A Daily Diary Investigation of Self-Regulation in Gambling

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Abstract

Although self-regulation, especially sticking to one's gambling limits, is an important issue in the domain of gambling, prior research on this matter is nascent. According to the framework of self-regulation and its depletion (Muraven & Baumeister, 2000), self-regulation failure in a certain domain is more likely when one's self-regulatory resources have recently been used up in order to deal with cognitive, emotional and behavioural demands they face. However, very little is known about individual difference variables and situational variables related to self-regulation capacity that contribute to the violation of one's gambling limits once one has started to gamble.

In this study, we used a daily diary approach in order to investigate the research questions about self-regulation issues specific to gambling. Specifically, we assessed both individual difference variables and daily proximal variables that are associated with gambling limits violation as well as the intensity of gambling urges experienced and incidence of gambling (versus not gambling). A baseline survey was used to measure individual difference variables while 21-day daily diaries were used to assess daily proximal variables. Hierarchical linear modeling analyses were conducted in order to assess the degree to which gambling limits violation was predicted by individual difference variables, daily proximal variables and their interactions.

Consistent with the self-regulatory resource depletion framework (Muraven & Baumeister, 2000), we found that gambling limits were more likely to be violated on days when self-regulatory resources were previously exerted to resist other additive urges and by people whose trait self-control is low. Furthermore, when self-regulatory resources were exerted on resisting many addictive temptations, participants with high trait self-control were more likely to violate their gambling limits than those with low trait self-control.

Keywords: self-regulation, gambling limits, daily diary

Introduction

It is estimated that 76% of Canadians gamble (Cox, Yu, Afifi, & Ladouceur, 2005), whereas only 1-4% of Canadians meet criteria for problem gambling, depending on how problem gambling status is determined (Williams, Volberg, & Stevens, 2012). Thus, the large majority of individuals who gamble do not experience problem gambling, indicating that gambling can be done at low-risk or moderate-risk levels. Recent research shows that gamblers engage in a wide range of self-regulation strategies to limit or reduce their gambling behaviours, such as cognitive strategies (e.g., recalling previous problems from gambling; thinking about how one's money can be better spent), financial management (e.g., cutting up credit cards or leaving ATM cards at home when going to gambling sites), behavioural substitution (e.g., engaging in a new form of entertainment or distraction), self-exclusion (e.g., banning oneself from gambling venues), etc. (Drawson et al., 2017; Hing et al., 2017; Hodgins & el-Guebaly, 2000; Moore et al., 2012; Rodda et al., 2017, 2018). Although relative effectiveness of self-regulation strategies used to reduce gambling has not been thoroughly investigated, the strategy of setting one's gambling limits in terms of money or time appears to have strong potential in reducing problematic gambling activities since money or time limits provide gamblers specific targets against which one's gambling activities may be compared. In other words, trying to keep gambling within pre-set limits requires that individuals actively engage in self-regulation, which may succeed or fail depending on a myriad of factors (Carver & Scheier, 1998). Indeed, researchers have found that individuals can successfully stay within pre-set gambling limits (Moore et al., 2012), although they may periodically fail in self-regulation and transgress their limits. At the same time, although problem gamblers are generally prone to impaired control of their gambling behaviour, they may exercise self-control in some situations. However, research on factors that differentiate self-regulation successes and transgressions is lacking. The gap of research in this domain inspired the current research.

Literature Review

Self-Imposed Gambling limits as a Self-Regulation Strategy

Problem gambling is a disorder characterized by deficits in self-regulation (Blaszczynski & Nower, 2002). Self-regulation is essential for maintaining healthy gambling behaviour by enabling individuals to set reasonable standards for their gambling and then track their actions in relation to these set goals. In some instances, this may be a goal of non-gambling. In others, it may be a limit in amount or time spent on gambling. Although self-imposed gambling limit is one of a diverse set of strategies that may be used to reduce gambling activities (Rodda et al., 2018), this strategy is of high interest since its specificity enables gamblers and researchers to judge whether self-regulation succeeded or failed in each gambling episode.

Once a gambling-related goal has been cognitively set and activated (e.g., not to risk more than $50 during a gambling occasion), individuals will then evaluate their

thoughts and/or their behaviour with respect to their goals (Carver & Scheier, 1998). If gambling related behaviours are found to be discrepant in comparison to these goals, individuals may attempt to engage in self-regulation efforts in order to re-align with previously set goals (e.g., if individuals' begin to entertain thoughts about spending more than their pre-determined amount of $50, they may then inhibit or control themselves from engaging in further gambling activity in order to stick to their goal). However, self-regulation attempts are not always successful. Despite best intentions, people often violate their gambling-related goals, spend substantially more money and/or time on gambling than intended, and then feel guilty about their gambling. Although it appears that problem gamblers are substantially more likely to fail to regulate their gambling behaviour than non-problem gamblers (Moore et al., 2012), little is known about situational variables that increase the likelihood of violating gambling-related goals in people who engage in extensive gambling versus those who gamble more responsibly.

Despite growing interest in self-regulation in the gambling domain, the majority of research pertains to the introduction of limit-setting systems to electronic gaming machines (e.g., EGMs) in specific jurisdictions (see Ladouceur, Blaszczynski & Lalande, 2012 for a review). Previous research on self-initiated regulation of gambling is limited to identifying self-regulation strategies or qualitative explorations of limit-setting practices used by problem-gamblers and non-problem gamblers. For example, Moore and colleagues assessed the frequency of using self-regulation strategies (e.g., avoiding gambling venues, focusing on other hobbies, thinking about negative consequences of gambling, setting money or time limits, etc.) among problem gamblers versus low-risk gamblers (Moore et al., 2012). Lalande and Ladouceur (2011) focused on limit-based self-regulation strategies and explored how pathological and non-pathological gamblers differ in their attempt to stick to their predetermined limits. Although limit setting was common in both problem and non-problem gamblers, going over the limit was more frequent among problem-gamblers than non-problem gamblers. Many problem gamblers and some non-problem gamblers were tempted to ignore the pre-determined limit (e.g., "I need to keep going a little bit, and I will be able to win back some money"). Although these studies provide important information about various types of self-regulation strategies, they tell us little about the conditions under which self-regulation strategies are effective or not effective. To best support gamblers in better regulating their gambling and adhering to their pre-set gambling limits, we need to understand what works and what does not work for setting limits and sticking to them. That is, for gamblers to be successful at remaining within pre-determined limits, we need to advise on how to create optimal conditions for self-regulation and avoid or modify conditions that undermine self-regulation attempts.

Self-Regulation and Depletion

One important theoretical model for understanding self-regulation of gambling behaviour is the model of self-regulatory resource depletion (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Baumeister & Heatherton, 1996). According to theories of ego depletion (Vohs & Baumeister, 2004; 2011) and self-regulatory resource depletion (Muraven & Baumeister, 2000), self-regulation is similar to a muscle or limited energy source, such that engaging in one act of self-control compromises the energy source

and temporarily limits further acts of self-control.

One important area that requires further investigation within the gambling field is the ways in which resources for self-regulation are used and then depleted. Some self-regulation strategies may require a substantial amount of limited mental resources, which may be temporarily constrained due to other self-control demands.

According to Muraven and Baumeister (2000), successful resistance of temptation requires the employment of self-regulatory resources, which is a general-purpose reservoir of resources tapped to deal with diverse cognitive, emotional and behavioural demands. Because the pool of self-regulatory resources is limited, having previously exerted self-control necessarily reduces the amount of resources available for subsequent self-regulation efforts, increasing the chance of giving into the temptation despite good intentions (i.e., self-regulation failure). For example, Tice, Bratslavsky and Baumeister (2001) explored conflict between the hedonic goal of short-term reward and optimal long-term goals. They hypothesized that conflict between these goals would be exacerbated during states of emotional distress, and thus self-regulatory resources would be constrained. Indeed, the long-term goal was more likely to be violated in return for gratification of the short-term hedonic goal when people experienced emotional stress. Similarly, in a study on self-regulation in dieting, attempts to stick to a diet were less successful when individuals were required to suppress their emotions than when they were allowed to freely express their feelings (Hofmann, Rauch, & Gawronski, 2007), further indicating that efforts at self-control in one domain (i.e., for affect regulation) interfere with self-regulation in other domains.

Depletion of self-regulation resources can occur through many sources. One source of depletion involved the use of self-resources resources towards other activities that require self control. When individuals are engaging in self-control of one behaviour (e.g., dieting), this depletes self-regulation resources towards other behaviours (e.g., trying to stick to one's gambling limits). In addition, self-regulation resources might be depleted through management of stress or negative affect. Chronic negative mood states (e.g., depression and anxiety) have been identified as a risk factor for pathological gambling (Blaszczynski & Nower, 2002), suggesting that emotional distress may undermine attempts at self-control over gambling. In addition, depressed mood has been linked to gambling problems via refusal self-efficacy, indicating that individuals experiencing chronic negative mood states feel less capable of self-control (i.e., refusing a gambling opportunity; Takamatsu, Martens, & Arterberry, 2016).

The majority of studies on ego depletion and self-control have relied on experimental paradigms where 1) a self-control task is administered (or not in the case of the control condition) and 2) following the task, participants are asked to engage in an act of self-control. Due to depletion from the first task, it is expected that participants in the first condition (but not the control) will show a lack of self-control in the second task. While this hypothesis has received extensive support, there are also several criticisms of this research, including concerns that depletion effects are unreliable or even non-existent (Inzlicht & Schmeichel, 2012). A more compelling assessment of the ego depletion model of self-control on violating gambling limits would examine proximal relationships between situational factors that deplete self-control (negative affect, stress, self-control of other behaviours) and attempts at gambling self-control. Previous studies using daily diary methods to capture proximal antecedents of gambling have

found that negative affect increases the desire to gamble (although not gambling behaviour; Quilty, Watson, Toneatto, & Bagby, 2017), which may reflect a depletion of self-control and increase in gambling temptation in the context of emotional distress. Our goal was to understand self-control failures in gambling by examining gambling limits in a naturalistic setting – by asking people to report on their success and failure in sticking to gambling limits and potential barriers to self-control in their daily lives.

Although there is no other research using ego depletion as a framework to examine gambling behaviour, researchers have investigated this framework in the context of another addictive behaviour: alcohol use. For example, previous research found that manipulations intended to deplete self-regulatory resources increased alcohol consumption among drinkers even when they were told that they would be taking a simulated driving test later (Muraven, Collin, & Neinhaus, 2002). Furthermore, compared to hassle-free days, drinkers were more likely to violate their self-imposed drinking limits on days when their self-regulation resources were depleted due to coping with daily hassles (Muraven, Collins, Shiffman, & Paty, 2005). Moreover, sniffing the scent of alcohol led social drinkers to perform significantly worse on subsequent self-regulation exercises compared with sniffing water (Muraven & Shmueli, 2006).

Applying the ego depletion framework to the domain of gambling, we argue that resisting the temptation against a self-imposed gambling limit is likely to be difficult when self-regulatory resources have been constrained to meet situational demands, such as experiencing negative affect, previous acts of self-control in other domains (e.g., dieting), dealing with stressors and/or interpersonal problems, and reduced self-awareness due to alcohol consumption (Baumeister & Vonasch, 2015). In our view, these situational factors may substantially reduce the effectiveness of self-regulation strategies aimed at limiting gambling. However, this possibility has not been explored in the gambling domain so far.

Moderators of Self-Regulation Success and Failure

In addition to the proximal, situational factors that influence self-regulation of gambling, it is also important to consider moderators of these relationships. Previous research shows that the impact of situational variables on resource depletion varies depending on individual difference variables related to chronic tendency to exercise self-control or to act on a whim.

Trait self-control reflects stable individual differences in the chronic tendency to exert inhibition of undesired habits or impulses (Tangney, Baumeister, & Boone, 2004). Research on trait self-control has found that individuals vary in the extent to which they are able to exercise self-control across situations (Schmeichel & Zell, 2007). Previous findings indicate that those higher in trait self-control may be less vulnerable to situational factors that typically deplete self-regulation capacity than those with low trait self-control. For example, although depletion of self-regulation resources increased aggressive responding to an insulting provocation, this effect was significantly weaker for participants high versus low in trait self-control (DeWall, Baumeister, Stillman, & Gailliot, 2007). Furthermore, in a daily diary investigation, Muraven et al. (2005) found that although people drank more on days they had to regulate their moods or dealt with stress than unenventful days, this effect was moderated by trait self-control. In other words, those high in trait self-control drank less and were less likely to violate their

drinking limits than those low in trait self-control. However, the protective role of trait self-control in self-regulation resources depletion situations has not always been supported. For example, Imhoff, Schmidt and Gerstenberg (2014) reported that when self-regulatory resources were experimentally depleted, individuals with high trait self-control found it more difficult to resist temptation to eat candies and take unnecessary risks in lab settings than those with low trait self-control. This ironic finding was attributed to the possibility that individuals with high self-control tend to prevent the onset of impulses and thus may not be used to actively inhibiting and resisting infrequently experienced impulses once they transpire.

Another possible variable that may moderate the effect of depletion on self-control success and failure is impulsivity, which is associated with lack of planning, spontaneous decision making and acting without consideration of probable consequences (Whiteside & Lynam, 2001). Vohs and Faber (2007) found that when self-regulatory resources were depleted, participants with high buying impulsivity were willing to spend significantly more money in unanticipated buying situations than those with low buying impulsivity. Similarly, when self-regulatory resources are experimentally depleted, individuals high in self-reported impulsivity were likely to give in to implicit preferences for chocolate than those low in impulsivity (Wang et al., 2016). Since impulsivity is a well-established risk factor for problem gambling (e.g., Hodgins & Holub, 2015) and represents a more global measure of risky decision-making, impulsivity is likely to influence in-the-moment decisions regarding sticking to self-imposed gambling limits, particularly in the context of depleted resources for self-regulation.

However, to the best of our knowledge, the moderating role of trait self-control and impulsivity on depletion on self-control success and failure has not been investigated in the gambling context. In the current study, we explore whether trait self-control and impulsivity moderate the relationship between proximal factors (e.g., negative affect, other self-control acts) and gambling self-regulation.

Theoretical Framework and Research Questions

The purpose of the current study is to use this model of self-regulation to better understand how individual difference and situational variables interactively contribute to successful attempts at self-regulated gambling and compromise a gambler's use of self-regulation strategies. Applied to the gambling domain, the framework predicts that when self-regulatory resources are low due to dealing with stress, negative affect, fatigue and/or other pressing issues, the use of previously endorsed self-regulation strategies will be difficult, and gamblers will give into the temptation to start gambling and/or to exceed their pre-determined gambling limit. Within this framework, there are several daily proximal variables that impact the depletion of self-regulatory resources, including negative affect, self-control in other domains, and daily stressors or hassles. Identifying proximal variables that impact self-regulation of gambling in daily life is an important first step for developing interventions that promote responsible gambling via the use of self-regulation strategies that require a small amount of resources and thus are effective in resisting the temptations.

The ego depletion literature summarized in our literature review offers the theoretical framework for the current research. Trying to stick to self-imposed gambling

limits is not easy for most gamblers and thus requires exercise of self-regulation resources. However, several other emotional, cognitive and behavioural tasks also require self-regulation, resulting in depletion of these resources each day. We propose that, on days when self-regulatory resources are depleted due to managing negative affect, stressors and other temptation (e.g., alcohol, food), gamblers may find it difficult to stick to their self-imposed gambling limits. Furthermore, the main effect of depletion on self-regulation success or failure may be moderated by trait self-control and impulsivity. When self-regulatory resources are depleted, gamblers with low trait self control and high impulsivity will be less likely to stick to their self-imposed gambling limits than those with high trait self-control and low impulsivity.

Research questions derived from the self-regulatory resource depletion framework have been typically investigated with either controlled lab experiments or experience sampling methods. Despite offering the advantage of observing the effect of constraining self-regulatory resources (e.g., restraining the expression of feelings in response to stirring video clips; having to ignore tempting food smells), experimental methods are limiting when attempting to study more complex behaviours such as gambling and fail to accurately replicate the typical gambling context. Experience sampling methods are well suited to the regulatory resource depletion framework, in that participants are asked to record successful and unsuccessful self-regulation attempts and track situational variables that precede these episodes (see Hektner, Schmidt, & Csikszentmihalyi, 2007, for a review). Ecological momentary assessment (EMA), the most rigorous type of experience sampling method, involves having participants respond in real time several times a day, thus minimizing recall bias. EMA has been successfully employed to investigate gambling behaviour (Goldstein, Stewart, Flett & Hoaken, 2014) and to investigate the success and failure of self-control attempts, including the influence of personality traits, and situational variables that constrains self-regulatory resources and thus increases the likelihood of self-control failure in the dieting context (Hofmann, Adriaanse, Vohs & Baumeister, 2014), in the alcohol context (Muraven et al., 2005), and in diverse everyday temptations context (Hofmann, Baumeister, Förster, & Vohs, 2012).

In the context of EMA or other intensive repeated-measures designs where individuals respond to a survey multiple times over a measurement interval (e.g., one week), it is important to consider two levels of analysis: the diary level (Nezlek, 2012) and the person level. Measures assessed at the diary level (i.e., Level 1) are those that vary across short intervals of time (e.g., intervals within a day or across days) and are more proximal to a target event (e.g., gambling). Analysis of diary-level data occurs at the within-person level, meaning that relationships are assumed to vary across time within individuals, with the level or degree of this variable varying across days. Person-level variables (i.e., Level 2) are those that are considered stable and unlikely to vary over periods of time. Personality traits and other individual difference variables fall in this category and are assessed across individuals, meaning that the level or degree of a certain trait will vary across individuals.

Although we intend to use EMA to investigate the interplay between variables that vary across assessment intervals, successful implementation of EMA requires considerable time, effort and resources. In addition, because EMA requires participant responses several times per day, measures used in EMA must be targeted and brief

(say, less than 3 minutes to complete). However, there is limited availability of brief measures that can be used to assess factors that vary across measurement intervals. A necessary first step in this program of research is to conduct a daily diary study as a pilot investigation. Daily diary studies utilize less resources than EMA studies and provide an excellent opportunity for identifying those variables that are most integral to understanding factors that facilitate or undermine the use of self-regulation strategies in the gambling context. Daily diary study methodology has been used to study ways of coping with temptations to engage in other addictive behaviour, including alcohol use (Armeli, Tennen, Affleck, & Kranzler, 2000) and smoking (Brodeck, Bachmann, & Znoj, 2013; Volz et al., 2014).

Specifically, the research questions we investigated in the project were the following:

1. Are gambling urges more intense on days situational demands for self-regulatory resources are higher (e.g., negative affect, stress, having to deal with other temptations)? Is the association between daily proximal variables and the intensity of gambling urges significantly higher for individuals with high trait self-control and/or low impulsivity than for those with low trait self-control and/or low impulsivity?
2. Is the incidence of gambling higher on days situational demands for self-regulatory resources are higher? Is the association between daily proximal variables and the intensity of incidence of gambling significantly higher for individuals with high trait self-control and/or low impulsivity than for those with low trait self-control and/or low impulsivity?
3. Is the chance of going beyond one's self-imposed gambling limits once gambling started greater on days situational demands for self-regulatory resources are higher? Is the association between daily proximal variables and violation of gambling limits significantly higher for individuals with high trait self-control and/or low impulsivity than for those with low trait self-control and/or low impulsivity?

<u>Significance of the Topic</u>

Although it is common for people to set gambling limits, these limits are not always respected in the heat of the moment. This violation of a pre-set gambling limit is often referred to as a self-regulation failure, and problem gambling has been characterized as a deficit in self-regulation (Blaszczynski & Nower, 2002). Indeed, self-regulation is an essential skill for maintaining healthy gambling behaviour by enabling individuals to set reasonable standards for their gambling and then track their actions in relation to these set goals. Only a handful of studies have recently examined self-regulation strategies among problem vs. low risk-gamblers (Moore et al., 2012) and failures to stick to predetermined limits (Lalande & Ladouceur, 2011). However, we are not aware of any studies that have examined variables relevant to self-regulation capacity and behaviour that systematically influence individuals' success or failure in sticking to their gambling limits over time.

Using a web-based daily diary methodology, the purpose of the current study is to apply a self-regulation framework to better understand how individual difference variables, daily proximal variables, and their interaction may contribute to successful attempts at self-regulated gambling and/or compromise a gambler's ability to adhere to gambling-related limits.

Method

Participants

We recruited a community sample of adult gamblers from three data collection centres located in Guelph, ON, Toronto, ON and Winnipeg, MB. Participants were recruited from southern Ontario and Manitoba. Recruitment advertisements were posed online, such as Craigslist, Kijiji, Twitter and Facebook, in local newspapers (e.g., Metro in Toronto and Winnipeg) and through flyers posted around the universities and community centres. Once individuals contacted the research assistants by phone or email, a phone screening was conducted with a series of questions designed to assess the eligibility criteria. In order to be eligible for the study, individuals had to be 18 years or older, gambled at least once a week, currently adopted a goal of reducing gambling activities, and should not have received a psychological diagnosis in recent years. Once participants were determined eligible and agreed to participate, they were provided a respondent ID number to be used for both initial survey and daily diaries and directed to the initial online survey.

Instruments and Procedures

Initial survey

The first page of the initial survey contained information about the survey and the informed consent form. Once participants read the consent form and agreed to participate in the study, they were led to a series of questions pertaining to the initial survey. Participants were informed that they were allowed to skip questions they did not wish to answer. Participants received a $10 electronic gift card to a retailer of their choice or $10 via Paypal as compensation for completing the initial survey.
The initial survey included the following measures:

Demographics. Participants were asked to indicate their age, gender, level of education, employment and financial status, and ethnic background.

Personal gambling limits. Participants were asked to indicate whether they set any limits to their gambling within the past six months. Participants who set a limit were asked to indicate what type of gambling limits they considered from a choice of options, including limiting amount of money spent, limiting amount of time spent, limiting gambling to certain days of the week, limiting gambling to certain types (e.g., lottery tickets only), deciding to stop gambling altogether or other limits.

Participants were asked to indicate whether they had used each of 20 self-regulation strategies to limit their gambling in the past 30 days. The list of 20 self-regulation strategies were adapted from Moore, Thomas, Kyrios and Bates (2012) and are listed in Table 1.

Trait self-control. Individual differences in self-control were assessed with the 13-item brief version of the Self-Control Scale (Tangney, Baumeister, & Boone, 2004). This scale measures trait self-control on a 5-point Likert scale (1 = not at all like me; 5 = very much like me). Sample items are ‘‘I am good at resisting temptation’’ and ‘‘people would say I have iron self-discipline’’. Trait self-control scale had a high internal reliability in this study (Coefficient alpha = 0.86).

Impulsivity. Trait impulsivity was measured with the UPPS-P (Lynam, Smith, Whiteside, & Cyders, 2006). The UPPS-P is a 59-item self-report that assesses five distinct dimensions of impulse behavior in adults with five subscales: negative urgency, premeditation, perseverance, sensation seeking, and positive urgency. Negative urgency refers to the tendency to give in to strong impulses, specifically when accompanied by negative emotions such as depression, anxiety, or anger (12 items). Ten items were used to measure the lack of perseverance, which refers to ability to persist in completing jobs or obligations despite boredom and/or fatigue. 11 items were used to assess the lack of premeditation, which refers to the ability to think through the potential consequences of his or her behavior before acting. Sensation seeking refers to individual’s preference for excitement and stimulation (11 items). Lastly, positive urgency refers to the tendency to give in to impulses under conditions of high positive affect (14 items).

Gambling Behavior. Past 4-week gambling activities were assessed with the Gambling Timeline Follow-Back questionnaire (G-TLFB; Weinstock, Whelan, & Meyers, 2004) a retrospective calendar that assesses types of gambling, frequency and duration of gambling episodes, amount of money intended to gamble, amount of money spent, net amount of money won, and number of standard drinks consumed per gambling episode. To cue recall, participants first noted special events that occurred within the last 28 days (Sobell & Sobell, 1996). Weinstock et al. (2004) found good test-retest reliability for the G-TLFB over a 2-week period, with reliabilities for each of the gambling dimensions ranging from .74 to .96. We used an online version of G-TLFB adapted from a previously used format (Pederson, Grow, Duncan, Neighbors, & Larimer, 2012).

At the end of the online survey, we provided participants with a list of resources for gambling treatment for participants seeking treatment or counseling.

Daily Diary

Once participants completed the initial online survey, they were reminded that they would be participating in daily diaries for 21 days starting from the following day. Participants received a reminder email each morning to complete a web-based daily survey every afternoon (between 4-8 pm) for the 21 days following their completion of the initial survey. Participants received a $10 online gift card for each week of the study as long as they filled out 5 or more daily diaries that week. Because gambling and alcohol use were more likely to occur in the evenings, after the participant has completed their daily surveys, participants were asked to report on their behaviour (alcohol use, gambling) from the previous day. However, measures of gambling urges, mood and daily stressors reflected experiences from the current day. At the data

analysis stage, a lag variable was created so that assessments of gambling and alcohol were matched with assessments of mood and stressors from that same day.

The daily diary was divided into two parts: Part A and Part B. Part A referred to experiences from the current day and included the following measures:

Gambling Urges. Participants completed the 6-item Gambling Urge Scale (GUS: Raylu & Oei, 2004), which assesses urges to gamble at the time of reporting (e.g., It would be difficult to turn down a gamble right now) with response options ranging from zero to six (0 = totally disagree, 6 = totally agree). The GUS demonstrated good internal consistency (alpha = 0.97) in this study.

Daily stressors questionnaire. A measure developed by Bolger, Delongis, Kessler, and Schilling (1989) was used to assess sources of demands and tension experienced that day. The first part of the questionnaire was about sources of demands experienced on the day. Specifically, participants were asked to indicate whether they had a) a lot of work at home, b) a lot of work at job or school, c) a lot of demand made by family or spouse, d) are you sick or injured, e) are your child sick or injured, f) a lot of demands by other relatives or friends, g) other sources, h) problem with transportation, i) a financial problem within the past 24 days. The second part of the questionnaire was about sources of tension and arguments that took place on the day. Specifically, participants were asked to indicate whether they had any tension or argument with a) spouse or partner, b) children, c) disciplinary problem with children, d) sibling, e) parent, f) parent-in-law, g) other persons within the past 24 hours. Both parts of the questionnaire used the yes/no response format.

Mood. Participants were asked to rate their current mood on several dimensions of positive and negative affect on a 5-point scale from 0 = not at all to 4 = extremely. For brevity, eleven items (i.e., Happy, Excited, Sad, Anxious, Tense, Angry, Tired, Stressed, Bored, Hungry, Lonely) were chosen from the 60-item Positive and Negative Affective Schedule (PANAS-X: Watson & Clark, 1999). Items were selected to reflect a range of positive and negative affective experiences and are consistent with other measures of affect used in daily diary studies (e.g., Goldstein et al., 2012).

Exertion of self-regulatory resources. To assess the extent to which participants may have exerted self-regulatory resources by managing urges to use other substances or engage in other risky behaviours, we asked participants to indicate on a 4 point scale ranging from 1 (not at all) to 4 (a lot) the extent to they had resisted urges to engage in the following activities: a) food temptations, b) urges to smoke, c) urges to use alcohol, d) urges to use marijuana, e) urges to use other drugs, and f) other urges. Because daily assessment of these urges has not previously been assessed, this measure was created by the researchers for the current study.

Part B of the daily diary questionnaire included questions pertaining to subjective states and activities engaged on the previous day, and included the following questions:

Specifics of gambling episodes. Participants were asked whether they gambled on the previous day, and if so, they were asked a series of questions about the gambling episode they were in. Participants who reported not having gambled the day before

were not asked the remaining questions and were reminded of the following day's daily diary.
(1) Duration of gambling episode: "How long did you gamble yesterday?". Response options included: 1) less than 30 min, 2) 31-60 min, 3) 61-90 min, 4) 91-120 min, 5) more than 121 min.
(2) Location of gambling episode: "Where were you while you were gambling yesterday?"
(3) Company had during gambling episode: "Who were you with while you were gambling?"
(4) Types of gambling: "What type of gambling were you engaging in? Check all that apply." Eight types of gambling were listed: 1: cards, 2: casino-type table games (roulette, craps), 3: slot machines or VLT, 4: sports betting (e.g., sports, horses, fantasy sports, Proline, etc.) 5: scratch tickets or pull tabs, 6: lottery tickets, 7: bingos, 8: personally investing in stocks, options or commodity markets
(5) Duration of gambling episode in minutes: "How long did you spend gambling (e.g., 60 minutes)? Please record your response in minutes." The question about duration of gambling episode was asked again as an attention check.
(6) Intended budget for gambling: "How much money did you intend to spend while gambling, in dollars (e.g. $50)?"
(7) Amount spent on gambling: "How much money did you spend on gambling in dollars (e.g. $50)?"
(8) Net win/loss: Participants were first asked "Did you win or lose money when you gambled yesterday? Please consider your NET win or loss (e.g., amount won - amount lost)." Participants who reported a net win were asked "What was the net amount of money that you won, in dollars (i.e. wins - losses)?". Participants who reported a net loss were asked "What was the net amount of money that you lost, in dollars (i.e. losses - wins)?".
(9) Drinking during gambling episode. "Did you drink any alcohol while gambling? One standard drink = 12 oz. of beer, 5 oz. of wine, 1 oz. of liquor. If so, how many drinks?"

Questions about gambling limits from previous day's gambling episode. Participants were then asked a series of questions about limits set for the previous day's gambling as well as their success and failure in sticking to gambling limits. First, participants were asked whether they set any limits on their gambling on the previous day. Those who indicated not having set a limit for it skipped all the remining questions and received a reminder for the next day's daily diary. Those who indicated having set a limit were asked a series of the questions as follows.

(1) Intensity of temptation to violate gambling limits: "How intense was the temptation to violate your limit; for example, your urge to spend more than you had planned or spend more time gambling than you had set for yourself?" A 5-point scale was used as the response option (1 = Not at all intense, 2 = Somewhat intense, 3 = moderately intense, 4 = very intense, 5 = extremely intense).
(2) Success or failure in sticking to gambling limits: "Did you stick to your gambling limits?" Response options were "1 = Yes, I stuck to my gambling limits, 2 = No, I exceeded the limits I set for myself".

(3) Type of limit violated: “What limit did you violate? Select one”. Participants were asked to choose one of the five options (1= I exceeded the money limit I had set for myself and spent more than I intended, 2 = I exceeded/spent more time gambling than I intended. 3 = I gambled when I had planned not to gamble. 4 = I engaged in a type of gambling that I had not intended (e.g., casino gambling) 5= other limits).
(4) Reasons for ending of gambling episode: “Why did you eventually stop gambling yesterday?” Participants were asked to choose one of the following response options (1= ran out of money, 2 = I was interrupted, 3 = It was no longer fun, 4 = I ran out of time,
5 = I had won enough money, 6 = I had lost enough money, 7 = I got bored, 8 = other (please specify)).
(5) Feelings at the end of gambling episode: Participants were asked the question “How did you feel when you finally stopped gambling yesterday?”. They responded to seven emotion items (i.e., happy, excited, sad, anxious, tense, angry and guilty) on a 5-point scale (0 = not at all to 4 = extremely).
(6) Subsequent modification of gambling limits: “Did you do anything to modify your gambling related limit afterwards?” They were asked to choose one of the three response options (1 = Yes, I increased the limit (e.g., decided I would spend more money the next time). 2 = Yes, I decreased the limit (e.g., decided I would spend less money the next time), 3 = No, I did not change my limit. 4 = I did not have any limits to begin with.)
(7) Factor crucial to sticking to gambling limits: “What was the most important factor that helped you stick to your gambling related limit?” This was an open-ended question.

After this, participants were thanked for filling out a daily diary for the day and reminded of another daily diary for the following day.

Ethics Review

The procedures and instruments used for the current study were cleared by the institutional research ethics boards the three researchers are affiliated with (i.e., the University of Guelph, the University of Toronto and the University of Manitoba).

Analysis

Descriptive statistics are provided for demographic variables, gambling limit setting variables as well as individual differences in impulsivity and trait self-control. Bi-varate correlation analyses were conducted to assess covariation between individual differences and proximal antecedents of gambling self-control. In these analyses, daily diary variables were aggregated across the 21 days of daily dairies. Exploratory factor analysis was used in order to reduce the complexity of mood state items before they were analyzed in conjunction with individual difference variables.

Lag analysis was used to assess the effect of proximal factors on self-control and daily gambling. We used the shift function in SPSS to align mood and gambling urges reported on day *x* with gambling variables reported on day *x + 1* (e.g., gambling

incidence, amount spent on gambling, urges to gamble, experienced temptation to violate gambling limits, and failure to stick to gambling limits, etc.).

Lastly, Hierarchical Linear Modeling (HLM; Raudenbush & Byrk, 2002; Raudenbush, Byrk, Cheong, Congdon, & du Toit, 2011) was used to assess 1) daily (i.e., within-person) relationships between proximal variables known to deplete self-regulatory variables (negative mood, daily stress, resisting urges to engage in other risky or tempting activities, and alcohol use) and gambling self-control and behaviour; and 2) the moderating effects of individual differences in trait self-control and impulsivity on these within-person relationships. With HLM, multiple observations within an individual are seen as nested within the individual. The repeated observations, collected daily and proximal to gambling and limit violations, are the Level 1 variables. The individual difference variables, assessed at one point in time (i.e., baseline), are the Level 2 variables.

Results

Sample Characteristics

Participants were recruited by three research teams (Guelph, Toronto, and Manitoba). Overall, 389 individuals expressed interest in participating in the study; 155 were eligible and directed to the initial online survey. Data was dropped for 25 participants who discontinued the initial survey, resulting in a sample of 130 adult gamblers (*n* = 47 from Guelph, *n* = 56 from Toronto and *n* = 27 from Manitoba). Although we were hoping to recruit 300 participants for the initial survey, we found that this was very difficult even after extending the data collection period by additional 4 months. The main challenge was recruiting participants who had adopted a goal of reducing gambling. Furthermore, some participants did not wish to commit to a 21-day diary study. Future research should consider ways of better recruiting participants who meet these criteria. Findings of demographic variables and other sample characteristics are summarized in Table 2.

Sample Characteristics for Gambling, Limit-Setting, and Individual Differences in Gambling Risk

Past month gambling.

Following the procedures used by Weinstock, Whelan and Meyers (2004), we calculated the six indices from the 4-week Gambling Timeline Follow Back: duration, intent, risk, win, loss and drinks. Univariate statistics for the GTLFB indices are described in Table 3. Only two participants reported net wins for any days, whereas 29 participants reported net losses.

We also counted the number of participants who reported engaging in the eight gambling categories in the past 4 weeks, which are reported in Table 4.

Since an established index of problem gambling severity was not included in our battery of questions, we used amount of money lost (gambling loss) as a proxy for problem gambling severity. Specifically, we created five categories of participants based on the amounts lost during the four weeks prior to the study (i.e., quintiles). The mean amount lost was $17.69 for Group 1 (*N*=25), $43.42 for Group 2 (*N*=25), $99.79 for Group 3 (*N*=24), $204.66 for Group 4 (*N*=24), and $1593.04 for Group 5 (*N*=26). Group 4 and 5 can be considered heavy gamblers relative to the other groups. This grouping variable based on loss is used in later analyses in order to assess differences in gambling limit violations and other daily measures between heavy gamblers and light gamblers.

Setting of gambling limits.

About 93.4% of participants (*N* = 122) reported that they had considered setting limits to gambling within the past 6 months. Of the 122 participants, the large majority (90.8%) considered setting limits on the amount of money gambled. A significant proportion also reported setting limits on: time spent gambling (71.7%), type of gambling (68.3%), and specific days for gambling (55.5%); 45.3% of them reported having decided to stop gambling altogether at some point within the past 6 months. Participants often endorsed more than one limit for their gambling.

Use of self-regulation strategies to limit gambling.

When asked to indicate whether they had used each of the 20 self-regulation strategies in order to limit their gambling in the past 30 days, participants indicated having used certain strategies more than others. Frequencies of having used versus not used self-regulation strategies intended to limit gambling are listed in Table 1. As illustrated in the table, the majority of participants used strategies that represent avoidance of situations (e.g., avoided going to certain places like a casino) and distraction via other activities (kept busy with other activities so I am less tempted to gamble, spent more time with family and friends, focused on other hobbies). In addition, participants set monetary and time limits (set a target budget for my gambling and stuck to it, set a time limit on how long I would spend at a gambling venue, kept track of the money I spend on gambling), and reminded themselves of the consequences of gambling (thought about negative consequences of excessive gambling that I have observed, heard about or read about). In contrast, there were several strategies that participants did not use, with 60% of participants reporting that they **did** not actively seek support around their gambling (asked friends or relatives to mind or manage my money, got professional help to cope with my gambling, avoided gambling alone, went to gambling venues with friends so I won't be tempted to gamble too much, asked friends to look out for me when I am at a gambling venue), cut-off their ability to spend money (cut up my credit cards) and only went to gambling venues where there are other activities as well.

Individual Differences in Trait Self-Control and Impulsivity

Means, standard deviations and bivariate correlations for trait self-control and impulsivity subscales are listed in Table 5. As expected, facets of impulsivity were moderately intercorrelated. Negative and positive urgency were highly correlated (r = .80) and perseverance and sensation seeking were not correlated (*r* = -.08, ns). Furthermore, as expected, trait self-control was significantly correlated with all facets of impulsivity.

<u>Sample Characteristics for Daily Diary Variables: Gambling, Gambling Urges, Stressors, Mood, and Exertion of Self-Control</u>

Of the 130 participants who completed the initial survey, 19 respondents were dropped from the daily diary analyses due to providing two or fewer daily diary entries in the 21-day period or not following the instructions provided (e.g., filling out several daily diaries on a single day in order to be eligible to incentives). Thus, the final daily diary dataset of 111 participants was used for analysis. Overall, 1861 daily diaries were reported, which means, on average, about 11.8 daily diaries were filled by a respondent.

Gambling urges.

The six-items comprising Gambling Urges Scale (GUS: Raylu & Oei, 2001) had high internal reliability (Coefficient alpha = 0.97), and an index was created by taking the average of the six items. The GUS index had a means of 3.00 out of the 7-point scale, and its standard deviation was 1.66.

The histogram for the gambling urges index is shown in Figure 1. It is noticeable that the minimum value of one (out of the 7-point scale of GUS) was reported on about 19.6% of daily diaries, which implies that no gambling urges were reported about 20%

of the times. In contrast, the mid-point or greater intensity of gambling urges (i.e., 4 or higher on the 7-point scale) was reported on about 30.9% of daily diaries.

Daily stressors.

Frequency analysis of the sources of demands experienced on the day of daily dairy reports in Table 6 showed that financial problems, work at job/school and home were sources of stress for participants. In turn, spouse/partner and parent(s) were listed more often than other persons as personal sources of tension and arguments.

Mood.

To reduce the complexity of analysis, the 11 mood items were subjected to an exploratory factor analysis. A two-factor solution was deemed most appropriate. Sad, anxious, tense, angry, tired, stressed and lonely had very high loadings on the first factor and low loadings on the second factor. In contrast, happy and excited had very low loadings on the first factor and very high loadings on the second factor. Bored and hungry had intermediate loadings on both factors. Thus, we decided to create two index variables: 1) negative mood, which consisted of the mean of seven negative mood items (i.e., sad, anxious, tense, angry, tired, stressed and lonely; Coefficient alpha = 0.89); and 2) positive mood, which consisted of the mean of the two positive affective items (i.e., happy and excited; Coefficient alpha = 0.76). The other two items, bored and hungry, were used as individual. Means, standard deviations of the mood indices and items as well as their correlations are listed in Table 7.

Exertion of self-regulatory resources.

On average, participants reported greatest temptations regarding food (*M* = 2.16, SD = 1.10). Other temptations were relatively lower, including urges to smoke (*M* = 1.65, SD =1.03), and urges to use alcohol (*M* = 1.76, SD =1.10), marijuana (*M* = 1.65, SD =1.08) or other drugs (*M* = 1.55, SD =1.08).

Daily gambling episodes.

Gambling was reported on about 30.0% of days (i.e., 558 out of 1861 reports).

(1) *Duration of gambling episode*: The category of “less than 30 minutes” was most common (50.9%), followed by 31-60 minutes (22.4%), 61-90 minutes (10.0%), more than 121 minutes (10.0%) and 91-121 minutes (6.6%).

(2) *Location of gambling episode*: “Where were you while you were gambling yesterday?” About 55.6% of gambling episodes took place at home, and 45.2% occurred on the internet. Other locations included casinos (13.8%), bars (5.9%), and at parties or organized gatherings (3.9%)

(3) *Social context of the gambling episode*: About 74.0% of gambling episodes took place when participants were alone. This was followed by with friends (13.3%), with family (6.6%), strangers (6.8%), and dating partner/spouse (6.5%).

(4) *Types of gambling*: Of the eight types of gambling, slot machines or VLT (30.1%) were reported most often on days of diary reports, followed by sports betting (28.3%), scratch tickets or pull tabs (23.3%), and lottery tickets (23.3%). Card games (19.7%), casino table games (14.0%), investment in stocks, options, commodity markets (5.7%) and bingo (2.7%) were less common. Please note that participants were allowed to check all the response options that applied.

(5) *Duration of gambling episode in minutes*: Average duration of gambling episodes were 62.1 minutes (SD = 75.4). The histogram of this variable is shown in Figure 2. As

indicated earlier in Question (1), the most frequently indicated length were between 1 and 60 minutes.
(7) *Amount spent on gambling:* The average amount participants spent on gambling was $101.39 although there was a large amount of variability in spending (SD = 206.64). In about 40.5% of gambling episodes reported, $20 or less was spent. In 18.5% of gambling episodes, participants spent greater than $20 and less than $40. In 23.4% of gambling episodes, participants spent up to $100 but less than $40, they spent between $100 and $500 in 17.6% of gambling episodes reported and spent between $500 and $1600 in only about 5.2% of gambling episodes. The histogram of this variable is shown in Figure 4.
(8) *Net win/loss*: Net win was reported for about 38.8% of gambling episodes, whereas net loss was reported for about 59.6% of gambling episodes. “Neither win nor loss (i.e., $0) was reported for only about 1.6% of episodes.
For participants who reported net gains, the amounts of net gains up to $25 were the most common (51.8%). In about 29% of gambling episodes, net gains between $26 and $100 were reported. Net gains between $101 and $200 were reported in about 11.2%. However, net gains beyond $200 were very rare (i.e., 8%).
Net losses up to $25 were the most common (52.5%). In about 31.8% of gambling episodes, net losses between $26 and $100 were reported. Net losses between $101 and $200 were reported in about 7.1%. However, net losses beyond $200 were rare (i.e., 9%).
(9) Drinking during gambling episode. Drinking while gambling was reported in about 26.0% of gambling episodes. Less than 1 drink was reported for about 17.9% of gambling episodes reported. 1-2 drinks were reported for about 37.9% of gambling episodes. 3-4 drinks were reported for about 20.6% were reported. 5 up to 12 drinks were reported for about 23.4% of gambling episodes.

Gambling limits.
In 347 occasions out of 558 gambling incidence episodes (62.2%), participants reported having set limits for their gambling.

(1) *Intensity of temptation to violate gambling limits:* “Not at all intense” and “somewhat intense” were endorsed for about 25.4% and 31.8% of gambling episodes. “Moderately intense” was endorsed for about 25.1% of gambling episodes. “Very intense” and “extremely intense” were endorsed for only 17.6% of gambling episodes reported.
(2) *Success or failure in sticking to gambling limits:* In 268 out of 347 episodes in which gambling limits for the day had been set (77.2%), participants stuck to their gambling limits. Alternatively, gambling limits were violated for only 79 (22.8%) of the qualifying gambling episodes.
(3) *Type of limit violated*: In 60 out of 79 gambling limit violation episodes (75.9%), participants reported exceeding gambling amount limits. Reports of going beyond time limits for gambling were relatively infrequent (10.1%). In about 12.7% of gambling violation episodes, participants reported gambling when they planned not to gamble that day. Reports of engaging in a type of gambling they had not intended for the day was very rare (1.3%).

(4) *Reasons for ending of gambling episode*: When asked why they eventually stopped gambling the day before, participants reported the reason "ran out of money" most frequently, in 171 out of 558 gambling episodes (25.3%). This was followed by "lost enough money" (16.3%), "won enough money" (11.6%) and "ran out of time" (11.3%). Relatively few people chose "I was interrupted" (7.2%), "I got bored" (4.3%) and "It was no longer fun" (3.9%).
(5) *Feelings at the end of gambling episode*: When asked how they felt when they finally stopped gambling the day before on the 5 point scale ranging from zero (not at all) to four (extremely), the average rating was below the mid-point of 2 on each of the emotion items: happy (means = 1.76, SD = 1.27), excited (means =1.46, SD = 1.21), sad (means = 1.57, SD = 1.27), anxious (means =1.47, SD = 1.28), tense (means = 1.53, SD = 1.28), angry (means = 1.44, SD = 1.36), and guilty (means = 1.81, SD = 1.11).
(6) *Subsequent modification of gambling limits*: When asked whether they did anything to modify their gambling limit after an episode of gambling, the majority of gambling episodes were not followed by a plan to change the gambling limit: 361 out of 555 qualifying episodes (65.0%). Only a small percentage of episodes were followed by an intention to increase the limit (7.0%) and 16.0% of episodes were followed by a plan to decrease the limit. Lastly, the response that they did not have any limits for gambling that day was reported for 11.9% of the episodes.
(7) *Factors crucial to sticking to gambling limits:* In an open-ended question about "what was the most important factor that helped you stick to your gambling related limit?", participants provided a wide range of responses. The most common responses pertained to monetary limits or lack of monetary resources to continue gambling (e.g., "budget", "didn't want to lose more money" "don't bet what you can't lose", "financial reason", "money"). Other responses referred to participant's self-control or determination ("self-control", "set my mind to it", "determination"), social influences (e.g., "husband", "family support", "pressure from girlfriend to stop"), other goals (e.g., "I need to save up for vacation", "thinking of other things I want to spend my money on"), and self-imposed strategies (e.g., "only having that amount of cash in my wallet", "I only deposited $10 and put my credit cards away", "using a pre-paid visa with a limit").

The Relationship Between Individual Differences in Gambling Risk and Daily Experiences

We assessed bi-variate correlations between strategies to limit gambling and gambling behaviour (assessed at baseline) and daily diary variables (See Table 8).

Surprisingly, frequency of gambling episodes and limit violations were not significantly correlated with any of the individual difference variables. Age, gender and the number of types of gambling limits were not significantly correlated with any of the daily diary variables.

The number of gambling limits strategies endorsed at the baseline was positively correlated with daily temptations to violate gambling and daily stressors. This finding suggests that additional strategies for setting gambling limits may be needed by those who recognize that their temptation to engage in gambling is high, perhaps due to experiencing greater daily stressors.

We also assessed bi-variate correlations between individual difference variables (i.e., trait self-control and impulsivity) and daily diary variables. These correlations are reported in Table 9.

Overall, we found that frequency of gambling was significantly correlated with trait self control, but not the other individual difference variables. Higher trait self-control was associated with lower frequency of gambling across the 21 days. In addition, frequency of gambling limit violations was associated with lower trait self-control and greater urgency, but not other impulsivity facets.

Intensity of gambling urges and temptations to violate gambling limits was positively associated with trait self control and all facets of impulsivity.

Sources of daily and personal stress were negatively correlated with trait self control and positively correlated with urgency, positive urgency and (the lack of) premeditation subscales of impulsivity.

Finally, intensity of daily negative moods was negatively correlated with trait self control and positively correlated with all the impulsivity subscale. In contrast, the intensity of positive moods reported daily was not significantly correlated with any of the individual difference variables.

Strategies for Self-Regulation of Gambling: Between-Participant Analyses

Because this was a pilot study, we explored several aspects of gambling and self-regulation to better understand these relationships. We tested the relationship between number of gambling limit strategies (assessed at baseline) and recent gambling behaviour reported in G-TLFB. To assess the relationship between gambling limits and problem gambling behaviour, we computed the percentage of people who reported having used each strategy for the five groups derived from amount of money lost (as reported on the G-TLFB). Result for this analysis are listed in Table 10.

Although the percentages did not vary for some gambling limits strategies, one global pattern emerged. Percentages were greater in group 4 than group 1 for strategies #1 (“avoided walking or driving past certain locations”), #3 (“avoided going to certain locations like casino”), #6 (“set a time limit on how long I will spent at a gambling venue”), #13 (“asked a friend to look out for me when I am at a gambling venue”) and #18 (“talked to my friends or family about gambling activities”). Given that group 4 is the second highest in G-TLFB_Loss amount, these strategies are likely to be relatively ineffective strategies in helping reduce gambling violations compared to other strategies.

Within-Person Relationships: Mood, Stress, Use of Self-Control, and Gambling Urges and Behaviours

Predictors of Gambling Urges

Hierarchical linear modelling (HLM; Raudenbush & Byrk, 2002) was used to examine within-person relationships captured with the daily reports of gambling urges, gambling, and violations of gambling limits. All analyses were conducted using lagged variables created in SPSS. That is, because participants reported on their gambling from the day before, variables were shifted so that reports of mood and urges on a given day were matched with gambling episodes reported on the next day.

The first set of analyses explored within-person relationships (i.e., variables reported on daily diaries) and between-person moderators (i.e., variables reported on the initial survey) of gambling urges. It should be noted that it is not possible to include

all the variables collected from the initial survey and daily diaries, requiring the need to be selective in inclusion of key variables as predictors.

The first model considered prior use of self-control as a Level-1 predictor of gambling urges In addition, because gambling urges were significantly correlated with the number of sources of daily stressors ($r = .29$, $p < .01$), the sources of interpersonal stressors ($r = .39$, $p < .001$), and the intensity of negative mood ($r = .42$, $p < .01$), these daily variables were also included in the mode. For Level 2 variables, we included trait self-control in all hierarchical models given its prominence for theories of self regulation. Impulsivity not included due to its relatively high correlation with trait impulsivity. The baseline money lost while gambling and gender were included as covariates.

Results of the HLM model for gambling urges are listed in Table 11. Regarding within-person predictors, both negative mood and other stressors were significant predictors, indicating that urges to gamble were higher on days where participants experienced higher than average negative mood and a larger than average number of daily stressors. Regarding between-subjects predictors, the amount of money lost group variable and trait self-control were significant predictors. The intensity of urges to gamble was higher for people who recently lost a greater amount of money on gambling and those whose trait self-control was lower than average. None of the cross-level interactions were significant, indicating that trait self-control and amount of money lost while gambling did not moderate the relationship between 1) negative mood and gambling urges; and 2) stressors and gambling urges.

Predictors of Gambling Episodes

The next set of analyses explored predictors of gambling episodes (i.e., gambling taking place versus not taking place in daily diaries). The same set of predictors was used here as in the HLM model for gambling urges.

As with the HLM for gambling urges, negative mood and prior exertion of self-regulatory resources for resisting other addictive behaviour were included as within-person predictors (Level 1). Daily stressors and interpersonal difficulties were not included in the model as these were not significantly correlated with the incidence of gambling episodes in the bivariate analysis of aggregated gambling (across the 21 days) and daily proximal variables. Instead, the intensity of gambling urges experienced daily was included as another Level 1 predictor.

At the between-person level (Level 2), trait self-control, gender and baseline gambling losses were included, as with the model for gambling urges.

Results of the HLM for incidence of gambling episodes are outlined in the Table 12. The only significant predictor of gambling episodes was gambling urges. Specifically, on days when gambling urges were higher than average, there was a significantly higher likelihood of gambling (vs. not gambling), which is consistent with the overall rate of gambling across the daily diary reports. None of the other within-person variables (negative mood, resisting other urges) were significant predictors of gambling episodes. In terms of the individual difference variables associated with gambling, none of the individual difference variables were significant predictors over and above the effects of gambling urges. There were no significant cross-level interactions, indicating that trait self-control did not moderate any of the within-person associations.

Characteristics of episodes of gambling where limits were violated vs. not violated

A series of t-tests were conducted to examine differences between gambling episodes in which gambling limits were violated and those where limits were not violated. These t-tests were conducted in order to assess average differences between limit violation and non-violation episodes of gambling over time, in other words, what differentiates episodes of gambling where limits are violated vs. when they are not violated. Thus, all the variables entered for the t-tests were daily proximal variables collected from daily diaries.

As illustrated in Table 13, on days in which gambling limits were violated versus not violated, gambling activities engaged in were significantly riskier (i.e., more time was spent gambling and more money was lost), urges to engage in gambling and temptations to violate limits were stronger, and the number of daily stressors were higher. Furthermore, significantly less positive (less happy and excited) and more negative emotions (greater sadness, anxiety, tension, anger and guilt) were reported after gambling episodes on days in which gambling limits were violated versus not violated.

Predictors of gambling limit violations

The last set of analyses involved examining within- and between-person predictors of gambling limits violations. For level 1, we included variables that are most immediate to gambling limits violation: exertion of self-regulation resisting other urges, gambling urges and temptation to violate gambling limits. For level 2, we included trait self control, gender and GTLFB_loss grouping variable as predictors as with other HLM models. The interaction terms between trait self control and the daily proximal variables were included in the model as well.

Table 13 shows the results of HLM for gambling limit violations. It should be noted that days in which gambling episodes were reported were included in the analysis, whereas days in which gambling did not take place were not. This is necessary because violations of gambling limits could only occur on days in which gambling was initiated.

As illustrated in Table 14, across all gambling days, participants were more likely to maintain their limits, rather than violate them. However, participants had greater limit violations on days when their exertion of self-regulation to limit other behaviours (food intake, smoking, alcohol use, marijuana use) was higher as well as on days when they had greater temptations to violate their limits. This finding indicates that violation of gambling limits is more likely when subjective feeling of temptation to violate gambling limit is higher than usual and when self-regulatory resources have already been used up trying to resist other addictive behaviours. However, the finding that negative urges was negatively associated with gambling limit violation was not easy to interpret.

In addition, at the individual difference level, likelihood of violating gambling limits was significantly higher for people with lower self-control than average. Finally, there was a significant cross-level interaction where trait self-control moderated the within-person relationship between exertion of self-regulatory resources and violating gambling limits. The pattern of findings for this interaction is illustrated in Figure 5. Specifically,

the positive within-person relationship between exertion of self regulatory resources and limit violations was weaker at low level of trait self-control than at high level of trait self-control. Specifically, when little self-regulatory resources were previously exerted, participants with high trait self-control were less likely to violate their gambling limits than those with low trait self-control. In contrast, when self-regulatory resources were exerted on resisting many addictive temptations, participants with high trait self-control were more likely to violate their gambling limits than those with low trait self-control. There were no other significant cross-level interactions, which indicates that trait self-control did not moderate the impact of temptation to violate limits or gambling urges on limit violations.

Discussion

Although self-regulation, especially sticking to one's gambling limits, is an important issue in the domain of gambling, prior research on this matter is nascent. According to the framework of self-regulation and its depletion (Muraven & Baumeister, 2000), self-regulation failure in a certain domain is more likely when one's self-regulatory resources have recently been used up in order to deal with other cognitive, emotional and behavioural demands. Furthermore, overall capacity for self-regulation and ability to maintain self-control in the face of challenges are likely to vary depending on individual differences in trait self-control (Tangney et al., 2004; Schmeichel & Zell, 2007) and impulsivity (Hodgins & Holub, 2015). Despite the application of models of self-regulation and ego depletion to other addictive behaviours (alcohol use; Muraven et al., 2002, 2005, 2006), this framework has not been studied in the gambling field. This is surprising, given that limit-setting has been identified as an important method for encouraging responsible gambling (e.g., Wohl, Gainsbury, Stewart, & Sztainert, 2013). In addition, the current study represents an important extension of the research on self-regulation and ego depletion – taking this work out of the lab and into the daily lives of gamblers. To best understand factors that impact success and failure in sticking to one's gambling limits, we included both proximal predictors that vary across self-control episodes (e.g., negative moods, stressors, trying to resist temptation to drink) and individual differences in impulsivity and trait self-control. The current study represents a preliminary analysis of the ego depletion model as it applies to self-regulation of gambling among gamblers attempting to set limits on their gambling behaviour.

Prior to assessing the model of ego depletion, we examined participants' strategies for limit setting and some interesting findings emerged. Participants tended to rely on strategies that were largely avoidant – they avoided casinos or distracted themselves by spending time with friends or involved in other hobbies. They also reminded themselves of the consequences of their gambling and set firm limits on the amount of money they would spend. However, participants were much less likely to elicit support – either in the form of professional help or by telling friends about their limits, asking friends to help them resist temptations, and avoiding gambling alone. These findings suggest that gamblers are more likely to rely on themselves, rather than others, to set limits on their gambling. These findings are consistent with other research on barriers to help seeking for gamblers, where gamblers frequently identify a desire to handle gambling problems on their own (Suurvali, Cordingley, Hodgins, & Cunningham,

2009). These findings also point to the need for more resources to support gamblers in implementing self-help strategies, as discussed further below.

The primary analyses for this study involved examining daily relationships between proximal factors influencing urges to engage in gambling, gambling behaviour, and violating gambling limits. Overall, it was found that urges to gambling were in the moderate-to-high range on almost one-third of days, and that gambling occurred on almost the same number of days, indicating that gamblers were managing gambling temptations on a significant number of days and had difficulty resisting the urge to gamble. Although about one half of gambling episodes were less than 30 minutes in duration, gambling episodes that were one hour or longer were not uncommon (i.e., 27% of gambling episodes). The amount spent on gambling varied a great deal. Whereas $20 or less was spent in about 40.5% of gambling episodes, expenditures of $100 or more were reported in about 22.8% of gambling incidents.

We found that intensity of gambling urges was higher on days on which negative mood and the number of sources of daily stressors were higher (relative to the person's average mood/stress) and for people with lower trait self-control and who recently lost a large amount of money than average participants. The association between daily intensity of gambling urges and proximal determinants of self-control (e.g., negative mood or daily stressors) was not significantly moderated by individual differences in trait self-control or impulsivity. In addition, the likelihood of gambling was higher on days when gambling urges were higher, but it was not significantly associated with negative mood or prior exertion of self-regulation resources for resisting other temptations. These findings are partly consistent with another daily diary study conducted by Quilty et al. (2017) who found that gambling urges, but not gambling behaviour, was greater on days when participants experienced increased negative affect.

These findings suggest that gambling urges may mediate the relationship between negative affect/daily stressors and actual gambling. From an ego depletion perspective, increases in gambling urges may reflect the self's more limited capacity to resist temptation in the context of managing negative mood and stress, but might not always result in increased gambling. That is, on days of high stress and poor mood, an individual may have a greater urge to gamble (i.e., "I had such a bad day, I would just like to gamble right now"), but may not have the opportunity to translate this urge into an actual behaviour. In addition, because the relationship between gambling urges and gambling behaviour is so strong, it likely reduces the impact of other proximal predictors of gambling behaviour, including negative mood and prior exertion of self-regulation resources. It should also be noted that the likelihood of gambling was not significantly predicted by trait self-control, gender or the amount of money recently lost on gambling, which was a proxy for heavy gambling, further pointing to gambling urge as the strongest predictor of actual gambling. Finally, the type of gambling behaviour might also play a role. That is, self-regulation of gambling among those who have set limits may be more important for types of gambling that involve in-the-moment decision-making around placing bets and setting time limits. Participants in the current study reported that one of the ways they limited their gambling was to avoid going to gambling venues (i.e., casinos). Participants in the daily diary study may have already been limiting their time in high-risk gambling situations, resulting in less opportunity to convert urges into gambling. Indeed, data from the daily diary indicate that participants were

often spending small amounts of money on gambling (about $20 or less for 40% of gambling episodes) and that lottery tickets was the most common form of gambling. Participants may have already taken steps to limit in-the-moment decisions about gambling by engaging in forms of gambling that present less self-control risk.

The next set of analyses examined episodes of gambling where participants violated their pre-set gambling limits. Examining violations of gambling limits provides a unique opportunity to assess factors that impact self-control, assuming that these efforts have been undermined when participants have a gambling limit and then exceed it. Gambling limits violations were reported in about 22.8% of gambling episodes. This suggests that although participants in our daily diary study were relatively successful in sticking to their gambling limits on majority of days, violation of gambling limits is not infrequent. We first examined associations between characteristics of gambling episodes and limit violations. As expected, time spent gambling and net losses were significantly higher for gambling episodes where limit violations were reported compared to episodes where limits were not violated. In addition, participants reported more sources of stress, greater negative emotions and lower positive emotions following gambling when they violated a gambling limit. Considering the previous finding that intense negative feelings experienced after drinking limit violation led people to drink on the following day ((Muraven, Collins, Shiffman, & Paty, 2005), our findings highlight the detrimental effects of limit violations and raise concerns regarding a potential cycle of limit violations, followed by negative affect and then subsequent or persistent gambling, despite losses, to manage these emotions or due to further depleting resources.

We found that gambling limits violation was significantly more likely on days when self-regulatory resources were previously exerted for resisting urges to engage in other addictive behaviours (e.g., drinking, smoking, marijuana, drugs, etc.) and temptation to violate gambling limits were higher than average. This finding is consistent with the self-regulatory resource framework (Muraven & Baumeister, 2000), which posits that self-regulation is more likely to fail when self-regulatory resources have been recently depleted in order to cope with cognitive, emotional and behavioural demands than when resources are still intact. Previous researchers have found that directing self-control resources at negative mood and stress management impacts self-control for diet (Hofmann, Rauch, & Gawronski, 2007) and alcohol (Muraven, Collins, Shiffman, & Paty, 2005), but this is the first study to test these effects for gambling. In addition, our study is the first to assess these effects in the daily lives of gamblers, providing evidence for external validity of the ego depletion model.

Despite the expected findings regarding depletion of self-control and violation of gambling limits, the finding that intensity of gambling urges was negatively associated with limit violations was surprising. However, it may be the case that lower gambling urges were associated with increased limit violations because participants who violated their limits had less awareness regarding their urge to gamble. In the self-control domain, self-awareness has been identified as protective against self-regulatory failures (Alberts et al., 2011). When individuals are aware of their limited self-control capacity, they are more likely to engage in cognitive strategies that encourage self-control. Participants who has set a gambling limit, but were aware of their urge to gamble, may have been less likely to violate the limit because they were prompted to reflect on their gambling urge.

In the same hierarchical linear model, we found that the higher one's trait self-control, the lower the likelihood of violating one's gambling limits. This result is consistent with recent findings that the chronic ability to exercise self-control plays a protective role against self-regulation problems in diverse domains (Baumeister & Heatherton, 1996; Tangney, Baumeister, & Boone, 2004). Furthermore, we found that the above-mentioned positive main effect of prior exertion of self-regulation resources on the likelihood of violating gambling limits was significantly moderated by trait self-control. Specifically, we found that when participants exerted fewer resources towards self-regulation of other urges, higher trait self-control was associated with a ***lower*** likelihood of violating gambling limits compared to lower trait self-control. In contrast, when self-regulatory resources were exerted towards resisting many other temptations, participants with high trait self-control were ***more*** likely to violate their gambling limits than those with low trait self-control.

This finding may appear ironic considering previous findings about protective roles of trait self-control against self-regulation problems (e.g., DeWall et al., 2007; Muraven et al., 2005). However, this finding is in fact consistent with the view that individuals with high trait self-control less frequently engage in effortful inhibition of impulses in tempting situations than others because they tend to frequently use strategies to pre-emptively avoid encounters with tempting situations (Hofmann, Baumeister, Förster, & Vohs, 2012). Empirical support for this view has been recently reported (Ent, Baumeister, & Tice, 2015). Thus, once pre-emptive avoidance strategies fail and tempting situations transpire in the backdrop of self-regulatory resources depletion, individuals with high trait self-control may find it more difficult to inhibit the temptation to continue gambling and go over their gambling limits than those with low trait self-control. This finding is compatible with findings from a series of recent studies by Imhoff and associates (2014) that individuals with high trait self-control ate more candies and took greater unnecessary risks than those with low trait self-control when their self-regulation resources were experimentally depleted. Given this finding, we suggest that although trying to avoid situations in which one may feel tempted to gamble is generally an effective way of reducing gambling limit violations, this strategy may actually backfire once this strategy fails and one starts to gamble, especially in situations where one's self-regulatory resources have been depleted due to resisting other urges. In order to prevent this, individuals who usually try to avoid gambling venues or tempting situations need also to be trained to start using strategies intended to help them stick to gambling limits once they decide to gamble. This poses very important practical implications for clinical interventions for gamblers. Future studies are necessary in order to empirically test whether pre-emptive self-regulation strategies intended to avoid gambling sessions more frequently and more successfully used by gamblers with high trait self-control than by those with low trait self-control. Overall, our findings provide important addition to the literature of self-regulation and its failure in the domain of gambling as well as offer practical implications for gamblers who try to stick to gambling limits and clinicians.

Clinical Implications

The current findings have several implications for clinical practice. First, the findings indicate that negative affect and daily stressors are particular triggers for

gambling urges and, in turn, that greater urges to gamble impact gambling behaviour. When considering interventions for individuals who are attempting to reduce their gambling, strategies should focus on negative mood regulation and stress management as well as urge reduction. One intervention that warrants further investigation is Mindfulness Based Cognitive Therapy (de Lisle, Dowling, & Allen, 2011), which focuses on both negative mood management and urge reduction strategies via cognitive and mindfulness techniques. Second, as noted above, there may be some benefit to using behavioural strategies to gradually expose gamblers to increasing high-risk situations, allowing practice of self-control. If self-control is indeed a "muscle" that needs to be strengthened over time, then exposure to situations that might undermine self-control are needed to fully exercise it. Recent advances in behavioural treatments for pathological gambling include cue exposure using virtual reality. Repeated exposure to gambling-related cues is thought to reduce urges to gamble through behavioural extinction, resulting in reduced risk in the presence of gambling-related cues (Park et al., 2015). Finally, the current findings also have important implications for relapse prevention. One aspect of relapse prevention is psychoeducation regarding the abstinence violation effect – the notion that an initial lapse in behaviour (such as violating a pre-set gambling limit) is more likely to lead to a full-blown relapse (abandoning limit-setting altogether) when individuals attribute the lapse to personal failure or stable internal factors beyond their control (Larimer, Palmer & Marlatt, 1999). Because self-regulation failures are common, gamblers who are trying to set limits should anticipate some trial-and-error, especially when they are first learning to exercise this muscle. To avoid shame and guilt regarding these self-regulation lapses, individuals who are trying to set limits on their gambling would benefit from learning about ego depletion and the situational – rather than internal – factors that can undermine sticking to their limits.

Limitations

Our study is not without limitations. First, the sample size for the current study was relatively small. Although 130 people completed the baseline survey, only 111 provided usable data for the daily diary portion due to attrition. While this sample is smaller than intended, it is consistent with other daily dairy studies in the gambling field (e.g., see Goldstein et al., 2012; Quilty et al., 2015). Furthermore, since we used a community sample, self-selection bias is likely to be present. In other words, it is possible that participants who agreed and filled out they daily diary surveys conscientiously may be systematically different from typical frequent gamblers who have been found to experience problems in many aspects of their lives (e.g., Roberts et al., 2017). To avoid these problems, future research may make better use of pre-existing resources for capturing the daily lives of gambler such as recruiting participants who frequently use a single gambling website. For example, a provincial gambling corporation, such as Ontario Lottery and Gaming Corporation or Manitoba Liquor and Lotteries, may collaborate with researchers and ask individuals who regularly log in to their online gambling website to participate in a daily diary study assessing various aspects of their online gambling (i.e., gambling limits, gambling urges, prior exertion of self-regulation resources, etc.). In addition to enhancing participant recruitment, this method of data collection would also allow us to collect information regarding gambling

episodes (e.g., duration, money risked, net loss, violation of gambling limits). While the daily diary method reduces recall bias compared to longer retrospective methods (e.g., reporting on past week or past month gambling), collecting data through an online gambling site would further enhance reliability. Of course, stringent research ethics need to be applied so that gamblers are informed that they are free to select to participate in the study and withdraw at any time.

Another limitation was in the use of a dichotomous response option (yes/no) for assessing self-regulation strategies to limit gambling (See Table 1). We may have collected richer data if we had asked participants to report on the frequency with which they use each strategy. Although this was a calculated decision on our part to reduce participant burden, we were unable to perform more sophisticated analyses on these data (e.g., principal component or exploratory factor analysis, comparing the frequency of using different self-regulation strategies in a sensitive manner). In future studies, it will be beneficial to include a continuous scale for assessing self-regulation strategies, explore its factor structure, and eliminate redundant items to better capture daily variations in their usage. In other words, it would be possible to explore whether frequent usage of certain self-regulation strategies is effective in reducing actual gambling limit violations over time.

Furthermore, one of the limitations of daily diary approaches is the need for brevity in measures used to assess various aspects of participants' experiences. For example, mood was measured with a subset of mood descriptors from the full 60--item PANAS-X (Watson & Clark, 1999). We used exploratory factor analysis of the 11 mood items we used in order to check its dimensionality before forming indices of positive and negative moods. However, since psychometric properties of the 11-item version of PANAS-X has not been previously investigated, our results pertaining to mood states need to be interpreted with caution. Response options for the daily stressors questionnaire (Bolger et al., 1989) were also limited (to yes/no) and thus may not have captured the degree of stress experienced due to specified sources. Future studies should consider using more sensitive measures to capture experiences with daily stressors and hassles.

A final limitation of the study was the omission of a standard measure for problem gambling severity. Although the 9-item Canadian Problem Gambling Index instrument (CPGI: Ferris & Wynne, 2001) was included in the original version of the initial survey, it was later decided to verbally administer it at the point of initial contact when potential participants' study eligibility was checked. However, the University of Guelph Research Ethics Board insisted that the CPGI should not be included in the set of study eligibility questions since CPGI score would not be used as a screening device by us. When we decided to abide by this feedback, we should have put the CPGI instrument back into the initial online questionnaire, but this was not done. We regret that this oversight took place. We created a five-grouping variable based on the amount of G-TLFB_Loss ($) as a proxy for Problem Gambling Severity Index of CPGI. Although we believe that this is a reasonable proxy variable for gambling problem severity, it was not possible for us to directly compare our findings to previous studies on gambling self-regulation that used a standard index of problem gambling severity.

Despite these limitations, the current findings provide new and important information regarding self-regulation of gambling, specifically self-initiated gambling limits violation. This is the first daily diary study to explore the ego depletion model and the first to apply this model to gambling. Consistent with the self-regulatory resource depletion framework (Muraven & Baumeister, 2000), our findings indicated that gambling limits were more likely to be violated on days when self-regulatory resources were previously exerted to resist other additive urges and by people whose trait self-control is low.

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Table 1. Use of self-regulation strategies intended to limit gambling

Self-Regulation Strategy	Yes	No	Missing
1. Avoided walking or driving past certain locations	40	79	11
2. Asked friends or relatives to mind or manage my money	22	96	12
3. Avoided going to certain places like casino	83	36	11
4. Set a target budget for my gambling and stuck to it	87	33	10
5. Gone to gambling venues with friends so I won't be tempted to gamble too much	29	88	13
6. Set a time limit on how long I will spend at a gambling venue	70	50	10
7. Limited the amount of alcohol I consume while I am gambling	45	73	12
8. Kept myself busy with other activities so I am less tempted to gamble	92	29	9
9. Avoided taking my credit cards to gambling venues	58	63	9
10. Avoided gambling alone	38	81	11
11. Only gone to gambling venues where there are other activities as well	32	84	14
12. Voluntarily excluded myself from a gambling venue	51	66	13
13. Asked a friend to look out for me when I am at a gambling venue	31	85	14
14. Cut up my credit cards	17	100	13
15. Gotten professional help to cope with my gambling	11	106	13
16. Kept track of the money I spend on gambling	88	31	11
17. Thought about the negative consequences of excessive gambling that I have observed, heard about or read about	91	29	10
18. Talked to my friends or family about gambling activities	49	67	14
19. Spent more time with family and friends	79	41	10
20. Focused on other hobbies (e.g., sport, art, dancing, volunteering, playing computer games, etc.)	87	32	11

Note: The self-regulation strategy items were adapted from findings from Moore, Thomas, Kyrios and Bates (2012). “Yes” refers to the number of participants who indicated having used the particular self-regulation strategy in order to limit their gambling. “No” refers to the number of those who indicated not having used it. N=130.

Table 2. Summary of sample characteristics

Number of participants included in the analysis: 130	
Gender	
	Male (49.2%)
	Female (49.2%)
	Non-binary (0.8%)
	Transgender (0.8%)
Ethnicity	
	Caucasian (55.4%)
	East Asian (22.1%)
	South Asian (15.4%)
	Native Canadian/First Nations (3.8%)
	Other (9.2%)
Age	
	29 yeas or less (40.0%)
	30-39 years (29.2%)
	40-49 years (16.2%)
	50-59 years (11.5%)
	60 years or higher (3.1%)
Relationship status	
	Single (36.2%)
	In long-term relationship (22.3%)
	Married or common-law (34.6%)
	Separated or divorce (5.4%)
Annual income	
	Less than $20,000 (25.4%)
	$20,000 - $39,999 (30.8%)
	$40,000 - $59,999 (23.1%)
	$61,000 - $79,999 (10.8%)
	$80,000 - $99,999 (5.4%)
	$100,000 or more (4.6%)
Annual disposable income [a]	
	Less than $2,000 (23.1%)
	$2,000 - $5,000 (23.8%)
	$5,001 - $10,000 (22.3%)
	$10,001 and $20,000 (12.3%)
	$20,001 or more (16.8%)
Family history related to addictive behaviours	
	either of parents ever had had a problem with gambling or received treatment (17.7%)
	either of their parents ever had a problem with alcohol or received treatment (26.2%)

[a] Note: Annual disposable income refers to the amount to save or spend on things after paying taxes, rent or mortgage, utilities, child support, basic food and other necessities.

Table 3. Gambling characteristics of the sample

	N	Min.	Max.	Mean	SD
Episode duration (in min)	121	0	267,869	3,442.16	24,639.36
Amount intended to spend	122	0	64,000	1,254.72	5,853.46
Amount risked	123	0	33,000	1,339.68	3,222.84
Amount won	2	290	530	410.00	169.71
Amount lost	29	24	409,800	4,333.69	10,159.76
Number of drinks	120	0	280	13.38	32.39

Table 4. G-TLFB gambling types engaged in in past 4 weeks

	Categories of gambling	# of people reported engaging in every week	Missing or not reported
Type 1	Cards (e.g., poker)	25	105
Type 2	Casino-table games (roulette, craps)	19	111
Type 3	Slot machines or VLTs	33	97
Type 4	Sports betting (sports, horses, fantasy sports, proline, etc.)	28	102
Type 5	Scratch tickets or pull tabs	38	92
Type 6	Lottery tickets (lottery, fundraising, raffle, etc.)	52	78
Type 7	Bingo	5	125
Type 8	Personally investing in stocks, options or commodity markets	7	123

Table 5. Means and standard deviations of trait self-control and impulsivity subscales and their bi-variate correlations

	Means	Urgency	Premedi-tation	Perseve-erance	Sensation-seeking	Positive urgency
TSC	3.03 (0.65)	***-.71***	***-.55***	***-.45***	***-.48***	***-.62***
Urgency	2.32 (0.57)		***.40***	***.32***	***.51***	***.80***
Premeditation	2.88 (0.46)			***.50***	***.30***	***.44***
Perseverance	3.02 (0.44)				.08	***.29***
Sensation-seeking	2.30 (0.61)					***.59***
Positive Urgency	2.53 (0.77)					

Note. All bolded values are significant at $p < .05$. All bolded and italicized values are significant at $p < .01$.

Table 6. Participant experiences of daily stressors

(a) Sources of Demands

	Sources of Demands	Yes	No	Missing
1	A lot of work at home	686 (36.9%)	1134 (60.9%)	41 (2.2%)
2	A lot of work at job/school	722 (38.8%)	1091 (58.6%)	48 (2.6%)
3	A lot of demands made by your family or spouse	428 (23.0%)	1378 (74.0%)	55 (3.0%)
4	You are sick or injured	283 (15.2%)	1527 (82.1%)	51 (2.7%)
5	Your child sick or injured	74 (4.0%)	1719 (92.1%)	73 (3.9%)
6	A lot of demands made by relatives or friends	277 (14.9%)	1526 (82.0%)	58 (3.1%)
7	Problems with transportation	369 (19.8%)	1456 (78.2%)	36 (1.9%)
8	Financial problems	738 (39.7%)	1069 (57.4%)	55 (3.0%)

(b) Personal Sources of Tension and Arguments

	Personal sources of Tension and Arguments	Yes	No	Missing
1	Spouse/partner	283 (15.2%)	1603 (81.9%)	54 (2.9)
2	Child/children	765 (3.5%)	1788 (92.0%)	84 (4.5)
3	Disciplinary problem with your children	95 (5.1%)	1702 (91.5%)	64 (3.4%)
4	Brother or sister	176 (9.5%)	1620 (90.2%)	65 (3.5%)
5	Parent	254 (13.6%)	1547 (83.1%)	60 (3.2%)
6	Parent-in-law	53 (2.8%)	1743 (93.7%)	65 (3.5%)
7	Other	62 (3.3%)	1042 (56.0%)	757 (40.7%)

Table 7. Means, standard deviations and correlations among mood items

	Mean	SD	Negative mood	Bored	Hungry
Positive mood	1.63	1.00	-0.05	0.13**	0.16**
Negative mood	1.38	1.00		0.54**	0.43**
Bored	1.15	1.20			0.42**
Hungry	1.32	1.23			

Note: ** indicates significance at the 0.01 level (2 tailed)

Table 8. Bivariate relationships between daily proximal variables (aggregated across 21 days) and individual difference variables

Individual Difference	Gender	Age	Number of types of gambling limits	Number of limits strategies endorsed	Time Spent Gambling
Daily Proximal Variables					
Gambled	-.15	.16	-.02	-.16	-.10
Violated limits	-.04	.10	.08	.03	.19
Gambling urge	-.04	-.14	.11	**.27**	.06
Temptation to violate limit	.11	-.12	-.01	.16	**.24**
Self-regulation of other behaviours	-.09	-.07	.04	.01	-.07
Daily stressors	.06	-.10	.11	**.30**	.10
Daily arguments	.05	.00	.17	.16	.05
Daily positive mood	-.10	-.01	.12	.05	.02
Daily negative mood	.00	-.15	.09	.11	**.22**

Table 9. Bivariate relationships between daily proximal variables and multi-item scale variables for individual difference variables

Individual difference Variable	*Trait Self-Control*	*UPPS Negative Urgency*	*UPPS Premed-itation*	*UPPS Perse-verance*	*UPPS Sensation seeking*	*UPPS Positive urgency*
Daily Variables						
Gambled	***-.29***	.13	.18	.04	.03	.11
Violated limits	**-.25**	***.29***	.15	.17	.07	.15
Gambling urge	***-.43***	***.47***	***.43***	***.28***	**.33**	***.44***
Temptation to violate limit	***-.32***	***.36***	***.21***	***.37***	***.27***	***.32***
Self-regulation of other behaviours	-.15	.12	.09	-.04	.17	**.21**
Daily stressors	***-.30***	***.32***	***.31***	.15	.15	***.27***
Daily arguments	**-.23**	***.26***	***.28***	.07	**.22**	***.27***
Daily positive mood	.14	-.15	.05	-.11	-.04	-.05
Daily negative mood	***-.43***	***.42***	**.24**	**.23**	**.24**	***.32***

Note. All bolded values are significant at $p < .05$. All bolded and italicized values are significant at $p < .01$.

Table 10. Percentage of participants having used gambling limit strategies for the five groups derived from G-TLFB_Loss index

	Group 1	Group 2	Group 3	Group 4	Group 5
1	0.19	0.26	0.38	0.46	0.34
2	0.24	0.09	0.19	***0.13***	0.19
3	0.57	0.59	0.52	0.96	0.70
4	0.77	0.74	0.81	***0.79***	0.71
5	0.24	0.32	0.33	0.17	0.25
6	0.38	0.64	0.59	0.67	0.58
7	0.33	0.50	0.52	***0.29***	0.38
8	0.68	0.61	0.76	0.88	0.75
9	0.32	0.45	0.59	0.42	0.47
10	0.29	0.32	0.41	0.29	0.32
11	0.20	0.23	0.45	0.33	0.26
12	0.48	0.45	0.57	0.58	0.44
13	0.19	0.09	0.32	0.46	0.28
14	0.10	0.14	0.20	***0.08***	0.14
15	0.05	0.14	0.05	0.04	0.10
16	0.77	0.73	0.81	0.75	0.73
17	0.62	0.83	0.86	0.75	0.75
18	0.33	0.43	0.45	0.50	0.41
19	0.68	0.59	0.68	***0.75***	0.67
20	0.77	0.64	0.77	0.75	0.73

Note: See Table 1 for labels for numbered gambling limits regulation strategies.
Group 1 refers to the first quintile of individuals who reported the smallest amount of loss on G-TLFB, whereas Group 5 consists of those who reported the largest amount of gambling loss.
All bolded and italicized values are significant at $p < .01$.

Table 11. Predictors of urges to gamble in Hierarchical Linear Model

Predictor	Coefficient	SE	t-ratio (*df*)	*p*
γ_{00} Intercept	**3.27**	**0.12**	**28.22 (88)**	**<.001**
Level 1 main effects				
γ_{10} Negative mood	**0.28**	**0.08**	**3.48 (1178)**	**<.001**
γ_{20} Exertion of self-regulation	0.07	0.08	0.90 (1178)	0.37
γ_{30} Daily stressors	**0.08**	**0.03**	**2.70 (1178)**	**0.007**
γ_{40} Daily arguments	-0.05	0.04	-1.16 (1178)	0.27
Level 2 main effects				
γ_{01} Gender	-0.19	0.22	-0.87 (88)	0.39
γ_{02} Money lost[a]	**0.24**	**0.21**	**2.54 (88)**	**0.013**
γ_{03} Trait self-control	**-1.03**	**0.21**	**-4.80 (88)**	**<0.001**
Cross-level interactions (with trait self-control)				
γ_{11} Negative mood	-0.15	0.09	-1.67 (1178)	0.10
γ_{12} Exertion of self regulation	0.17	0.14	1.23 (1178)	0.223
γ_{13} Daily stressors	-0.01	0.06	-0.20 (1178)	0.84
γ_{14} Daily arguments	0.01	0.07	0.07 (1178)	0.91

[a] Note: Money lost group reflects groups of participants based on the amount of money lost while gambling as reported on the G-TLFB at baseline. Higher scores are associated with greater monetary losses.

Table 12. Predictors of episodes of gambling in Hierarchical Linear Model

Predictor	Coefficient	SE	t-ratio (*df*)	*p*
γ_{00} **Intercept**	**-1.07**	**0.12**	**-9.04 (86)**	**<.001**
Level 1 main effects				
γ_{10} Negative mood	0.24	0.15	1.66 (954)	0.10
γ_{20} **Gambling urges**	**0.34**	**0.06**	**5.16 (954)**	**<.001**
γ_{30} Exertion of self-regulation	0.12	0.12	1.00 (954)	0.32
Level 2 main effects				
γ_{01} Gender	-0.22	0.23	-0.94 (86)	0.35
γ_{02} Money lost[a]	0.12	0.08	1.35 (86)	0.09
γ_{03} Trait self-control	-0.44	0.25	-1.72 (86)	0.18
Cross-level interactions (with trait self-control)				
γ_{11} Negative mood	-0.10	0.26	-0.40 (954)	0.69
γ_{12} Gambling urges	0.01	0.12	0.07 (954)	0.94
γ_{13} Exertion of self-regulation	0.09	0.22	0.42 (954)	0.67

[a] Note: Money lost group reflects groups of participants based on the amount of money lost while gambling as reported on the G-TLFB at baseline. Higher scores are associated with greater monetary losses.

Table 13. Factors associated with violating gambling limits during episodes of gambling

	Did Not Violate Limit *M* (*SD*)	Violated Limit *M* (*SD*)	t-test	*p*-value
Time spent gambling	**42.68 (45.26)**	**97.76 (92.77)**	**6.62**	**<.001**
Net loss on gambling	**30.25 (37.46)**	**180.93 (320.07)**	**5.29**	**<.001**
Number of drinks while gambling	1.78 (0.42)	1.71 (0.46)	1.06	.29
Gambling urges	**3.09 (1.67)**	**3.76 (1.85)**	**2.77**	**.006**
Temptation to violate limit	**2.12 (0.99)**	**3.15 (1.24)**	**7.01**	**<.001**
Exertion of self-regulatory resources	1.77 (0.94)	1.75 (0.75)	0.17	0.87
Daily stressors	**1.83 (1.77)**	**2.48 (2.01)**	**2.58**	**0.01**
Daily arguments	0.40 (0.75)	0.61 (1.01)	1.81	0.07
Mood when stopped gambling				
Happy	**1.80 (1.13)**	**1.33 (1.08)**	**2.70**	**.008**
Excited	**1.38 (1.15)**	**0.94 (0.85)**	**2.46**	**.015**
Sad	**1.22 (1.22)**	**1.79 (1.14)**	**3.03**	**.003**
Anxious	**1.17 (1.16)**	**1.78 (1.17)**	**3.36**	**.001**
Tense	**1.25 (1.12)**	**1.66 (1.16)**	**2.30**	**.022**
Angry	**1.04 (1.15)**	**1.72 (1.29)**	**3.69**	**<.001**
Guilty	**1.43 (1.21)**	**2.07 (1.26)**	**3.40**	**.001**

Table 14. Predictors of gambling limits violations in Hierarchical Linear Model

Predictor	Coefficient	SE	t-ratio (*df*)	*p*
γ_{00} Intercept	**-1.89**	**0.70**	**-2.71 (74)**	**.008**
Level 1 main effects				
γ_{10} **Temptation to violate limit**	**0.82**	**0.28**	**2.94 (194)**	**.004**
γ_{20} **Exertion of self-regulation**	**0.67**	**0.27**	**2.47 (194)**	**.014**
γ_{30} **Gambling urges**	**-0.39**	**0.16**	**-2.37 (194)**	**.019**
Level 2 main effects				
γ_{01} Gender	0.42	0.42	1.00 (74)	0.32
γ_{02} Money lost[a]	0.03	0.18	0.18 (74)	0.87
γ_{03} **Trait self-control**	**-1.02**	**0.26**	**-3.86 (74)**	**<.001**
Cross-level interactions (with trait self-control)				
γ_{11} Temptation to violate limit	-0.33	0.28	-0.72 (194)	.47
γ_{12} **Exertion of self-regulation**	**1.20**	**0.54**	**2.23 (194)**	**.03**
γ_{13} Gambling urges	-0.12	0.26	-0.47 (194)	.64

Note. The outcome variables are whether the participant violated their gambling limit. Only gambling days were included in these analyses. [a] Money lost group reflects groups of participants based on the amount of money lost while gambling as reported on the G-TLFB at baseline. Higher scores are associated with greater monetary losses.

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Figure 1. Histogram of the index gambling urges experienced “right now”

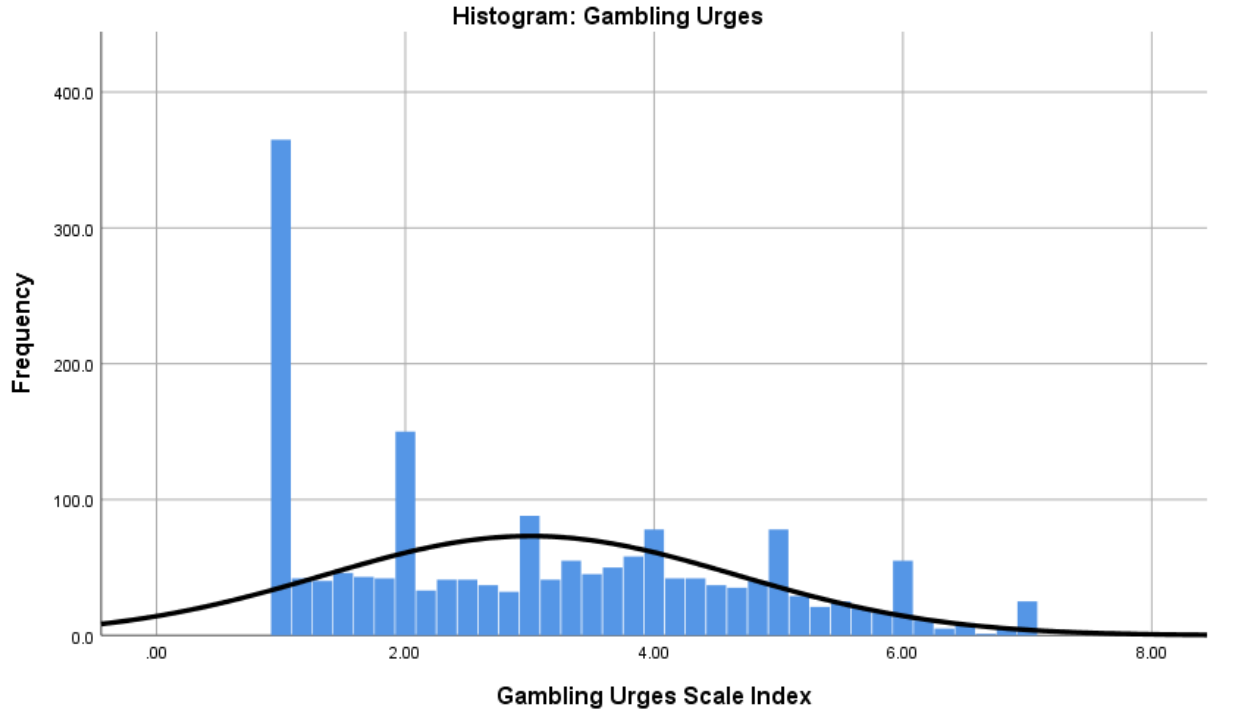


Figure 2. Histogram of the duration of gambling episodes in minutes

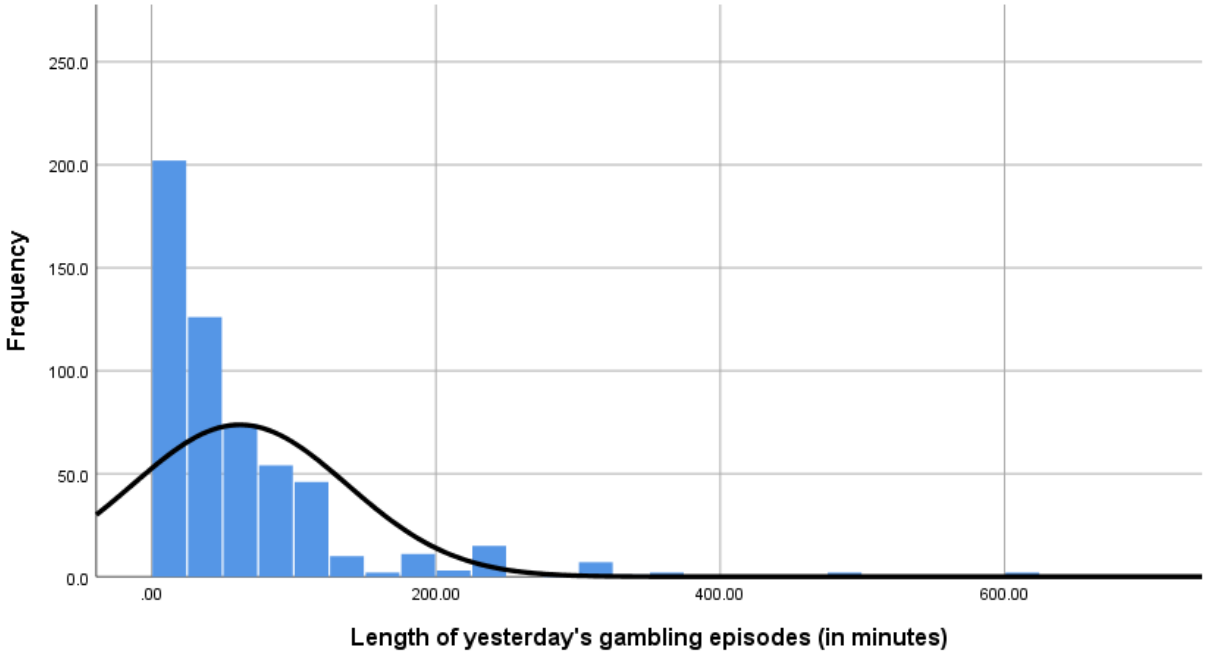
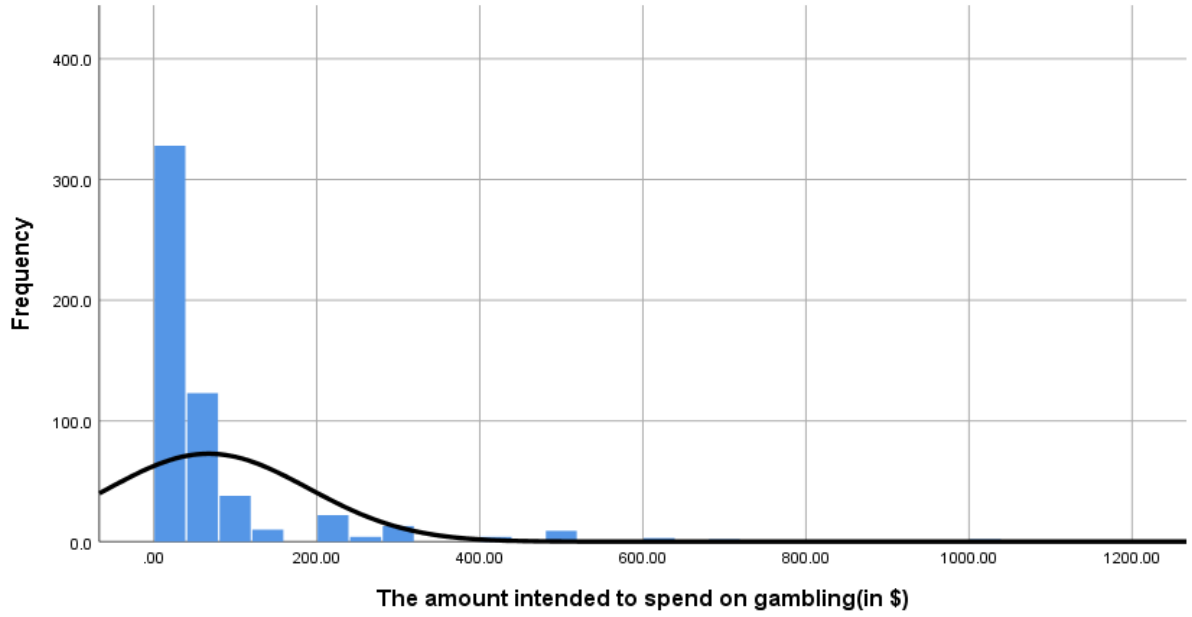


Figure 3. Histogram of intended budget for gambling



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