

Running Head: EXCESSIVE GAMING AND DEPRESSION

Examining the Temporal Associations Between Excessive Gaming and Depression

by

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## Abstract

In North America, excessive videogame use frequently co-occurs with negative mood (i.e., depression). Current literature provides mixed support for three different models of temporal precedence: the vulnerability model (depression precedes excessive gaming), the scar/complication model (excessive gaming precedes depression), and the reciprocal model. The present longitudinal study examined the directional associations between excessive gaming and depression, using a short-term, multi-wave study design. As a novel contribution to the field, this study examined excessive gaming in two distinct forms: gaming-related problems and time spent gaming. A sample of 289 participants from across North America completed a three-wave four-week study through Amazon Mechanical Turk. Participants filled out questionnaires at each wave (i.e., baseline, two weeks, one month) assessing time spent playing video games, intensity of gaming-related problems, and depression symptoms. Two cross-lagged panel models (CLPMs) were run to test the temporal associations between depression and excessive gaming, in terms of both time spent gaming and gaming-related problems. The first CLPM showed evidence for reciprocal effects between depression and gaming-related problems, though the effects over time were more consistent for depression preceding excessive gaming problems, lending support to the vulnerability model. The second CLPM showed no cross-lagged associations between depression and time spent gaming. Both models were invariant across gender. Results further knowledge of the temporal associations between depression and excessive gaming, as well as clarifies depression's unique relation to gaming-related problems. Results support the utility of targeting depressive symptoms in young people with gaming problems.

*Keywords:* video game addiction, excessive gaming, depression, temporal association

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## Examining the Temporal Association Between Depression and Gaming Addiction

### **Scope of the Problem**

In the past 50 years, there has been rapid expansion in the use of video games (Nielsen Company, 2018). Current research estimates that 44% of the internet-using global population play video games (Spilgames, 2013). In Canada, approximately 54% of the population plays video games, equating to almost 19 million individuals (Entertainment Software Association of Canada, 2015). In comparison, approximately 66% of the U.S. population over the age of 13 play video games (Nielsen Company, 2018). Additionally, there are almost equal number of males and females playing videogames (Entertainment Software Association of Canada, 2015), which is a marked shift from the traditional male gamer stereotype (Williams, 2005). Of North Americans that play video games, 45% report playing games every day, which is slightly more than the 39% global average (PayPal Canada, 2018). Some, but not all individuals who spend time playing video games go on to develop problems with excessive gaming (Brunborg, Mentzoni & Froyland, 2014; Gentile et al., 2011). Some people are at risk for developing serious problems from excessive gaming (Festl, Scharkow, & Quandt, 2013; Gentile et al., 2011), and are more likely to develop disordered gaming (Rho et al., 2016). However, it is still unclear which factors distinguish people who develop gaming problems from those who do not.

While gaming has some positive effects (e.g., can improve executive functioning and enhance classroom teaching; Annetta, 2008; Green & Bavelier, 2012;), excessive gaming has been linked to a myriad of negative consequences (Jones et al., 2014). Excessive gaming is associated with increased aggression (Anderson et al., 2010; Anderson & Dill, 2000), greater behavioural difficulties (Baer et al., 2011), less prosocial behaviours (Baer et al., 2011), and more risky behaviours like drug use and drinking (Padilla-Walker et al., 2010). Excessive

gaming has been linked with experiencing negative affect, namely depression (Gentile et al., 2011; González-Bueso et al., 2018). In other studies, excessive gaming has also been linked indirectly to depression through its symptoms and correlates, such as poorer social connections (Lo, Wang, & Fang, 2005), lower academic performance (Brunborg, Mentzoni, & Froyland, 2014; Gentile et al., 2011), increased alcohol and drug use (Padilla-Walker, Nelson, Carroll, & Jensen, 2010), loneliness (Krossbakken et al., 2018), interpersonal sensitivity (Starcevic, Berle, Proter & Fenech, 2011), and low self-esteem (Walther, Morgenstern, & Hanewinkel, 2012). Despite the large number of studies on excessive gaming and depression, few studies to date have examined the temporal dynamics of these associations. The current study aimed to fill this gap by testing the directional and reciprocal associations between depression and excessive gaming using a three-wave four-week self-report study of North American adults.

### **Internet Gaming Disorder**

Only recently has the excessive use of video games been recognized as a potential disorder. The American Psychiatric Association (APA) has included Internet Gaming Disorder (IGD) in section III of the Diagnostic and Statistical Manual- Fifth edition (DSM-5) as a disorder for future consideration (APA, 2013). IGD has been tentatively labelled as “Internet” Gaming Disorder, although it encapsulates both internet and non-internet-based gaming (APA, 2013; Kuss, Griffiths, & Pontes, 2017). IGD is characterized by persistent and recurrent engagement with video games leading to clinically significant impairment or distress (APA, 2013). Similar to DSM-5, the International Classification of Diseases- eleventh edition (ICD-11), of the World Health Organization has included a beta version of Gaming Disorder (World Health Organization, 2018). In a recent study, 3.2% of gaming Canadians surveyed met criteria for IGD (Sanders et al., 2017), which is similar to other countries (Peukert, Sieslack, Barth & Batra,

2010; Müller et al., 2015). Males generally report more gaming-related problems (Desai, Krishnan-Sarin, Cavallo, & Potenza, 2010; Parker, Taylor, Eastabrook, Schell & Wood, 2008; van Rooij et al., 2014) and hence show higher rates of IGD (González-Bueso et al., 2018).

Excessive gaming is conceptualized as an addictive behaviour, with similar consequences and mechanisms as other recognized addictions (i.e., substance addiction, gambling addiction). Excessive gaming is similarly characterized by increasing amounts of time invested in gaming, impaired control over gaming, and experiencing adverse consequences of gaming (Sanders, Williams, & Damgaard, 2017). Excessive gamers also show differences in brain structures (e.g., frontal areas, striatum) and altered patterns of neurotransmitters (e.g., dopamine) which are associated with reward processing, impulse control, and memory, similar to other addictions (Leeman & Potenza, 2013; Olsen, 2011; Weinstein, 2010). In a recent imaging study by Kühn et al. (2011), 154 adolescents were evaluated using both structural and functional neuroimaging methods. It was found that frequent gamers had greater left ventral striatal grey matter volume, an area of reward processing, compared to infrequent gamers (Kühn et al., 2011). Greater left ventral striatal grey matter volume has also been found in cocaine dependent individuals when they are expecting rewards (Jia et al., 2011), pointing to the potential neurobiological similarities between gaming addiction and other known addictions. Additionally, excessive gamers also show patterns of altered neurotransmitters in the reward system pathways. A study by Koeppe et al. (1998) found evidence for increased dopamine release in the striatum during videogame play. Another study found evidence of higher reward dependency and increased prevalence of dopamine polymorphism genes in excessive gamers (Han et al., 2007).

Excessive gaming is also comparable to other addictions in that it commonly co-occurs with a host of other mental health problems, such as depression. Mood, anxiety, and addiction

disorders are often bundled as common mental disorders, speaking to their interconnectivity (de Graaf, Bijl, Spijker, Beekman, & Vollebergh, 2003). In a meta-analysis by González-Bueso et al., (2018), IGD was demonstrated to be correlated with many major mental illnesses. In the IGD meta-analysis, 92% of selected studies described significant correlations with anxiety, 89% described a significant correlation with depression, and 87% described a significant correlation with ADHD/ hyperactivity symptoms (González-Bueso et al., 2018). Of the 15 studies which looked at depression included in this meta-analysis, 11 reported moderate-to-large effect sizes with IGD symptoms. The comorbid nature of depression and excessive gaming disorder is largely supported by other cross-sectional literature (APA, 2013; Brunborg et al., 2013; Lemola et al., 2011; Starcevic et al., 2011).

### **Potential Theoretical Models**

Despite the multitude of cross-sectional research, the temporal associations between excessive gaming and depression remain unclear (Desai et al., 2010; González-Bueso et al., 2018). Drawing parallels with the addiction literature, we would expect three potential models of how depression relates with excessive gaming (Musquash et al. [2013]): the *vulnerability model* where depression precedes excessive gaming (Khantzian, 1997), the *scar/complication model* where excessive gaming precedes depression (Schuckit, 2006), and the *reciprocal model* where excessive gaming and depression bidirectionally influence each other (Krossbakken et al., 2018).

#### Vulnerability Model

The vulnerability model posits that depression precedes excessive gaming. Specifically, the self-medication theory suggests that individuals may engage in addictive behaviours to numb painful emotions (Khantzian, 1997). To illustrate, the literature demonstrates that individuals who misuse alcohol and/or drugs do so because they are trying to cope with strong negative

emotions, like depression. (Carrigan & Randall, 2003; Frone, 2016; McKernan et al., 2015; Weiss, Griffin & Mirin, 1992). Self-medication theory may also apply to excessive gaming as well, as individuals are known to use video games to avoid or distract themselves from negative moods (Hussain & Griffiths, 2009). In using video games to reduce negative emotions, video games become a dysfunctional coping strategy that persists over time (Thalemann, 2009). There is research supporting this directional relation, where lower psychosocial well-being (i.e., depression) is more likely to be a cause rather than a consequence of excessive gaming (Kowert, Vogelgesang, Festl, & Quandt, 2015; Lemmens, Valkenburg & Peter, 2011; Seay & Kraut, 2007). A longitudinal study by Lemmens and colleagues (2011) suggested that depression precedes excessive gaming in a population of Dutch adolescents. In this study, researchers conducted a 2-wave 6-month survey which demonstrated that perceived social competence and self-esteem (i.e., symptoms and correlates of depression) were significant predictors of excessive gaming in terms of the time participants spent gaming (Lemmens et al., 2011).

#### Scar/Complication Model

In contrast to the vulnerability model, the scar/complication model suggests that depressive symptoms are a consequence of excessive gaming (Bagby, Quilty, & Ryder, 2008; Schuckit, 2006). Some longitudinal studies suggest that excessive gaming leads to internalizing symptoms (e.g., depression; Lobel et al., 2017), and may contribute to elevated emotional distress among adolescents (Wartberg, Kriston, Ziegelmeier, Lincoln, & Kammerl, 2019). A longitudinal study by Gentile and colleagues (2011) supports the scar/complication model for excessive gaming in terms of both gaming-related problems and time-spent gaming. This 3-wave 2-year research study conducted in a population of Singapore children demonstrated that

depression, anxiety, and social phobia were outcomes, rather than causes, of excessive gaming (Gentile et al., 2011).

### Reciprocal Associations Model

Some longitudinal research suggests that excessive gaming leads to depression, and other research suggests that depression leads to excessive gaming (Gentile et al., 2011; Kowert et al., 2015). This being said, it is also possible that there are reciprocal associations in which excessive gaming both impacts and is impacted by depression. Loneliness, a symptom of depression, has been found to be both a precursor to, and a consequence of excessive gaming (Lemmens et al., 2011). Further, a recent study from Norway also suggests that loneliness, as well as depression, were reciprocally associated with gaming-related problems (Krossbakken et al., 2018). In this 3-wave 3-year study by Krossbakken and colleagues (2018), 3000 adolescents completed self-report measures on video game addiction and mood. Results using a cross-lagged path model suggested that there are temporal associations between depression and excessive gaming, and that these are reciprocal (Krossbakken et al., 2018). Additionally, these findings were consistent across gender groups in their sample, indicating that these reciprocal associations existed for both boys and girls during adolescence (Krossbakken et al., 2018). To date, there are no cross-lagged studies examining these temporal associations in a North American adult population, and very few studies exist like the Krossbakken and colleagues (2018) article worldwide.

### **The current study**

The current study used a short-term longitudinal design to examine the temporal associations between excessive gaming and depression. For this study, participants were recruited from across North America using Amazon's Mechanical Turk (MTurk) and were asked to complete online questionnaires assessing gaming habits, gaming-related problems, and mood

(i.e., depression) at baseline, two-weeks, and one-month timepoints. Overall, the goal of this study was to explore three competing theories of the directionality between depression and two aspects of gaming behaviours (time spent gaming and associated problems). Therefore, no strong hypotheses were made about the temporal associations between these variables over time.

The novelty of the present study is three-fold. First, a large portion of the available literature on the relations between depression and excessive gaming is based on cross-sectional designs, which limit inferences about temporal precedence. Hence, the short-term, multi-wave longitudinal design used in this study aimed to better address the temporal effects between depression and gaming behaviours. Moreover, any longitudinal studies that exist study either only younger age groups or populations from other countries (i.e., Gentile et al., 2011; Krossbakken, 2018; Lemmens et al., 2011). Seeing as North American adults have higher rates of daily gaming compared to other countries (PayPal Canada, 2018), there is a need to explore these temporal associations in a North American adult population. Second, as previously indicated, video game use does not necessarily indicate gaming-related problems (Brunborg, Mentzoni & Froyland, 2014; Gentile et al., 2011). Brunborg and colleagues (2014) found evidence showing that IGD symptoms, but not amount of time spent playing video games, was related to negative outcomes like depression. The current study made this distinction by measuring excessive gaming in terms of both time spent gaming and gaming-related problems. This distinction in measurement allowed greater clarification of the relation between depression and excessive gaming. Third, the present study tested if the temporal associations between depression and gaming were similar (or different) for men and women.

## **Method**

### **Participants and Procedure**

The Research Ethics Board at the University of Manitoba approved this study. Informed consent forms can be found in Appendices A through C. A sample of 289 participants were recruited at time one through Amazon Mechanical Turk, an online marketplace for workers to complete surveys. Only participant data with verifiable MTurk worker codes were included in the analyses. See Table 1 for full participant information. Participants consisted of 56.7% males, and 42.9% females, with one missing data point (0.3%). Participants' age ranged from 18 to 74, with the largest majority of the participants in their late twenties to early thirties (57.1%). The majority of participants reported being of White ethnicity (72%). Most participants had at least a college or university degree (64.4%) and many reported having a full-time job (76.5%).

Data were also collected on the nature of video games played (see Table 2). Participants were asked to select each category of gaming which applied to them, with multiple responses allowed. The largest portion of participants used a computer system to play video games (76.5%), followed by mobile device (54%) and PlayStation console (47.4%). As for the genre of games played by participants, the majority of participants reported playing action/adventure games (65.7%), followed by puzzle games (49.5%), shooter games (46.6%), and role-playing games 38.1%). When playing video games, 51.9% of participants reported communicating with other players over headsets, 48.4% reported using in game text chats to communicate with others, and 33.2% reported no communication with other players. Additionally, the largest portion of participants (20.4%) reported spending approximately \$100 per month on video games (not including buying the game itself, but instead on subscriptions, loot boxes, and upgrades).

In line with previous short-term, multi-wave studies (Mackinnon & Sherry, 2012; Musquash et al., 2012), a 3-wave 4-week questionnaire administration schedule was used. Short-term, multi-wave studies allow dynamic changes, such as in addictive behaviours or mood, to be

captured in an efficient and accurate manner (Musquash, et al., 2013). Additionally, using short-term follow ups allow for the minimization of potential recall biases that are sometimes associated with depression (Abela, Hankin, Sheshko, Fishman, & Stolow, 2012). Data collection occurred from March to April of 2019. Demographics were only collected at Time 1, otherwise questionnaires were the same in all waves. Participants were English-speaking adults (aged 18+) from North America. Eligible participants had previously completed at least 300 Human Intelligence Tasks (HITS) on Amazon Mechanical Turk with an approval rating not less than 95%. All questionnaire materials were completed through Qualtrics, an online survey platform.

Participants completed three waves of questionnaires, where Time 1 was the baseline measure, Time 2 was collected two-weeks after baseline, and Time 3 was four weeks after baseline. Questionnaires consisted of demographics, a Gaming Habits Questionnaire (GHQ), a Gaming TimeLine Follow-Back (G-TLFB), the Internet Gaming Disorder Scale- Short Form (IGDS-SF9; Pontes & Griffiths, 2015), and the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1997). Participants received \$2.50 for each timepoint they completed, with a \$2.00 bonus if they complete all three timepoints for a total potential compensation of \$9.50. After the Time 3, participants were given access to a debriefing form. Attrition rates were consistent with other research in video game addiction literature (Scharnow, Festl, & Quandt, 2014; Strittmatter et al., 2016). Of the 289 participants who completed Time 1, 237 (82%) participants completed Time 2, and 185 (64%) participants completed Time 3.

### **Measures**

**Gaming Habits Questionnaire.** The Gaming Habits Questionnaire (GHQ) was created to assess type and method of video gaming activity. Participants were instructed to answer questions on their preference of different video games genres (e.g., action, massively multiplayer

online role-playing games, role playing, shooter, etc.), gaming systems used (e.g., Xbox, Wii, Nintendo), and money spent on gaming (i.e., “How money do you spend on video games in six months [on subscriptions, game upgrades, loot boxes, not original game purchase]?). The GHQ also assessed proportion of time spent playing games alone compared to time spent gaming with others, where they chose to game (e.g., home, arcade, friend’s house), and with whom (e.g., alone, family, friends). Additionally, the GHQ assessed forms of communication with others while playing games (e.g., headset, text chats). Participants completed this questionnaire at all three timepoints.

**Gaming Timeline Follow-Back.** The Gaming Timeline Follow-Back (G-TLFB) was adapted from the TLFB method by Sobell and colleagues (1996), which was originally created to assess alcohol consumption. The G-TLFB was adapted to assess time spent playing games each day over the previous two weeks. Participants were instructed to estimate the number of hours each day spent playing video games (i.e., “On days when you did not play games, you should enter a ‘0’. On days when you did play games, you should enter in the total number of hours you spent playing”). The G-TLFB was completed at all three timepoints and was used as the primary measure of time spent gaming. The TLFB method of recalling engagement in behavioural addictions has been shown to be reliable and valid in both disordered and non-disordered gambling populations (Weinstock, Whelan, & Meyers, 2004). Seeing as gambling and excessive gaming are similar in nature (Hellman, Schoenmakers, Nordstrom & Van Holst, 2013), a TLFB method was appropriate in capturing time spent gaming.

**Internet Gaming Disorder Scale - Short Form.** The Internet Gaming Disorder Scale-Short Form (IGDS-SF9; Pontes & Griffiths, 2015) included nine items and provided a measure of gaming disorder symptoms (i.e., “Do you feel more irritability, anxiety, or even sadness when

you try to either reduce or stop your gaming activity?”). Each of the nine items related directly to the Diagnostic and Statistical Manual of Mental Disorder’s criteria for Internet Gaming Disorder. The IGDS-SF9 was administered at all three timepoints and was used as the primary measure of gaming problems. Participants responded to items on scales ranging from 1 (*never*) to 5 (*very often*). Total scores were used, with possible scores ranging from 9 to 45, where higher scores indicated greater severity of gaming disorder symptoms. A cut-off score of 36 or more indicated disordered gaming (Pontes & Griffiths, 2015). Pontes & Griffiths (2015) note that the purpose of this scale is not to diagnose IGD, but instead to assess severity of gaming problems and negative impact on their life. The IGD-SF9 has been shown to be reliable and valid (Pontes & Griffiths, 2015). In this study, the IGD-SF9 showed to have high internal consistency across all timepoints (see Table 3).

**The Center for Epidemiological Studies Depression Scale.** The Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1997) included 20 items and provided a measure of depressive symptoms during the past two weeks (e.g., “I felt that everything I did was an effort”). The CES-D was administered at all three timepoints and was used as the primary measure of depressive symptoms. Participants responded to items on scales ranging from 0 (*rarely or never*) to 3 (*most or all of the time*). Total scores ranging from 0 to 60 were used, where higher scores indicated more depressive symptoms. The CES-D has been shown to have high internal consistency ( $\alpha = 0.85-0.90$ ) and moderate test-retest reliability ( $r = 0.40$ ; Radloff, 1997). In this study, the CES-D showed to have high internal consistency across all timepoints (see Table 3).

## **Data Analysis**

### **Data Analysis Overview**

All statistical analyses were performed using IBM SPSS Statistics and MPlus (version 8.0). Before conducting the CLPMs, descriptive statistics for all measures were inspected and a missing data analysis was conducted to identify any possible baseline differences between individuals with complete versus those with incomplete data across the timepoints. As noted below (in the results), the preliminary t-tests revealed that participants with incomplete data were systematically different from those with complete data in terms of baseline depression and IGD symptoms. This suggested that data were (initially) missing not at random (Enders, 2010). In this situation, it is recommended that auxiliary or covariate variables (those that can account for missingness, like certain demographic factors) be explored to see if they can reduce the bias associated with systematic missingness. Data can be considered missing at random with the inclusion of relevant auxiliary variables in a statistical model (Enders, 2010). Once the missing data analyses were complete, two CLPMs were conducted: one examining the autoregressive and cross-lagged effects between time spent gaming and depression across all timepoints and the other examining the same effects but between gaming-related problems and depression. Based on recommended guidelines (Hooper, Coughlan, & Mullen, 2008; Kline, 2016), model fit was considered excellent if the following guidelines were met: non-significant  $\chi^2$  ( $p > .05$ ), comparative fit index [CFI]  $\geq 0.95$ , root-mean-square error of approximation [RMSEA]  $\leq 0.06$ , and standardized root mean square residual [SRMR]  $\leq 0.08$ . Full information maximum likelihood estimation was used for both CLPMs.

The CLPM analyses began with testing a model containing all autoregressive and cross-lagged effects across timepoints. Relevant time invariant auxiliary variables (identified during the missing data analysis) were also included. If this initial model provided inadequate fit to the data, then theoretically permissible paths were added to the model to improve fit. Modification

indices were also inspected for this purpose. Once each model achieved good fit, the invariance of each model was tested across gender groups (i.e., men and women). Path invariance testing proceeds in three main steps. First, the retained model was tested in each gender group separately to ensure good fit. Second, a configural model was estimated (i.e., an average model across gender) and fit was assessed relative to the established cut-offs. Third, providing good fit of a model at step one and two, a path invariance model was estimated – one which constrains effects to be equal across gender groups. If there were no substantial differences in model fit between configural and path invariant models, then this supports that the retained CLPM applies equally to both men and women (i.e., no gender differences). Differences in fit between nested models was evaluated using the  $\Delta\chi^2$  test and the change in the CFI value. A substantial difference between models was supported if the *p*-value for the  $\Delta\chi^2$  test was below .05 and/or the  $\Delta$ CFI was  $\geq .01$  (Cheung & Rensvold, 2002).

## Results

### Descriptive Statistics and Missing Data Analysis

Demographics of the 289 participants are summarized in Table 1. Mean, standard deviation, alpha reliabilities for each timepoint is summarized in Table 3. Average levels of depression symptoms, gaming-related problems, and time spent gaming show high stability for all three behaviours across time. Average depression symptoms as measured by the CES-D were slightly lower to comparable with other Canadian averages (Frohlich, Rapinda, O'Connor, & Keough, 2018; Musquash et al., 2013). Average gaming-related problems as measured by the IGD-SF9 are comparable to sample populations in Australia and slightly lower than the U.S average (Stravopoulous et al., 2018). Average time spent gaming as measured by the G-TLFB was much higher compared to other U.S. estimates (Nielsen Company, 2018), but similar to average

hours reported in a study from Australia (Johnson, Gardner, & Sweetser, 2016). Skew and kurtosis were deemed acceptable following the cut-offs suggested by Kline (2016), where skew should have a value below 3, and kurtosis should have a value below 10.

Potential baseline differences between those with incomplete (coded as 0;  $n = 105$ ) and those with complete (coded as 1;  $n = 184$ ) data using t-tests. There were no statistically significant baseline group differences in time spent gaming [ $t(287) = -.047, p = .961, d = .194$ ]. However, participants who dropped out had more severe gaming-related problems at baseline [ $t(287) = 5.694, p < .001, d = .471$ ], and more severe depression symptoms [ $t(287) = 5.843, p < .001, d = .254$ ]. Three covariates were examined to see if they accounted for missingness: (1) self-identified ethnicity, (2) job status (i.e., full-time, part-time, or unemployed), and (3) level of education. Inclusion of these three auxiliary variables was based on previous work. Research has demonstrated inconsistent differences in video game use according to ethnicity (Carson, Lê Cook, Chen & Alegria, 2012), with some research indicating minorities use video games more often than White individuals (Bickham et al., 2003; Elliot, Ream, McGinsky, & Dunlap 2012), and other research indicating White individuals use more video games than minorities (Williams, 2005). People who are unemployed are at greater risk for excessive gaming (Ream, Elliott, & Dunlap, 2011), and those who are employed are less likely to be problem gamers (Elliot et al., 2012). Finally, higher educational attainment is negatively correlated with excessive gaming (Elliot et al., 2012). Therefore, our covariates were whether the participant was White (1 = White, 0 = Minority), had a full-time job (1 = full-time job, 0 = less than full-time job), and had held a university degree (1 = Bachelors or higher, 0 = lower than a university degree).

Hierarchical multiple regressions were used to examine if the three identified covariates accounted for the associations between missingness and depression/gaming-related problems. In

the first regression, gaming-related problem severity at baseline (outcome) was regressed on the three covariates and baseline depression (step 1) followed by the binary missingness variable (step 2). After including the covariates (explaining 49.8% of the variance), missingness did not account for much additional variance in gaming-related problems at baseline ( $\Delta R^2 = .009$ ). In the second regression, depression symptom severity at baseline (outcome) was regressed on the three covariates and baseline gaming-related problems (step 1) followed by the binary missingness variable (step 2). After including the covariates (explaining 49.1% of the variance), missingness again did not account for much additional variance in baseline depression symptoms severity ( $\Delta R^2 = .014$ ). Overall, the inclusion of the three relevant covariates reduced the associations between missingness and depression/gaming-related problems substantially. Therefore, these were included in both CLPMs.

### **Cross-Lagged Panel Models**

#### **Model 1: Depression and Gaming-Related Problems**

The original model included four autoregressive paths and four cross-lagged paths. The three covariates (White ethnicity, university graduate education, and full-time employment) were included at the first timepoint for both depression and gaming-related problems. This initial model provided suboptimal fit to the data (see Table 4). Accordingly, the modification indices suggested adding two parameters to the model – a covariance among error terms for Time 1 and Time 3 depression and another covariance among error terms for Time 1 and Time 3 gaming-related problems. This substantially improved model fit, as indicated by a statistically significant  $\Delta\chi^2$  test and a  $\Delta\text{CFI}$  of 0.018. Fit of this modified model was excellent and therefore it was retained (see Table 4 and Figure 1).

As seen in Figure 1, all autoregressive paths were statistically significant, suggesting stability in depression and gaming-related problems over the study period. Most of the cross-lagged paths were significant: Time 1 depression to Time 2 gaming-related problems, Time 2 depression to Time 3 gaming problems, and Time 2 gaming-related problems to Time 3 depression. The cross-lagged path between Time 1 gaming-related problems to Time 2 depression was non-significant. The pattern and strength of the cross-lagged effects suggests that there are reciprocal associations between depression and gaming-related problems – albeit the effects were more consistent for the direction from depression to gaming-related problems.

Next, the invariance of the above model was then tested across gender groups (see Table 4). The model fit the data well in both men and women, separately. This permitted for the sequential testing of configural and path invariant models. As seen in Table 4, there were no statistically significant differences between these models, suggesting that the effects in the overall retained CLPM did not differ across gender groups.

### **Model 2: Depression and Time Spent Gaming**

The original model included four autoregressive paths and four cross-lagged paths. The three covariates (White ethnicity, university graduate education, and full-time employment) were included at the first time point for both depression and time spent gaming. This initial model provided suboptimal fit to the data (see Table 5). Accordingly, the modification indices suggested adding one parameter to the model – a covariance among error terms for Time 2 and Time 3 depression. This substantially improved model fit, as indicated by a significant  $\Delta\chi^2$  test and a  $\Delta\text{CFI}$  of 0.012. Fit of this modified model was excellent and therefore it was retained (See Table 5 and Figure 2).

As seen in Figure 2, all autoregressive paths were statistically significant, suggesting stability in depression and time spent gaming over the study period. None of the cross-lagged paths were significant, suggesting no directional or reciprocal associations between depression and time spent gaming.

Next, the invariance of the above model was then tested across gender groups (see Table 5). The model fit the data well in both men and women, separately. This permitted for the sequential testing of configural and path invariant models. As seen in Table 5, there were no statistically significant differences between these models, suggesting that the effects in the overall retained CLPM did not differ across gender groups.

### **Discussion**

The current thesis aimed to clarify the nature of the relations between excessive gaming and depression, using a short-term, multi-wave study design. This study aimed to address existing gaps in literature by examining the temporal associations between excessive gaming and depression in a North American adult population, distinguishing between gaming-related problems and time spent gaming, as well as testing the models across genders. Following previous literature, three possible models were theorized: the vulnerability model (depression precedes excessive gaming; Khantzian, 1997), the scar/complication model (excessive gaming precedes depression; Schuckit, 2006), and the reciprocal model (Krossbakken et al., 2018).

The CLPM examining depression and gaming-related problems showed support for a reciprocal model, though the effects over time were more consistent for depression preceding excessive gaming problems. This is to say that there was evidence of a bidirectional influence between depression and gaming-related problems, where depression led to gaming-related problems and gaming-related problems led to depression, similar to other research (i.e.,

Krossbakken et al. 2018). However, these reciprocal effects were not consistently observed over time. In the first half of the CLPM for depression and gaming-related problems, there was stronger evidence of the vulnerability model, where depression led to gaming-related problems. There was no significant cross-lagged effect between Time 1 gaming-related problems and Time 2 depression. The vulnerability model of associations between depression symptoms (i.e., perceived social competence and self-esteem) and gaming-related problems has been demonstrated in other research (i.e., Lemmens et al., 2011).

The CLPM examining depression and time spent gaming resulted in no evidence of temporal associations, therefore not fitting any of the three proposed models. This finding is in line with other research which suggests that time spent playing video games may not be related to negative outcomes like depression (i.e., Brunborg et al., 2014; Gentile et al., 2014). The unique association between depression and gaming problems is similar to the broader addiction literature on coping motivated alcohol and substance use. Using alcohol to cope with negative feelings is associated with a wide array of negative problems, regardless of levels of drinking (Merrill & Read, 2010). This same pattern has also been observed in substance use behaviours, where coping motives for marijuana use mediated the relations between negative feelings and marijuana use problems but was not related to frequency of marijuana use (Buckner, Bonn-Miller, Zvolensky, & Schmidt, 2007). Overall, the present study's pattern of finding evidence of reciprocal and vulnerability model associations between depression and gaming-related problems, but not time spent gaming, is consistent with wider addiction literature.

Interestingly, both CLPMs were invariant across genders. This is to say that the temporal associations between depression and gaming-related problems as well as the lack of temporal associations between depression and time spent gaming were demonstrated in both male and

female participants. This is in line with other research studies that found gender invariance in the relations between depression and excessive gaming (i.e., Brunborg et al., 2013; Krossbakken et al., 2018; Lemmens et al., 2011). This gender invariance across models suggests that although males are more likely to be problematic video gamers (Desai et al., 2010; Parker et al., 2008; Turner et al., 2012), the way in which depression relates to gaming behaviours is similar. Additionally, the present study's sample was almost equal for gender representation, with only 56.7% male participants. This may reflect more equal gender rates of video game play (Entertainment Software Association of Canada, 2015), with a marked shift away from the traditional "young White male" gamer stereotype (Williams, 2005). Current research estimates that 55% of online gamers are women (Paypal Canada, 2018).

### **Limitations and Future Directions**

The results of this thesis should be interpreted with three main limitations in mind. First, while the CLPM design can provide insight into temporal precedence, it cannot give direct evidence for causality due to the relatively limited timeframe of the study. CLPMs rely on the lag in between measurement waves to indicate temporal precedence, and cannot ensure an actual causal relation (Kearney, 2017). Despite temporal associations demonstrated in this study, these results do not confirm that depression causes excessive gaming or vice versa. Future research should aim for a longer-term multi-wave study that can follow developmental sequence of events. As an example, it may be helpful to look at temporal associations between depression and excessive gaming over the course adolescence and young adulthood. This would provide a deeper understanding about the emergence of depression and gaming behaviours, as well as how these are associated through the course of early development. Examining these associations earlier in life would allow researchers to capture how the onset of one behaviour (e.g.,

depression) is causally linked with the onset of the other behaviour (e.g., gaming). I was unable to make causal inferences in my study due to the relatively limited developmental scope, as well as the fact that (some) adults would have already developed these issues before the study period.

The second limitation of this study is that only one relevant mental health concern (i.e. depression) was examined. The decision to examine depression specifically was based on the consistently high co-occurring rates between depression and excessive gaming found in previous research (i.e., Brunborg et al., 2013; Lemola et al., 2011; Starcevic et al., 2011). Nevertheless, future research should aim to examine the associations between excessive gaming and multiple mental health issues (e.g., depression, social anxiety, obsessive compulsive symptoms, ADHD symptoms), as mental health issues rarely occur in isolation (de Graaf et al., 2003). Research by González-Bueso et al., (2018) demonstrated the high correlational nature between excessive gaming and mental health issues, but the authors note that future studies should examine the causal nature of the associations over a developmental trajectory.

The third limitation is that the present study did not examine *why* depression and excessive gaming were related over time. Following the evidence found supporting the vulnerability model, it may be worthwhile to examine different motives for playing video games. The self-medication theory (Khantzian, 1997) posits that individuals use video games to cope with negative feelings. Therefore, coping motives might be a proximal reason for why depression leads to gaming-related problems. Examining coping motives has helped explain the relationship between depression and other addictive behaviours, such as drinking alcohol (Keough & O'Connor, 2016), and using drugs (Stewart, Karp, Pihl, & Peterson, 1997). Further understanding of why depression is linked to gaming-related problems may help to create targeted interventions.

Additionally, future research should also attempt to subtype gamers according to the gamer characteristics (e.g., types of games played, mood characteristics, demographics). Subtyping participants according to individual and mood characteristics has been demonstrated in other addictions (e.g., alcohol subtypes by Lau-Barraco, Linden-Carmichael, Braitman, & Stamatos, [2016]). Creating subtyped addiction models leads to a more well-rounded understanding of individual characteristics and risk factors, which can aid in intervention and treatment planning (Babor & Caetano, 2006). Exploring subtypes may be especially useful determining the role of the reciprocal and vulnerability models in the associations between depression and gaming-related problems. Immersive games, such as multiplayer or role-playing games are more likely to result in video game addiction in comparison to other genres of games (van Rooij et al., 2010). Following this, depressed individuals may be more likely to choose immersive games to help cope with their negative feelings. Further immersion in video games may exacerbate gaming-related problems as well as feelings of isolation and depression. In knowing these subtypes, specific characteristics and risk factors (e.g., onset of depression symptoms as a risk for future excessive gaming problems) for individuals can be explored.

The results have important clinical implications. The reciprocal and vulnerability model associations found between depression and gaming-related problems support the utility of targeting depressive symptoms in young people with gaming problems. By targeting these depressive symptoms early in the developmental trajectory, perhaps the severity of both depression and impact of gaming-related problems can be reduced. Additionally, the differentiation between problems experienced and time spent may be helpful in determining problematic from unproblematic video game play among individuals with depressive symptoms. This may help to

provide knowledge to the public about the characteristics of excessive gaming and help create awareness of what problematic video game use looks like.

### **Conclusions**

In conclusion, the present study found support for reciprocal associations between depression and gaming-related problems, however the effects over time were more consistent for the vulnerability model, where depression more likely preceded gaming-related problems. In contrast, no temporal associations were found between depression and time spent gaming. Additionally, the results were the same for both men and women. This research suggests that targeting depressive symptoms in treatments for problem gaming may be worthwhile.

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Table 1

*Demographics*

		Frequency (Percent)
<u>Sex</u>		
	Male	164 (56.7%)
	Female	124 (42.9%)
	Missing	1 (0.3%)
<u>Gender</u>		
	Man	168 (58.1%)
	Woman	119 (41.2%)
	Transgender	1 (0.3%)
	Non-binary	1 (0.3%)
<u>Age</u>		
	18-24	27 (9.3%)
	25-34	138 (47.8%)
	35-44	85 (29.4%)
	45-54	25 (8.7%)
	55-64	10 (3.5%)
	65-74	4 (1.4%)
<u>Ethnicity</u>		
	Indigenous	6 (2.1%)
	Asian	17 (5.9%)
	Black	28 (9.7%)
	Hispanic	23 (8.0%)
	Pacific Islander	1 (0.3%)
	White	208 (72%)
	Other	6 (2.1%)
<u>Education</u>		
	Less than HS	1 (0.3%)
	High school	34 (11.8%)
	1-2 years post HS but not college	3 (1.0%)
	Trade/ professional diploma	11 (3.8%)
	Some college or university	54 (18.7%)
	College or university degree (Bachelors)	126 (43.6%)
	Post graduate work	15 (5.2%)
	Post graduate degree	45 (15.6%)
<u>Job</u>		
	No	27 (9.3%)
	No, attending school	1 (0.3%)
	Part time (>9 hours/week)	8 (2.8%)
	Part time (10-19 hours/week)	13(4.5%)
	Part time (20< hours/ week)	19 (6.6%)
	Full time (40< hours/ week)	221 (76.5%)

Table 2

*Participant Gaming Characteristics*

	Frequency (Percent)
<u>Game Type</u>	
Action/Adventure	190 (65.7%)
Augmented Reality	49 (17%)
Facebook/ Browser	82 (28.4%)
Fighting	75 (26%)
Gambling (non-monetary)	90 (31.1%)
MMORPG	77 (26.6%)
Party	60 (20.8%)
Platform	100 (34.6%)
Puzzle	143 (49.5%)
Racing	81 (28%)
Role Playing	110 (38.1%)
Rhythm/ Music	46 (15.9%)
Sandbox	98 (33.9%)
Simulation	81 (28%)
Shooter	134 (46.4%)
Sports	88 (30.4%)
Strategy	90 (31.1%)
Other	8 (2.8%)
<u>Console Use</u>	
Computer System	221 (76.5%)
Xbox	91 (31.5%)
PlayStation	137 (47.4%)
Atari/ Sega	16 (5.5%)
Older Nintendo	56 (19.4%)
Newer Nintendo	52 (18%)
Wii/ WiiU	50 (17.3%)
Mobile device	156 (54%)
Gameboy/ DS	41 (14.2%)
Arcade	10 (3.5%)

Table 3

*Means, standard deviations, and alpha reliabilities for depression symptoms, gaming-related problems, and time-spent gaming.*

Variable	Time 1			Time 2			Time 3		
	<i>M</i>	<i>SD</i>	$\alpha$	<i>M</i>	<i>SD</i>	$\alpha$	<i>M</i>	<i>SD</i>	$\alpha$
CES-D	16.45	13.81	.946	15.01	13.53	.949	13.08	12.65	.947
IGD-SF9	18.90	9.54	.951	17.22	9.05	.956	14.90	7.29	.939
G-TLFB	25.56	16.42	-	24.42	17.25	-	22.29	17.11	-

*Note.* CES-D = Center for Epidemiological Studies Depression Scale (Radloff, 1977); IGD-SF9= Internet Gaming Disorder Scale-Short Form (Pontes & Griffiths, 2015); G-TLFB = Gaming Timeline Follow Back (adjusted from Sobell et al., 1996). G-TLFB were measured using self-report quantities; therefore, alpha reliabilities are not available.

Table 4

*Model 1 Depression and Gaming-Related Problems Fit Information*

Model Type	Chi-square	<i>df</i>	<i>p</i> value	CFI	RMSEA	SRMR	Chi-squared difference	<i>df</i>	<i>p</i> value	CFI difference
Original cross-lagged	52.179	16	<.0001	0.978	0.088	0.018				
Model with error covariances	20.24	14	0.1227	0.996	0.039	0.025	31.393	2	<.001	0.018
Model in Men	18.022	14	0.2058	0.996	0.041	0.039				
Model in Women	14.29	14	0.4283	1	0.013	0.023				
Configuration Path	32.313	28	0.0262	0.997	0.033	0.034				
Invariance	52.68	47	0.2637	0.997	0.029	0.053	20.367	19	0.37	0

*Note.* Model cut-offs are as follows: Chi-square ( $p > .05$ ), CFI  $\geq .95$ , RMSEA  $\leq .06$ , SRMR  $\leq 0.08$ , chi-squared change ( $p < .05$ ) and CFI difference  $< .01$ .

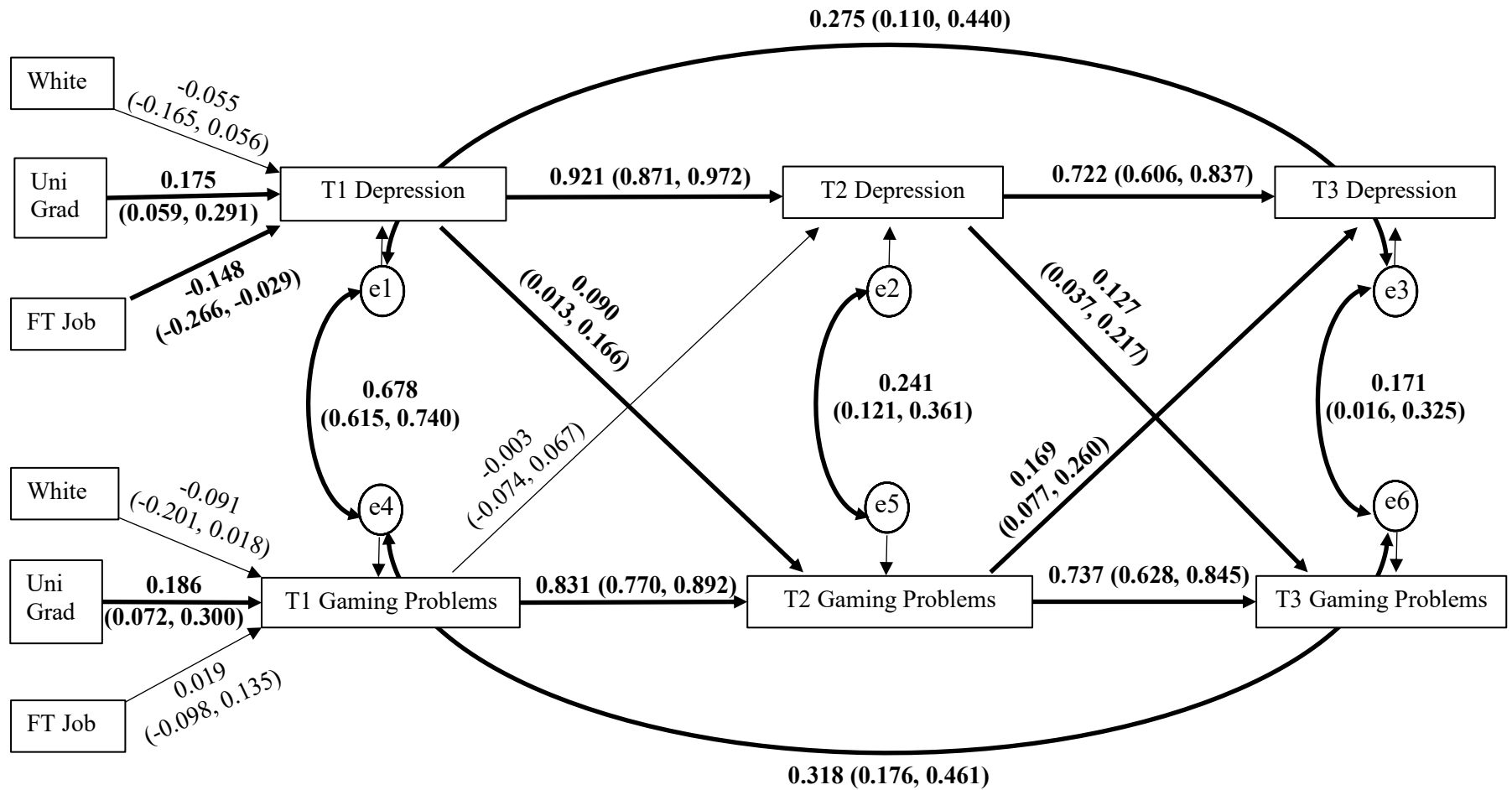
Table 5

*Model 2 Depression and Time Spent Gaming Fit Information*

Model Type	Chi-square	<i>df</i>	<i>p</i> value	CFI	RMSEA	SRMR	Chi-squared difference	<i>df</i>	<i>p</i> value	CFI difference
Original cross-lagged	38.878	16	0.0011	0.981	0.07	0.022				
Model with error covariances	23.25	15	0.0789	0.993	0.044	0.02	15.628	1	<.0001	0.012
Model in Men	24.307	15	0.0601	0.988	0.061	0.034				
Model in Women	11.391	15	0.7244	1	0	0.034				
Configuration Path Invariance	35.698	30	0.2181	0.995	0.036	0.034				
	62.75	47	0.0618	0.987	0.048	0.073	27.052	17	0.057	-0.008

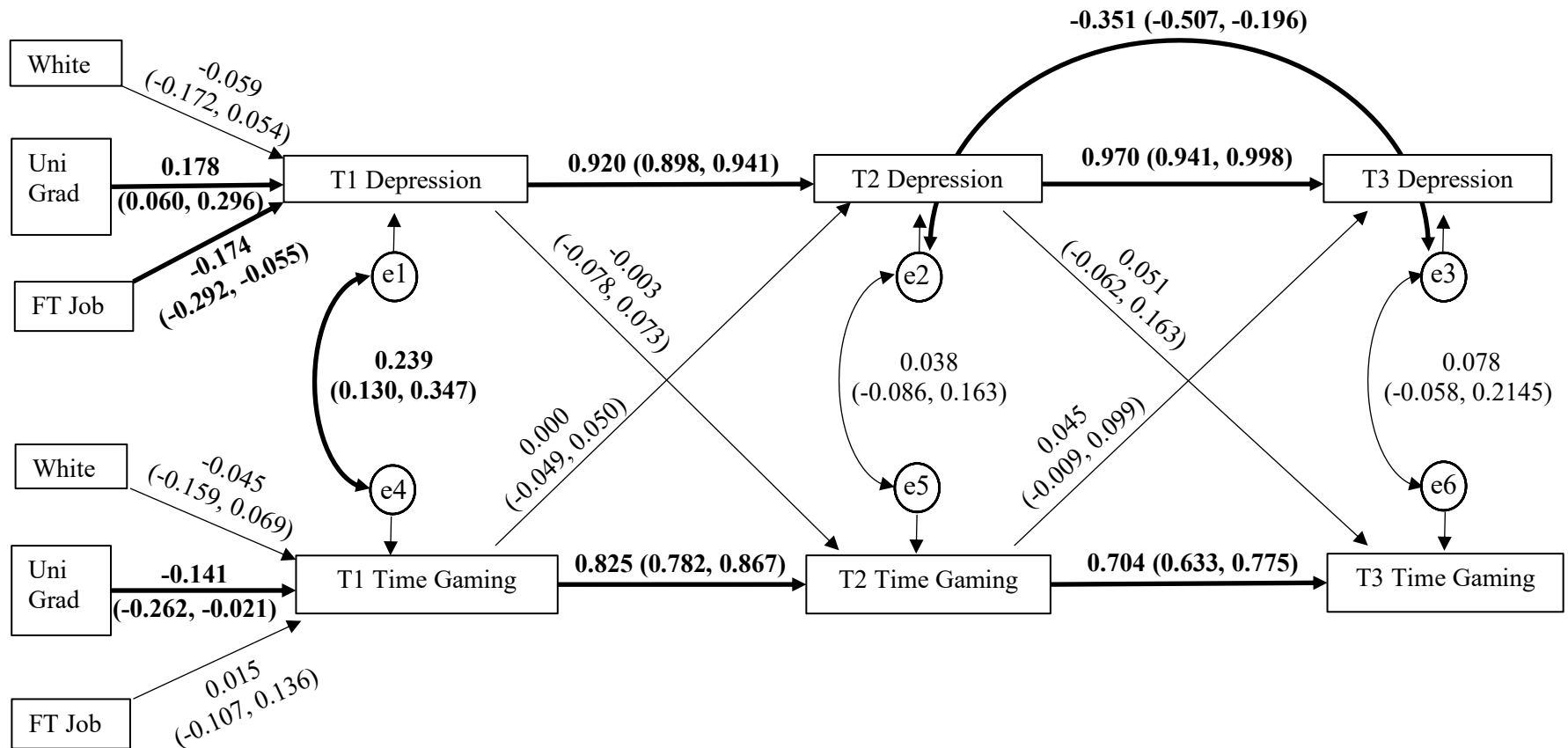
*Note.* Model cut-offs are as follows: Chi-square ( $p > .05$ ), CFI  $\geq .95$ , RMSEA  $\leq .06$ , SRMR  $\leq 0.08$ , chi-squared change ( $p < .05$ ) and CFI difference  $< .01$ .

Figure 1. A three timepoint cross-lagged panel model examining the temporal relation between depression and gaming-related problems.



Note. Bolded paths are significant at 95% confidence interval (CI). T = Time. Statistics displayed as: standardized weights (lower-bound CI, higher-bound CI).

Figure 2. A three timepoint cross-lagged panel model examining the temporal relation between depression and time spent gaming.



Note. Bolded paths are significant at 95% confidence interval (CI). T = Time. Statistics displayed as: standardized weights (lower-bound CI, higher-bound CI).

## Appendix A

## Time One Consent Form



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**Dr. Matthew Keough, Ph.D.**  
**University of Manitoba, Department of Psychology**  
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Phone: 204-474-7400  
Email: Matthew.Keough@umanitoba.ca  
rapindak@myumanitoba.ca

---

**Title of Research:** Examining Video Gaming Habits, Mood, and Substance Use

**Principal Investigator:** Karli Rapinda, BA (Hons)

**Supervisor:** Dr. Matthew Keough, Ph.D.

**This consent form, a copy of which can be downloaded and/or printed for your records and reference, is only part of the process of informed consent. It should give you the basic idea of what the research is about, who is involved in the research, and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask via the contact information provided. Please take time to read this carefully and to understand any accompanying information.**

**Purpose of the Study:**

The primary purpose of this study is to better understand factors related to gaming habits and personality traits, mood, and substance use.

**Study Procedure:**

Should you choose to participate, there will be three time-points of the study (now, in two weeks from now, and a month from now). At each time point, you will be asked to fill out several surveys related to your behavior, personality, and use of cannabis and alcohol. You will also be asked to complete a small number of questions related to basic demographic information in the first time-point. Each time-point should take approximately 15-20 minutes and you will receive \$2.50 for each time-point, with a \$2 bonus for completing all three time-points, for a total possible amount of \$9.50.

**Potential Risks and Benefits of the Research:**

The study contains surveys which ask about thoughts, emotions, and behaviors in a variety of situations. Some participants may find thinking about these situations leads to experience minor levels of stress. Other surveys ask about levels of use of certain substances. Reflecting on levels of use alcohol and cannabis may cause participants to conclude that their usage of these substances is problematic. Additionally, cannabis use is still illegal in some US states. However, our servers for these questionnaires are located in Canada, meaning that your data will be stored

in Canada and not in the US. You may choose not to answer questions if you are uncomfortable giving information about illegal drug use.

This research also has many benefits. As you complete the survey measures you may enjoy learning about yourself. The survey measures may make you more aware of your patterns of gaming and alcohol and cannabis use.

If at any time you become concerned with your thoughts or behaviours about substance use, gaming behaviour, or well-being, please seek help. Here are some resources to get you started: An online treatment program:

<https://lastdoor.org/treatment/biopsychosocial-supports/>

Resources for Canadian provinces:

<https://www.canada.ca/en/health-canada/services/substance-use/get-help/get-help-problematic-substance-use.html>

For US states:

<https://findtreatment.samhsa.gov>

### **Voluntary Participation:**

Participation in this study is voluntary and you may end your participation at any time without loss of payment or reprisal for that time-point. You may refuse to answer any questions that you do not wish to. However, to receive your payment, you must proceed to the end of the survey to order to obtain the code to submit. Should you choose to wish to opt out of the study after completing part or all of the survey, you may have the option to press the “next” button at the bottom of the webpage to submit your responses or have your responses deleted by contacting the principal investigator ([addictions.lab@umanitoba.ca](mailto:addictions.lab@umanitoba.ca)).

### **Confidentiality:**

All your responses will be kept entirely confidential. Responses provided by participants are collected via Qualtrics™. Similar to social media and e-mail sites such as Facebook or Yahoo™ mail, risks to confidentiality are minimal. Your Mechanical Turk Worker ID will be used to connect responses from the first, second, and third surveys. This information will be permanently deleted upon the conclusion of the third survey. Only the principal investigators and associated researchers will have access to the data. The anonymous data will be stored on password-protect computers in a locked laboratory room in the Duff Roblin building. For quality-assurance and safety purposes, the University of Manitoba Research Ethics Board(s) may also require access to the research records.

Our intentions are to present the findings of this study in academic journals and at academic research conferences. Any publication of findings will only report aggregate results (i.e., averages across participants). You will be provided an explanation of the purpose of this study in further detail at the end of this study. A summary of aggregate findings will be available at <https://addictionslab.weebly.com/evg.html> within one year of the conclusion of the third survey – approximately one year and three months from now.

This research has been approved by the Psychology Research Ethics Board. If you have any concerns or complaints about this project you may contact any of the above-named persons

or the Human Ethics Coordinator (HEC) at 1-204-474-7122, or email [humanethics@umanitoba.ca](mailto:humanethics@umanitoba.ca). A copy of this consent form has been given to you to keep for your records and reference.

---

By clicking “Agree” below you will indicate that you have understood to your satisfaction the information regarding participation in the research project and agree to participate. In no way does this waive your legal rights nor release the researchers or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time, and /or refrain from answering any questions you prefer to omit, without prejudice or consequence. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation (by sending an email to [addictions.lab@umanitoba.ca](mailto:addictions.lab@umanitoba.ca)).

Agree

Decline

**Follow-Up Study:**

There will be follow-up surveys that will occur at approximately 2 weeks and one month after the completion of this study. You will be contacted through Amazon Mechanical Turk at that time, through Mechanical Turk HIT information. You will then need to re-consent to participate in that time-point of the study.

## Appendix B

## Time 2 Consent Form



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**Dr. Matthew Keough, Ph.D.**  
**University of Manitoba, Department of Psychology**  
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Phone: 204-474-7400  
Email: Matthew.Keough@umanitoba.ca  
rapinda@myumanitoba.ca

---

**Title of Research:** Examining Video Gaming Habits, Mood, and Substance Use

**Principal Investigator:** Karli Rapinda, BA (Hons)

**Supervisor:** Dr. Matthew Keough, Ph.D.

**This consent form, a copy of which can be downloaded and/or printed for your records and reference, is only part of the process of informed consent. It should give you the basic idea of what the research is about, who is involved in the research, and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask via the contact information provided. Please take time to read this carefully and to understand any accompanying information.**

**Purpose of the Study:**

The primary purpose of this study is to better understand factors related to gaming habits and personality traits, mood, and substance use.

**Study Procedure:**

You are receiving this consent form for time 2, as you have completed the first time-point of this study. Should you choose to participate in this time 2 study, you will be asked to fill out several surveys related to your behavior, personality, and use of cannabis and alcohol just as before. This time-point should take approximately 15-20 minutes and you will receive \$2.50 for this time-point. Remember, the third time-point will also be worth an additional \$2.50, and a \$2 bonus for completing all three time-points.

**Potential Risks and Benefits of the Research:**

The study contains surveys which ask about thoughts, emotions, and behaviors in a variety of situations. Some participants may find thinking about these situations leads to experience minor levels of stress. Other surveys ask about levels of use of certain substances. Reflecting on levels of use alcohol and cannabis may cause participants to conclude that their usage of these substances is problematic. Additionally, cannabis use is still illegal in some US states. However, our servers for these questionnaires are located in Canada, meaning that your data will be stored in Canada and not in the US. You may choose not to answer questions if you are uncomfortable giving information about illegal drug use.

This research also has many benefits. As you complete the survey measures you may enjoy learning about yourself. The survey measures may make you more aware of your patterns of gaming and alcohol and cannabis use.

If at any time you become concerned with your thoughts or behaviours about substance use, gaming behaviour, or well-being, please seek help. Here are some resources to get you started:  
An online treatment program:

<https://lastdoor.org/treatment/biopsychosocial-supports/>

Resources for Canadian provinces:

<https://www.canada.ca/en/health-canada/services/substance-use/get-help/get-help-problematic-substance-use.html>

For US states:

<https://findtreatment.samhsa.gov>

### **Voluntary Participation:**

Participation in this study is voluntary and you may end your participation at any time without loss of payment or reprisal for that time-point. You may refuse to answer any questions that you do not wish to. However, to receive your payment, you must proceed to the end of the survey in order to obtain the code to submit. Should you choose to wish to opt out of the study after completing part or all of the survey, you may have the option to press the “next” button at the bottom of the webpage to submit your responses or have your responses deleted by contacting the principal investigator ([addictions.lab@umanitoba.ca](mailto:addictions.lab@umanitoba.ca)).

### **Confidentiality:**

All your responses will be kept entirely confidential. Responses provided by participants are collected via Qualtrics™. Similar to social media and e-mail sites such as Facebook or Yahoo™ mail, risks to confidentiality are minimal. Your Mechanical Turk Worker ID will be used to connect responses from the first, second, and third surveys. This information will be permanently deleted upon the conclusion of the third survey. Only the principal investigators and associated researchers will have access to the data. The anonymous data will be stored on password-protect computers in a locked laboratory room in the Duff Roblin building. For quality-assurance and safety purposes, the University of Manitoba Research Ethics Board(s) may also require access to the research records.

Our intentions are to present the findings of this study in academic journals and at academic research conferences. Any publication of findings will only report aggregate results (i.e., averages across participants). You will be provided an explanation of the purpose of this study in further detail at the end of this study. A summary of aggregate findings will be available at <https://addictionslab.weebly.com/evg.html> within one year of the conclusion of the third survey – approximately one year and three months from now.

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humanethics@umanitoba.ca. A copy of this consent form has been given to you to keep for your records and reference.

---

By clicking “Agree” below you will indicate that you have understood to your satisfaction the information regarding participation in the research project and agree to participate. In no way does this waive your legal rights nor release the researchers or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time, and /or refrain from answering any questions you prefer to omit, without prejudice or consequence. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation (by sending an email to [addicitons.lab@umanitoba.ca](mailto:addicitons.lab@umanitoba.ca)).

Agree

Decline

**Follow-Up Study:**

There will be one more follow-up survey after this one that will occur at approximately 2 weeks from the completion of this time-point. You will be contacted through Amazon Mechanical Turk at that time, through Mechanical Turk HIT information. You will then need to re-consent to participate in that time-point of the study.

## Appendix C

## Timep Three Consent Form



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**Dr. Matthew Keough, Ph.D.**  
**University of Manitoba, Department of Psychology**  
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**Purpose of the Study:**

The primary purpose of this study is to better understand factors related to gaming habits and personality traits, mood, and substance use.

**Study Procedure:**

You are receiving this consent form for time 3, as you have completed the first two time-points of this study. Should you choose to participate in this time 3 study, you will be asked to fill out several surveys related to your behavior, personality, and use of cannabis and alcohol just as before. This time-point should take approximately 15-20 minutes and you will receive \$2.50 for your participation in this time-point. Reminder, if you complete all three time points, you will receive an extra \$2.00.

**Potential Risks and Benefits of the Research:**

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For US states:

<https://findtreatment.samhsa.gov>

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---

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Agree

Decline