains.

**Other Health-Related Behaviours.** Participants indicated how often they engaged in other health-related behaviours. They were asked how many caffeinated drinks they consumed in a typical gaming session, how often they currently smoked cigarettes or vaped e-cigarettes, and how often they used recreational drugs such as marijuana. (Appendix C contains survey questions pertaining to demographics, gaming behaviour, and other health-related behaviours).

**Gaming Benefits.** Participants completed the 10-item Benefits of Gaming scale adapted from a similar gambling-related scale developed by Delfabbro, Georgiou, and King (2020) (see Appendix D). Each item had a 5-point response scale, where 1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. Higher scores indicated that the person derived greater benefits from gambling. To adapt from the Delfabbro Georgiou, and King (2020) measure, each instance of the world "gambling" was replaced with the word "gaming".

**Internet Gaming Disorder.** This study used Petry et al.'s (2014) 9-item DSM-derived diagnostic measure to assess for IGD (see Appendix E). Participants were asked to endorse or refute each item. Scores of 4 or below indicate non-pathological gaming, whereas scores of 5 or above indicate symptoms consistent with IGD. The checklist has been used in clinical and neurobiological studies of IGD, and shown strong psychometric qualities (King et al., 2020a, 2020b). In this sample, 84 participants (17.8%) endorsed five or more items, consistent with IGD.

**Problem Gambling.** Participants completed the Problem Gambling Severity Index (PGSI) (Ferris & Wynne, 2001) (see Appendix F). Each item has a 4-point response scale, where 0 = Never, 1 = Sometimes, 2 = Most of the time, and 3 = Almost always. The PGSI has a 12-month time frame. Scores of 0 indicate recreational gambling or non-participation, 1 to 2 indicate low-risk gambling, 3 to 7 moderate-risk gambling, and scores of 8 to a maximum 27 indicate

problem gambling. This sample contained 12 problem gamblers (3.5%), 21 moderate-risk gamblers (4.4%), 59 low-risk gamblers (12.5%), and 379 recreational gamblers or gambling non-participants (80.3%).

**Psychological Distress.** Participants completed the Kessler 10 (K10) (Kessler et al., 2003) which is a 10-item questionnaire reflecting the symptomatic frequency of depression, anxiety, and stress experienced in the previous 4 weeks (see Appendix G). Each item has a five-point rating scale, where 1 = Never, 2 = A little of the time, 3 = Some of the time, 4 = Most of the time, and 5 = All of the time. Higher scores indicate greater distress.

**Gaming Harm.** To assess gaming-related harm, this study utilised the gambling-related harm questionnaire developed by Browne et al. (2016) and scored using the method applied in Delfabbro, Georgiou and King (2020). Harm items are divided into six categories, with each category ranging from mild to the most severe harm: Financial (reduced savings due to gambling - becoming bankrupt); Work/Study (being late for work - losing a job); Psychological (regret - suicide attempts); Social (spending less time with important people - relationship separations); and Other (mostly deviant behaviours, such as crime and stealing money). Items were adapted to reflect gaming-related harm - any mention of the word "gambling" was simply replaced with "gaming". Particularly extreme items (e.g., suicide, bankruptcy) were eliminated from the survey due to its online administration. (Appendix H contains the full harm scale used.)

Each harm item was first presented without reference to gaming (e.g., "In the last 12 months, feelings of regret have been…") with a 5 point rating scale (0 = Not a problem, 1 = A minor problem, 2 = A moderate problem, 3 = A major problem, and 4 = A very serious problem). Any participant giving a response of 1 or more was given a follow-up item, asking for their attribution of harm to gaming (e.g., "My feelings of regret were…") with another 5-point

scale (0 = Not caused by my gaming, 1 = Slightly caused by gaming, 2 = Moderately caused by my gaming, 3 = Mostly caused by my gaming, and 4 = Totally caused by my gaming). The final harm measure was 57 items in length, with 13 financial items, 11 health items, 10 psychological items, 9 social items, 7 work and study items, and 7 other items.

**Validity Checks.** Participants answered two simple questions to ensure they were not responding invalidly (see Appendix C). The first question asked them to select the former US president from the options of Donald Trump, Joe Biden, Barack Obama, and Vladimir Putin. The second question asked them to select the odd number from a list of otherwise even numbers. While two participants did not correctly identify Barack Obama as a former US president, they both remained in the sample due to their a) otherwise consistent responding and b) residence outside of the United States.

## Data Analysis

Harms were scored in three ways using the method employed by Delfabbro, Georgiou, and King (2020) and developed originally by Blaszczynski et al. (2015). A person was considered to have endorsed 'General Harm' if they scored 1 or more on the first question of any item (i.e., indicating "A minor problem" or more). If these participants then gave a score of 1 or more on the second question (i.e., attributing it to being "Slightly caused by my gaming" or more), they were considered to have reported this harm for gaming. Any item endorsed in this way was labeled 'Any Harm' due to gaming. The final category of harm ('Moderate Harm') required that participants give a score of 2 or more on the first question of any item (i.e., "A moderate problem" or more), *and* give a score of 2 or more on the follow-up question (i.e., attributing it to being "Moderately caused by my gaming" or more). Using these methods, it was

possible to add up the total number of items indicating: ‘General Harm’, not necessarily connected to gaming; ‘Any Harm’ due to gaming; or, any ‘Moderate Harm’ due to gaming.

## Results

### Gaming Behaviour

Consistent with the inclusion criteria, participants reported playing between 3 and 7 days in a typical week ($M$ = 5.91, $SD$ = 1.29) and hours per week ranged between 4 and 77 ($M$ = 25.6, $SD$ = 15.7). A total of 45 participants played less than 10 hours per week (9.6%), 287 played between 10 and 30 hours per week (60.9%); and 139 played more than 30 hours per week (29.5%). Four different platforms were selected as participants’ platform of choice: desktop and/or laptop computers were most common (71.8%) followed by home gaming consoles (21.9%); mobile and/or tablet apps (5.5%); and, handheld gaming consoles (0.8%). Twelve different gaming genres were selected as participants’ favourites, with the four most popular being: first person shooter games (23.6%); multiplayer online battle arena games (18.0%); traditional role playing games (16.6%); and, massively multiplayer online role playing games (11.0%).

Gaming expenditure in the past three months was converted to US dollars in four domains: amount spent on gaming in general ($M$ = 90.2, $SD$ = 294.1); amount spent on gaming software ($M$ = 40.7, $SD$ = 75.5); amount spent on loot boxes ($M$ = 2.81, $SD$ = 12.0); and amount spent on other microtransactions ($M$ = 9.20, $SD$ = 48.9). In the prior three months, 385 participants had spent money on gaming in general (81.7%), 312 had spent money on gaming

software (66.2%), 51 had spent money on loot boxes (10.8%), and 140 had spent money on non-loot box microtransactions (29.7%).

### Health-Related Behaviours

Participants were also surveyed about other recreational habits. A total of 153 reported consuming caffeine while gaming (32.5%); 54 reported smoking cigarettes at least weekly (11.5%); with 41 of these smoking daily (8.7%); and 52 reported smoking e-cigarettes at least weekly (11.0%), with 40 of these smoking daily (8.5%). A total of 133 reported using recreational drugs ("such as marijuana") at least once a year (28.2%) with 27 of these using weekly (5.7%) and 12 using daily (2.5%). 252 reported gambling at least once per year (53.5%), and 60 reported gambling weekly or more often (12.7%).

### IGD Status, Problem Gambling Severity, and Other Psychometric Measures

The average score on the Petry et al. (2014) IGD measure was 2.98 (*SD* = 1.93), with a minimum of 0 to a maximum of 9 (reflecting the theoretical range). A total of 84 participants scored 5 or more, indicating they met criteria for IGD (17.8%). In comparison, the mean PGSI score was 0.66 (*SD* = 2.03), with a minimum of 0 and a maximum of 16 (from a theoretical range of 0 to 27). A total of 379 participants recorded a 0 (80.3%), 59 scored in the low-risk category (12.5%), 21 were moderate-risk (4.5%), and 12 scored in the problem gambler range (2.5%).

The average score on the K10 was 21.2 (*SD* = 8.69), with a minimum of 10 to a maximum of 49 (from a theoretical range of 10 to 50). A total of 145 participants were in the low

range of psychological distress (30.8%), 145 were in the moderate range (30.8%), 88 were in the high range (18.7%), and 93 were in the very high range (19.7%).

**Harm Measures**

Table 2 summarises the total harm items endorsed by participants who did or did not meet the IGD criteria, and for the sample as a whole. The maximum possible score for each of the 3 scoring methods was 57. As indicated, those with IGD scored significantly higher on all three counts with large effects.

Table 2. Total harm counts by IGD status. ($N = 471$)

| Category | Overall | IGD (n = 84) | No IGD (n = 387) | | | |
|---|---|---|---|---|---|---|
| | M (SD) | M (SD) | M (SD) | *t(469)* | *p* | *d* |
| General Harm | 14.9 (7.54) | 20.7 (8.51) | 13.6 (6.70) | 8.35 | <.001 | 0.93 |
| Any Harm | 4.48 (5.55) | 10.8 (8.55) | 3.11 (3.35) | 13.5 | <.001 | 1.18 |
| Moderate Harm | 1.00 (2.44) | 3.15 (4.50) | 0.53 (1.29) | 9.78 | <.001 | 0.79 |

*Note.* *T*-score, *p*-value, and Cohen's *d* are all in reference to independent samples *t*-tests between IGD statuses.

Table 3 displays the domain-specific harm totals based on IGD classification. These analyses indicated that IGD-positive gamers reported more harm than IGD-negative gamers in

every harm category, and irrespective of how harm was scored. These differences are shown in Figure 1 to provide a clearer graphical illustration.

Table 3. M (SD) harm counts within each domain of harm by IGD status. ($N$ = 471)

| Category | Overall | IGD (n = 84) | No IGD (n = 387) | | | |
|---|---|---|---|---|---|---|
| | M (SD) | M (SD) | M (SD) | *t(469)* | *p* | *d* |
| *General Harm* | | | | | | |
| Financial | 2.24 (2.25) | 3.43 (3.02) | 1.99 (1.96) | 5.48 | <.001 | 0.57 |
| Health | 4.05 (2.19) | 5.38 (2.31) | 3.75 (2.06) | 6.42 | <.001 | 0.74 |
| Psychological | 6.13 (2.84) | 7.82 (2.16) | 5.77 (2.84) | 6.24 | <.001 | 0.81 |
| Social | 2.29 (2.17) | 3.52 (2.55) | 2.02 (1.98) | 5.97 | <.001 | 0.66 |
| Work and Study | 1.48 (1.59) | 2.33 (1.89) | 1.29 (1.45) | 5.63 | <.001 | 0.62 |
| Other | 0.19 (0.64) | 0.57 (1.21) | 0.11 (0.39) | 6.24 | <.001 | 0.51 |
| *Any Harm* | | | | | | |
| Financial | 0.61 (1.37) | 1.46 (2.36) | 0.42 (0.94) | 6.64 | <.001 | 0.58 |
| Health | 1.45 (1.77) | 3.35 (2.44) | 1.03 (1.27) | 12.5 | <.001 | 1.19 |
| Psychological | 1.59 (2.09) | 3.71 (2.73) | 1.13 (1.59) | 11.6 | <.001 | 1.15 |
| Social | 0.77 (1.45) | 2.00 (2.26) | 0.50 (1.03) | 9.34 | <.001 | 0.85 |
| Work and Study | 0.80 (1.33) | 1.68 (1.82) | 0.61 (1.12) | 6.99 | <.001 | 0.71 |
| Other | 0.07 (0.43) | 0.25 (0.90) | 0.03 (0.20) | 4.32 | <.001 | 0.34 |

| Category | Overall | IGD (n = 84) | No IGD (n = 387) | | | |
|---|---|---|---|---|---|---|
| | M (SD) | M (SD) | M (SD) | *t(469)* | *p* | *d* |
| *Moderate Harm* | | | | | | |
| Financial | 0.10 (0.45) | 0.25 (0.78) | 0.06 (0.33) | 3.49 | <.001 | 0.31 |
| Health | 0.41 (0.98) | 1.31 (1.71) | 0.22 (0.56) | 10.3 | <.001 | 0.86 |
| Psychological | 0.30 (0.97) | 0.95 (1.80) | 0.16 (0.57) | 7.22 | <.001 | 0.59 |
| Social | 0.18 (0.70) | 0.63 (1.32) | 0.09 (0.42) | 6.70 | <.001 | 0.55 |
| Work and Study | 0.25 (0.74) | 0.65 (1.14) | 0.16 (0.59) | 5.71 | <.001 | 0.54 |
| Other | 0.01 (0.09) | 0.01 (0.11) | 0.01 (0.09) | 0.38 | .71 | 0 |

*Note.* *T*-score, *p*-value, and Cohen's *d* all reference independent samples *t*-tests.

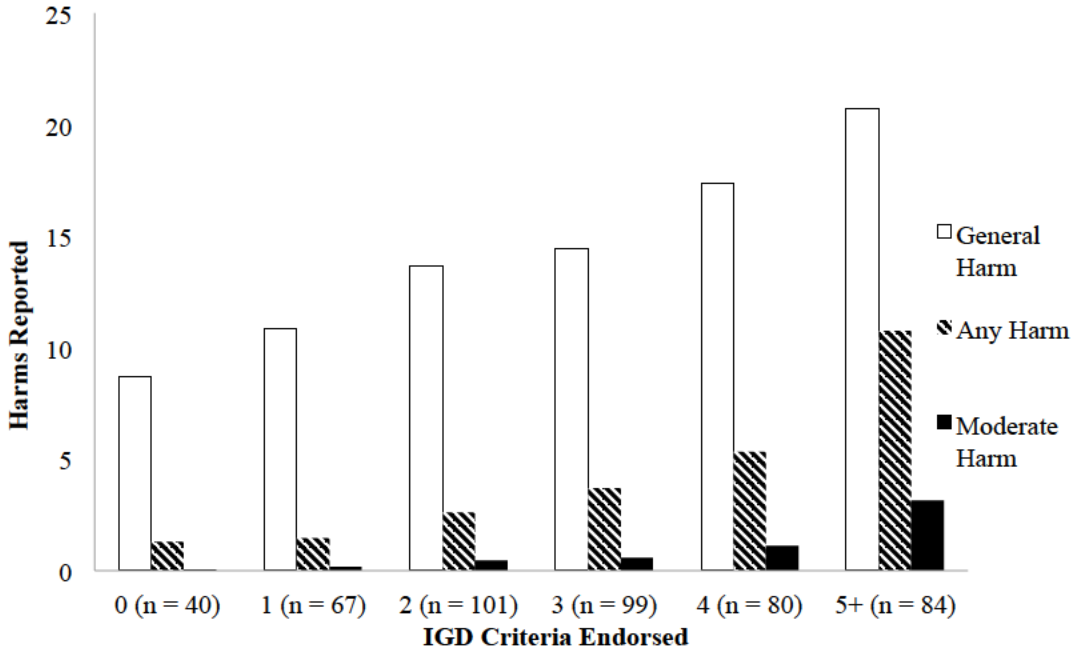


*Figure 1*. Number of Internet gaming disorder (IGD) criteria endorsed through the Petry et al. (2014) measure, versus General, Any, and Moderate Harm reported. ($N$ = 471)

**Association Between Loot Box Expenditure and Financial Harm**

A total of 51 participants reported spending money on loot boxes in the past three months (10.8%). Of the participants reporting loot box expenditure, loot boxes were engaged an average of 2.10 times in the past three months ($SD$ = 2.21), with an average of US$16.49 spent on each occasion ($SD$ = 18.26). When extrapolated, these participants spent an average of US$25.97 ($SD$ = 27.24) on loot boxes in the past three months. The highest recorded loot box expenditure over the past three months was by a participant who reported spending US$133.20.

Table 4 summarises the association between participants' loot box expenditure and their reports of General Harm, Any Harm, and Moderate Harm on the thirteen Financial items. Pearons's $r$ correlations revealed significant positive associations between loot box expenditure and all three harm severities, disregarding harm category. There was a non-significant positive

association between the sample's loot box expenditure and reports of general financial harm, but significant but small positive correlations for harms scored using the other two methods. These findings were consistent with the hypothesised associations.

Table 4. Pearson correlations between loot box expenditure and financial harm

| Measure | 1 | 2 | 3 |
|---|---|---|---|
| 1. Loot box expenditure | | | |
| 2. General Harm, Financial | .02 | | |
| 3. Any Harm, Financial | .14** | .51*** | |
| 4. Moderate Harm, Financial | .22*** | .21*** | .51*** |

*Note.* Loot box expenditure pertained to spending activity in the past three months. Participants reported a value in the currency of their choice, with conversion to US dollars performed by the researchers using Table CC. ** $p < .01$, *** $p < .001$.

**Predictors of General Harm, Any Gaming Harm, and Moderate Gaming Harm**

Table 5 summarises the results of Pearson correlation analyses examining the bivariate relationships between a variety of survey variables and the three harm categories. A number of variables were not significantly related to harm scores. These included: all forms of non-loot box gaming expenditure; perceived benefits of gaming; vaping frequency; and recreational drug use frequency. Conversely, smoking frequency and financial vulnerability (i.e., reported difficulty in raising US$2000 in an emergency) had a weak positive association with General Harm. Age was significantly negatively associated with General Harm, with harm counts smaller in older

participants (albeit weakly). As previously discussed, loot box expenditure was not found to be associated with General Harm, but was positively associated with Any and Moderate harm.

Table 5. Pearson correlations between survey variables and harm counts

| Measure | General Harm | Any Harm | Moderate Harm |
|---|---|---|---|
| IGD criteria endorsed | .47*** | .59*** | .46*** |
| Gaming hours per week | .15** | .18*** | .21*** |
| Expenditure, loot boxes | .02 | .17*** | .20*** |
| Expenditure, other microtransactions | .05 | .05 | .04 |
| Expenditure, gaming software | .05 | .08 | .05 |
| Expenditure, gaming in general | .05 | .03 | .01 |
| Financial vulnerability | .26*** | .03 | .05 |
| Psychological distress | .44*** | .18*** | .14** |
| Problem gambling severity | .20*** | .42*** | .35*** |
| Benefits of gaming | -.01 | -.01 | -.04 |
| Age range | -.11* | -.09 | -.06 |
| Caffeine consumption | .10* | .15** | .13** |
| Smoking frequency | .14** | .02 | .03 |
| Vaping frequency | -.01 | .00 | .01 |
| Drug use frequency | .08 | .03 | .00 |

Notes. * $p < .05$, ** $p < .01$, *** $p < .001$.

As indicated in Table 5, gaming hours per week and caffeine consumption were found to have small significant positive associations with all three harm scoring categories. K10 scores were related to harm scores across all three scoring categories. PGSI scores were positively associated with General, Any, and Moderate categories, with the strongest relationships observed for the harm associated with gaming (Any and Moderate Harm counts). Overall, the strongest predictor in all three harm categories was the number of IGD criteria met (i.e., the score on the Petry et al. [2014] measure).

**Multiple Regression**

Multiple regression analysis was used to investigate the best predictors of moderate harm, using variables presenting a significant bivariate association with moderate harm (see Table 5). The results indicated that the model significantly predicted Moderate Harm scores ($F(7, 463) = 26.1$, $p < .001$, $R^2 = .31$). Significant predictors in the model were: IGD criteria endorsed ($B = 0.48$, $p < .001$); gaming hours per week ($B = 0.02$, $p < .001$); loot box expenditure ($B = 0.02$, $p < .01$); PGSI score ($B = 0.27$, $p < .001$); and perceived benefits of gaming ($B = -0.07$, $p < .01$). Non-significant variables were: caffeine consumption during gaming ($B = 0.01$, $p = 0.10$); and K10 score ($B = -0.01$, $p = 0.43$).

An updated multiple regression discarded the non-significant variables. This model also explained a significant proportion of the variance in Moderate Harm scores ($F (5, 465) = 40.9$, $p < .001$, $R^2 = .31$). All variables remained significant predictors of harm score: IGD criteria endorsed ($B = 0.47$, $p < .001$); gaming hours per week ($B = 0.02$, $p < .001$); loot box expenditure ($B = 0.02$, $p < .01$); PGSI score ($B = 0.27$, $p < .001$); and perceived benefits of gaming ($B = -0.07$, $p < .01$).

## Discussion

The present study aimed to examine the extent to which regular gamers classified as having IGD differed from other gamers on a range of harm dimensions. The study also investigated whether new features such as loot boxes were associated with greater harm; in particular, financial harm. The results were generally as hypothesised. Gamers who met criteria for IGD reported more harm than regular gamers who did not meet criteria. Differences were observed across all harm dimensions, irrespective of whether the harms were considered 'slightly' or 'moderately' related to gaming. The results also showed that loot box expenditure was associated with greater gaming-related financial harm. The results further showed that IGD symptoms were positively related to harm after controlling for other co-morbidities (e.g., scores on the PGSI) and other life-style factors. However, some of these factors were significant in their own right. For example, harm scores were positively related to how many hours of gaming were undertaken each week; overall levels of psychological distress (K10 scores); problem gambling severity (PGSI scores); and the level of reported caffeine consumption. Moderate gaming harm was also predicted by the amount of loot box expenditure per month.

Overall, these findings confirm, using a systematic taxonomy of harms, many of the findings from previous studies. However, an important feature of this study was the use of questions that required respondents to attribute the harms to gaming. Consistent with previous studies (e.g., Männikkö, Billieux, & Kääriäinen, 2015; Satghare et al., 2016; Tetik et al., 2018), the most common form of harm in IGD related to physical health (e.g., items related to poor diet, sleep, hygiene). For this category, the count of moderately scored harm was six times higher for those with IGD than those without. The next most commonly endorsed form of harm was

psychological, with IGD-classified individuals reporting problems such as distress, anxiety or depression six times more commonly than non-IGD participants. This was consistent with some past studies (Cheng et al., 2018; González-Bueso et al., 2018; Kim et al., 2016; Wu et al., 2015). We also observed that higher scores on the PGSI were associated with greater gaming harm, which is consistent with other studies that have observed evidence of cross-addiction (e.g., Burleigh et al., 2019; Spekman, Konijn, Roelofsma, & Griffiths, 2013). Disruptions to work and study were generally reported less, but much more likely to be reported by IGD-classified individuals, consistent with past studies (Northrup & Shumway, 2014).

On the other hand, despite concerns about the potentially increasing financial risks of gambling, we found that expenditure on loot boxes was generally low. Nevertheless, in support of the findings of other studies (e.g., Kristiansen & Severin, 2020; Zendle, Meyer, & Over, 2019; Zendle & Cairns, 2018, 2019), we observed that loot box expenditure was positively associated with gaming-related harm. Notably, no other avenues of gaming expenditure had a significant association with gaming-related harm. We believe that the relationship between loot box expenditure and gaming-related harm probably results from the fact that gamers who have higher levels of gaming involvement or commitment are more likely to use loot boxes. Higher involvement very likely acts as a common antecedent to both greater loot box use and harm. This observation is consistent with studies in gambling (e.g., Delfabbro, King, Browne, & Dowling, 2020; Hing, Russell, & Vitartas, 2018) which note that problem gamblers (or higher frequency gamblers) tend to engage in a wider range of, and often in more ‘exotic’, gambling activities. Further analysis of populations of gamers with greater involvement in loot box playing would be needed to determine whether this result is merely an outcome of the nature of the sample used in the present study. As per the recommendation of Delfabbro and King (2020), a longitudinal

design of loot box-engaging gamers would assist in understanding whether engagement is differentially associated with the development of a) gaming harm and b) problem gambling severity.

### Limitations

There are several limitations that need to be taken into account. First, this study was based on a self-report methodology and used an online panel, so it is unclear whether the findings can be generalised to all gamer populations. Second, the study focused on adults and did not capture the experiences of adolescents who are also engaged in high levels of gaming. Third, it may be that adapting harm items from the gambling field omitted some gaming specific harms (such as vision problems, or bad posture) that are relevant to excessive screen time. Fourth, the study, for ethical reasons, omitted items relating to suicidality or self-harm, so it is not clear if a small number of gamers might have endorsed those items. Fifth, we recognise that our sampling strategy might not have targeted those gamers who are most likely to spend money on loot boxes. Use of a specific mobile gaming population rather than our general gamer population sample may have yielded stronger insights into the links between loot boxes and financial harm. Finally, given that the study was conducted early in the COVID-19 pandemic, some of the harms reported could have been due to pandemic-related health, economic, and occupational conditions.

## Conclusion

The results of this study show that regular gamers who met the criteria for IGD were significantly more likely to report harm than other gamers across all the different harm dimensions. Loot box expenditure was also related to greater endorsement of gaming-related financial harm. These findings provide further evidence of the convergent validity of the Petry et al. (2014) IGD criteria. These findings encourage the need for further development of gaming-specific measures of harm, as well more detailed analysis of harm severity. Although the IGD classification used in this study appears to identify people with clearly more negative experiences of gaming, this does not mean that these harms are necessarily as severe as those observed for other conditions (such as disordered gambling).

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# Appendix A: Participant Information Sheet


## PARTICIPANT INFORMATION SHEET

**PROJECT TITLE: The benefits and harms of gaming**
**HUMAN RESEARCH ETHICS COMMITTEE APPROVAL NUMBER: 20/08**
**PRINCIPAL INVESTIGATOR:**

Dear Participant,

You are invited to participate in the research project described below.

**What is the project about?**
This research project is about people's perceptions of the benefits and potential harms associated with an involvement in video games. It involves asking you a number of questions about the sorts of activities with which you are involved, your perceptions of the harms and benefits, as well as a few other questions about gambling behaviour. There will also be some questions about your demographic situation, lifestyle, and mental health.

**Who is undertaking the project?**
This project is being conducted by a team of researchers in the School of Psychology at the University of Adelaide.

**Why am I being invited to participate?**
You are being invited as you are a person who has identified that you engage in video games 3-7 days per week and that you are over 18 years of age.

**What am I being invited to do?**
You are being invited to complete an anonymous survey that will take around 15-20 minutes to complete.

**Are there any risks associated with participating in this project?**
We do not anticipate that involvement in the project will involve any risks. However, if you experience any discomfort as a result of reflecting upon some of the negative experiences associated with gambling, we encourage you to seek advice from established gambling advice and treatment services including the National Gambling Helpline in Australia (1800 858 858) or GambleAware in the UK.

**What are the potential benefits of the research project?**
The project will provide clearer insights into the nature and types of harms and benefits experienced by people who play video games frequently. As gaming media continues to change, so does our understanding of how it affects its players. This study will hopefully contribute to a growing body of public health literature.

**Can I withdraw from the project?**
Participation in this project is completely voluntary. If you agree to participate, you can withdraw from the study at any time.

**What will happen to my information?**
All information will be collected and stored anonymously.

**Who do I contact if I have questions about the project?**
You could contact the principal investigator using the email address overleaf.

**What if I have a complaint or any concerns?**
For any questions about the ethical conduct of the research, please contact Dr. Diana Dorstyn (Diana.Dorstyn@adelaide.edu.au) as the Acting Chair of the Human Research Subcommittee in the School of Psychology at the University of Adelaide, South Australia.

Yours sincerely,

School of Psychology
University of Adelaide
[redacted]

# Appendix B: Consent Form


**Human Research Ethics Committee (HREC)**

**CONSENT FORM**

1. I have read the attached Information Sheet and agree to take part in the following research project:

| | |
|---|---|
| **Title:** | **The benefits and harms of gaming.** |
| **Ethics Approval Number:** | **20/08** |

2. I have had the project, so far as it affects me, and the potential risks and burdens fully explained to my satisfaction by the researchers. I have had the opportunity to ask any questions I may have about the project and my participation. My consent is given freely.

3. Although I understand the purpose of the research project is to improve a body of scientific knowledge, it has also been explained that my involvement may not be of any benefit to me.

4. I agree to participate in the activities as outlined in the participant information sheet.

5. I understand that as my participation is anonymous, I can withdraw any time up until submission of the survey.

6. I have been informed that the information gained in the project may be published in a journal article and/or thesis.

7. I have been informed that in the published materials I will not be identified and my personal results will not be divulged.

8. I understand my information will only be disclosed according to the consent provided, except where disclosure is required by law.

9. I am aware that I should keep a copy of this Consent Form, when completed, and the attached Information Sheet.

10. I understand that proceeding with this online survey (by clicking "Next") means granting consent as per the conditions above.

## Appendix C: Survey Questions Regarding Demographics, Video Game Behaviour, Other Behaviour, and Response Validation

**What is your gender?**

□ Female

□ Male

□ Other

**Your age range:**

□ 18-30

□ 31-40

□ 41-50

□ 51-60

□ 61+

**What is your current work status?**

□ Employed full-time

□ Employed part-time

□ Casual employment

□ Unemployed/looking for work

□ Home duties

□ Other (please specify): _____

**What is your current relationship status?**

□ Single

□ In relationship/married/have a partner

□ Divorced

□ Widowed

□ Other (please specify): _____

**In which country do you currently reside?**

_____

**What is your current living circumstance?**

□ Living with parents

□ Living independently (renting)

□ Living independently (owner and occupier)

**How easily could you raise 2000 US Dollars, 1000 Great British Pounds, 1000 Euros, or rough equivalent, in an emergency?**

□ Easily

□ With sacrifices

□ Drastic measures needed

□ Could not do it

**Please indicate the platform or console you engage with the most. Select ONE only.**

□ Home gaming console (e.g. PlayStation, XBOX, Nintendo Switch)

□ Desktop/laptop computer (e.g. PC, Mac)

□ Mobile phone/tablet (e.g. Android phone, iPhone, iPad)

□ Handheld gaming console (e.g. portable Nintendo Switch, PSP)

□ Arcade games (*not* emulated on computer – if playing arcade games on computer, select "Desktop/laptop computer")

□ Other (please specify): _____

**Please indicate the genre of game you engage with the most. Select ONE only.**

□ First-person shooter (e.g. Call of Duty, Halo)

□ Sport (e.g. FIFA, NBA 2K)

□ RPG (e.g. Assassin's Creed, Legend of Zelda)

□ Strategy (e.g. Age of Empires, Total War)

□ Multiplayer online battle arena (e.g. Fortnite, League of Legends)

□ Mobile/tablet games (e.g. Candy Crush, Angry Birds)

□ Family/farm simulation (e.g. The Sims, Farmville)

□ Open world (e.g. Grand Theft Auto, Red Dead Redemption)

□ Massively multiplayer online role-playing games (e.g. World of Warcraft)

□ Arcade games (e.g. Pacman, Space Invaders)

□ Other (please specify): _____

**How often have you played video games over the last 12 months?**

□ Never

□ 1-2 times per year*

□ 3 times per year, up to monthly*

□ About once per month*

□ 2-3 times per month*

□ About once per week*

□ More than once per week

**If participants selected any of these options, they were disqualified from the survey.*

**How many days per week?**

□ 0*

□ 1*

□ 2*

□ 3

□ 4

□ 5

□ 6

□ 7

**If participants selected any of these options, they were disqualified from the survey.*

**What would be the average hours per day? (Round up)**

_____

**We would now like you to estimate how much you have spent on gaming in the last month.**

**Please choose a currency as a reference point for the next few answers.**

□ $ (US)

□ € (EUR)

□ £ (GBP)

□ $ (AU/NZ/CAD)

□ Other (please specify): _____

**How many times in the last three months have you spent money on gaming in total? How much would you say you spent each time?**

Times: _____

Amount on each occasion: _____

**How many times in the last three months have you spent money on gaming software (e.g. game downloads, game discs) specifically? How much would you say you spent each time?**

Times: _____

Amount on each occasion: _____

**How many times in the last three months have you spent money on loot boxes specifically? How much would you say you spent each time?**

Times: _____

Amount on each occasion: _____

**How many times in the last three months have you spent money on other in-game transactions? How much would you say you spent each time?**

Times: _____

Amount on each occasion: _____

**How many caffeinated drinks would you consume each time you have a gming session?**

□ 0

□ 1-2

□ 3-4

□ 5+

**Please tick the category that is closest to your current consumption.**

| | Never | Only on special occasions | <1 per month | Weekly | Daily |
|---|---|---|---|---|---|
| Cigarettes | | | | | |
| E-cigarettes/Vaping | | | | | |
| Recreational drugs (e.g. marijuana) | | | | | |

**How often have you gambled on the following activities in the last 12 months?**

| | Never | 1-2 times per year | 3 times per year, up to once per month | 2-3 times per month | Weekly or more often |
|---|---|---|---|---|---|
| Card games for money (e.g. poker, blackjack) | | | | | |
| Poker machines | | | | | |
| Racing (e.g. greyhounds, horses) | | | | | |
| Sports (not including racing) | | | | | |
| Lotteries, Keno, scratch tickets | | | | | |

**Before we go further, we need to confirm that the high quality responses you are providing are not being compromised by other invalid responses.**

**Please select the former US president.**

□ Boris Johnson

□ Joe Biden

□ Barack Obama

□ Vladimir Putin

**Which of these is an odd number?**

□ 4

□ 8

□ 11

□ 12

## Appendix D: Benefits of Gaming Scale

**Please indicate the extent to which you agree with the following statements about gaming.**

1. Gaming usually makes me happy.
□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly agree

2. Gaming keeps my mind active.
□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly agree

3. Gaming gets me out of the house and gives me something to do.
□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly agree

4. Gaming is exciting for me.
□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly agree

5. Gaming gets me out doing things with other people.
□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly agree

6. Gaming makes my life more interesting.
□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly agree

7. Gaming gives me something to look forward to.
□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly agree

8. I would miss not being able to participate in gaming if the activity was not available.
□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly agree

9. I would go out less if there were no gaming activities.
□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly agree

10. I would feel unhappy or bored if I could not participate in gaming.
□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly agree

## Appendix E: Petry et al. (2014) Internet Gaming Disorder Measure

| **In the past 12 months have you:** | Yes | No |
|---|---|---|
| Spent a lot of time thinking about games even when you were not playing, or planning when you could play next? | | |
| Felt restless, irritable, moody, angry, anxious or sad when attempting to cut down or stop gaming, or when you were unable to play? | | |
| Did you feel the need to play for increasing amounts of time, play more exciting games, or use more powerful equipment to get the same amount of excitement you used to get? | | |
| Did you feel that you should play less, but were unable to cut back on the amount of time you spent playing games? | | |
| Did you lose interest in or reduce participation in other recreational activities (hobbies, meetings with friends) due to gaming? | | |
| Did you continue to play games even though you were aware of negative consequences, such as not getting enough sleep, being late to school/work, spending too much money, having arguments with others, or neglecting important duties? | | |
| Did you lie to family, friends or others about how much you game, or try to keep your family or friends from knowing how much you game? | | |
| Did you game to escape from or forget about personal problems, or to relieve uncomfortable feelings such as guilt, anxiety, helplessness or depression? | | |
| Did you risk or lose significant relationships, or job, educational or career opportunities because of gaming? | | |

## Appendix F: Problem Gambling Severity Index

**In the last 12 months, how often have you…**

1. Bet more than you could really afford to lose?
□ Never □ Sometimes □ Most of the time □ Almost always

2. Needed to gamble with larger amounts of money to get the same feeling of excitement?
□ Never □ Sometimes □ Most of the time □ Almost always

3. Gone back another day to try and win back the money you lost?
□ Never □ Sometimes □ Most of the time □ Almost always

4. Borrowed money or sold anything to get money to gamble?
□ Never □ Sometimes □ Most of the time □ Almost always

5. Felt that you might have a problem with gambling?
□ Never □ Sometimes □ Most of the time □ Almost always

6. Felt that gambling has caused you health problems, included stress and anxiety?
□ Never □ Sometimes □ Most of the time □ Almost always

7. Been criticised for your betting by other people, or told you that you have a gambling problem, whether or not you thought it was true?
□ Never □ Sometimes □ Most of the time □ Almost always

8. Felt your gambling has caused financial problems for you or your household?
□ Never □ Sometimes □ Most of the time □ Almost always

9. Felt guilty about the way you gamble or what happens when you gamble?
□ Never □ Sometimes □ Most of the time □ Almost always

## Appendix G: Kessler 10

**In the past 4 weeks:**

1. About how often did you feel tired out for no good reason?

□ None of the time □ A little of the time □ Some of the time □ Most of the time □ All of the time

2. About how often did you feel nervous?

□ None of the time □ A little of the time □ Some of the time □ Most of the time □ All of the time

3. About how often did you feel so nervous that nothing could calm you down?

□ None of the time □ A little of the time □ Some of the time □ Most of the time □ All of the time

4. About how often did you feel hopeless?

□ None of the time □ A little of the time □ Some of the time □ Most of the time □ All of the time

5. About how often did you feel restless or fidgety?

□ None of the time □ A little of the time □ Some of the time □ Most of the time □ All of the time

6. About how often did you feel so restless you could not sit still?

□ None of the time □ A little of the time □ Some of the time □ Most of the time □ All of the time

7. About how often did you feel depressed?

□ None of the time □ A little of the time □ Some of the time □ Most of the time □ All of the time

8. About how often did you feel that everything was an effort?

□ None of the time □ A little of the time □ Some of the time □ Most of the time □ All of the time

9. About how often did you feel so sad that nothing could cheer you up?

□ None of the time □ A little of the time □ Some of the time □ Most of the time □ All of the time

10. About how often did you feel worthless?

□ None of the time □ A little of the time □ Some of the time □ Most of the time □ All of the time

## Appendix H: Gaming Harm Questionnaire

Note: The second question of each item (e.g. Item 1's "My feelings of regret were:") was not displayed if the participant answered "Not a problem" to the item's first question.

**We will now ask you some questions about life in general, and some problems you may have faced.**

| **ITEM 1** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
|---|---|---|---|---|---|
| During the past 12 months, feelings of regret were… | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My feelings of regret were: | | | | | |
| **ITEM 2** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, feeling ashamed was… | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My feelings of shame were: | | | | | |
| **ITEM 3** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, feelings angry or losing control was… | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My feelings of lost control were: | | | | | |

| **ITEM 4** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
|---|---|---|---|---|---|
| During the past 12 months, feeling distressed was… | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My feelings of distress were: | | | | | |
| **ITEM 5** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, feeling hopeless was… | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My feelings of hopelessness were: | | | | | |
| **ITEM 6** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, feeling like a failure was… | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My feelings of failure were: | | | | | |
| **ITEM 7** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, experiences of extreme distress were… | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My feelings of extreme distress were: | | | | | |

| **ITEM 8** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
|---|---|---|---|---|---|
| During the past 12 months, feeling insecure or vulnerable was… | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My feelings of insecurity or vulnerability were: | | | | | |
| **ITEM 9** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, feeling worthless was… | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My feelings of worthlessness were: | | | | | |
| **ITEM 10** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, thoughts of running away or escaping were… | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My thoughts of running away or escaping were: | | | | | |
| **ITEM 11** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, reductions in my available spending money were: | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| Reductions in available spending money were: | | | | | |
| **ITEM 12** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, reductions in my savings were: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| The reduction in my savings were: | | | | | |
| **ITEM 13** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, having less money to spending on recreational expenses (e.g. eating out, going to the movies) was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| Having less money to spend on recreational expenses was: | | | | | |
| **ITEM 14** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, late payments on bills were: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My late payments on bills were: | | | | | |

| **ITEM 15** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
|---|---|---|---|---|---|
| During the past 12 months, reduced expenditure on insurance, education, car, and maintenance was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| The reduced expenditure on expenses such as insurance, education, car and home maintenance was: | | | | | |
| **ITEM 16** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, increased credit card debt was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| The increased credit card debt was: | | | | | |
| **ITEM 17** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, selling personal items for money was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| The sale of personal items was: | | | | | |
| **ITEM 18** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, needing assistance from welfare organisations (e.g. food banks) was: | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My need for assistance from welfare organisations was: | | | | | |
| **ITEM 19** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, reduced expenditure on essential expenses (e.g. medication, healthcare, food) was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My reduced expenditure on essential expenses was: | | | | | |
| **ITEM 20** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, taking on additional employment was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My taking on additional employment was: | | | | | |
| **ITEM 21** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, losing significant assets was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My loss of significant assets was: | | | | | |

| **ITEM 22** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
|---|---|---|---|---|---|
| During the past 12 months, needing emergency accommodation was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My need for emergency or temporary accommodation was: | | | | | |
| **ITEM 23** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, losing supply of my utilities was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| The loss of utilities items was: | | | | | |
| **ITEM 24** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, losing sleep due to stress or worry was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My loss of sleep due to stress and worry was: | | | | | |
| **ITEM 25** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, increased experiences of depression were: | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My increased experience of depression was: | | | | | |
| **ITEM 26** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, stress-related health problems (e.g. headaches, heart problems) were: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My stress-related health problems were: | | | | | |
| **ITEM 27** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, eating too much was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My over-eating was: | | | | | |
| **ITEM 28** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, reduced physical activity was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My reduced physical activity was: | | | | | |
| **ITEM 29** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, increased tobacco use was: | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My increased use of tobacco was: | | | | | |
| **ITEM 30** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, not eating as much as I should was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My poor eating habits were: | | | | | |
| **ITEM 31** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, increased alcohol consumption was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My increased consumption of alcohol was: | | | | | |
| **ITEM 32** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, neglect of hygiene or self-care was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My neglect of hygiene and self-care was: | | | | | |
| **ITEM 33** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, neglecting my medical needs was: | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My neglect of my medical needs was: | | | | | |
| **ITEM 34** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, increased use of medical services because of health issues arising was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My increased use of medical services due to health issues was: | | | | | |
| **ITEM 35** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, living in unhygienic conditions was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My unhygienic living conditions were: | | | | | |
| **ITEM 36** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, taking money or items from family and friends (without asking) was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My taking of money or items from family or friends without asking first was: | | | | | |

| **ITEM 37** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
|---|---|---|---|---|---|
| During the past 12 months, promising to pay back money without genuinely intending to do so was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| Promising to pay back money without genuinely intending to do so was: | | | | | |
| **ITEM 38** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, feeling compelled to commit a crime or steal money was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| Committing a crime or stealing money was: | | | | | |
| **ITEM 39** | Not a problem, or N/A | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, not fully attending to the needs of my children was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| Not fully attending to the needs of my children was: | | | | | |
| **ITEM 40** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, engaging in petty theft or dishonesty was: | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My engagement in petty theft or dishonesty was: | | | | | |
| **ITEM 41** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, being involved in violent incidents with others was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My involvement in violent incidents with others was: | | | | | |
| **ITEM 42** | Not a problem, or N/A | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, leaving my children unsupervised was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| Leaving my children unsupervised was: | | | | | |
| **ITEM 43** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, getting less enjoyment from the people I care about was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| The reduced enjoyment from with people I care about was: | | | | | |

| **ITEM 44** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
|---|---|---|---|---|---|
| During the past 12 months, spending less time attending social events was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| Spending less time attending social events was: | | | | | |
| **ITEM 45** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, feeling socially isolated was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| Feeling socially isolated was: | | | | | |
| **ITEM 46** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, experiencing greater tension in my relationships was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My experience of greater tension in my relationships was: | | | | | |
| **ITEM 47** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, experiencing greater conflicts in my relationships was; | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| The greater conflict in my relationships was: | | | | | |

| **ITEM 48** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
|---|---|---|---|---|---|
| During the past 12 months, neglecting my relationship responsibilities was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My neglect of relationship responsibilities was: | | | | | |
| **ITEM 49** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, feeling belittled/insulted in my relationships was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My feeling belittled was: | | | | | |
| **ITEM 50** | Not a problem, or N/A | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, threats of relationship separation or ending were: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| The threat of a relationship ending was: | | | | | |
| **ITEM 51** | Not a problem, or N/A | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, actual relationship separation/s was/were: | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| The actual separation or ending of a relationship with me was: | | | | | |
| **ITEM 52** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, being late for study or work commitments was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My being late for work or study commitments was: | | | | | |
| **ITEM 53** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, absence from study or work was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My absence from work or study was: | | | | | |
| **ITEM 54** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, reductions in work or study performance were: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My reduced performance at work or in study was: | | | | | |

| **ITEM 55** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
|---|---|---|---|---|---|
| During the past 12 months, a lack of progression in work or study was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My lack of progression in my job or study was: | | | | | |
| **ITEM 56** | Not a problem, or N/A | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, conflict with co-workers was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My conflict/s with co-workers was/were: | | | | | |
| **ITEM 57** | Not a problem | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, hindered job-seeking efforts were: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My job seeking efforts being hindered was: | | | | | |
| **ITEM 58** | Not a problem, or N/A | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, exclusions from study (i.e., could not continue course) were: | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My exclusion from study was: | | | | | |
| **ITEM 59** | Not a problem, or N/A | A minor problem | A moderate problem | A major problem | A very serious problem |
| During the past 12 months, losing my job was: | | | | | |
| | Not caused by my gaming | Slightly caused by my gaming | Moderately caused by my gaming | Strongly caused by my gaming | Totally caused by my gaming |
| My loss of job was: | | | | | |

## Appendix I: Journal of Gambling Studies Instructions for Authors

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Double-blind peer review
This journal follows a double-blind reviewing procedure. Authors are therefore requested to submit:

A blinded manuscript without any author names and affiliations in the text or on the title page. Self-identifying citations and references in the article text should be avoided.

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The title page should include:

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A concise and informative title
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A clear indication and an active e-mail address of the corresponding author
If available, the 16-digit ORCID of the author(s)

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Please provide an abstract of 150 to 250 words. The abstract should not contain any undefined abbreviations or unspecified references.

Keywords
Please provide 4 to 6 keywords which can be used for indexing purposes.

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Use the automatic page numbering function to number the pages.
Do not use field functions.
Use tab stops or other commands for indents, not the space bar.
Use the table function, not spreadsheets, to make tables.
Use the equation editor or MathType for equations.
Save your file in docx format (Word 2007 or higher) or doc format (older Word versions).

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LaTeX macro package (zip, 183 kB)

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Please use no more than three levels of displayed headings.

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Abbreviations should be defined at first mention and used consistently thereafter.

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Footnotes can be used to give additional information, which may include the citation of a reference included in the reference list. They should not consist solely of a reference citation, and they should never include the bibliographic details of a reference. They should also not contain any figures or tables.

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Acknowledgments

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Please use the standard mathematical notation for formulae, symbols etc.:

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Roman/upright for numerals, operators, and punctuation, and commonly defined functions or abbreviations, e.g., cos, det, e or exp, lim, log, max, min, sin, tan, d (for derivative)

Bold for vectors, tensors, and matrices.

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Cite references in the text by name and year in parentheses.

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