Investigating the role of health factors and psychological well-being in Gaming Disorder

Abstract

The recent recognition of Gaming Disorder (GD) as a mental health issue has provided a unique opportunity for researchers to advance our current understanding of the intricate relationships between GD and specific health-related factors and well-being. The present study sought to investigate the role of key physical and psychological health and well-being factors in GD. To achieve this, the three goals were explored. First, we tested whether GD can be predicted by health and well-being factors such as depression, anxiety, loneliness, attention problems, physical health problems (PHP), and psychological well-being (PWB). Second, we assessed the role of distress tolerance (DT) as a moderator in the relationship between PWB and GD. Third, we examined whether PWB would mediate the relationship between PHP and GD. A sample of 474 participants ($Mean_{age}$ = 28.86 years; SD = 9.23; range: 18-66 years; 47% female) was recruited. The results of the multiple linear regression analysis indicated that age, attention problems, and PHP significantly predicted GD (R^2 = .15). Additionally, the mediation findings uncovered an important direct association between PHP and GD despite the lack of mediation effects through PWB and the absence of moderating effects from distress tolerance. The present findings signify important health-related implications related to GD that are further discussed here in terms diagnosis, treatment, and prevention efforts.

Keywords: gaming disorder, physical health, psychological health, psychological well-being

Introduction

Electronic gaming is increasingly becoming one of the largest forms of leisure and entertainment activity worldwide. The increased availability and accessibility to the expanding genres of video games in recent years has led to the wider interest and growing popularity of gaming as a leisure activity. There are currently numerous video games on the market, some of which contain hundreds of hours of playable content. Furthermore, streaming platforms such as *Twitch, Facebook,* and *YouTube* have also helped increase the popularity of video games[1, 2] since for some gamers, watching other players play is more enjoyable than playing the game itself.[3] Consequently, the growing popularity of video games has led to greater interest within psychological research on the potential positive and negative effects of gaming on psychological health and well-being.

Despite the many advantageous and beneficial effects gaming can have,[4-6] excessive and dysregulated engagement has been shown to be associated with poor psychological, social, and physical well-being.[7-9] As a result, in 2019, the World Health Organisation (WHO) officially recognised Gaming Disorder (GD) as a mental health condition in the eleventh revision of the *International Classification of Diseases* (ICD-11).[10] The ICD-11 characterises GD as excessive video gaming behaviour marked by patterns of impaired control over gaming, increased priority given to gaming over other life priorities, and persistent engagement with video games despite knowledge of its negative effects on psychological, social, and physical well-being.[11]

Previously, Internet Gaming Disorder (IGD) was added to the fifth revision of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) in 2013 as an area for further research.[12] IGD and GD differ in terms of number of diagnostic criteria, with the DSM-5 proposing nine core criteria defining IGD, while the WHO suggested three main criteria to diagnose GD, in addition to the experience of significant functional impairment.[13]

Although previous research has identified health factors for wide and narrow measures of disordered gaming, research on the predictors of GD using the more recent WHO framework remains scarce. Thus, there is a clear need to identify predictors of GD in order to develop effective diagnostic tools for GD and aid the development of effective treatment and prevention strategies.

In terms of prevalence rates, a recent meta-analytic study reviewing the evidence from 53 studies conducted in 17 different countries reported a worldwide prevalence of GD of 3.05%, a figure that was adjusted to 1.96% when considering only studies using robust sampling techniques.[14] In Australia, GD has been shown to affect around 1.8% of adolescents,[15] coinciding with prevalence rates of other countries of up to 5%.[15] Prevalence of GD also appears to be moderated by age, with studies consistently demonstrating that adolescents experience greater symptomology of disordered gaming than older adults.[8, 16]

The relatively low prevalence rates of GD reported in most western populations should not de-emphasise the need for GD as a clinical diagnosis since past research has shown that GD is related to poorer levels of health and well-being cross-sectionally and longitudinally.[17, 18] Specifically, GD has been associated with greater levels of stress,[19] fatigue,[9] attention problems,[20] medical illnesses, [21] lower life satisfaction,[22] and increased levels of depression, anxiety, loneliness, and poorer psychological health.[7, 8, 18, 23] It is worth noting though, that such relationships have been shown to be bi-directional under specific contexts,[24-26] therefore, the investigation of the nature of the associations proposed in this study are exploratory albeit needed since there are growing concerns about the potential detrimental effects that GD may have on health.[27]

The Current Study

Research focussing on the potential associated risk factors of GD is paramount for effective understanding and diagnosis of the disorder.[28] Due to the relative recency of the acceptance of GD by the WHO, relationships between GD and negative health outcomes (both mental and physical) are currently under researched when considering the WHO framework defining GD.[10] Therefore, the main aim of this study was to investigate the role of key physical and psychological health measures alongside well-being factors in GD, so that clinicians may better identify those who are at greater risk of developing GD, and to assist the development of future preventative strategies for GD.

Therefore, three key exploratory goals were devised for the present study. First, we tested whether GD can be predicted by health and well-being factors including depression, anxiety, loneliness, attention problems, physical health problems (PHP), and psychological well-being (PWB). Second, given that distress tolerance (DT) has been identified as an important protective factor for mental health disorders, including addictive disorders,[29-31] this study examined the role of DT as a moderator in the relationship between PWB and GD. Third, we assessed whether PWB mediated the relationship between PHP and GD.

Methods

Participants and procedure

An a-priori power analysis for testing linear models was conducted using G*Power (v.3.1.9.6).[32] The a-priori test was estimated with the six main predictor variables of the study, and had a pre-set power (1 - β = .95), medium effect size (f^2 = .15), and α = .05. The choice of the effect size was informed by previous research reporting medium effects regarding the association between disordered gaming and health-related outcomes (see [33-35]).

The results of the power analysis indicated that a minimum sample size of 146 participants would be required to obtain a power of .95.

A total of 515 participants were recruited online. However, data from 41 participants were excluded due to failing at least one attention check. Therefore, data from a total of 474 participants was analysed in the present study. To be eligible for the study, participants had to: i) be at least 18 years old, ii) be either an Australian citizen or resident, and iii) be a fluent English speaker. Participants' ages ranged from 18 to 66 years, with a mean age of 28.86 years (SD = 9.23) and 47% (n = 224) reporting being female.

The online survey was created on *SurveyMonkey*, with data being collected from June to September, 2020. Participants were recruited online via social media platforms (i.e., *Facebook*, *Reddit*, and *Instagram*) and *Prolific*. The first page of the survey provided information about the study complying with Plain Language Information Statement (PLIS) guidelines and ensuring participants of their anonymity, confidentiality, and right to withdraw. Participants recruited via *Prolific* received approximately $2.22 AUD (£1.13 GBP) as monetary compensation, while those recruited via social media were not compensated for their participation. The present study was granted ethics approval by the Tasmania Social Sciences Human Research Ethics Committee (Project ID: 20602).

Measures

Sociodemographics and video game use. Participants provided data on their basic sociodemographic features (e.g., age, gender) and gaming behaviours (see Table 1 for a full description).

[Insert Table 1 about here]

Disordered gaming. The Gaming Disorder Test (GDT)[36] was used to assess GD as defined in the ICD-11.[11] The GDT examines both online and offline video game use/behaviour across a 12-month timeframe. All items are answered using a 5-point Likert scale (from 1: *never* to 5: *very often*). Total scores are obtained by summing all responses and can range from 4 to 20, with higher scores indicating greater levels of disordered gaming behaviour. The GDT has been previously shown to psychometrically sound.[36] In the present study, the GDT had adequate internal consistency (α = .82).

Psychological health. The depression and anxiety subscales from the Depression Anxiety and Stress Scales – 21 (DASS-21)[37] were utilised to measure symptoms and severity of depression and anxiety. Each subscale consists of seven items, with responses given using a 4-point Likert scale (from 1: *never* to 4: *always*). Total scores for depression and anxiety range from 7 to 49, with higher scores being indicative of greater levels of depression or anxiety. In the present study this tool had adequate internal consistency (depression α = .93 and anxiety α = .86).

Physical health and psychological well-being. The Two-item PROMIS Global Health scale (v 1.20)[38] consists of two subscales containing two items each, with one scale measuring PHP and the other measuring PWB. Responses are given using a 5-point Likert scale for items 1-3 (from 1: *excellent* to 5: *poor*) and for item 4 (from 1: *completely* to 5: *not at all*). Total scores for PHP and PWB can range from 2 to 10, with higher scores indicating greater presence of PHP and or poorer PWB. In the present study this tool had adequate internal consistency (α = .71).

Loneliness. The Three-Item Loneliness Scale[39] utilises three items to assess symptoms of loneliness. Responses are given using a 4-point Likert scale (from 1: *never* to 4: *always*). Total scores can range from 3 to 12 with higher scores being indicative of higher levels of

loneliness. In the present study the Three-Item Loneliness Scale had adequate internal consistency (α = .85).

Attention problems. The Attention Problem Scale[40] consists of three items designed to measure attentional difficulties. Responses are given using a 5-point Likert scale (from 1: *strongly disagree* to 5: *strongly agree*). Scores range from 3 to 15 with higher scores being indicative of greater levels of attention problems. In the present study this tool had adequate internal consistency (α = .75).

Distress tolerance. The Distress Tolerance Scale-Short Form (DTS-SF)[41] is a four-item measure of DT.[42] Responses are given using a 5-point Likert scale (from 1: *strongly disagree* to 5: *strongly agree*). Total scores range from 5 to 20 with lower scores being indicative of greater ability to tolerate distress. In the present study the DTS-SF had adequate internal consistency (α = .87).

Statistical analysis

Prior to conducting the formal statistical analyses, parametric assumptions were checked to ascertain the appropriateness of the analyses. Shapiro-Wilk tests of normality were significant ($p < .001$), suggesting non-normal distribution of scores for all variables. Further inspection of the Skewness and Kurtosis levels for each main variable indicated that depression, anxiety, loneliness, attention problems, PHP, PWB, and DT scores met the univariate normal distribution assumption (Skewness < 3.0 and Kurtosis < 8.0).[43] Potential multicollinearity issues were assessed, and values for Variance Inflation Factors were below 2.5 while Tolerance levels were above 0.4, thus not indicating multicollinearity.[44]

To investigate the study's first goal a multiple linear regression model was estimated using R (4.0.2)[45] to test a predictive model for GD based on the following health and well-being predictors: depression, anxiety, loneliness, attention problems, PHP, and PWB, including age as a control variable. Both the Breusch Pagan test of heteroscedasticity and

Bartlett's test of homogeneity were significant ($p < .001$), suggesting heteroscedasticity within the multiple linear regression model. Thus, the model was estimated using robust standard errors to account for this issue.[46] To investigate the remaining goals of the study, a moderated mediation analysis was conducted using *Jamovi* (1.2.5.0)[47] to examine the potential mediating effect of PWB, between PHP and GD, while also accounting for the potential moderating effect of DT.

Results

Multiple linear regression

Overall, the model accounted for approximately 15% of the total variance in GD (R^2 = .15, ΔR^2 = .14, $F(7, 466) = 11.86$, $p < .001$). In terms of specific predictors, age (β = -0.04, t = -2.55, p = .011), attention problems (β = 0.24, t = 3.69, $p < .001$), and PHP (β = 0.26, t = 2.31, p = .021) emerged as statistically significant predictors. Conversely, depression (β = 0.09, t = 1.76, p = .079), anxiety (β = 0.04, t = 0.67, p = .503), loneliness (β = 0.11, t = 1.24, p = .215), and PWB (β = 0.16, t = 1.42, p = .157) did not emerge as significant predictors of GD (see Table 2).

[Insert Table 2 about here]

Moderated mediation

A moderated mediation model with 1,000 bootstrapped samples was estimated to test for mediation effects of PWB on the relationship between PHP and GD, conditional of DT. It was found that DT had no moderation effects in the model (B = 0.00, SE = 0.02, 95%CI [-0.04, 0.05], β = 0.02, p = .905). Moreover, the direct and indirect pathways of the model

revealed a statistically significant negative effect of PHP on PWB (*a* path) (*B* = -0.49, SE = 0.06, 95%CI [-0.59, -0.37], β = -0.36, $p < .001$), suggesting that PHP worsen PWB.

However, PWB was not shown to have a significant effect on GD (*b* path) (*B* = -0.08, SE = 0.09, 95%CI [-0.27, 0.10], β = -0.05, $p = .386$). The indirect effect (*ab* path) was found to be non-significant (*B* = 0.04, SE = 0.05, 95%CI [-0.05, 0.13], β = 0.02, $p = .389$), indicating that PWB does not fully, nor partially mediate the relationship between PHP and GD in this model. Finally, the direct effect (*c'*) was found to be significant (*B* = 0.26, SE = 0.12, 95%CI [0.04, 048], β = 0.12, $p = .020$), indicating that higher levels of PHP are associated with higher levels of GD.

[Insert Figure 1 about here]

Discussion

The main aim of this study was to explore the role of health and well-being factors in predicting GD. In the present study, particular focus was given to physical health, considering additional psychological factors. With the WHO acknowledging GD as a behavioural addiction, there is a need for identifying predictors of GD to assist with the future diagnoses of GD and the development of prevention strategies and treatment for this condition. Previous research on disordered gaming using the APA framework for IGD identified depression, anxiety, loneliness, attention problems, PHP, and PWB, as important correlates of IGD.[7, 8]

In regard to the first goal of this study, the multiple linear regression model investigating whether GD could be predicted by following health and well-being factors (i.e., depression, anxiety, loneliness, attention problems, PHP, and PWB) was able to account for about 15% of the total variance in GD scores, with age, attention problems, and PHP being the most relevant predictors. Interestingly, PHP was the strongest predictor of GD in this study. Nevertheless, the findings that depression, anxiety, loneliness, and PWB were not

significant predictors of GD are not consistent with previous empirical literature reporting associations between GD and these factors.[7, 18, 48-50] Following this, a moderated mediation analysis was conducted to explore the second and third aims of the present study.

This study found that attention problems predicted GD successfully, a finding that converges with previous research reporting positive associations between ADHD and GD, and subclinical attention issues and GD.[20, 51-53] Although causality cannot be inferred here, previous literature has provided theoretical perspectives on the relationship between attention and gaming.[20, 39, 45] For instance, the engaging and exciting nature of video games may be what draws people with attention problems to gaming.[54] Video games are enticing, challenging, and have attention grabbing features, and while these features may attract gamers, they may also make it more difficult for individuals with attention problems to divert their attention elsewhere and stop playing.[20, 54] Furthermore, video games may also be used as a coping or escape method for such attention problems.[48] In light of previous research,[55] it can be concluded that individuals with attention problems may be more prone to impulsive decision-making, which may lead to GD.

The results obtained in this study showing that PHP is associated with increases in GD mirror those of previous work finding positive associations between PHP and excessive gaming.[9, 21] More specifically, PHP was shown to meaningfully predict changes in GD, within the regression model, suggesting that PHP is a unique correlate of GD, and that individuals who experience general physical impairments (e.g., overweight, physical injuries, illness) are at greater risk of developing GD.

There are a few potential reasons underpinning the relationship between PHP and GD. Previous research has suggested that time spent gaming may reduce one's availability for physical activity.[56] Another plausible explanation is that physically unwell individuals may use gaming as a method of coping and escaping from their health issues.[13] This finding aligns

with previous reports suggesting that gaming can constitute a coping mechanism for non-physical illnesses such as schizophrenia.[57] Furthermore, GD has been associated with other addictive disorders such as smoking and alcohol use, which can also negatively impact physical health.[21, 58]

It is known that the etiology of addiction in the context of illness has been hypothesised as a form of self-medication.[59] The self-medication hypothesis suggests that when an individual is experiencing poor health, they are more likely to develop addictive disorders that provide relief from their symptoms, rendering them more vulnerable to addictions.[59] While the self-medication hypothesis is more commonly used to explain the development of substance abuse, a recent study found escapism to be the greatest predictor of GD among common motivations for gaming, thus providing indirect evidence of video games acting as a form of self-medication.[13] At the theoretical level, the current findings provide support for the self-medication hypothesis.

Despite previous literature finding moderating effects of DT between relationships of poor psychological health and addictions,[60, 61] this study found that DT did not play a protective role against the development of GD for those with greater symptomology of depression, anxiety, and/or poorer PWB. This analysis also found a significant main effect of PHP on PWB, however, no indirect effect of PHP on GD was found through PWB, and DT did not significantly moderate the pathway between PWB and GD. This indicates that PWB did not mediate the relationship between PHP and GD when accounting for the moderating effects of DT.

There are several important implications that can be drawn from this study. For example, health practitioners should assess for GD alongside the related health factors identified in this study. In doing so, health practitioners may pinpoint underlying health issues potentially causing, or being caused by, GD, or otherwise identify comorbidities of

mental illness experienced by clients. This will aid the development of effective treatment plans for individuals who experience GD. An additional implication of the present findings is that they may help identify populations more susceptible to developing GD and, as such, prevention strategies targeting these at-risk populations should be implemented. More specifically, video game use should be monitored in individuals who experience attention problems, so that gaming does not reach unhealthy levels. As previously suggested,[28] this onus of responsibility is not only on the individual, nor on health practitioners, but also the gaming industry itself.[62] The findings reported in the present study pave the way to future individual differences research examining potential gender effects in GD. Given the existing mixed findings regarding GD prevalence rates in terms of gender, it is paramount to test the present findings to further elucidate about specific gender-related vulnerability and impairments.

The present study was not without potential limitations. First, the sampling strategy that was used limited recruitment to a population of internet users, and thus, sampling bias may be present. Moreover, the sample was not recruited from a clinical setting, therefore, the results should be interpreted within a dimensional perspective based on higher and lower GD symptom severity and how these fluctuations may affect other variables proportionally. The use of a cross sectional design also presents with limitations and renders the findings reported not causal in nature. Another potential limitation of this study relates to the current COVID-19 pandemic, which may interfere with the present results given the potentially increased level of mental health issues experienced globally,[63, 64] particularly in the context of technology use.[65] Furthermore, results pertaining to video game use may have been affected by increased engagement in internet and gaming activities as a coping response to pandemic-induced stress and global restrictions (e.g., lockdowns).[66-69] Finally, this study did not test for

specific illness or injuries (e.g., fatigue, body mass index, broken limbs, and cancer), so the relationship between PHP and GD may be limited in nature.

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