Substitution behaviors among casino gamblers during COVID-19 precipitated casino closures

Silas Xuereb

Department of Psychology, Carleton University

Hyoun S. Kim

Department of Psychology, Ryerson University

Luke Clark

Centre for Gambling Research at UBC, and Department of Psychology, University of British Columbia

Michael J. A. Wohl*

Department of Psychology, Carleton University

Address for Correspondence: Michael J. A. Wohl, michael.wohl@carleton.ca, 613-520-2600 x2908, Department of Psychology, Carleton University. 1125 Colonel By Drive, K1S 5B6, Ottawa, ON, Canada.

Abstract

The COVID-19 pandemic triggered the closure of licensed casinos throughout the United States of America in March and April 2020. This study sought to examine how Americans who gamble responded to the COVID-19 lockdown, including migration to online gambling, and changes in substance use and use of other technologies. On April 9, 2020, we recruited an online sample of 424 Americans who gambled in the last three months via Amazon's Mechanical Turk. Self-reported changes in online gambling and other addictive behaviors since the onset of COVID-19 and problem gambling severity were measured. Overall, online gambling decreased following the onset of COVID-19 casino closures, while alcohol, tobacco, and cannabis use increased among gamblers. Among gamblers who reported no online gambling involvement prior to COVID-19, 15% reported migrating to online gambling. These migrators had higher levels of problem gambling and lower income than gamblers who had never gambled online. The response to COVID-19 is heterogeneous: the majority of gamblers reported reducing their online gambling but increased their substance use. A minority of vulnerable gamblers substituted casino gambling with online gambling. Because these individuals are characterized by problem gambling symptoms and lower income, they may be considered a vulnerable group.

Key words: Gambling; COVID-19; substitution; addiction; substance use

Introduction

In late March 2020, mounting concern over the COVID-19 pandemic triggered an unprecedented event in the American gambling landscape: the mass closure of casino venues. For several months, American gamblers experienced an unexpected and dramatic contraction in their access to gambling. One avenue for gambling remained notably open: online gambling. Although the prevalence of online gambling remains fairly low (Kairouz & Nadeau, 2014), technological developments in mobile access have resulted in a rapid expansion of this form of gambling (Wardle et al., 2019).

The term substitution refers to the migration of activities (i.e., switching one substance for another) when access to a preferred substance is blocked (Allsop et al., 2014; Lucas et al., 2013). Despite the substantial literature on substitution among people who use substances, a paucity of empirical attention has been directed at people who gamble when their access is blocked, however, preliminary evidence suggests that substitution does occur for gamblers (Kim, 2020). This is perhaps unsurprising given that at the heart of substitution is the search for reinforcements that are similar to the addictive behavior that has been blocked (Kazdin, 1966). For example, a person who gambles to cope with negative life events but who no longer has access to gambling may increase their use of other addictive substances (e.g., alcohol) or behaviors (e.g., online gambling) as a replacement route of escape. At present, the literature has been relatively silent on possible substitution within forms of gambling (e.g., from land-based to online gambling). This knowledge gap is striking in light of the concerns that have been expressed about the possibility of migration to online gambling due to the COVID-19 precipitated closure of land-based gambling venues.

It is likely that gamblers' response to the casino closure may have been shaped by a number of further facets of the pandemic. Physical distancing measures may lead to boredom and social isolation, which can be potent triggers of gambling in at least some individuals

(Mercer & Eastwood, 2010). In addition, the pandemic precipitated an economic crisis at both the country and individual level. Although the relation between GDP and gambling is complex (Baumöhl & Výrostová, 2017; Olason et al., 2017), gambling participation increased following the Icelandic banking collapse (primarily in lottery products), and these effects may be stronger among individuals who were financially affected (Economou et al., 2019; Wohl et al., 2014). Herein, we tested the idea that the COVID-19-related closure of land-based casinos, combined with social isolation and economic crisis, may have resulted in gamblers substituting land-based casino gambling for online gambling.

In addition to substituting to online gambling, it is possible that casino gamblers may increase their engagement in other addictive behaviors (Kim, 2020). There is accumulating evidence that alcohol sales increased after physical distancing measures were introduced (Rehm et al., 2020), and there is preliminary evidence for similar increases in cannabis use (George-Cosh, 2020). It is possible that in addition to migrating to online gambling, casino gamblers may substitute with other substances during the current pandemic as a way to alleviate negative emotional states (Bilocati et al., 2016). Understanding whether a pattern of increased online gambling along with increases in substance use is taking place has important implications given that simultaneous use of gambling and substances may increase gambling harms (Punia et al., in press; Sagoe et al., 2017).

When access to gambling is consitrticted, gamblers may also increase their use of other potentially addictive technologies (e.g., video games, pornography), which often co-occur with disordered gambling (Potenza et al., 2018). Indeed, Kim (2020) found that people who recovered from gambling were more likely to report substituting to behavioral addictions, including addictive technologies, than to psychoactive substances. We had an *a priori* interest in social casino games. Social casino games are a specific genre of video games that simulates gambling using virtual credits instead of real money. Social casino

games have been found to increase real money gambling when people use them to improve their gambling skills, but may also decrease real money gambling when used to downregulate craving to gamble (Hollingshead et al., 2016; Kim et al., 2015). Thus, it is possible that during COVID-19 (a time when opportunities for in-person gambling are reduced) an increase in social casino gaming may be related to readiness to change among land-based casino gamblers.

The goal of the present study was to examine patterns of substitution in land-based gambling in the United States following the COVID-19 precipitated casino closures, with particular attention to their migration to online gambling. It is important to note that despite the fact that online gambling is illegal in some U.S. states, many states now permit online casinos, online poker and/or online sports betting, and studies have shown that tens of millions of Americans gamble online each year (e.g., Cooper, 2011; Sloan, 2020). Additionally, a systematic review by Nagelhout and colleagues (2017) showed that illegal drug use increases during an economic downturn. As such, substitution behavior is ripe for study in light of COVID-19 precipitated casino closures and the shuttering of the economy to reduce the spread of COVID-19. To this end, we examined whether there were changes in online gambling following the closure of land-based casinos in the United States due to COVID-19. We also examined changes in use of legal as well as illegal substances and other putative behavioral addictions during COVID-19. Open-ended questions assessed people's reasons (e.g., boredom) for reported changes. Lastly, we compared demographic and gambling characteristics in those who migrated to online gambling compared to those who did not.

Methods

Procedure

We pre-registered our primary hypothesis, sample size (*N*=500) and exclusion criteria on AsPredicted (https://aspredicted.org/vu6mf.pdf). Our analysis deviated from our pre-registration in that we used a two-tailed t-test instead of a one-tailed test, because the mean change in online gambling had the opposite sign to that expected.

Given the novel nature of this research, we did not conduct an *a priori* power analysis. Instead, after the data was collected, we conducted a sensitivity analysis using G*Power 3.1.9.7. This analysis revealed that our sample of 221 individuals with online gambling experience had 80% power to detect an effect size of *d*=0.172 at α=0.05. In other words, our sample size was sufficient to detect small effects.

We hosted a survey on Amazon's Mechanical Turk (MTurk) on April 9th, 2020 that was described as seeking regular gamblers for a study about gamblers' behavioral responses to the closure of land-based casinos due to COVID-19. After providing informed consent, gamblers completed a Captcha to prevent bots from completing the survey.

We obtained ethics approval for this research from the Research Ethics Board associated with the first author's institution.

Participants

MTurk workers were eligible to participate if they were American citizens, at least 18 years of age, and had gambled at a land-based casino within the past three months. We restricted the time-frame to last three months to reduce potential bias stemming from gamblers' poor recall about their gambling behaviour (see Wohl et al., 2017). Of the 639 people who started the survey, three did not provide consent to participate, 58 did not pass our eligibility screening, and 67 did not complete the survey, leaving 506 complete surveys. These participants were compensated with $0.75 (median completion time was seven minutes and 42 seconds). To address concerns with MTurk data integrity, and as outlined in our pre-registration, we removed 31 participants who passed the eligibility criteria but later indicated

that they had not gambled in the past three months, 10 participants who left open-ended

questions blank and 41 who provided incoherent open-ended responses or only provided

extreme responses (which can be indicative of bots and inattentive responding). Our final

sample consisted of 424 gamblers who ranged in age from 19-82 (M=37.93, SD=12.33) and

36.1% were female. Ninety-five percent of participants confirmed that casinos had closed in

their area.

Materials

      Online gambling. Participants were asked whether they had ever engaged in online

gambling prior to the closure of land-based casinos. If they had not, they were asked whether

they had started online gambling since the closures. Measures related to online gambling

were assessed if participants responded affirmatively to either of these questions. These

measures included whether their online gambling had increased, stayed the same, or

decreased since the casino closures (coded as 1, 0 and -1, respectively), and the magnitude of

change in their online gambling on a scale from 0 ('Not at all') to 3 ('A lot'). Additional

measures regarding limit setting were assessed but are not reported here.

      Changes in other behaviors due to COVID-19. Changes in other potentially

addictive behaviors, including alcohol use, tobacco use, cannabis use, video gaming, social

casino gaming, and pornography use, were assessed using similar items as those presented for

changes in online gambling. Participants were asked whether each behavior had increased,

stayed the same, decreased, or stayed the same because they had never used it, and the

magnitude of the change in their behavior.

      An open-ended question asked participants to explain why their behaviors had

increased ('Please tell us why you increased the use of substances or other behaviors') or

decreased ('Please tell us why you decreased the use of substances or other behaviors').

Open-ended responses were read by the first author and coded according to participants'

expressed motivation to increase their substance and behavioral addictions.

      Readiness to change. The Readiness to Change ladder (Biener & Abrams, 1991) was

used to assess participants' preparedness to change their gambling behavior on a scale from 0

('No thought of changing') to 10 ('Taking action to change (e.g., cutting down, enrolling in a

program)').

      Problem gambling. Problem gambling severity was measured using the Problem

Gambling Severity Index (PGSI; Ferris & Wynne, 2001) (M=7.83, SD=7.05; α=.94). The

PGSI contains nine total items and are anchored on a scale at 0 ('Never') and 3 ('Almost

always'). As such, participant's scores ranged from 0 to a maximum of 27. We kept the scores

as a continuous variable in our analyses.

      Demographics. Participants answered demographic questions to assess their age,

gender, marital status, ethnicity, education, job status, and household income.

Data Preparation / Analysis

      Analyses were carried out using SPSS 25. Our primary dependent variable was

change in online gambling. This was computed as the product of the direction of change in

online gambling and the magnitude of change in online gambling. Other behavior change

variables were computed in the same fashion. Individuals who had never used a substance or

technology were treated as missing and excluded analysis by analysis.

      Non-parametric tests were used because the dependent variables were not normally

distributed according to Shapiro-Wilk tests. Wilcoxon signed rank tests were used to assess

whether each behavior had significantly changed since the closure of land-based casinos,

with $r=Z/\sqrt{n}$ used as a measure of effect size (Tomczak & Tomczak, 2014). Kruskal-Wallis

tests were used to compare migrators to online gambling, previous online gamblers and

purely land-based gamblers, on demographics, problem gambling severity and behavioral

change scores with partial η^2 calculated as suggested by Murphy and colleagues (2014) used as a measure of effect size. We have not corrected for familywise error rate because, aside from the test of change in online gambling, the tests were purely exploratory. Parametric tests can also be found in the supplemental files on OSF.

Results

Table 1 reports demographic characteristics of the respondents. Our sample is slightly younger and significantly more male than the general United States population (U. S. Census Bureau, 2020a). Individuals with higher education levels and those in the middle of the income distribution are also overrepresented (U. S. Census Bureau, 2020b).

[Table 1]

Although in the subsequent analyses we used the PGSI as a continuous measure, a participant's total PGSI score can be used to place them into one of four categories: non-problem gambler (score of 0), low-risk gambler (score of 1 or 2), moderate-risk gambler (score of 3 to 7), and problem gambler (score of 8 to 27). For descriptive purposes, in the current sample, 13% (n=58) were non-problem gamblers, 21% (n=89) were low-risk gamblers, 21.9% (n=93) were moderate-risk gamblers and 43.4% (n=184) were problem gamblers.

Activities of land-based gamblers during COVID-19

Spearman correlations between variables are reported in Table 2. As predicted, an increase in online gambling was positively associated with PGSI, r_{219}=0.210, p=0.002. Furthermore, online gambling change was positively associated with alcohol use, r_{159}=0.169, p=0.032, tobacco use, r_{127}=0.274, p=0.002, pornography use, r_{151}=0.228, p=0.005, and social casino gaming, r_{181}=0.342, p<0.001. Contrary to our hypothesis, an increase in online gambling was positively (not negatively) associated with readiness to change, r_{219}=0.139, p=0.039.

[Table 2]

Behavior change. Using Wilcoxon signed-rank tests, we assessed whether substance use and other addictive behaviors increased since the closure of land-based casinos (see Table 3). Contrary to expectations, participants who gambled online reported a significant decrease in online gambling since the casino closure, Z=-3.06, p=0.002, r=0.21. However, as predicted among those who had ever used each substance, there were significant increases in alcohol, tobacco, and cannabis use, ps <.01. Likewise, there were significant increases in technology use, including video games, pornography use, and social casino gaming, ps <.001.

 [Table 3]

Motivations to increase behaviors. 56.9% of respondents indicated that increases in potentially addictive substances and behaviors were due to boredom or an increase in free time, 11.2% indicated that it was due to increased stress or anxiety, and 1.2% indicated it was to fill the void left by the lack of land-based gambling. The remaining respondents either did not increase any behaviors or did not provide a clear motivation.

Online gambling: Between group comparisons

Inspection of the data revealed three subgroups of casino gamblers: 1) those who migrated to online gambling as a result of the casino closures (n=35; 8% of full sample; 15% of gamblers without any prior online gambling involvement), 2) those who gambled online prior to the COVID-19 casino closures (n=186; 44%), and 3) those who neither gambled online prior nor during the casino closures (n=203; 48%).

[Table 4]

Kruskal-Wallis tests were used to compare these three groups on demographic characteristics and behavior changes (Table 4). There were significant differences between groups on PGSI, χ^2=74.32, p<0.001, partial η^2=0.159. Gamblers who had never gambled online had significantly lower PGSI (*Mean rank*=159.16) than migrators (*Mean*

rank=267.03), 95% CI for difference in mean ranks=[64.04, 151.70], *p<0.001*, and previous online gamblers (*Mean rank*=260.46), 95% CI for difference in mean ranks=[77.00, 125.60], *p<0.001*. Household income also differed significantly across groups, χ^2=10.61, *p*=0.005, partial χ^2=0.025 with migrators (*Mean rank=161.46*) earning significantly less income than gamblers who had never gambled online (*Mean rank*=228.71), 95% CI for difference in mean ranks=[-110.84, -23.66], *p*=0.007. Group differences in age were also present, χ^2=13.54, *p*=0.001, partial χ^2=0.032: exclusively land-based gamblers (*Mean rank*=234.56) were significantly older than previous online gamblers (*Mean rank*=192.90) 95% CI for difference in mean ranks=[-66.00, -17.32], *p*=0.002. There were no significant differences between groups in changes in alcohol use, tobacco use, or cannabis use. Group differences existed in changes in video gaming, χ^2=7.67, *p*=0.022, partial χ^2=0.025, pornography use, χ^2=8.28, *p*=0.016, partial χ^2=0.025, and changes in social casino gaming, χ^2=12.19, *p*=0.020, partial χ^2=0.047. Pornography use increased more for migrators (*Mean rank*=159.00) than land-based gamblers (*Mean rank*=117.33), 95% CI for difference in mean ranks=[10.97, 72.37] *p*=0.024. Video gaming increased more for previous online gamblers (*Mean rank*=163.7) than land-based gamblers (*Mean rank*=135.20), 95% CI for difference in mean ranks=[8.29, 48.71], *p*=0.017. Social casino gaming increased more for migrators (*Mean rank*=170.22) than both previous online gamblers (*Mean rank*=134.02), 95% CI for difference in mean ranks=[6.88, 65.52], *p*=0.0476, and land-based gamblers (*M*=115.16), 95% CI for difference in mean ranks=[23.76, 86.37] *p*=0.002.

Discussion

Results from our assessment of people who gambled at land-based casinos prior to COVID-19 show that these gamblers decreased their online gambling during the pandemic lockdown. This is consistent with Turner (2020) who found that gambling-related helpline calls decreased during COVID-19 casino closures. At the same time, a portion of land-based

casino gamblers displayed substitution to online gambling. Specifically, 15% of our

participants with no prior online gambling involvement reported starting to gamble online as

a result of casino closures. This is in line with Price (2020) who found 54% of gamblers in

Ontario reported gambling online during the pandemic while only 23% reported gambling

online regularly prior to the pandemic.

Of concern, in the current study, those who migrated also had elevated disordered

gambling symptomatology and had lower income than exclusively land-based gamblers.

These results are in line with previous studies that found that although only a minority of

people will engage in addiction substitution, those who do are likely to be vulnerable to

problematic engagement in addictions (Kim, 2020). Given that problematic gamblers account

for a disproportionate amount of gambling revenue, that migrators were higher in disordered

gambling symptomatology may explain the elevated revenues of online gambling operators

in the United States observed during the pandemic (American Gaming Association, 2020).

Additionally, these results support preliminary research in Sweden that suggested the

closure of land-based gambling venues may trigger a subset of vulnerable individuals to

switch to online gambling (Håkansson, 2020). In this light, it is prudent for gambling

operators to monitor for spikes in new gamblers, and whether these gamblers are gambling

excessively in response to fluctuations in land-based gambling opportunities with the ongoing

pandemic. If so, gambling operators and regulators may consider a variety of actions as part

of a public health response, and in anticipation of possible later waves of COVID-19

infections or a future pandemic, including a more cautious approach to marketing, imposing

mandatory loss limits, and increased provision of responsible gambling tools (Gainsbury et

al., 2018).

Interestingly, aside from the migrators, online gambling decreased on average since

the closure of land-based casinos due to COVID-19. Given the suspension of most major

sports leagues during the early stages of the pandemic, this phenomenon may be partially

driven by a fall in sports betting (Auer et al., 2020). At the same time, overall use of addictive

substances (e.g., alcohol, cannabis) and engagement with addictive technologies (e.g., social

casino gaming) increased. Although we lack control data on population-level changes in

these activities, these results may suggest a broader substitution effect among land-based

gamblers during COVID-19. Specifically, there may be compensatory increases in other

activities when one addictive behavior is no longer available. Similar to addiction substitution

during recovery, those who substitute land-based gambling with other addictive substances or

behaviors during COVID-19 are at risk of ultimately developing new dependencies on those

substances and behaviors (Kim, 2020). Unfortunately, simultaneous use of substances whilst

(online) gambling is associated with excessive gambling (Papineau et al., 2018). Thus,

although online gambling decreased overall, migration to online gambling and the increased

use of other addictive substances may lead to increased prevalence of disordered gambling

and other substance use disorders as a result of COVID-19.

More than half of the participants noted negative affect (e.g., boredom, anxiety) as

their primary reason for their increased use of other addictive substances and behaviors.

Although our data does not shed light on the mechanism linking these two, this finding is in

line with previous research that found that negative affect was one of the most common

reasons people reported for engaging in addiction substitution (Kim, 2020). Specifically,

participants were likely searching for a new means to manage distress, now that their pre-

COVID means (land-based gambling) were not available. This supports the notion that

people will engage in addiction substitution when the new addiction provides similar

reinforcements to the primary addiction (Adler, 1966; Kim, 2020). Unfortunately, physical

distancing measures and economic crisis are likely to increase the presence of mental health

concerns and at the same time limit healthy alternative coping skills to manage distress (e.g.,

social supports). In this light, it may be prudent for online treatments and supports to

acknowledge and provide strategies consistent with restrictions placed by COVID-19.

We note that participants also reported increased use of social casino gaming

following casino closure. Although concerns have been raised that social casino games may

increase future gambling (Kim et al., 2015), it is important to acknowledge that social casino

gaming may have prophylactic effects in current gamblers. As reported by Hollingshead and

colleagues, gamblers may turn to these free-to-play casino-style games as a means of

regulating their craving to gamble with no associated financial costs (Hollingshead et al.,

2016). Unfortunately, we did not assess why some gamblers turned to social casino games.

However, it is likely that some participants yielded benefits from playing social casino games

(i.e., a reduction in gambling). Although the similarities between gambling and social casino

games have generally been considered to be problematic, in the context of COVID-19, it may

provide an alternate and less harmful activity to both land-based and online gambling.

To our knowledge, the current study is the first to directly test the effect of the casino

closure in the United States on online gambling and substitution to substances and other (non-

gambling) technologies among land-based casino gamblers. We conducted this study, in part,

because of media speculation that alcohol, cannabis, video gaming, and pornography use

were increasing aftere physical isolation measures were put in place. Examining whether

people are transitioning to online gambling and other addictive behaviors during COVID-19

is of importance given the high accessibility of online gambling (and thus the potential for

excessive spending) and increased use of addictions in the context of physical distancing and

economic burden.

Limitations

Some limitations of the current research should be noted. First, due to the cross-

sectional design, the cause of migration to online gambling and changes in other addictions is

undetermined. Although we established that gamblers have increased their substance use and some gamblers have migrated to online gambling in the past couple months, we cannot attribute these changes directly to the closure of land-based casinos. Furthermore, we did not compare our sample to a control group of non-gamblers and thus future studies are needed to replicate our findings. Second, longitudinal studies are needed to assess the longer-term influences that COVID-19 has on land-based gamblers' behavior. Third, the results presented are based on subjective reports of behavior and behavior change. However, given the recency and salience of COVID-19, variance from objective measures (e.g., casino player account data) is likely minimal. Fourth, our sample consisted of MTurk participants and thus is not a representative sample of land-based casino gamblers. Indeed, rates of problem gambling on the PGSI were considerably higher in our sample than population-level prevalence, likely as a result of selection bias. Nevertheless, crowdsourcing platforms have shown utility for recruiting addiction populations including people who engage in gambling (Kim & Hodgins, 2017). Research with a representative sample of land-based casino gamblers and objective data (e.g. from account-based gambling) would inform both short and long term strategies to contend with problems experienced by gamblers as a result of the changing access to gambling following COVID-19. Finally, collecting data on state of residency would be useful to assess whether substitution that involves online gambling is greater in jurisdictions that have legalized online gambling compared to juridictions in which online gambling is illegal.

Conclusion

The ongoing COVID-19 pandemic is unprecedented in its impact on societal disruption. Importantly for the present research, it has been hypothesized that the closure of land-based casinos may have precipitated migration to online gambling (see Marsden et al., 2020). In line with other recent research (Price, 2020), we found empirical evidence to support this supposition. Additionally, we also demonstrated that the migration to online

gambling should not be the only concern among land-based casino gamblers. Indeed, we found significant increases in other substance and behavioral addictions. Physical distancing measures and economic uncertainty arising from COVID-19 may have an array of negative effects on people's mental health and well-being. The current study adds to the growing body of research on these effects by demonstrating that the closure of casinos may result in addiction substitution and a potential increase in disordered gambling among those who migrate to online gambling. Public health officials and treatment providers should prepare for this potential outcome of COVID-19.

Data availability statement. All data and code used in this research can be found at

https://osf.io/py45w/?view_only=513a3b58d0884e1c87c5558b2212c4ec

References

Adler, J. (1966). Gambling, Drugs, and Alcohol: A Note on Functional Equivalents. *Issues in*

Criminology, *2*, 111.

Allsop, D. J., Dunlop, A. J., Sadler, C., Rivas, G. R., McGregor, I. S., & Copeland, J. (2014).

Changes in cigarette and alcohol use during cannabis abstinence. *Drug and Alcohol*

Dependence, *138*, 54–60. https://doi.org/10.1016/j.drugalcdep.2014.01.022

American Gaming Association. (2020, August). *2020 Q2 Commercial Gaming Revenue*

Tracker. https://www.americangaming.org/wp-content/uploads/2020/08/2020-Q2-

Commercial-Gaming-Revenue-Tracker.pdf

Auer, M., Malischnig, D., & Griffiths, M. D. (2020). Gambling Before and During the

COVID-19 Pandemic Among European Regular Sports Bettors: An Empirical Study

Using Behavioral Tracking Data. *International Journal of Mental Health and*

Addiction. https://doi.org/10.1007/s11469-020-00327-8

Baumöhl, E., & Výrostová, E. (2017). Do people gamble more in good times? Evidence from

27 European countries. *Applied Economics Letters*, *24*(18), 1311–1314.

https://doi.org/10.1080/13504851.2016.1273484

Biener, L., & Abrams, D. B. (1991). The contemplation ladder: Validation of a measure of

readiness to consider smoking cessation. *Health Psychology*, *10*(5), 360–365.

Bilocati, R., Pissani, S., & Mancini, G. (2016). "I cannot stand the boredom." Binge drinking

expectancies in adolescence. *Addictive Behaviors Reports*, *3*, 70–76.

http://dx.doi.org/10.1016/j.abrep.2016.05.001

Cooper, A. F. (2011). *Internet gambling offshore: Caribbean struggles over casino*

capitalism. Springer.

Economou, M., Souliotis, K., Malliori, M., Peppou, L. E., Kontoangelos, K., Lazaratou, H.,

Anagnostopoulos, D., Golna, C., Dimitriadis, G., Papadimitriou, G., & Papageorgiou,

C. (2019). Problem Gambling in Greece: Prevalence and Risk Factors During the

Financial Crisis. *Journal of Gambling Studies*, *35*(4), 1193–1210.

https://doi.org/10.1007/s10899-019-09843-2

Ferris, J. A., & Wynne, H. J. (2001). *The Candian problem gambling index.* Canadian Centre

on Substance Abuse.

Gainsbury, S. M., Abarbanel, B. L. L., Philander, K. S., & Butler, J. V. (2018). Strategies to

customize responsible gambling messages: A review and focus group study. *BMC

Public Health*, *18*(1), 1381. https://doi.org/10.1186/s12889-018-6281-0

George-Cosh, D. (2020, April 16). *Ontario online pot purchases jump 600% amid COVID-19

pandemic, data shows.* BNN Bloomberg. https://www.bnnbloomberg.ca/ontario-

online-pot-purchases-jump-600-amid-covid-19-pandemic-data-shows-1.1422369

Håkansson, A. (2020). Changes in Gambling Behavior during the COVID-19 Pandemic—A

Web Survey Study in Sweden. *International Journal of Environmental Research and

Public Health*, *17*(11), 4013. https://doi.org/10.3390/ijerph17114013

Hollingshead, S. J., Kim, H. S., Wohl, M. J. A., & Derevensky, J. L. (2016). The Social

Casino Gaming-Gambling Link: Motivation for Playing Social Casino Games

Determines Whether Self-Reported Gambling Increases or Decreases Among

Disordered Gamblers. *Journal of Gambling Issues*, *33*, 52.

https://doi.org/10.4309/jgi.2016.33.4

Kairouz, S., & Nadeau, L. (2014). *Portrait du jeu au Québec: Prévalence, incidence et

trajectoires sur quatre ans* (p. 64). Université Concordia.

Kim, H. S. (2020). *Addiction Substitution and Concurrent Recovery in Gambling Disorder:

Evidence from Multiple Studies* [University of Calgary].

https://prism.ucalgary.ca/handle/1880/112406

Kim, H. S., & Hodgins, D. C. (2017). Reliability and validity of data obtained from alcohol,

cannabis, and gambling populations on Amazon's Mechanical Turk. *Psychology of*

Addictive Behaviors, *31*(1), 85–94. https://doi.org/10.1037/adb0000219

Kim, H. S., Wohl, M. J. A., Salmon, M. M., Gupta, R., & Derevensky, J. (2015). Do Social

Casino Gamers Migrate to Online Gambling? An Assessment of Migration Rate and

Potential Predictors. *Journal of Gambling Studies*, *31*(4), 1819–1831.

https://doi.org/10.1007/s10899-014-9511-0

Lucas, P., Reiman, A., Earleywine, M., McGowan, S. K., Oleson, M., Coward, M. P., &

Thomas, B. (2013). Cannabis as a substitute for alcohol and other drugs: A

dispensary-based survey of substitution effect in Canadian medical cannabis patients.

Addiction Research & Theory, *21*(5), 435–442.

https://doi.org/10.3109/16066359.2012.733465

Marsden, J., Darke, S., Hall, W., Hickman, M., Holmes, J., Humphreys, K., Neale, J., Tucker,

J., & West, R. (2020). Mitigating and learning from the impact of COVID-19

infection on addictive disorders. *Addiction*, *115*(6), 1007–1010.

https://doi.org/10.1111/add.15080

Mercer, K. B., & Eastwood, J. D. (2010). Is boredom associated with problem gambling

behaviour? It depends on what you mean by 'boredom.' *International Gambling

Studies*, *10*(1), 91–104. https://doi.org/10.1080/14459791003754414

Murphy, K. R., Myors, B., & Wolach, A. (2014). *Statistical power analysis: A simple and

general model for traditional and modern hypothesis tests.* Routledge.

Nagelhout, G. E., Hummel, K., de Goeij, M. C. M., de Vries, H., Kaner, E., & Lemmens, P.

(2017). How economic recessions and unemployment affect illegal drug use: A

systematic realist literature review. *International Journal of Drug Policy*, *44*, 69–83.

https://doi.org/10.1016/j.drugpo.2017.03.013

Olason, D. T., Hayer, T., Meyer, G., & Brosowski, T. (2017). Economic Recession Affects

Gambling Participation But Not Problematic Gambling: Results from a Population-

Based Follow-up Study. *Frontiers in Psychology*, *8*, 1247.

https://doi.org/10.3389/fpsyg.2017.01247

Papineau, E., Lacroix, G., Sévigny, S., Biron, J.-F., Corneau-Tremblay, N., & Lemétayer, F.

(2018). Assessing the differential impacts of online, mixed, and offline gambling.

International Gambling Studies, *18*(1), 69–91.

https://doi.org/10.1080/14459795.2017.1378362

Potenza, M. N., Higuchi, S., & Brand, M. (2018). Call for research into a wider range of

behavioural addictions. *Nature*, *555*(7694). https://doi.org/10.1038/d41586-018-

02568-z

Price, A. (2020). Online Gambling in the Midst of COVID-19: A Nexus of Mental Health

Concerns, Substance Use and Financial Stress. *International Journal of Mental

Health and Addiction*. https://link.springer.com/article/10.1007/s11469-020-00366-1

Punia, K., deVillaer, M., Mackillop, J., & Balodis, I. M. (in press). Understanding the overlap

between cannabis use and gambling behavior: A systematic review of empirical

findings and consideration of policy implications. *Current Addiction Reports*.

Rehm, J., Kilian, C., Ferreira-Borges, C., Jernigan, D., Monteiro, M., Parry, C. D. H.,

Sanchez, Z. M., & Manthey, J. (2020). Alcohol use in times of the COVID 19:

Implications for monitoring and policy. *Drug and Alcohol Review*, *39*(4), 301–304.

https://doi.org/10.1111/dar.13074

Sagoe, D., Mentzoni, R. A., Leino, T., Molde, H., Haga, S., Gjernes, M. F., Hanss, D., &

Pallesen, S. (2017). The effects of alcohol expectancy and intake on slot machine

gambling behavior. *Journal of Behavioral Addictions*, *6*(2), 203–211.

https://doi.org/10.1556/2006.6.2017.031

Sloan, S. (2020). Putting Texas Back in Texas Hold 'Em. *Sports Lawyers Journal*, *27*, 103–

136.

Tomczak, M., & Tomczak, E. (2014). *The need to report effect size estimates revisited. An overview of some recommended measures of effect size. 1*, 7.

Turner, N. E. (2020). COVID-19 and Gambling in Ontario. *Journal of Gambling Issues*, *44*(0), Article 0. https://doi.org/10.4309/jgi.2020.44.1

U. S. Census Bureau. (2020a). *2019 American Community Survey Table S0101*. https://data.census.gov/cedsci/table?q=Age%20and%20Sex&tid=ACSST1Y2019.S0101&hidePreview=false

U. S. Census Bureau. (2020b). *2019 Current Population Survey Historical Income Tables*. https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-income-households.html

Wardle, H., Reith, G., Langham, E., & Rogers, R. D. (2019). Gambling and public health: We need policy action to prevent harm. *BMJ*, *365*, l1807. https://doi.org/10.1136/bmj.l1807

Wohl, M. J. A., Branscombe, N. R., & Lister, J. J. (2014). When the Going Gets Tough: Economic Threat Increases Financial Risk Taking in Games of Chance. *Social Psychological and Personality Science*, *5*(2), 211–217. https://doi.org/10.1177/1948550613490964

Wohl, M. J. A., Davis, C. G., & Hollingshead, S. J. (2017). How much have you won or lost? Personalized behavioral feedback about gambling expenditures regulates play. *Computers in Human Behavior*, *70*, 437–445. https://doi.org/10.1016/j.chb.2017.01.025

Table 1 Demographic characteristics of the sample

Variable	n	%
Age	37.9 (12.3)	
Gender		
Male	270	63.7
Female	153	36.1
Other	1	.2
Education level		
High school or less	57	13.4
Some post-secondary	102	24.1
Bachelor's degree	181	42.7
Graduate degree	84	19.8
Job status		
Employed full-time	333	78.5
Employed part-time	38	9.0
Unemployed	21	5.0
Household income		
Under $30,000	50	11.8
$30,000 - $49,999	94	22.2
$50,000 - $69,999	92	21.7
$70,000 - $99,999	101	23.8
Over $100,000	87	20.5
Marital status		
Married/common-law	259	61.1
Single	141	33.3
Separated/divorced/widowed	24	5.7
Ethnicity		
White	307	72.4
Black	71	16.7
Latin American	17	4.0
Other	29	6.8

Note. Mean (SD) presented for age. Percentages may not add up to 100% due to rounding.

Table 2 Correlations between key variables.

	1.	2.	3.	4.	5.	6.	7.	8.
1. Change in online gambling								
2. PGSI	.210**							
3. Readiness to change	.139*	.602**						
4. Change in social casino gaming	.342**	.247**	.129*					
5. Change in alcohol use	.169*	.085	.023	.150*				
6. Change in tobacco use	.274**	.163*	.030	.223**	.438**			
7. Change in cannabis use	.140	.123	.086	.135*	.354**	.405**		
8. Change in video gaming	.072	.104	.025	.240**	.072	.080	-.016	
9. Change in pornography use	.228**	.261**	.101	.301**	.172*	.122	.286**	.243**

Note. ** $p < 0.01$, * $p < 0.05$. Bivariate Spearman correlations presented. PGSI = Problem Gambling Severity Index.

Table 3 Changes in substance and technology use among land-based gamblers since casino closures.

	Mean (SD)	P-value	Z	r
Change in online gambling	-0.324 (1.68)	0.002	-3.06	0.206
Change in alcohol use	0.327 (1.31)	<0.001	4.03	0.229
Change in tobacco use	0.316 (1.36)	0.003	3.00	0.209
Change in cannabis use	0.247 (1.27)	0.009	2.62	0.196
Change in video gaming	1.223 (1.34)	<0.001	10.99	0.635
Change in pornography use	0.473 (1.31)	<0.001	5.45	0.339
Change in social casino gaming	0.532 (1.42)	<0.001	5.18	0.319

Note. Each variable was measured on a scale from -3 (decreased a lot) to 3 (increased a lot).

P-value refers to the results of one-sample Wilcoxon signed-rank t-tests with H_0: median=0.

Table 4 Differences between migrators, online gamblers and land-based gamblers.

	Migrators	Online gamblers	Land-based gamblers	χ^2	P-value	Partial η^2
PGSI	267.03a	260.46a	159.16b	74.32	<0.001	0.159
Age	182.13	192.90a	234.56b	13.54	0.001	0.032
Household income	161.46a	204.42	228.71b	10.61	0.005	0.025
Change in alcohol use	170.70	148.13	158.96	2.10	0.350	0.007
Change in tobacco use	115.94	101.54	103.37	1.06	0.588	0.005
Change in cannabis use	88.94	90.30	88.44	0.06	0.970	0.000
Change in video gaming	148.11	163.70a	135.20b	7.67	0.022	0.025
Change in pornography use	159.00a	134.11	117.33b	8.28	0.016	0.032
Change in social casino gaming	170.22a	134.02b	115.16b	12.19	0.002	0.047

Note. Mean ranks with different subscripts differed significantly at α=0.05 using Dunn's test

for pairwise comparisons with Bonferroni correction for familywise error rate.