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Gaming as a Coping Strategy During the COVID-19 Pandemic

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Abstract

Early in the COVID-19 pandemic, social interactions were constrained by physical distancing guidelines. Consequently, some individuals may have turned to video games to cope with isolation and negative emotions. Previous studies have shown that people who struggle with anxiety and depression are at particular risk for developing problem gaming behaviours. However, there is a paucity of longitudinal research testing pathways from negative emotionality to problem gaming behaviours, especially during the COVID-19 pandemic. Accordingly, we conducted a multi-wave longitudinal study and predicted that high levels of emotional vulnerability (anxiety and depression) in the first month of the pandemic would prospectively relate to elevated time spent gaming and related problems six months later. We also predicted that elevated coping motives for gaming would mediate these associations. A sample of 332 Canadian gamers (M_{age} = 33.79; 60.8% men) completed three surveys on Prolific, with the first occurring in April 2020 (one-month after the declared COVID-19 state of emergency) and subsequent surveys were spaced three months apart. High initial levels of emotional vulnerability predicted excessive time spent gaming, as well as related problems, six months into the pandemic. Elevated coping motives for gaming uniquely mediated these pathways. This longitudinal study is the first to show that negative emotionality was a vulnerability factor for coping-related problem gaming during the COVID-19 pandemic. As we continue to cope with the longer-lasting impacts of the pandemic, it will be important for individuals who struggle with mood and anxiety issues to find more effective ways of coping.

Keywords: gaming; coping; COVID-19; pandemic; problematic gaming; anxiety; depression

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Introduction

Background

The Coronavirus disease of 2019 (COVID-19) pandemic brought with it public health efforts to reduce its spread, including mandated lockdowns and physical distancing, resulting in fewer opportunities for social interaction and for effective coping (Restubog et al., 2020; Rettie & Daniels, 2021). Preliminary data from early stages of the

pandemic demonstrated that people from many countries experienced higher levels of distress, anxiety, and depression than they had prior to the pandemic (Alyami et al., 2021; Centers for Disease Control and Prevention, 2020; Fountoulakis et al., 2021; Hyland et al., 2020; Shah et al., 2021; C. Wang et al., 2020). Given that the COVID-19 pandemic hindered social interactions for the greater part of two years, individuals may have sought solitary coping methods to deal with their isolation and negative emotions. Studies have demonstrated that the ongoing disruptions caused by COVID-19 include reduced social connectedness, along with disruptions to psychological and physical well-being (Krause et al., 2022; McMahon et al., 2022). Along with the chronicity of these disruptions, new stressors have emerged relating to these disruptions, including the repeated re-opening and closures of businesses and recreational activities, chronic work and family stress, and the emergence of new variants (Calvano et al., 2022; Jain & Jolly, 2021; Mohanty et al., 2022). A study conducted by Gillen et al. (2022) examined cross-sectional data of UK participants at three time points throughout the pandemic (May–July 2020; November 2020–January 2021; May–July 2021). The researchers found that overall well-being decreased between the first and second time points. Moreover, the researchers also found that negative coping strategies such as substance use, and behavioural disengagement increased between the first and last time points. These results suggest that individuals may be adopting riskier coping techniques to manage these disruptions and stressors.

Video games are one such coping mechanism that individuals may have turned to during the COVID-19 pandemic. Prior to COVID-19, over 23 million Canadians (61% of Canadians) identified themselves as "gamers" (Entertainment Software Association of Canada, 2018). Though this number did not change at the beginning of the pandemic (Entertainment Software Association of Canada, 2020), 58% of adult gamers and 80% of teen gamers have endorsed gaming more regularly during COVID-19 (Entertainment Software Association of Canada, 2020). A few studies have shown an increase in gaming since the start of the COVID-19 pandemic. In America, Verizon reported a 75% increase in online gaming activity that corresponds with stay-at-home directives, whereas Italy saw a 70% increase in internet traffic related to *Fortnite*, a popular online video game (King et al., 2020). India also saw a 30% increase in online mobile gaming and a 35% increase in multi-player games (Amin et al., 2022). Live stream gaming such as YouTube Gaming and Twitch have also reported a 10% increase in audiences (López-Cabarcos et al., 2020), indicating that people had turned not only to gaming during the pandemic, but also to other gaming-related activities. While gaming is not an inherently problem activity, approximately 3.2% individuals who game go on to develop Gaming Disorder (Petry & O'Brien, 2013; Przybylski et al., 2017; Sanders et al., 2017; Stevens et al., 2021). People with pre-existing vulnerabilities, like mood and anxiety disorders, are particularly susceptible to developing Gaming Disorder (Fazeli et al., 2020; King et al., 2019; Viana & de Lira, 2020).

Gaming Disorder is a formalized diagnosis found in the International Classification of Diseases, 11th Revision (ICD-11; World Health Organization, 2019) that is characterized by impaired control over gaming habits, as well as an escalation of gaming despite related problems (Jo et al., 2019). In contrast, "Internet Gaming Disorder" (IGD) has been included in section III of the Diagnostic and Statistical manual—Fifth edition (DSM-5; APA, 2013) as a disorder for future consideration by the American Psychiatric Association. For the purposes of this paper, the term "*Gaming Disorder*" will be used to encompass the list of symptoms described in the DSM-5. Although its name suggests that it encompasses only internet gaming, IGD encapsulates both internet- and non-internet-based gaming behaviours (APA, 2013; Kuss et al., 2017). Finally, excessive gaming is a term used to conceptualize addictive behaviour related to gaming, without a formal diagnosis being attached to the definition (Sanders et al., 2017).

Gaming Disorder has been associated with a number of other mental health concerns including anxiety (C.-Y. Wang et al., 2017), depression (Liu et al., 2018), and substance use (Na et al., 2017). This is particularly important to consider, given that anxiety and depression have been linked to increases in problematic gaming behaviour (Männikkö et al., 2020). During the COVID-19 pandemic, the proportion of Canadians who self-reported high or extremely high anxiety quadrupled (from 5% to 20%), and rates of high depression symptoms more than doubled (from 4% to 10%; Dozois, 2021). Several studies from outside North America have demonstrated that COVID-19-related increases in mood and anxiety symptoms were positively associated with problematic gaming (Fazeli et al., 2020; Teng et al., 2021). A longitudinal study conducted by Teng et al. (2021) collected self-reported survey data from 1,778 children and adolescents from Southwest China at two time points; one prior to the COVID-19 pandemic (October–November 2019), and one during the COVID-19 pandemic (April–May 2020). Participants reported more time spent video gaming, as well as increases in anxiety and depression from time one to time two. Moreover, cross-lagged modeling showed that pre-pandemic anxiety and depressive symptoms predicted both Internet Gaming Disorder and time spent gaming during the pandemic. The authors also found that there was an uptick in the incidence of Gaming Disorder post-pandemic. Fazeli et al. (2020) examined the association of the pandemic on adolescents' mental health and gaming behaviours in Iran using a cross-sectional study. In this study,

1,512 Iranian adolescent participants were asked to complete self-report questionnaires between May–August 2020 surrounding symptoms of IGD, depression, anxiety, and stress. The results showed strong positive associations between depression, anxiety, stress, and gaming-related problems.

Motivational theory has been a long-standing framework for understanding addictive behaviours; namely, that motivational types have been studied extensively in relation to alcohol (Cooper et al., 1995; Cox & Klinger, 1988; Miller et al., 2000) and other substance use (Barnett et al., 2012; Cooper et al., 2016; Rohsenow et al., 2004), but also in relation to other addictive behaviours such as gambling (Chantal & Vallerand, 1996; Rodriguez et al., 2015) or gaming (Przybylski & Weinstein, 2019; Weinstein et al., 2017). Similarly, according to motivational models of addiction (Cooper, 1994; Myrseth et al., 2017), people who are emotionally vulnerable are at risk for excessive gaming and related harms (Balhara et al., 2018). These people may have been the ones who increased their gaming in efforts to cope with the pandemic situation, resulting in greater gaming-related problems. While some literature links anxiety and depressive symptoms to the onset of Gaming Disorder during the pandemic (Teng et al., 2021), longer-term longutudinal studies have not been conducted to examine these associations and the underlying mechanisms in the general population of North Americans during the COVID-19 situation.

Gaming motives are proximal cognitive factors that are believed to mediate the effects of individual differences (e.g., anxiety and depression) on excessive gaming and related harms (Király et al., 2015; Marino et al., 2020). Myrseth et al. (2017) identified four key motives for gaming, namely: enhancement motives (internal, positive reinforcement; gaming for the pleasurable experience of gaming itself), coping motives (internal, negative reinforcement; reduction of negative emotions), social motives (external, positive reinforcement motives; increasing social interaction), and self-gratification motives (gaming to satisfy one's own personal desires). Coping motives seem to be the most central to problematic gaming, particularly among those with emotional vulnerabilities (Myrseth et al., 2017). While enhancement motivations tend to predict greater engagement in gaming activities, coping motivations have been found to predict increased risk for gaming harms. Furthermore, coping motives independently predict a loss of control of gaming behaviours as well as the development of gaming problems (Myrseth et al., 2017).

A more recent systematic review also found that coping motives, along with avoidance motives, not only predict the development of Internet Gaming Disorder, but that these motives also mediate the role between psychological factors (e.g., anxiety, loneliness, or self-esteem) and problematic gaming behaviours (Melodia et al., 2020). A further study conducted by Caro and Popovac (2021) found that individuals who turned to gaming during difficult life experiences also experienced more maladaptive emotional regulation along with lower coping self-efficacy, with coping self-efficacy being a significant predictor of gaming during difficult life circumstances.

These data suggest that coping motives may well be the most salient cognitive mechanism explaining the effects of depression and anxiety on pandemic-related increases in gaming and related harms among emotionally vulnerable individuals. To our knowledge, no previous studies have explored how coping motives for gaming are linked to excessive gaming during the COVID-19 pandemic among emotionally vulnerable people using a longitudinal design.

The Present Study

This three-time point design was used with Canadian participants completing survey measures via Prolific approximately three months apart beginning after the COVID-19 emergency was declared (on March 17, 2020). Our primary goal was to understand how emotional vulnerability early in the pandemic was prospectively related to coping-motivated gaming and related problems six months into the COVID-19 pandemic. Currently, very little is known about how gaming habits and related problems have changed over the course of the pandemic, and our goal is to fill this critical gap in the literature. Several studies have examined cross-sectional or short-term associations between emotional vulnerability (i.e., depression and anxiety) and problematic gaming during the COVID-19 pandemic (Fazeli et al., 2020; Teng et al., 2021); however, our study is novel in several ways. It is the only study to examine temporal pathways from emotional vulnerability to gaming during the first six months of the COVID-19 pandemic using a multi-wave longitudinal design, giving insight to how these pathways or variables might change over time. Second, previous studies have not focused on coping motives as a primary mediator of emotional vulnerability-gaming associations during the pandemic. Finally, the present study applied a path model to both sexes (male vs. female) and in larger or smaller provinces (e.g., Ontario vs. all other provinces) using invariance testing.

For the current study, we hypothesized that higher levels of emotional vulnerability (i.e., anxiety and depression) in the early stages of the pandemic (Time 1) would prospectively predict greater time spent gaming and related problems at six-months into the pandemic (Time 3). We also hypothesized that increasing coping motives for gaming (Time 2) would explain these effects. Invariance tests were also conducted for location, particularly Ontario versus all other provinces, and for sex (male versus female). A majority of our sample originated from Ontario, and given the regional differences in lockdown procedures across Canada (Plett et al., 2022) including changes in economic activity (McCormack, 2021), freedom of movement, masking and social distancing regulations, and capacity limitations (Cameron-Blake et al., 2021). Previous studies have found sex differences in the way and amount that men and women game, their preferences for gaming, as well as their confidence in their gaming ability (Lange & Schwab, 2018; Lucas & Sherry, 2004; Terlecki et al., 2011). Furthermore, Gaming Disorders are more prevalent in males (Marraudino et al., 2022). It is therefore important to ensure that the hypothesized pathways do not differ across sex or location so that we are able to ensure that the interpretations of our results are consistent across our sample. We did not have a suitable sample size of participants who identified as non-binary, and as such, these participants were excluded from our analysis.

Methods

Participants and Procedure

The data for this research was derived from a larger longitudinal study on addictive behaviours during the COVID-19 pandemic (Baptist Mohseni et al., 2022; Wardell et al., 2020). This research was reviewed and approved by the York University Research Ethics Board (Human Participants Review Committee certificate #e2020-118). Participants were recruited through Prolific, a web-based survey platform purposefully designed for the scientific community to conduct research (Palan & Schitter, 2018). Participants were Canadian adult gamers who reported gaming within the past three months prior to the time of baseline data collection. It should be noted that all participants who endorsed gaming at baseline were included in the analysis, even if they reported no gaming at the follow up surveys. Participants also needed to have a history of high-quality responses on the Prolific platform. These participants were taken from a larger sample of participants who also self-identified as regular drinkers of alcoholic beverages. The sample consisted of 332 self-reported gamers (M_{age}= 33.79, SD_{age}=8.92, 60.7% male, 39.2% female), with most of the participants (64.5%) identifying as being White. A majority of these participants (86.2%) reported being employed prior to the COVID-19 pandemic and reported stable or increased income (56.3%) since the start of the pandemic. Approximately 91% of our sample self-identified as being at high-risk for COVID-19, and spent less than one hour (80.4%) per day watching COVID-19 related news. Most of our participants did not live alone (66.6%) and had children (72.9%). Four attention check items (Prolific, 2018) were also included to ensure that the participants were responding conscientiously. Participants were excluded from the analysis if they failed two or more attention check items. Two participants were excluded from the analysis as a result of meeting these criteria. Data collection took place as follows: end of April/beginning of May 2020 (Time 1), July 2020 (Time 2), and October 2020 (Time 3). Participants answered the questionnaires based on the 30-days prior to each survey. The baseline data collection took place 1–2 months after a state of emergency was declared across Canada (occurring between March 12 and March 22, 2020, depending on location; The Canadian Press, 2020). Participants were compensated $13 CAD at each time point.

Measures

Table 1 outlines the timeline of the study as well as which measures were used at each time point.

General Anxiety Disorder-7 (GAD-7)

The GAD-7 is a 7-item brief self-report measure of anxiety symptoms. It measures anxiety symptoms over the past two weeks (e.g., *Over the last two weeks how often have you been bothered by…feeling nervous, anxious, or on edge*). It has been validated in both clinical and non-clinical populations (Löwe et al., 2008; Spitzer et al., 2006; Williams, 2014). Participants respond to items on a 0 (*not at all*) to 3 (*nearly every day*) point Likert Scale. Higher scores are associated with a higher severity of symptoms of GAD. A score of 0–4 is considered "minimal anxiety", 5–9 is considered "mild anxiety", 10–14 is considered "moderate anxiety", and a score of 15–21 is considered "severe

anxiety". The GAD-7 has been shown to have good criterion and construct validity, along with excellent internal consistency (α = .92; Spitzer et al., 2006). The internal consistency of the GAD-7 for the present study was α = .91 at Time 1.

Table 1. *Synopsis of Measures Used at Time 1, Time 2, and Time 3.*

	Time 1 (May 2020)	Time 2 (July 2020)	Time 3 (October 2020)
Measures used	GAD-7	GAD-7	GAD-7
	PHQ-9	PHQ-9	PHQ-9
	EGMQ	EMGQ	EMGQ
	TLFB	TLFB	TLFB
	IGDS-SF9		

Note. GAD-7: Generalized Anxiety Disorder-7; PHQ-9: Patient Health Questionnaire; EGMQ: Electronic Gaming Motives Questionnaire; TLFB: Timeline Follow-back; IGDS-SF9: Internet Gaming Disorder Scale, Short Form.

Patient Health Questionnaire (PHQ-9)

The PHQ-9 is a 9-item brief self-report measure of depressive symptoms occurring over the past two weeks (e.g., *Over the last 2 weeks, how often have you been bothered by…feeling tired or having little energy*). It has been validated in both clinical and non-clinical populations (Doi et al., 2018). It utilizes the nine DSM-5 criteria for depression, with each item being rated on a 0 (*not at all*) to 3 (*nearly every day*) point Likert scale (Kroenke & Spitzer, 2002; Kroenke et al., 2001). Scores ranging between 1–4 are considered "minimal depression, while scores between 5–9 are reflective of "mild depression", 10–14 are considered "moderate depression", 15–19 are considered "moderately severe depression", and scores between 20–27 are considered to be "severe depression". The PHQ-9 has been shown to have good construct and criterion validity along with excellent internal consistency (α = .89; Kroenke et al., 2001). The internal consistency of the PHQ-9 for the present study was α = .87 at Time 1.

Electronic Gaming Motives Questionnaire (EGMQ)

The EGMQ is a self-report measure of video gaming motives (Myrseth et al., 2017). It consists of 14 items measuring four motives: enhancement (e.g., *because you like the feeling*), coping (e.g., *to forget your worries*), social motives (e.g., *because it makes a social gathering more enjoyable*), and self-gratification motives (e.g., *as a way to celebrate*). Participants respond to the items on a scale ranging from 1 (*almost never/never*) to 4 (*almost always*) (Myrseth et al., 2017). The EGMQ has been shown to have good criterion validity, and good internal consistency (α = .67 to .84; Myrseth et al., 2017). The internal consistency in our sample for baseline coping motives was α = .80 at baseline and α = .81 at Time 2. The internal consistency in our sample for baseline enhancement motives was α = .77 at baseline and α = .80 at Time 2.

Timeline Follow-Back (TLFB)

Though the TLFB method was initially created to assess for alcohol use (Sobell & Sobell, 1992), it has also been successfully used to measure gambling-related behaviours (Weinstock et al., 2004), substance use (Agrawal et al., 2008), and video gaming (Peter et al., 2020) in previous studies. In the current study, participants completed an online, self-report version of the TLFB. Participants used the TLFB method to measure the time spent gaming (in hours) at the three time points of data collection. At each time point, the time spent gaming is based on the week prior to completing the survey (e.g., *To help us evaluate your game use, we need to get an idea of your game use was like in an average week in the past month (30 days). To do this, we would like you to fill out the calendar below*). Participants were asked to fill in the number of hours that they typically spent gaming on each day of the week over the past month. The number of hours spent gaming per day were then summed across the days.

Internet Gaming Disorder Scale—Short Form (IGDS-SF9)

The IGDS-SF9 scale is a 9-item self-report measure that was adapted using the nine core DSM-5 criteria that defines Internet Gaming Disorder (APA, 2013). Items are rated on a 1 (*never*) to 5 (*very often*) Likert-type scale (e.g., *Do you feel more irritability, anxiety, or even sadness when you try to either reduce or stop your gaming activity?*), with higher

scores being indicative of higher levels of Internet Gaming Disorder (Lemmens et al., 2015). It has been shown to have good internal consistency (α = .83), along with good criterion and concurrent validity (Lemmens et al., 2015; Pontes & Griffiths, 2015). The internal consistency of the IDGS-SF9 in our sample ranged from α = .90 and α = .91.

Data Analysis Overview

We conducted preliminary analyses prior to hypothesis testing with path modelling. This involved data screening (i.e., winsorizing extreme values to ± 3.29 standard deviations from the mean and verifying multiple regression assumptions) and conducting a missing data analysis. For the missing data, we used a series of *t*-tests to examine potential baseline differences between participants with complete data versus those with incomplete data (Enders, 2010). This was done to determine the nature of data loss. Next, we used Structural Equation Modeling (SEM) in MPlus v7.4 to test the hypothesized model (Muthén & Muthén, 2017).

In the main SEM analysis, we modelled emotional vulnerability as a latent predictor, with anxiety and depression as indicator variables. It has been previously demonstrated that excessive gaming is positively associated with symptoms of depression and anxiety (Ballabio et al., 2017; Fazeli et al., 2020; Kim et al., 2016; Teng et al., 2021). Depression and Anxiety have been shown in several studies to be highly comorbid with one another (Gorman, 1996; Hirschfeld, 2001; Pollack, 2005; Sartorius et al., 1996). Given this high comorbidity, the current literature has suggested that anxiety and depression should be conceptualized as one transdiagnostic factor rather than separate entities (Brown & Barlow, 2009; Craske, 2012). Given this association, we captured this underlying dimension of depression and anxiety together by creating a latent predictor, emotional vulnerability, using scores from the Generalized Anxiety Disorder Scale (GAD-7), and the Patient Health Questionnaire (PHQ-9) to calculate the shared variance between the two. Emotional vulnerability at Time 1 was specified as the main predictor; coping and enhancement motives at Time 2 (controlling for Time 1) were entered as correlated mediators; and time spent gaming and related problems at Time 3 (controlling for Time 1) were specified as correlated outcomes. We opted to include only internal motives for gaming in the main SEM analysis based on the literature showing that these motives are generally associated with greater gaming-related harms relative to external motives (Ballabio et al., 2017; Hellström et al., 2015; Kuss et al., 2012; Myrseth et al., 2017). Including enhancement motives in the model also allowed us to demonstrate the specificity of coping motives as a hypothesized mediator. Overall, our specified longitudinal SEM analysis allowed us to establish complete temporal precedence among predictors, mediators, and outcomes, which strengthened our interpretation of mediational effects.

Fit of the hypothesized model was evaluated using several indices. Fit was considered excellent if the following guidelines were met: a χ^2/df ratio ≤ 3.0 (Kline, 2010); a root mean square error of approximation (RMSEA) ≤.06; a comparative fit index (CFI) ≥.95; and a standardized root mean square residual (SRMR) ≤.08 (Hu & Bentler, 1999) In addition, the precision and reliability of direct and indirect paths were evaluated using a bootstrapped bias-corrected 95% Confidence Interval (CI) approach (Fritz & MacKinnon, 2007). If the 95% CI for a given direct or indirect path coefficient does not include zero, the effect is considered to be supported (Fritz & Mackinnon, 2007; Hu & Bentler, 1999; Kline, 2013). Full information maximum likelihood (FIML) was used to handle missing data and Maximum Likelihood Ratio (MLR) was used to obtain fit indices, given the non-normality of the gaming outcomes (Muthén & Muthén, 2012). Following the main SEM, the invariance of our model was tested across biological sex (i.e., men vs. women) and Canadian province (Ontario vs. other provinces). Approximately 51% of our sample originated from Ontario, which was a province that had quick and widespread lockdowns, along with other provincial guidelines. In addition, Ontario is the largest province in terms of population size and density. As such, we wanted to ensure that the model was similar in Ontario versus the rest of Canada.

In order to proceed with the path invariance testing, the proposed model was first tested in each sex or provincial group individually to ensure good fit. A configural model was then tested, one that allows the paths to vary freely between groups. Assuming that good model fit was established in these first two steps, a path invariance model was estimated that constrains the direct effects to be equal effects across sex groups or provincial groups, accordingly. If there were no significant differences in model fit between the configural and invariant models, then it was inferred that the overall model applies equally across sex (i.e., to both males and females) or provincial (i.e., to both Ontario and other provinces) groups. Differences in fit between path invariant and configural models were evaluated using the $\Delta\chi^2$ test and the change in CFI value. A significant difference between models is supported if the *p*-value for the $\Delta\chi^2$ test is below .05 and/or the ΔCFI is ≥ .01 (Cheung & Rensvold, 2002).

Results

Descriptive Statistics

Table 2 shows the descriptive data for the observed variables. The mean score on the IGDS-SF9 suggested that the Gaming Disorder symptoms in our sample were well below the clinical cut-off of 36 (Pontes & Griffiths, 2015) that would be indicative of disordered gaming behaviours. Our participants spent on average approximately 20 hours per week (*SD* = 16.08) gaming at the beginning of the study (~2.86 hours per day), and approximately 13 hours per week (*SD* = 14.55) gaming at Time 3 (~1.86 hours per day). The scores for both the PHQ-9 and the GAD-7 were indicative of endorsement of mild symptoms of depression and anxiety, respectively. Despite the mean being low in this sample, we did observe a wide range of gaming activity, and symptoms of anxiety and depression. As such, this gave us variability in order to allow us to analyze our SEM model.

Table 2. *Descriptive Statistics for the Observed Variables.*

Variable	Mean	Median	*SD*	Range
Gaming Problems (T1)	15.13	13	6.38	9–45
Gaming Problems (T3)	14.07	12	6.00	9–37
Time Spent Gaming (T1)	19.95	17	16.08	0–164
Time Spent Gaming (T3)	13.37	9	14.55	0–111
PHQ-9 (T1)	7.81	7	5.32	0–27
GAD-7 (T1)	5.96	6	4.67	0–21
Coping Motives (T1)	9.50	9	2.85	4–16
Coping Motives (T2)	8.90	8	2.94	4–16
Enhancement Motives (T1)	8.86	9	2.24	3–12
Enhancement Motives (T2)	8.69	9	2.37	3–12

Of the original sample, a total of n = 264 completed the second time point, and n = 228 completed the third time point. T-tests examining baseline differences between completers (coded as 1; n = 228) and non-completers (coded as 0; n = 104) did not reveal significant differences on any measures included in the main SEM model: PHQ-9, $t_{(330)} = -0.13$, $p = .90$, GAD-7, $t_{(330)} = -1.07$, $p = .29$, time spent gaming, $t_{(330)} = 0.82$, $p = .42$, gaming problems, $t_{(330)} = 0.31$, $p = .75$, coping motives, $t_{(330)} = -1.62$, $p = .11$, or enhancement motives, $t_{(330)} = -.91$, $p = .36$.

Mediation Model

Model Results

The fit of our original hypothesized model was excellent: $\chi^2 = 36.65$, $df = 21$, $p = .018$, $\chi^2/df = 1.74$; CFI = .982, RMSEA = .047, 95% *CI* [.019, .072], SRMR = .036. The coefficients and 95% CIs for the direct paths are shown in Figure 1. As hypothesized, high levels of emotional vulnerability at baseline predicted elevated coping motives at Time 2, controlling for coping motives at Time 1. The effect of emotional vulnerability on enhancement at Time 2, controlling for enhancement motives at Time 1, was not statistically significant. Coping motives at Time 2 were significant positive predictors of both gaming problems and time spent gaming at Time 3, controlling for baseline gaming behaviours. Enhancement motives at Time 2 were not a significant predictor of gaming problems or time spent gaming at Time 3, after controlling for baseline gaming behaviours. Next, indirect effects were inspected. As hypothesized, there were supported mediational effects from emotional vulnerability (Time 1), via coping motives (Time 2), to both gaming problems β = .018, 95% *CI* [0.001, 0.055], and time spent gaming β = .016 95% *CI* [.001, .047] at Time 3. No mediational effects were observed from emotional vulnerability to gaming behaviours via enhancement motives, suggesting specificity through coping motivations. Overall, our findings show that elevated depression and anxiety early in the pandemic relate to future coping-motivated gaming and associated harms.

Next, the invariance of the proposed model was tested across sex (male vs. female), as well as location (Ontario vs. other provinces). The fit and model values for these invariance tests can be found in Table 3. The model fit the

data well for males and for females. As seen in Table 3, there was no significant difference between the configural and path invariant models, suggesting that the effects in our path model did not differ between the sex groups. Similar results were obtained for invariance testing across provinces (see Table 3), suggesting that the hypothesized model was applicable to individuals living across Canada.

Table 3. *Invariance Testing by Sex and by Province: Model Fit Information.*

Model Type	χ^2	*df*	*p* value	CFI	RMSEA	SRMR	χ^2 difference	*df*	*p* value	CFI difference
					Sex					
Overall	36.65	21	.018	.982	.047	.036				
Male	16.50	21	.741	1.000	.000	.026				
Female	37.51	21	.014	.951	.060	.054				
Configural	54.02	44	.143	.988	.037	.040				
Path Invariance	66.27	50	.061	.981	.044	.048	12.25	6	.056	.007
					Province					
Overall	36.65	21	.018	.982	.047	.036				
Ontario	24.24	21	.281	.993	.030	.044				
Rest of Canada	31.41	21	.067	.974	.055	.049				
Configural	61.61	44	.041	.980	.049	.045				
Path Invariance	66.79	50	.056	.981	.045	.048	5.18	6	.521	.001

Note. Model cut-offs are as follows: Chi-square (p >.05), CFI ≥.95, RMSEA ≤.06, SRMR ≤ .08, chi-squared change (p < .05) and CFI difference < .01.

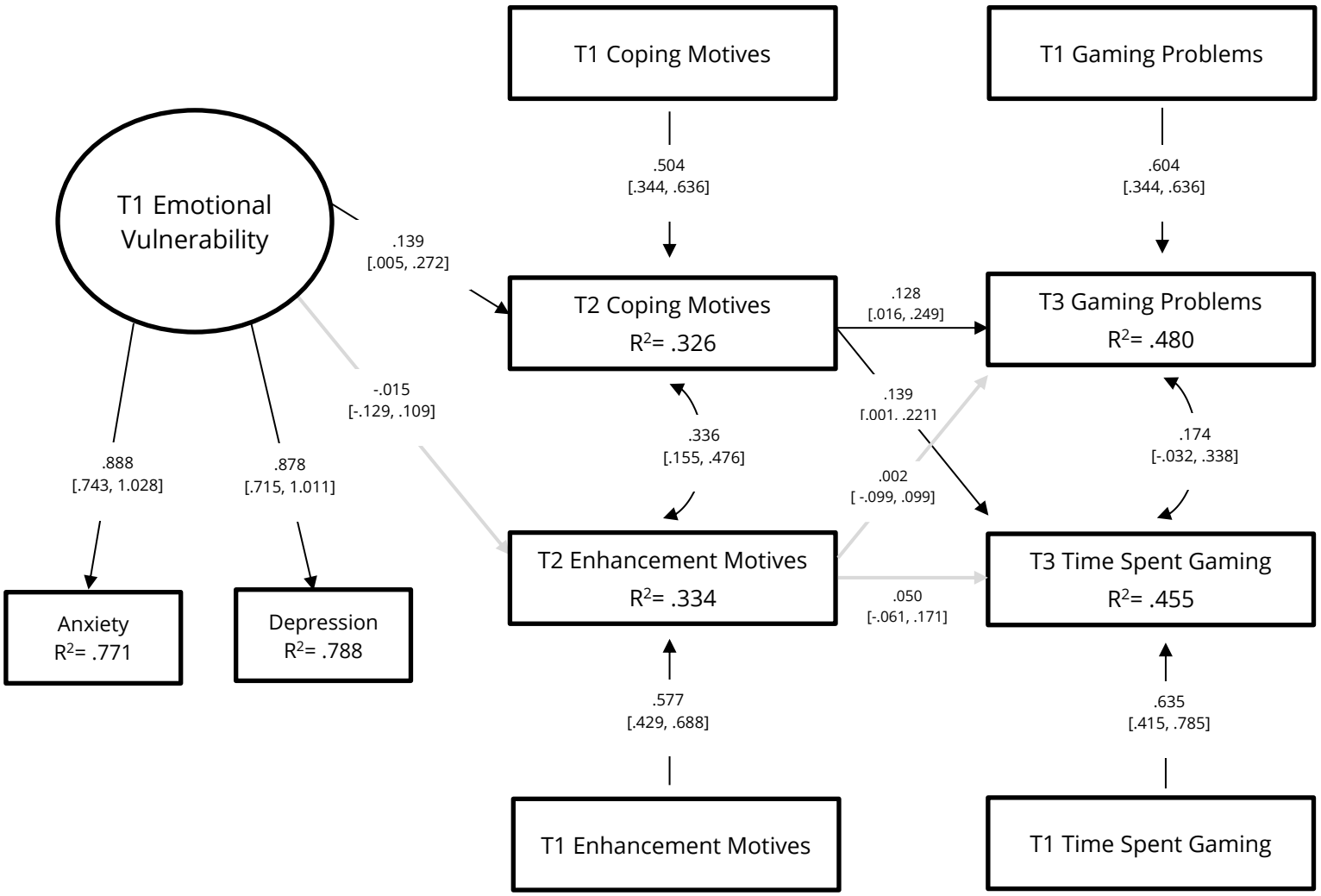
Discussion

This study is the first to longitudinally examine the motivational mechanisms underlying the relationship between emotional vulnerability and gaming-related problems during the COVID-19 pandemic. We found that participants who had higher levels of emotional vulnerability tended to use gaming as a form of coping with that emotional distress.

Moreover, our research demonstrated that those with greater coping motives for gaming at three months into the pandemic also endorsed more gaming problems at six-months into the pandemic along with more time spent gaming. This suggests that during the COVID-19 pandemic, individuals may have been turning to gaming in an attempt to cope with their emotional vulnerability or their newfound social isolation. Furthermore, this suggests that some individuals were not gaming for the simple pleasure of gaming in and of itself and may have been attempting to use gaming as a method of reducing their emotional distress. This model seemed to apply to both males and females, and those across Canada, as evidenced by the invariance testing that was conducted.

These findings are consistent with previous research, showing that those who report higher levels of stress and anxiety also tend to demonstrate an increase in passive coping styles such as escapism (Fu et al., 2020) and that coping motives are strongly associated with a heightened risk of problematic addictive behaviours (Moitra et al., 2015; Wisener & Khoury, 2021). These findings are particularly important when considering the context of the COVID-19 pandemic. There are established links between emotional vulnerability and problematic gaming (Balhara et al., 2018); however, the motivational mechanisms of this association, particularly during the pandemic, have not been described prior to this study (Fazeli et al., 2020; Teng et al., 2021). Research has shown that those who are emotionally vulnerable were disproportionately affected by the pandemic (Panteli et al., 2022; van der Velden et al., 2020), and these individuals may have used gaming excessively as a way to distract themselves from those negative emotions (King et al., 2020; Teng et al., 2021). Although many individuals use gaming as a positive coping method to mitigate their stress, anxiety, depression, and loneliness (Barr & Copeland-Stewart, 2022; Pallavicini et al., 2022), for individuals who were at-risk for addictive behaviour (e.g., male youths or those with maladaptive or avoidant coping styles), excessive gaming has been found to have long-term increases in symptoms of anxiety, depression, and overall stress, but short-term relaxing effects to the player (Pallavicini et al., 2022).

Figure 1. *Structural Equation Model of Emotional Vulnerability to Gaming Behaviours Through Coping and Enhancement Gaming Motivations.*



Note. Grey arrows represent non-significant pathways, while black arrows denote significant pathways. Standardized estimates are shown with their corresponding 95% confidence intervals. The covariances among all T1 variables were included in the model but omitted from the figure.

This relationship may be further explained by the self-medication hypothesis, which states that individuals who are more emotionally vulnerable and are at risk for gaming excessively do so to cope with their emotional distress (Balhara et al., 2018; González-Bueso et al., 2018; King & Delfabbro, 2016; Liu et al., 2018; Vadlin et al., 2016; Wartberg et al., 2017). Within the context of the COVID-19 pandemic, studies have found that those who experience heightened stress, depression, or anxiety due to social isolation or loneliness, also tend to experience excessive gaming behaviours (Rozgonjuk et al., 2022; Sallie et al., 2021; Xu et al., 2021). Furthermore, previous research has also found higher emotional distress among those who game excessively during the COVID-19 pandemic (Giardina et al., 2021). Therefore, it may be that these individuals are gaming as a means to cope with their emotional distress.

The results of this study may help to determine how gaming is being used during the pandemic as a coping method and may subsequently inform interventions relating to problematic gaming or pandemic-related coping methods. Given that coping motives seem to be associated with increased problematic gaming, it may be beneficial to incorporate coping motives for gaming and emotional vulnerability into interventions designed to curb the incidence or severity of Gaming Disorder, particularly within the context of the COVID-19 pandemic. In particular, it may be beneficial for interventions to focus on establishing or strengthening coping mechanisms or reducing pre-existing emotional vulnerability. This may be an area for future research.

This study had some limitations. Firstly, the participants in this study were Canadian; given that the data came only from one country, the results may not necessarily be generalizable to other countries. Secondly, given the convenience recruitment of the participants through Prolific, an online survey platform, and that we do not have comprehensive pre-pandemic information on the participants' gaming behaviours, we are unable to speak to

changes in gaming from pre- to post-pandemic, and can only interpret the findings of changes during the pandemic. Furthermore, participants all were self-reported regular drinkers of alcoholic beverages. It may be beneficial to repeat this study with a participant pool from the general population that includes people who do not drink as well, to increase generalizability of our findings. The socioeconomic status of our sample is also relatively high, and most of our participants did not live alone which may limit the generalizability of results to more diverse socioeconomic populations or those with higher levels of isolation. In addition, our sample was largely subclinical in their gaming behaviours and emotional vulnerability. As such, while our results are consistent with theories of gaming behaviour, this study should be replicated and extended to populations with more severe emotional vulnerability and gaming problems. Future studies should aim to replicate this study using larger and more diverse samples and may wish to consider COVID-specific contextual factors such as incidence rate in the participants' location and adherence to governmental guidelines regarding physical distancing. Furthermore, future studies should aim to consider using measures that have been validated for COVID-19-specific concerns and behaviours.

Conclusion

These findings aid in our understanding of gaming behaviours and gaming motivations during the COVID-19 pandemic. This longitudinal study provides information not only to how individuals were coping with the extreme changes that have occurred due to the pandemic and governmental guidelines, but also how emotional vulnerability may have influenced their gaming behaviours. Given that since the time of data collection there have been significant changes- most notably, the introduction of COVID-19 vaccines- it will be important to determine how these coping motivations and gaming behaviours are altered as the pandemic continued. It has been suggested that the impacts of the pandemic on addictive behaviours will be long-term given the increased psychological distress that accompanies the pandemic (Rehm et al., 2020), and it will be important to investigate these long-term impacts.

Conflict of Interest

The authors have no conflicts of interest to declare.

Authors' Contribution

Rebecca Lewinson: writing—original draft, writing—review & editing, formal analysis. **Jeffrey D. Wardell:** conceptualization, methodology, writing—review & editing. **Naama Kronstein:** data curation, project administration, investigation, writing—review & editing. **Karli K. Rapinda:** data curation, project administration, investigation, writing—review & editing. **Tyler Kempe:** data curation, project administration, investigation. **Joel Katz:** supervision, writing—review & editing. **Hyoun S. Kim:** methodology, writing—review & editing. **Matthew T. Keough:** supervision, writing—review & editing, formal analysis, conceptualization, methodology.

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