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Determinants of problematic online gaming in younger and older adults: emotional dysregulation, trait impulsivity and risk taking

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1. Introduction

Internet use has had exponential growth in modern society including the global phenomenon of online video gaming. 56% of UK children aged three to 15 years old and 39% of UK adults aged 16 years and over play online games (Ofcom, 2022). In 2019, the gaming industry contributed an estimated £2.8 billion (GVA) to the UK economy (Department of Culture, Media and Sport, 2023). Globally, there are 2.9 billion gamers with an estimated worldwide worth of \$300 billion per year (Accenture, 2021). The Internet is constantly evolving with positive and negative implications for human behaviour and society. Also, there is considerable debate about whether online video gaming behaviour can be classified as an addiction or disorder. The widespread availability and access to the internet enable people to engage in activities online rather than causing addiction itself and addiction is related to specific behaviors accessed through the internet, such as gaming and gambling, which might require tailored treatment and support. The internet serves as a platform that makes it easier to access and participate in these activities, but it is the nature of the activities, rather than the internet, that can become addictive for some individuals (Remon, 2024). There is great concern about problematic use of online video gaming in adolescence and emerging adulthood in particular with males but also a need to understand more about adult gamers across the lifespan (Roberts et al., 2022)

Problematic Online Gaming is defined by Gaming Disorder (GD) and Internet Gaming Disorder (IGD) which are criteria used for identifying patient characteristics in a clinical setting. GD was classified in 2019 by the World Health Organisation International Classification of Disease (ICD-11) with three criteria, “a pattern of gaming behaviour ('digital-gaming' or 'video-gaming') characterized by impaired control over gaming, increasing priority given to gaming over other activities to the extent that gaming takes precedence over other interests and daily activities, and continuation or escalation of gaming despite the occurrence of negative consequences.”(World Health Organisation, 2023).

Kuss et al. (2018)'s systematic review of neurobiological correlates in IGD showed that gaming addicts have impaired prefrontal cortex functioning and cognitive control, poorer response inhibition and emotion regulation, visual and auditory functioning, poorer working memory and decision-making capabilities, and a deficiency in their neuronal reward system similar to substance-related addictions. Marchica et al. (2019)'s systematic review on the role of emotional dysregulation in gambling disorder and video gaming demonstrated a significant relationship between gambling disorder and online gaming with similar negative outcomes for some individuals including risk taking behaviour and greater emotional dysregulation. Consequently, this relationship between gambling and gaming industries has implications for policy makers to ensure they are making research informed policy improvements due to the different economic, social and health outcomes. In particular regulating features like loot boxes and daily rewards in online games can be considered as forms of unregulated gambling. Interestingly, there are different global regulatory practices across different countries like Japan, the Netherlands, Belgium, and China enforcing bans on certain in-game features, while others like the UK leave regulation to the gaming industry itself. (Department of Culture, Media and Sport, 2023; Pour, 2024)

1.1 Emotional Dysregulation

Researchers have observed links between emotional dysregulation and high rates of comorbidity across psychopathology such as online gaming disorder, substance abuse, gambling, and attention deficit/hyperactivity disorder (Paulus et al., 2021).

The definition of emotional regulation includes the ability to: identify, understand, and accept emotional experiences, control impulsive behaviours when distressed, and flexibly modulate emotional responses to different situation appropriately. In typical development emotional regulation abilities increase with age. However, emotional dysregulation (ED) can occur across the lifespan (Gratz & Roemer, 2004). Kokonyei et al. (2019) in a sample of Hungarian adolescent student gamers (age 12 to 20 years old) assessed cognitive ER strategies for stressful life events and problematic online video gaming in terms of difference to gender and game genres. Males had greater emotional dysregulation in planning, reappraisal and putting things into perspective. Adolescents who reported a preference for shooter, role playing, and Multiple Player Battle Arena games had higher problem gaming scores than those who preferred casual, or strategy games. This implies that motivations underlying gaming and personality factors may influence relationship with problematic

online gaming. Age differences and other constructs associated with problem gaming like impulsivity, sensation seeking and risk taking were not investigated.

Schettler et al. (2023)'s longitudinal study on with children and adolescents gamers (10 to 13 years and 14 to 17 years) investigated whether ED as measured by Difficulties in Emotional Regulation Strategies – Short Form (DERS-SF) could predict symptoms of problematic online gaming. Problematic online gaming was assessed using the Internet Gaming Disorder Scale (IGDS) based on standardized DSM-5 and The Gaming Disorder Scale for Adolescents (GADIS-A) based on ICD-11 criteria. The results showed that ED was a significant predictor of problematic online gaming for 10 and 17 years old gamers. Differences between age groups showed that children have difficulty recognizing emotions and adolescents have more problems accepting them. Boys have more deficits in awareness of their emotions, while girls had more deficits in accepting their own emotions which is attributed to their cortical development. However, the relationship between other constructs such as impulsivity and risk taking behaviours with consideration of age-related changes was not explored.

1.2 Trait Impulsivity

Impulsivity is a multidimensional concept defined as engaging in behaviours without thinking and rashly responding to stimuli that often produce negative consequences (Moeller et al., 2007). Facets of this concept under measurement instrument such as Short UPPS-P Impulsive Behaviour Scale (SUPPS-P) include urgency which is the tendency to act rashly when experiencing extreme emotions. For example, Positive urgency (PU) refers to acting rashly when experiencing extreme positive emotions and negative urgency (NU) refers to acting rashly when experiencing extreme negative emotions. Willie et al. (2022) investigated the predictive value of emotional impulsivity on problematic behaviour of adults (18 to 57 years old) recruited via online platforms from Australia, New Zealand, United Kingdom, Canada and USA. Online gambling disorder and social media addiction were measured. Results showed that NU was the strongest predictor of social media addiction and PU was strongest predictor of online gambling disorder suggesting emotional valence may be an important factor to consider when differentiating predictors and addressing certain problematic behaviour.

Raybould et al. (2022) explored whether impulsivity is a factor in the transition from recreational to problematic online gaming for 372 adults ($M = 26$, $SD = 6.84$) recruited online. The findings showed that both PU and NU were associated with higher symptom counts of

IGD and GD. The age range of adult participants was relatively large however differences due to age were not investigated. Rivero et al. (2023) investigated the role of PU and NU in the relationship between craving and symptoms of internet gaming disorder (IGD) with a focus on video-gaming related problems in a sample of 454 adults (18 to 65 years old) from Spain and Ecuador. The results showed partial positive correlations between urgency facets of impulsivity and IGD. Constructs such as craving were assessed as deficits of emotional regulation however, risk taking and age differences in the adult population were not explored.

The current study aimed to explore the role of emotion regulation in the relationship between urgency facets and problematic online gaming. Previous studies demonstrated relationships between emotion regulation and problematic gaming (Blasi et al., 2019; Marchica et al., 2020) however, despite urgency facets showing strong links with various addictions (Um et al., 2019) the mechanisms through which urgency leads to problematic gaming is yet to be explored.

1.3 Risk taking behaviour

Risk taking behaviours are defined as those involving some potential for danger or harm while it may also provide an opportunity to obtain some form of reward (Lejuez et al., 2002). Cyders and Smith (2008) argue that risk taking behaviours are associated with emotion-based urgency facets, PU and NU. Furthermore, Arnet (2000) claims that risk taking reaches its peak during emerging adulthood between the ages of 18 to 25 year old.

Tian et al. (2018) examined adolescent sample with internet gaming disorder (IGD) used the Balloon Analogue Risk Task (BART) (Lejuez et al., 2002), a delay discounting task alongside an impulsivity self-report questionnaire, Barratt Impulsiveness Scale-11 (BIS-11) (Patton et al. 1995) which measured three scales of impulsivity (attentional impulsiveness, motor impulsiveness, and non-planning impulsiveness). However, emotional-based impulsivity was not assessed. The results indicated that adolescents with IGD had a larger degree of delay discounting in terms of more impulsive decision making and higher scores for three subscales of BIS-11 than a comparison group. Further empirical studies are needed to support the associations between these factors and IGD with consideration of age.

1.4 The present study

The present study investigated the relationships between four variables: problematic online gaming, ED, trait impulsivity and risk taking behaviour across different age groups of adult gamers. The study aimed to establish whether there were age-related differences

between younger adults and older adults across these variables and whether there are similarities with other behavioural addictions. Furthermore, the potential indirect effects of emotion regulation in the relationship between urgency facets and problematic online gaming was tested.

Based on the rationale and the literature review provided, the following hypotheses were proposed:

H1. Younger Adult Gamers (18 to 24 years old) have greater problematic online gaming, emotional dysregulation, trait impulsivity and risk taking behaviours than Older Adult Gamers (25 years old and over).

H2. There will be a significant and positive correlation between problematic online gaming, emotional dysregulation, urgency facets and risk taking behaviours

H3. Emotional dysregulation and risk taking behaviours will significantly predict problematic online gaming.

H4. Urgency facets of trait impulsivity will significantly predict problematic online gaming.

H5. Emotion regulation will mediate the effects of urgency facets on problematic online gaming.

2. Method

2.1 Participants

Participants recruited were 18 years old and over and played online video games using an opportunity sample and snowball sampling from 1 May to 3 July 2023. The study was available through SONA Research Participant Pool and other online platforms like Whats app, LinkedIn and Facebook. Participants were not compensated with monetary incentives.

330 respondents were registered in Qualtrics. 174 responses were excluded from final analysis, 171 responses due to unfinished behavioural task and 3 responses due to missing age. $N = 156$ ($M = 26.42$, $SD = 6.82$) in the final dataset were aged between 18 and 49 years old. 86 males (55.1%), 68 females (43.6%) and two non-binary (1.3%). Statistical power was estimated prior to data collection using G Power (Faul et al. 2007) which demonstrated the sample was adequately powered at $N = 156$.

2.2 Materials

2.2.1 Problematic Online Gaming Questionnaire Short Form (POGQ-SF) (Papay et al., 2013)

The POGQ-SF is a 12-item instrument which is a revised version of the original 18-item Problematic Online Gaming Questionnaire (POGQ) (Demetrovics et al., 2012). The POGQ was based on psychometric qualities of behavioural addiction as defined by the DSM-IV criteria for psychoactive substance use dependence by the American Psychiatric Association. Responses are given on a 5-point Likert scale (1 = Never to 5 = Always). Higher scores indicate higher risk for problematic online video gaming. The scale comprised of six factors with two items per factor: Preoccupation ($\alpha = .65$), Overuse ($\alpha = .66$), Immersion ($\alpha = .67$), Social Isolation ($\alpha = .66$), Interpersonal Conflicts ($\alpha = .66$) and Withdrawal ($\alpha = .68$). The total scale showed good internal consistency ($\alpha = .88$).

2.2.2 The Difficulties in Emotion Regulation Scale Short Form (DERS-SF) (Kaufman et al., 2016)

DERS-SF is an 18-item instrument which is a revised version of the 36-item Difficulties in Emotion Regulation Scale (DERS) (Gratz & Roemer, 2004). Responses are given using a 5-point Likert scale, from 1 (Almost never) to 5 (Almost always). Higher scores indicated greater difficulties in emotion regulation. Comprised of six factors each composed of three items: Strategies, ($\alpha = .86$), Non-Acceptance ($\alpha = .83$), Impulse ($\alpha = .89$), Goals ($\alpha = .89$), Awareness ($\alpha = .76$) and Clarity ($\alpha = .77$). The scale showed good internal consistency ($\alpha = .88$).

2.2.3 Short UPPS-P Impulsive Behaviour Scale (SUPPS-P)(Lynam, 2013)

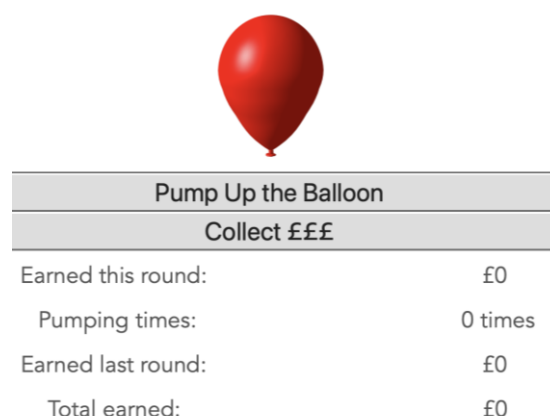
Impulsive personality traits were measured using SUPPS-P. It is a 20-item instrument which is a revised version of the 59-item instrument UPPS-P (Lynam et al. 2006). Responses were given using a 4-point Likert scale ranging from 1 (Agree strongly) to 4 (Disagree strongly). Higher scores indicate greater impulsivity. Some items from Lack of Perseverance and Lack of Premeditation are reversed-scored. The scale comprised of five factors with 4 items per factor: Negative Urgency ($\alpha = .78$), Lack of Premeditation ($\alpha = .77$), Lack of Perseverance ($\alpha = .64$), Sensation seeking ($\alpha = .62$) and Positive Urgency ($\alpha = .78$). The scale showed good internal consistency ($\alpha = .70$).

2.2.4 Balloon Analogue Risk Task (BART) (Lejuez et al., 2002)

BART is a computerized decision-making task that provides a useful tool for testing behavioural risk taking in adolescents and adults. It is comprised of three measures: earnings, pumps and explosions. Higher scores across the three measurements indicate higher risk taking behaviour. Participants are given 30 (default) balloons and are asked to pump up each balloon as many times as they wish in return for hypothetical money for each pump without explosion. However, if a balloon explodes before the indicated number of pumps is reached, participants lose all their potential winnings for the current balloon (See Figure 1). Test-retest study results indicate that risk behaviour on the BART has adequate test-retest stability. Therefore, performance on the task on a single occasion is likely to be representative of an individual's performance on other occasions (White et al., 2008). BART was designed in Qualtrics. A pilot was run before recruitment with two volunteers which confirmed accuracy of responses against data output.

Figure 1

Design of BART in Qualtrics



2.3 Procedure

Participants were directed to Qualtrics, an online survey tool where they were briefed on the study prior to giving consent including data sharing and ethical considerations. Firstly, demographics, device used and time spent online video gaming per day were recorded. This was followed by three self-report questionnaires and a behavioural test. Participants were given a full debrief including summary of the study and contact details for psychological support.

2. Results

Table 1 reports descriptive statistics across all variables of interests. It shows significantly higher mean scores for younger adult gamers (18- 24 years old) than older adult gamers (25-49 years old) for Strategies, Goals and Clarity as measured by DERS-SF, in addition to Explosions as measured by BART.

Table 1

Differences between Younger Adult Gamers and Older Adults Gamers in POGQ-SF, DERS-SF, SUPPS-P and BART scores

Measure	Younger Adult Gamers		Older Adult Gamers		<i>t</i>	Cohen's <i>d</i>
	(18-24 years)		(25-49 years)			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
POGQ- SF						
Preoccupation	4.18	1.62	3.84	1.46	1.39	0.23
Immersion	5.77	2.06	5.25	2.90	1.64	0.26
Withdrawal	3.34	1.37	3.11	1.52	0.98	0.16
Overuse	3.94	1.95	3.67	1.69	0.91	0.15
Interpersonal Conflict	3.23	1.64	3.36	1.73	-0.47	-0.08
Social isolation	3.25	1.31	3.18	1.53	0.33	0.05
DERS-SF						
Awareness	10.28	3.10	11.04	2.68	-1.64	-0.26
Clarity	6.69	2.58	5.70	2.33	2.50*	0.40
Non-Acceptance	7.55	3.16	6.66	3.09	1.79	0.29
Goals	9.40	3.27	7.97	2.95	2.84**	0.46
Impulse	6.17	2.82	5.38	2.95	1.70	0.27
Strategies	7.37	3.15	5.90	2.91	3.01**	0.48
SUPPS-P						
Negative Urgency	9.72	2.57	8.93	2.73	1.86	0.30

Lack of Perseverance	8.64	1.42	8.63	1.39	0.04	0.01
Lack of Premeditation	9.93	1.52	8.86	1.58	0.26	0.04
Sensation Seeking	10.25	2.47	10.71	2.55	1.14	-0.18
Positive Urgency	8.43	2.50	8.22	2.85	0.50	0.08
BART						
Earnings	2454.58	1234.94	2077.47	1065.38	2.03*	0.33
Explosions	6.63	4.07	4.82	3.46	2.96**	0.48
Pumps	157.39	47.14	148.19	39.6	1.31	0.21

Note. POGQ-SF = Problematic Online Gaming Questionnaire - Short Form; DERS-SF = Difficulties in Emotional Regulation Scale Short Form; SUPPS-P = Short UPPS-P Impulsive Behaviour Scale; BART = Balloon Analogue Risk Task. Mean parameter values for each of the analyses are shown for Younger Adults Gamers (n = 83) and Older Adult Gamers (n = 73).

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

Table 2 reports the correlations between POGQ-SF Total Scores and facets of DERS-SF, SUPPS-P and BART. The variables that showed most significant and positive correlations with POGQ-SF were Positive Urgency and Negative Urgency facets of the SUPPS-P, and Impulse facet of the DERS-SF.

Table 2*Correlations between POGQ-SF Total Scores and Facets of DERS-SF, SUPPS-P and BART*

Measure	POGQ-SF	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Awareness	-.08													
2. Clarity	.18*	-.22												
3. Non-Acceptance	.18*	-.02	.46***											
4. Goals	.18*	.05	.41***	.40***										
5. Impulse	.33***	-.05	.46***	.48***	.45***									
6. Strategies	.21**	-.05	.51***	.61***	.55***	.59***								
7. Negative Urgency	.31***	-.10	.42***	.44***	.43***	.56***	.49***							
8. Lack of Perseverance	-.12	-.12	-.11	-.17*	-.20*	-.13	-.21*	-.21**						
9. Lack of Premeditation	-.04	.24**	.06	.03	-.01	.18*	.05	.18*	.25**					
10. Sensation Seeking	.20*	-.18*	.07	.01	-.02	.06	-.17*	.11	-.05	.07				
11. Positive Urgency	.36***	.23**	.32***	.25**	.14	.38***	.28***	.54***	-.03	.23***	.33***			
12. Earnings	.08	-.10	-.01	.15	.14	.07	.00	.10	-.12	.09	.06	-.03		
13. Explosions	.09	-.13	.04	.07	.09	.00	.04	.10	-.20*	.05	.06	.05	.65***	
14. Pumps	.07	.02	-.02	.02	.01	-.03	.00	.03	-.12	.04	.06	-.07	.61***	.60***

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

3.1 Problematic Online Gaming and Emotional Dysregulation

An enter method regression analysis was conducted to explore whether emotional dysregulation significantly predicted POGQ-SF. Age and gender was controlled in the first step of the analysis. The six facets of the DERS-SF were entered in the second step of the analysis. The results showed Impulse facet of the DERS-SF was the only significant predictor of problem gaming and could explain 39% variance in POGQ-SF, $F(1, 151) = 7.996, p < .001$ ($\beta = .39$, 95% CI [0.53, 1.52]). Age ($\beta = -.18, p = .020$) and gender ($\beta = -.19, p = .013$) were significant and negative predictors of the problem gaming in the first step suggesting younger age and male participants at higher risk of problem gaming. When emotion dysregulation facets were included in the second step, gender remained significant ($\beta = -.33, p < .001$).

3.2 Problematic Online Gaming and Risk Taking Behaviours

Another regression analysis was conducted to examine whether risk taking behaviours (BART) significantly predicted POGQ-SF. Risk-taking behaviours did not significantly predict POGQ-SF across each measurement (Earnings, Explosions and Pumps).

3.3 Problematic Online Gaming and Urgency

A two-step hierarchical regression analysis was carried out to test whether urgency facets would predict POGQ-SF over and above other impulsivity facets of SUPPS-P. Lack of Perseverance, Lack of Premeditation, Sensation Seeking and Negative Urgency were entered in the first step. In the second step of the analysis, Positive Urgency was added to the model. The first step of hierarchical regression results demonstrated that the model was statistically significant ($R^2 = .14, F(4, 148) = 5.816, p < .001$) and could account for 14% of the variance in POGQ-SF within this sample. Negative Urgency was the most significant predictor of POGQ-SF in this model ($\beta = .31$, 95% CI [0.42, 1.32], $p < .001$), followed by Sensation Seeking ($\beta = .17$, 95% CI [0.04, 0.96], $p = .033$). The second step of the analyses demonstrated a good model fit for the data ($R^2 = .18, F(5, 147) = 6.389, p < .001$) and a total of 18% variance in POGQ-SF being accounted for. Positive Urgency was the most significant predictor of POGQ-SF when other SUPPS-P facets were controlled ($\beta = .27$, 95% CI [0.21, 1.27], $p = .006$) (See Table 3).

Table 3

Regression Results of POGQ-SF scores on Urgency Facets Controlling for Other SUPPS-P Facets

	<i>B</i>	<i>SE B</i>	β	R^2	ΔR^2
Step 1				.14	.14**
Lack of Perseverance	-0.21	0.43	-.04		
Lack of Premeditation	-0.49	0.40	-.10		
Sensation Seeking	0.50	0.23	.17*		
Negative Urgency	0.87	0.23	.31***		
Step 2				.18	.04**
Positive Urgency	0.74	0.27	.27**		

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

3.3.1 Emotion regulation as a mediator in the relationship between urgency and problem online gaming.

A mediation analysis was conducted using PROCESS v4.0, model 4 (Hayes, 2017) to test the indirect effect of urgency facets on problem online gaming through emotion regulation. The indirect effect was tested using non-parametric bias corrected bootstrapping procedures (Hayes, 2017).

There were significant indirect effects of positive urgency ($\beta = .06$, 95% Confidence Interval (CI) = .01, .14) and negative urgency ($\beta = .11$, 95% Confidence Interval (CI) = .01, .22) on problematic online gaming via difficulties in emotion regulation. Higher levels of positive ($\beta = .27$, 95% CI = .37, 1.21), and negative urgency ($\beta = .20$, 95% CI = .08, 1.08) were directly related to the problematic online gaming. The reduced but still significant standardised beta for urgency facets after inclusion of difficulties in emotion regulation in the model suggests that the relationship between urgency facets and problematic online gaming is mediated through the difficulties in emotion regulation, although it is a partial mediation. This suggests that greater levels of urgency leads to greater levels of difficulties in emotion regulation

which in turn was related to higher problematic online gaming. This relationship was stronger for positive urgency. The urgency facets were tested in two separate mediation analysis since these facets show high positive correlation. These facets have also been tested separately in previous studies to explore their unique contributions to various addictions (e.g., Um et al., 2019). The results for the mediation analyses are shown in Table 4.

Table 4

Mediation analyses of emotion dysregulation (DERS) in the relationship between urgency and problem online gaming (POGQ-SF).

X	M	Y	Indirect Effect Standardised β	Standardised SE	95% CI
<i>Positive Urgency</i>					
PU	→	POGQ	.27	.21	.37, 1.21*
PU	→ DERS →	POGQ	.06	.01	.01, .14*
<i>Negative Urgency</i>					
NU	→	POGQ	.20	.25	.08, 1.08*
NU	→ DERS →	POGQ	.11	.06	.01, .22*
<i>Problematic Online Gaming</i>					
Covariates	Age		-.10	.08	-.27, .04
	Gender		-.28	1.10	-.6.28, -2.16**

Note. POGQ-SF = Problematic Online Gaming Questionnaire - Short Form; DERS-SF = Difficulties in Emotional Regulation Scale Short Form; PU=Positive Urgency; NU=Negative Urgency. * $p < .05$, ** $p < .01$, *** $p < .001$

3.4 Additional Analyses

Gender differences were also assessed to explore whether male and female scores significantly differed across the measures used in this study. It was found that males had significantly higher scores on POGQ ($M = 24.34$, $SD = 7.53$) than females ($M = 21.61$, $SD = 7.50$), $t(152) = 2.23$, $p = .013$; and they scored significantly higher on risk taking measure (total exploded balloons) ($M = 6.49$, $SD = 4.09$), as compared to females ($M = 4.90$, $SD = 3.48$),

$t(152) = 2.55, p = .006$. Males were also significantly higher on sensation seeking facet of trait impulsivity ($M = 11.02, SD = 2.48$) than females ($M = 9.81, SD = 2.41$), $t(152) = 3.048, p = .001$.

Further analysis was performed to explore gender in relation to the subgroups of younger (Males 53%, Females 46%) and older adult gamers (Males 58%, Female 42%). Younger adult males had higher scores on POGQ ($M = 25.09, SD = 7.58$) than younger adult females ($M = 22.15, SD = 7.18$), and older adult males also had higher scores on POGQ ($M = 23.57, SD = 7.49$) than older females ($M = 20.93, SD = 7.95$). However the interaction of gender and age on problematic online gaming was nonsignificant.

4. Discussion

The current study is first of its kind to assess psychological risk factors for problematic online gaming in two adult samples, younger and older adults. Furthermore, despite the existence of prior research examining contributions of emotion regulation and trait impulsivity, no research exist assessing the combined contributions of emotion dysregulation, trait impulsivity and risk taking behaviour to problem online gaming in adult population. These variables have been separately shown to have significant contribution to various behavioural and substance addictions however, the interplay between these in understanding problematic online gaming remained to be explored. Additionally, the current study explored the mechanisms through which trait impulsivity leads to problematic online gaming.

The first hypothesis investigated whether 18 to 24 years old adult gamers have greater problematic online gaming, emotional dysregulation (ED), impulsive personality traits and risk taking behaviours than adult gamers who were 25 years old and over. This hypothesis was partially supported as younger adult gamers had significantly greater ED deficits in strategies, goals and clarity, as well as significantly greater risk taking behaviours (explosions and earnings) than older adult gamers. This is in line with Kokonyei et al. (2019), where it was found that 18 to 20 years old male gamers have similar deficits in emotional regulation, but greater than females. In comparison, Schettler et al. (2023)'s findings on adolescent gamers where children (10-13 yrs) and youth (14-17 yrs) were assessed, different facets of ED were shown to affect youth gamers. While children's problematic gaming (PG) showed strong association with emotional awareness and clarity, for youth's higher PG was positively associated with difficulties in acceptance of emotional responses. Furthermore, the current study found that 18 to 24 years old who play online games take greater risks even when there was potential to lose earnings and motivated by earning a reward even if imaginary.

The second hypothesis investigated whether there is a significant and positive correlation between problematic online gaming, ED, impulsivity and risk taking behaviours. This hypothesis was partially supported. Results showed significant and positive correlations between POGQ-SF and PU, NU, SS facets of trait impulsivity, and between POGQ and Clarity, Non-Acceptance, Goals, Strategies and Impulse facets of emotion dysregulation. This suggests that problematic online gaming is an emotion-driven problem behaviour which is associated with acting rashly when experiencing both positive and negative emotions. This study is in line with findings from Raybould et al. (2022) and Rivero et al. (2023) that suggested specific traits, PU and NU are associated with adult problematic online gaming. Similarly to Willie et al. (2022), PU and NU are observed in other internet addictions. For example, PU is associated with online gambling disorder and NU is associated with social media addiction. In contrast to Kokonyei et al. (2019) where impulsivity as a facet of ED was not assessed, the findings of the present study suggest that adult gamers who are over 20 years old have deficits in emotional regulation linked to impulsivity, and prone to engage in problem online gaming when experiencing negative emotions.

The third hypothesis investigated whether ED and risk taking behaviours predicted problematic online video gaming. The first part of the hypothesis was supported as the results showed that ED was a significant predictor. The results of this study support and extend those of Schettler et al. (2023) where it was shown that ED was a predictor of problematic online gaming for a sample of 10 to 17 years old and the present study found that ED is also a predictor of problem online gaming for sample of 18 to 49 years old. The results are also in line with Kokonyei et al. (2019) where deficits in emotional regulation driven by negative emotions were found in 12 to 20 years old gamers. The second part of the hypothesis was not supported as risk taking behaviours did not significantly predict problematic online gaming for the overall sample.

The fourth hypothesis investigated whether urgency facets of trait impulsivity uniquely predicted problematic online video gaming. This hypothesis was supported as urgency facets significantly predicted problematic online video gaming. PU was the most significant predictor of problem online gaming, followed by NU when other facets of SUPPS-P were controlled for. This infers that both greater positive urgency and greater negative urgency predict greater problematic online gaming. This is in line with Raybould et al. (2022), where it was shown that PU is the most significant risk factor for problematic online gaming for adult gamers. The results of this study also demonstrate similarities with

other internet addictions (Willie et al., 2022) where PU is the most significant predictor for online gambling disorder and negative urgency is the most significant predictor of social media addiction.

The final hypotheses tested the mediating effects of the emotion regulation in the relationship between urgency facets and problematic online gaming. This hypothesis was supported as positive and negative urgency was found to be significantly linked to problematic online gaming through emotion regulation. This suggests that individuals with high trait urgency are particularly at risk for problematic online gaming when experiencing emotional difficulties. The mediating effects of emotion regulation was stronger for positive urgency and problematic online gaming relationship. A similar indirect findings were found for recognized substance addictions such as alcohol and cannabis addictions. Um et al. (2019) found that interaction of urgency facets (particularly negative urgency) with emotion dysregulation predicted highest levels of alcohol and cannabis use, employing the same measures. This shows that psychological risk factors for engagement in problematic online gaming are similar to risk factors for substance misuse.

Limitations

The present study should be considered with its limitations. One of which is the reliability of the problematic online gaming questionnaire used. Although the total questionnaire had good reliability, the reliability of individual subscales were lower than expected. Similar challenges were found by Schetter et al. (2023) and Rivero et al. (2023) where problem gaming subscales did not demonstrate good reliability.

The self-report questionnaires used may be subject to social desirability bias and recall bias as participants may feel self-conscious or do not see their behaviours as problematic. Consequently, this can affect scores which may have contributed to low correlation coefficients as shown in the present study and previous studies (Raybould et al., 2022; Schettler et al., 2023; Rivero et al., 2023). Future research could consider employing a mixed methods approach and qualitative methods for a more in-depth understanding of the risk factors for problematic online gaming in different age groups.

The sample of older adult gamers was difficult to access due to the time constraints of the project. Recruiting older participants was achieved however the accessed sample split into two groups, younger adults ($n = 83$) and older adults ($n = 73$) demonstrated a relatively large age range for older adults which was between 25 and 49 years old. Similar recruitment

challenges were also evident in Raybould et al. (2022)'s study. Therefore, it is recommended for future studies to address these limitations by undertaking a longitudinal study with strategic recruitment of a larger sample of older participants between 25 and 50 years old so more age grouping variables can be analysed for potential differences.

The use of BART may have had measurement imprecision which contributed to the high number of unfinished BART removed for data analysis, inconsistency between the present study's findings and previous research. Possible design issues were the repetitive nature of the task and length of the study. The decision to not use financial incentives may have contributed to decreased participation, attrition and engagement. While monetary incentives can increase participant engagement and reduce attrition, the considerations for this study were made to reduce possible biases and ethical concerns for vulnerable participants. Furthermore, it could also become a confounding variable, making it harder to distinguish whether observed behaviors are due to the participants' natural tendencies or the influence of the financial incentives. Future research considerations could adapt BART to compare groups with and without monetary rewards or pay participants a research fee like Raybould et al. (2022).

Exploring use of other technologies, like event-related potential alongside BART to support understanding cognitive mechanism of risk-taking decisions could be explored. Applications of updated BART technologies using virtual reality should be considered to decrease the disparity between BART performance and real-world risk behaviour.

Implications

The findings of the current study can support clinicians, policy makers and contribute to a growing body of evidence in cyberpsychology exploring risk factors for problematic online gaming.

Understanding age-related differences informs timing of clinical intervention and prevention for those most vulnerable through psychosocial education such as emotional regulation training and healthy habits with technology use in childhood and adolescence before beginning young adulthood. Furthermore, gender differences informs gender-specific prevention and treatment, and prioritises males who are most at risk. It prioritises funding for specialist public healthcare for adult gamers in particular males who are experiencing problematic online gaming; More broadly, funding preventive programmes during childhood

and adolescence through psychosocial education; and applying appropriate government policies and protections for adolescents transitioning into emerging adulthood.

These research findings can inform policy for particular contexts where online gamers are targeted with mechanisms that exploit difficulties in emotion regulation and urgency possibly unregulated gambling such as loot boxes. It also reinforces the need for research informed policy improvements as the findings showed younger online gamers (18-24 years old) are more likely to take risks in games for potential rewards—even if imaginary.

Data

The materials, data and analytic code for this study are available on Qualtrics.

Data availability

Data will be made available on request

Conflict of Interest

Authors have no conflict of interest to disclose.

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