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RESEARCH ARTICLE

The psychosocial risk factors of internet gaming disorder among Malaysian young adult players

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ABSTRACT

Internet gaming disorder is a type of maladaptive behavior that can arise from gaming activities. Analyzing the risk factors is crucial to understanding the trajectory of the disorder. This study aims to determine the differences between low and high psychological risk factors (loneliness, basic psychological needs, state boredom, and family function) and their relationship with internet gaming disorder. The study also examines the role of risk factors as a potential influence. A cross-sectional design and an online survey questionnaire were utilized to carry out the study. A total of 462 Malaysian young adult players aged 18 to 30 participated (mean=23.44, SD=3.00). The findings indicate that the psychological risk factors have significant differences and relationships with internet gaming disorder symptoms, with loneliness, state boredom (including high arousal in boredom), and family function appearing as influential factors. However, the basic psychological needs in life do not significantly have relationships and cannot be influenced by the internet gaming disorder. Although the study has limitations in terms of generalizability, the findings can be valuable for guiding future comprehensive studies on internet gaming disorder among young adults, especially in the Malaysian population.

Keywords: internet gaming disorder; loneliness; basic psychological needs; boredom; family; young adults

1. Introduction

The gaming industry has seen a significant increase in participation due to new global technology. It is projected that by 2024, there will be 3.32 billion gamers worldwide, while the number of Malaysian consumers in the video game market is expected to reach 7.0 million users by 2027[1,2]. While playing games can be a temporary stress reliever for some individuals if it becomes maladaptive, it can lead to negative

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behaviors and potentially a disorder[3] called Internet Gaming Disorder (IGD). This disorder is currently under "condition for further study" in the Diagnostic and Statistical Manual of Mental Disorders 5th edition [DSM-5=TR]. It is defined as persistent use of the internet to play games, usually with others, resulting in a severe deterioration in everyday functioning, work, and/or education and clinically significant disturbance or anxiety[4,5].

Previous studies of IGD have had difficulty determining risk factors as they only examined a few independent variables[6,7]. However, some psychological factors, such as loneliness, basic psychological needs, boredom, and family functioning, have been identified as risk factors[8–11]. Nevertheless, there is still much uncertainty surrounding the relationship between the psychosocial risk factors of IGD, particularly among Malaysian young adults who are involved in games.

1.1. Risk factors of gaming disorder

Loneliness was selected as consistently appears as a psychological risk factor in prior research on IGD. Loneliness is a complex emotional state characterized by negative feelings associated with social interactions and a sense of isolation or separation[12]. Online connections, such as gaming, have become the primary source of support for lonely individuals[13]. However, studies have shown that players who feel lonely tend to be at a higher risk for developing problematic gaming habits[9,14,15]. Players reported feelings of loneliness[16]. Two longitudinal studies produced conflicting findings on the relationship between gaming problems and loneliness. While[17] found no correlation between gaming problems and loneliness,[18] discovered a significant correlation. However, as both studies only asked one question about loneliness, their findings may be subject to dispute.

Next, individuals who cannot meet their needs in real life may turn to playing games to meet various psychological needs [15,19]. Basic psychological needs (BPNs) are crucial as they are directly linked to a player's intrinsic motivation. Insufficient fulfilment of BPNs, which is autonomy-to have a choice and willingly support one's behavior; relatedness-to feel connected and a sense of belonging to others; and competence-mastery and practical experience in one's activities associated with a higher risk of developing IGD[6,20–22]. However, recent literature has presented conflicting results which is increased BPNs in life led to increased IGD symptoms during the COVID-19 pandemic[23]. As a result, the role of BPNs in the development of problematic gaming is still unclear, and further research is necessary to address these mixed findings, as they are often overlooked[19].

Engaging in gaming activities can alleviate or avoid boredom, which is identified as one of the etiological risk factors for IGD[24,25]. The state boredom (SB) has been associated with many behavioral addictions (e.g., live streaming addiction, Problematic Facebook Use (PFU), Internet Addiction (IA), phubbing, and media use[26–30]. Nevertheless, the present study found only one prior finding about the association between SB and IGD[e.g., 11], despite existing evidence linking boredom proneness and leisure boredom to IGD symptoms. Hence, SB was included because, although often overlooked, it is acknowledged in literature as a significant contributor to technology addiction.

Lastly, the neurobiological approach supported the relationship between family function and gaming disorder and its role in gaming addiction rehabilitation[31]. In addition, it has been found that young people with problematic internet use tend to have poorer family relationships[32,33]. Nevertheless, research frequently focuses on the relationship between this factor and IGD in adolescents[e.g., 8,34,35]. It is important to note that dysfunctional family interaction patterns contribute to the development of problematic behavior, and the quality of family relationships is a target in intervention programs for youth with behavioral problems[8].The established impact of family relationships on addictive behaviors, particularly in young adults frequently less examined.

It is necessary to know that these psychological risk factors are crucial in relationships with IGD. Some players with high levels of loneliness tend to engage in gaming as a social activity. A non-functioning family might worsen this situation because they are more susceptible to risk-taking behaviors[17,36], which may increase the likelihood of exhibiting IGD. Moreover, the lack of social stimulation in real life may predispose individuals to boredom and the use of Internet tools (such as games) as a socializing instrument for boredom and loneliness alleviation[37]. In addition, the unfulfilled needs might cause negative behavior aimed at compensating for their emotional distress[6,20], which is experienced along with feelings of loneliness, boredom, and family dysfunction.

1.2. The present study

The ongoing discussion is around the potential risk factors that may contribute to the emergence of symptoms associated with IGD. More research in the field is needed to comprehend the risk factors of IGD and the contradiction of the prior findings.

The objective of this study is to examine the risk variables, namely loneliness, BPNs in life, SB, and FF, that contribute to symptoms of IGD among young adult Malaysian players. Previous literature suggests that there is a hypothesis stating that risk factors are statistically significant (loneliness [positive]; BPNs in life and their components [negative]; state boredom and the components [positive]; and family function [negative]) relationship and predict the IGD symptoms.

2. Materials and methods

A cross-sectional survey was carried out due to its common usage in determining the prevailing characteristics of a population at a specific moment in time. The data was obtained via an online survey questionnaire (Google Form). The study employs non-probability sampling methods, purposive and snowball sampling, after consideration due to the challenge of acquiring a sample (the study was initially designed to use probability sampling techniques by sending requests for participation to 19 universities, 13 community colleges and vocational schools, and seven youth organizations. The present study faced challenges during data collection due to the limited number of participants, as only three institutions responded). The inclusion criteria for participation in the current study were individuals (i) aged 18 to 30, (ii) playing games, (iii) Malaysian, and (iv) possessing proficiency in reading, writing, and typing in either Malay or English.

2.1. Participants

Table 1 shows the demographics of the sample in this study. The sample consisted of 462 game-playing individuals (48.1% males; n=222) with mean age of 23.44 years old (SD=3.00). The sample had mostly identified as Malays (65.6%; n=302), following Chinese (13.9%; n=64), Indian (9.5%; n=44), and others (indigenous people; 11.1%; n=51). Approximately 62.8% (n = 290) of young adults had tertiary education and the remaining participants were in post-secondary or secondary education. Furthermore, half of the participants were students (48.3%; n=223). Mostly are unmarried (82.7%; n=382). The mean number of individuals living in the participants' household was 4.72 (SD=1.99).

Table 1. Demographics of the sample in the study.

Demographics	**Groups**	***f***	***%***
Gender	Male	222	48.1
	Female	240	51.9
Age (18-30 years old)	-	$\bar{x}$=23.44 (SD=3.00)	
Ethnicity	Malay	302	65.6
	Chinese	64	13.9

Demographics	Groups	*f*	*%*
	Indian	44	9.5
	Others	51	11.1
Level of educational	Tertiary education	290	62.8
	Post-/secondary education	172	37.2
Work status	Employed	217	47.0
	Student	223	48.3
	Unemployed	22	4.8
Marital status	Married	80	17.3
	Unmarried	382	82.7
Size of the families	-	$\bar{x}$=4.715 or 5 (SD=1.986)	

Table 1. (*Continued*)

f: frequency, %: percent, $\bar{x}$: mean, SD: standard deviation

2.2. Measures

The Malay version of the Internet Gaming Disorder Scale–Short Form (IGDS9-SF-M)[38,39] was used to assess the severity of IGD symptoms over the past 12 months. Item (e.g., "Have you deceived any of your family members, therapists or others because of the amount of your gaming activity?") are rated using a 5-point Likert scale from 1 (never) to 5 (very often). It has been shown to have a unidimensional factors structure across all its 15-language version (e.g., Malay, Chinese, and Korean) [40]. The scale compromises nine items, each representing the DSM-5-TR criteria for IGD. The reliability of internal consistency of the IGDS9-SF-M in the present study was excellent (Cronbach's alpha=.92). The IGDS9-SF-M cut-off values are 32, as suggested [41] were utilized in the present study. The individuals who exceeded the cut-off value (>32) were coded as '1' (high risk), and those below the cut-off value were coded as '0' (low risk).

Loneliness was measured using the University of California Los Angeles Loneliness Scale (ULS-20), version 3, which contains 20 unidimensional items[42]. It measures a person's subjective feeling of loneliness and social isolation (e.g., "How often do you feel that you are 'in tune' with the people around you?"). Items are rated using a 5-point Likert scale from 1 (never) to 4 (always). The reliability of the ULS-20 in the present study was considered good (Cronbach's alpha=.80). The original ULS-20 test is separated into four groups of loneliness (low, moderate, moderately high, and high). The median score of the present study is 50 (in the original test, it is a borderline between moderate and moderately high); thus, the individuals who exceeded the cut-off value (>50) were coded as '1' (high loneliness).

The Basic Psychological Need Satisfaction Scale (BPNSS)[43,44] measures the satisfaction of BPNs in life. This test tool is multidimensional and has three subscales (autonomy, relatedness, and competence) with a total of 21 items (e.g., "I feel like I am free to decide for myself how to live my life"). Each item is rated using a 7-point Likert scale from 1 (not true at all) to 7 (very true). Overall, the reliability of the BPNSS in the present study was excellent by subscales (Cronbach's alpha = .81 to .89) and overall (Cronbach's alpha=.95). The median cut-off was used since some items have been removed to increase the Cronbach's alpha value (as explained in subsection: Translation of the Self-report Measures into Malay Language), hence, the test's total score is calculated, followed by the determination of the median value from the total score and individual scores who exceed the median value are coded as '1'.

Multidimensional State Boredom Scale (MSBS)[45] measures the SB that consists of five subscales, namely, time perception, disengagement, inattention, low arousal, and high arousal that were measured by self-report with 29 items in the present study (e.g., "I am stuck in a situation that I feel is irrelevant"). Each item is rated using a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree), the highest score

indicating high SB. The reliability of the MSBS in the present study was excellent by subscales (Cronbach's alpha=.90 to .93) and overall (Cronbach's alpha=.98). The median cut-off value for overall scale and by dimensions was utilized in the present study since there is no available cut-off value.

FF was measured using the Family Distress Index Questionnaire (APGAR) developed by [46]. This test tool is unidimensional and contains five items. Each item measures five components of FF: Adaptability, Partnership, Growth, Affection, and Resolve, which produce the acronym APGAR (e.g., "I am satisfied that I can turn to my family for help when something is troubling me"). Items are measured using a 3-point Likert scale from 0 (very rarely) to 2 (almost always), the highest score indicating high family functionality. The reliability of the APGAR in the present study was good (Cronbach's alpha=.82). Scores 7-10 indicated high FF as stated from the original scale; hence, in the present study, individuals who have high FF were coded as '1', and those below the value (<7) were coded as '0' (low FF).

2.3. Translation of the self-report measures into malay language.

All scales (except IGDS9-SF-M) originally in English were translated with a forward-backwards translation for cross-cultural adaptation of self-reported[47,48]. The forward translation was done by a professional translator and reviewed by bilingual expert panels from psychologists and practitioners to ensure no expression is considered offensive or intrusive or to utilize the conceptual meaning of a word or phrase. The measurement was then undertaken by native Malay speakers and then back-translated by a professional translator with no prior knowledge of the scales. Further modifications were made by reviewing all versions until a satisfactory version was achieved, followed by a pilot study of 200 university students (January 25th-1st May 2023). A retest of the test instrument was conducted three weeks later in the same sample. The final step is to produce the final version of the customized test tool.

During the pilot and the present study, the BPNSS showed a low Cronbach alpha value when measuring the mix of positive and negative items. Therefore, in further analysis of the current study, the negative items were removed for BPNSS by taking into consideration that it is better not to use a mixed scale to control for agreement response bias as it may affect the accuracy of the response and consider the use either positive or negative versions is better[49]. The value of Cronbach's alpha mentioned above in the present study was after removing negative items.

2.4. Procedure

The data were collected using an online survey tool (Google Forms) from June 20th to September 30th, 2023. Invitation letters and posters advertising the study, including research information, participation criteria, and survey links via QR code, were sent to several universities, colleges, youth organizations, and social media gaming groups. Additionally, three Malaysian gaming content creators (gamers who are creating and sharing content related to video games on social media) shared the study information and survey link with other gamers who met the inclusion criteria (i.e., snowball sampling). Prior to the survey, participants were asked to confirm their eligibility. The survey took approximately 15-25 minutes to complete.

2.5. Statistical analyses

Statistical analyses were performed using SPSS version 29 (SSPS Inc., Chicago, IL). Descriptive statistics included means, medians, standard deviations, frequencies, and percentages. The present study used a dichotomous analysis approach because the Kolmogorov-Smirnov test revealed that the data in the present study exhibited a non-normal distribution ($p<.001$); hence, categorical data was used when handling non-normally distributed data, usually encountered when involving psychological studies[50].

Next, Pearson Chi-Square test analysis was used to compare and correlate groups with IGD. The interpretation of the strength of the association between the independent (i.e., loneliness, BPNs, SB, FF) and dependent variables (IGD) is determined by using the phi (ϕ) value, considering the contingency table of the categorical variables is 2x2. The Spearman correlation analysis was also used to determine the correlation between the study variables. Interpretation of the phi and correlation values (weak to strong) were referred to previous literature[51].

The present study used a procedure from[52] by using multiple logistic regression analysis to determine the influence between study variables by generating crude odds ratio (cOR) and adjusted odds ratio (aOR) with a 95% Confidence Interval (CI). The Hosmer-Lemeshow is used to assess the goodness of fit. The *p*-value more than a significant level ($p>.05$) indicated that the model is a good fit for the data[53].

3. Results

3.1. Correlation analysis

Table 2 presents the correlation matrix between the psychological risk factors with IGD. A Pearson Chi-square assessed the relationship between loneliness and IGD groups (high vs. low). There was significant strong relationship between the two variables, $\chi^2(1,462)=19.37$, $p<.001$, $\phi=.21$. Also, there was a significant positive relationship between loneliness and IGD, $r=.43$, $p<.001$ in Spearman analysis.

The second risk factor, overall BPNs in life was a significant moderate relationship between the variable and IGD, $\chi^2(1,462)=6.71$, $p<.05$, $\phi=.12$. However, Spearman analysis shows there was no significant relationship between overall BPNs in life and IGD, $r=.00$, $p>.05$. Autonomy ([$\chi^2(1,462)=5.36$, $p<.05$, $\phi=.11$]; r=.-.03, p>.05) and competence ([$\chi^2(1,462)=6.79$, $p<.05$, $\phi=.12$]; r=-.02, p>.05) was also show the same results. Interestingly, there was no significant relationship between relatedness and IGD for both analyses, [$\chi^2(1,462)=3.77$, $p>.05$, $\phi=.09$]; $r=.00$, $p>.05$.

The third risk factor, the percentage of participants that were in SB, did differ by IGD symptoms, which is strong relationship [$\chi^2(1,462)=19.80$, $p<.001$, $\phi=.21$]. Spearman analysis shows a significant positive and moderate relationship between the two variables, $r=.56$, $p<.001$. Furthermore, there was strong to very strong relationship between SB components and IGD symptoms, namely, high arousal [$\chi^2(1,462)=60.83$, $p<.001$, $\phi=.36$], low arousal [$\chi^2(1,462)=24.81$, $p<.001$, $\phi=.23$], inattention [$\chi^2(1, 462)=21.84$, $p<.001$, $\phi=.22$], time perception [$\chi^2(1,462)=17.22$, $p<.001$, $\phi=.19$], and disengagement [$\chi^2(1,462)=16.62$, $p<.001$, $\phi=.19$ respectively. Additionally, Spearman analysis resulted in a moderate and positive relationship between these variables and IGD, with high arousal ($r=.62$, $p<.001$) as the highest, followed by inattention ($r=.54$, $p<.001$), time perception ($r=.51$, $p<.001$), low arousal ($r=.48$, $p<.001$), and disengagement ($r=.45$, $p<.001$).

Lastly, the percentage of participants with FF did differ by IGD symptoms and there was a significantly negative and very weak relationship between FF and IGD, [$\chi^2(1, 462)=5.52$, $p< .05$, $\phi=-.04$]; $r=-.15$, $p<.05$.

3.2. Regression analysis

Table 3 shows the result of the logistic regression analysis performed to ascertain the effects of psychological risk factors and IGD.

The first analysis (Model 1) included all variables that show a significant relationship with IGD (relatedness in BPN was excluded), and the Hosmer and Lemeshow test is shows no goodness fit model to the data, $\chi^2(8,462)=26.83$, $p<.001$. Surprisingly, the present study failed to achieve the goodness fit model after removing all the non-significant variables from the analysis. Thus, considering that BPNs in life and its subcomponents failed to show a significant relationship in one of the analyses (Pearson chi-square or

Spearman analysis), the present study decides to remove the variable from further analysis due to inconsistent results.

In Model 2, the variables were removed based on the highest significant value until the model achieved a goodness fit to the study's data; hence, inattention (p=.90) and time perception (p=.49) were removed. The adjusted model with the remaining variables was statistically significant, $\chi^2(5,462)=94.76$, $p<.001$. The model explained the variance change, $R^2=18.50\%$ (Cox and Snell), $R^2=32.00\%$ (Nagelkerke), and correctly classified 86.60% of cases. Hosmer-Lemeshow reported this model as a goodness fit, $\chi^2(6,462)=10.60$, $p>.05$. High arousal in SB was 12 times (aOR=12.00, 95%CI [5.07, 28.40]) followed by FF with 5.43 times (aOR=5.43, 95%CI [2.74, 10.76]), and loneliness with 2.35 times (aOR=2.35, 95%CI [1.05, 5.30]) as likely to predict IGD. Furthermore, analysis between each variable and IGD shows that high arousal was still the highest likelihood to predict IGD with 12.53 times (cOR=12.53, 95%CI [5.84, 26.86]). However, loneliness was the second highest compared to the adjusted model with three times (cOR=3.14, 95%CI [1.86, 5.32]), and FF shows 1.88 times as likely to predict IGD.

The present results were supported by another analysis: the overall psychosocial risk factors and IGD (Model 3). After removing BPN in-life to achieve the goodness fit of the model to the data, the model of components risk factors was statistically significant, $\chi^2(3,462)=47.71$, $p<.001$. The model explained the variance change, $R^2=9.8\%$ (Cox and Snell), $R^2=16.9\%$ (Nagelkerke), and correctly classified 84.4% of cases. Hosmer-Lemeshow reported this model to be a goodness fit, $\chi^2(4,462)=2.67$, $p>.05$. To be precise, the FF was the highest risk factors that were four times as likely to predict IGD (OR=4.29, 95%CI [2.31, 7.95]) followed by SB with three times (OR=3.26, 95%CI [1.61, 6.59]), and loneliness with 2.6 times (OR=2.60, 95%CI [1.31, 5.14]). Based on the overall analysis, BPNs in life did not significantly predict IGD in our sample study.

4. Discussion

The present study examines the correlation and likelihood of the predictions between psychosocial risk factors and IGD symptoms in young adult Malaysian gamers. To sum up, the study found that the percentage of people who were lonely had BPNs in-life with important subcomponents like autonomy and competence, felt overall SB with subcomponents like time perception, disengagement, inattention, low arousal, and high arousal, and FF did differ based on symptoms of IGD. On the contrary, BPNs in life and their components exhibit no significant correlation with IGD, while other psychosocial risk factors indicate a weak to moderate relationship with IGD. In our sample study, among the only psychosocial risk factors that can predict the likelihood of IGD are loneliness, SB (both overall and high arousal), and FF.

4.1. Loneliness and IGD

It was hypothesized that there was a positive relationship and effect between loneliness and IGD. The results of this study show that those with a strong magnitude relationship, which is high loneliness, were more likely to have high IGD than those with low loneliness. Additionally, there was a positive and moderate correlation between the two variables. In Model 2 (adjusted) and Model 3 (overall score), loneliness was the third highest (between the other two significant variables) likely to predict IGD with 2.35 to 2.60 times, while in simple model (crude), loneliness is the second highest variable to predict IGD with 3.14 times. Increased loneliness leads to distress in early adulthood, which is an essential predictor of the game[54].

This finding is consistent with the previous research[14,17,55]. These relationships may partly be explained by increased loneliness, a factor linked to personal distress in early adulthood, which is a significant predictor of gaming problems as finding solace in the virtual world and alleviating feelings of loneliness[54,55], especially among young adult. Players with high engagement with the game are more likely to experience feelings of

loneliness and the desire to have more friends because of the feeling of comfort with their in-game relationships, leading them to unconsciously spend more time playing, potentially increasing symptoms of IGD[17,18]. It can, therefore, be assumed that loneliness can be a risk factor for IGD in the present study.

4.2. Basic psychology needs and IGD

On the question of BPN, this study found a moderate magnitude of the differences in overall satisfaction of BPN in life, autonomy, and competence with IGD symptoms. However, contrary to expectations, there was no significant result of the relationship and influence of BPN and its subcomponents with IGD. Therefore, the present study does not support the hypothesis that there was negative relationship to IGD[e.g., 6,19,21,22]. This contradictory finding could be explained by the fact that frustration with BPNs in life is a more crucial predictor of IGD symptoms[10] compared to satisfaction in life, as supported by the "pull" and "push" concept in-gaming[56]. This concept explains gaming through in-game needs satisfaction and reluctance to engage in problematic gaming due to frustration within life needs.

Furthermore, individuals with high BPNs in life, including autonomy and competence, were found to be more likely to develop high IGD symptoms than their counterparts. These results reflect those of a similar study by [23], who also found that individual who played many games that have been satisfying their BPN in life. Moreover, relatedness does not play an important role as risk factor of IGD. This further support the idea of that social game's motivation (socializing, relationships, and group collaboration) has no significant relationship or very low relationship with IGD, as proposed by[57]. Unfortunately, these findings are rather difficult to interpret because of the mixed findings with past literature. Therefore, further work is needed to develop reliable findings.

4.3. State boredom and IGD

There were differences between the two groups of overall-SB (including its subcomponents) and IGD symptoms. The results of this study accept the hypothesis that an increase in SB will increase the likelihood of IGD in a moderate magnitude from our study sample. Among the subcomponents of SB, only the odd that high arousal shows a significant predictor of IGD with 12.00 to 12.53 times larger than their counterpart. Additionally, overall SB is the second predictor of IGD symptoms. The present study supported the findings of [11]. The SB can be triggered by the environment and experienced by all individuals [30]. Hence, it is important risk factor and the emergence of behavioral problems in technology use[i.e, 28–30] including IGD.

Additionally, it is difficult to explain the result between high arousal and IGD due to a lack of previous research. However, it might be related to monotonous activities that can increase high emotional arousal in boredom such as frustration, anxiety, and agitation[58–60]. Simple games (e.g., Candy Crush) can cause low arousal for those who play [24]. It seems possible that to decrease the high level of arousal during boredom, which will cause feelings of frustration, anxiety, and agitation, can be lowered by playing simple games. Game designers strive to balance skill and challenge so that it is not too difficult or easy to maintain an optimal level of arousal [24]. Nevertheless, the literature study needs to provide an explicit analysis to elucidate the substantial impact of the components of SB. Therefore, this discussion should be handled with caution.

4.4. Family functioning and IGD

The present study found that the FF issues and IGD are independent and have a negative relationship with a very weak magnitude. If the FF is low or dysfunctional, it may increase the likelihood of IGD[33,35,61]. The most interesting finding is that the odds of developing high IGD from high FF are predicted to be around 1.88 to 5.43 times greater. This finding contradicts previous assumptions that high FF should lower the risk of IGD. The study suggests two possible explanations for this finding based on[62]. Firstly, family members

who are active players and regularly play may influence and normalize the game, leading to risky behavior. Secondly, permissive parenting (for example, during childhood) could contribute to game problems by not limiting game duration. Normalizing gaming activity in the family and parenting during childhood may lead to risky behavior and the development of IGD. It is worth noting that these findings are difficult to interpret because there is no significant evidence from previous studies, and this is the first study examining FF and IGD among young adults in Malaysia. Therefore, more research focusing on FF and IGD is recommended. Further study on FF and IGD among young adults is therefore suggested.

Overall, loneliness, boredom (high arousal), and family functioning seem to be significant risk factors for IGD. Within this context, individuals experiencing loneliness may report heightened boredom due to a lack of meaningful engagement or social connection. Boredom represents a dimension strictly associated with adverse effects, behaviors, and interpersonal relationships, as well as, accompanied by higher sensitivity for rewarding behaviors [37]. This boredom, mainly when associated with high arousal (restlessness and frustration), may lead individuals to gaming as an escape from their surroundings. Additionally, despite a supportive family environment that somehow normalizes the gaming activity, participants may feel social disconnected in their circle of friends. Therefore, they play more to seek for the relationships with friends. In short, these factors bring to bear upon each other a very intricate interaction of emotional distress, social disconnect, and family dynamics that would render a person particularly susceptible to IGD

Table 2. Correlation coefficient between risk factors and IGD (n=462).

Risk factors		**IGD**		**Pearson Chi-square**			**Spearman Rho**	
		Low, *n (%)*	**High, *n (%)***	***χ^2***	***df***	***p***	**Spearman, *r_s***	***p***
Loneliness	High	146 (31.6)	47 (10.2)	19.370	1	< .001**	.426	<.001**
	Low	244 (52.8)	25 (5.4)					
BPN in-life	High	179 (38.7)	45 (9.7)	6.708	1	.010*	.000	.993
	Low	211 (45.7)	27 (5.8)					
Autonomy	High	119 (25.8)	32 (6.9)	5.362	1	.021*	-.031	.506
	Low	271 (58.7)	40 (8.7)					
Relatedness	High	179 (38.7)	42 (9.1)	3.767	1	.052	.005	.919
	Low	211 (45.7)	30 (6.5)					
Competence	High	168 (36.4)	43 (9.3)	6.787	1	.009*	-.019	.677
	Low	222 (48.1)	29 (6.3)					
State Boredom	High	160 (34.6)	50 (10.8)	19.798	1	<.001**	.550	<.001**
	Low	230 (49.8)	22 (4.8)					
Time perception	High	162 (35.1)	49 (10.6)	17.224	1	<.001**	.505	<.001**
	Low	228 (49.4)	23 (5.0)					
Disengagement	High	169 (36.6)	50 (10.8)	16.620	1	<.001**	.448	<.001**
	Low	221 (47.8)	22 (4.8)					
Inattention	High	165 (35.7)	52 (11.3)	21.836	1	<.001**	.543	<.001**
	Low	225 (48.7)	20 (4.3)					
Low arousal	High	168 (36.4)	54 (11.7)	24.813	1	<.001**	.477	<.001**
	Low	222 (48.1)	18 (3.9)					
High arousal	High	152 (32.9)	64 (13.9)	60.828	1	<.001**	.617	<.001**
	Low	238 (51.5)	8 (1.7)					
Family Functional	High	207 (44.8)	49 (10.6)	5.519	1	.019*	-.146	.002*
	Low	183 (39.6)	23 (5.0)					

Table 3. Regression analysis between risk factors and IGD (n=462).

Risk factors	Model 1		Model 2				Model 3	
	β	**OR [95%CI]**	**β**	**aOR [95%CI]**	**β**	**cOR [95%CI]**	**β**	**OR [95%CI]**
Loneliness	.788	2.198 [.933, 5.182]	.856	2.353 [1.045, 5.297]*	1.145	3.142 [1.855, 5.320]**	.955	2.599 [1.314, 5.141]*
Constant					-2.278	.102**		
BPN in-life							.389	1.475 [.848, 2.565][a]
Autonomy	.733	2.082 [.903, 4.800]						
Competence	.597	1.817 [.779, 4.234]						
State Boredom							1.180	3.255 [1.608, 6.590]**
Time perception	-.018	.982 [.341, 2.828]	.341	.1.406 [.523, 3.779][a]				
Disengagement	-.804	.447 [.133, 1.502]	-.607	.545 [.189, 1.572]				
Inattention	-.073	.930 [.133, 1.502]	.086	1.090 [.276, 4.310][a]				
Low arousal	.645	1.907 [.429, 8.478]	.905	2.472 [.714, 8.557]				
High arousal	3.029	20.684 [7.587, 56.390]**	2.485	11.999 [5.069, 28.403]**	2.528	12.526 [5.843, 26.856]**		
Constant					-3.393	0.034**		
Family functional	1.551	4.718 [2.134, 10.431]**	1.691	5.425 [2.735, 10.760]**	.633	1.883 [1.104, 3.212]**	1.455	4.287 [2.311, 7.952]**
Constant	-5.543	.004**	-5.043	.006**	-2.074	.126**	-3.707	.025**
Omnibus Tests of Model								
Chi-square(df)	106.030 (9)**		94.758(5)**				47.707(3)**	
Model Summary								
Nagelkerke R2	.354		.320				.169	
Cox & Snell2	.205		.185				.098	
-2 log likelihood	293.797		305.069				352.121	
Hosmer & Lemeshow test								
Chi-square(df)	26.830 (8)		10.599(6)				2.670(4)	
p	.001**		.102				.615	

***p<.00; *p<.05; Crude odds ratio (cOR); Adjusted odds ratio (aOR)*

[a]*The variable(s) is not statistically significant and was removed to improve the model's goodness of fit.*

Note: *The table includes the Omnibus tests, model summary, and Hosmer & Lemeshow test after removing non-significant variables until the model adequately fit the data for Models 2 and 3.*

5. Limitations and recommendations of the study

Despite the interesting findings of the present study, the non-probability sampling techniques limit the generalizability of these findings to other populations, particularly in Malaysia. Large randomized controlled trials could provide more definitive evidence. Also, the most significant limitation is that the IGDS9-SF-M was not clinically confirmed among the Malaysian population[38]. The cut-off measurement still needs to be confirmed. More work will need to be done to determine the cut-off value and clinically validate the measurements used in the present study in the Malaysia context. Third, it is unfortunate that the study cannot show the causal effect of risk factors and IGD symptoms due to the cross-sectional study. Future research should be replicated by using longitudinal studies to confirm the possible risk factors contributing to understanding IGD in Malaysian populations.

6. Conclusion

While this study lacks generalizability, the findings can be valuable in estimating the level of IGD when conducting a more comprehensive analysis. This study contributes to the empirical study on IGD, which remains difficult to obtain, especially among Malaysian young adult players, compared to other disorders. Furthermore, research that parallels the progress of the gaming industry needs to move in tandem. In summary, understanding the complex interplay of factors influencing IGD is essential.

Author contributions

Conceptualization, Nur Laila Azzwa Nordin and Nor Ba'yah Abdul Kadir; Data curation, Nur Laila Azzwa Nordin; Formal analysis, Nur Laila Azzwa Nordin; Funding acquisition, Nor Ba'yah Abdul Kadir; Investigation, Nur Laila Azzwa Nordin; Methodology, Nor Ba'yah Abdul Kadir; Project administration, Nor Ba'yah Abdul Kadir; Supervision, Nor Ba'yah Abdul Kadir, Rusyda Helma Mohd, Mohd Rizal Abdul Manaf, Normaliza Ab Malik and Mark Griffiths; Validation, Nor Ba'yah Abdul Kadir, Rusyda Helma Mohd, Mohd Rizal Abdul Manaf, Normaliza Ab Malik and Mark Griffiths; Writing – original draft, Nur Laila Azzwa Nordin; Writing – review & editing, Nor Ba'yah Abdul Kadir and Rusyda Helma Mohd.

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Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the Research Ethics Committee of the Universiti Kebangsaan Malaysia (UKM) [Ref. No.: UKM/111/8/JEP-2022/704]. The present study also received ethical approval from the Faculty of Social Sciences and Humanities, UKM [Ref. No.: UKM.FKK.SPI 800-1/1/4]. All participants were assured that their data was anonymous and confidential and that they could withdraw their participation at any time.

Informed Consent Statement

All participants provided their informed consent.

Data Availability Statement

The data used in the present study is available on reasonable request from the corresponding author.

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Conflict of interest

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