



Online Gambling in the Midst of COVID-19: A Nexus of Mental Health Concerns, Substance Use and Financial Stress

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Abstract

This study examined the emerging impact of COVID-19 on gambling during the first 6 weeks of emergency measures in Ontario, Canada. A cross-sectional online survey of 2005 gamblers, including a sub-sample of 1081 online gamblers (age 18 years and older), was administered to assess risky gambling behaviours and motivations, financial impacts from COVID-19, the influence of COVID-19 on online gambling, mental health concerns and substance use. A series of odds ratio comparisons and measures of association were carried out. Results show significant likelihood of online gambling among those classified as high-risk gamblers (according to the Problem Gambling Severity Index) and those with past experience of online gambling, though migration from land-based gambling was apparent. Among high-risk online gamblers, the most predictive risk factors included moderate and severe anxiety and depression, reduced work hours, being influenced to gamble due to COVID-19, gambling under the influence of cannabis or alcohol and risky gambling motives tied to mental health concerns, including gambling because it helps with nervousness and depression, chasing gambling losses and seeking to earn income. This study has confirmed many of the risk associations presented in emerging COVID-19-related studies and past research on global economic crisis relating to gambling risk, mental health concerns and substance use. However, unlike many past studies, the present paper takes note of all of these elements holistically and provides incremental clarity on online gambling risk factors during the pandemic, specifically.

Keywords COVID-19 · Online gambling · Financial stress · Mental health · Substance use · Gambling motives

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During COVID-19, online gambling, in particular, has become a lens through which to observe serious public health effects. Broadly speaking, the pandemic has negatively impacted many social and economic determinants of health in jurisdictions around the world. In Canada, the national statistics agency reported a 5.5% fall in employment between February and March 2020 (Statistics Canada 2020). As a result, over 10.5 million applications to the federal government's COVID-19 financial assistance program, the Canada Emergency Response Benefit, have been submitted as of May 2020. This wide-scale financial disruption has raised questions about the potential impacts on public health outcomes and risk factors.

Thus far, gambling behaviour during the pandemic has been characterized by stable or decreased participation, although some at-risk groups featuring vulnerability to high-risk gambling and alcohol misuse have increased their gambling activity (Håkansson 2020). More investigation is necessary, however, as evidence has been limited by self-report research designs. At the time of writing, few studies have presented analyses of online behavioural data but do report modest online gambling activity compared with pre-pandemic levels, overall (Auer et al. 2020). Decreasing rates of gambling participation in some jurisdictions have been tied to a variety of factors, including the limited access to land-based venues, disruptions to professional sporting competitions, financial instability and others (Auer et al. 2020; Gambling Commission 2020).

Although evidence is still limited, emerging discourse on secondary impacts of COVID-19 has included substance use and gambling. Many papers take note of the effects of isolation, mental health concerns, pre-existing substance use disorders and ongoing access to online gambling and some substances (Douglas et al. 2020; Marsden et al. 2020). For instance, in many jurisdictions under lockdown, alcohol has remained an official essential commodity and even featured relaxed licensing for distribution, resulting in sale surges (Ahmed et al. 2020; Dubey et al. 2020). Emerging evidence from China also note a 46.8% increase in Internet use and dependence (including a 23% increase in severe Internet addiction) as well as an increase in alcohol consumption and alcohol relapse among ex-drinkers (Sun et al. 2020).

International research on the 2008 financial crisis has also noted similar patterns of comorbidity, including the strong relationship between financial stress and illicit drug use, alcohol use and gambling (Dom et al. 2016; Economou et al. 2019; Yang et al. 2018). For instance, in the European Union (EU), overall substance use fell during this crisis, although key sub-populations experienced increased levels of harmful consumption (Dom et al. 2016). In this and other studies, clear associations were established between alcohol-related harms and severe economic losses, characterized by unemployment (Colell et al. 2015; Gili et al. 2013; Harhay et al. 2014). Young adults (18–34 years) were identified as a population vulnerable to risky substance use and pronounced negative socio-economic impacts during a global financial crisis. Research evidence from Greece, Iceland and the United States (US) has also highlighted marked increases in risky gambling behaviour that was strongly associated with severe financial hardship during 2008 (Economou et al. 2019; Olason et al. 2015).

In recent months, a number of papers published on the impact of COVID-19 have focused specifically on mental health. Many of these studies have consistently shown increased anxiety, depression and other mental health conditions (Brooks et al. 2020; Gritsenko et al. 2020). One clinical case study from Ireland involving patients suffering from addiction noted heightened expressions of stress and anxiety as well as addictive behaviour (i.e. problem gambling) and substance misuse (Columb et al. 2020). These issues were compounded by increasing social isolation and the difficulty of patients in accessing physical clinics due to social distancing measures. One Chinese study ($n = 7236$) examining effects on anxiety,

depression and sleep quality noted significantly higher prevalence of anxiety among younger adults (< 35 years) and higher levels of depression among older adults (≥ 35 years) (Huang and Zhao 2020). Although a full understanding of key factors affecting mental health concerns relating to the COVID-19 pandemic is still emerging, some studies have identified the novel mediating effects of *fear* and *uncertainty* on depression, stress and anxiety and positive outlook (Ahorsu et al. 2020; Bakioglu et al. 2020). Other mediating factors relating to the severity of anxiety during the pandemic among college students in China have included *living in urban areas*, *family income stability* and *living with parents* (or close social relations) (Cao et al. 2020).

Studies of online gambling, in particular, have noted comorbid relationships between mental health outcomes, substance use and problem gambling (Awaworyi Churchill and Farrell 2018; Gainsbury 2015; Hing et al. 2014; LaPlante et al. 2009; Lloyd et al. 2010a; Scholes-Balog and Hemphill 2012; Wardle et al. 2011). For example, early studies of the relationship between mental health and online gambling report much lower levels of mental health than those who never gambled online (Petry 2006). Subsequent research involving university students ($n = 1356$) using the General Health Questionnaire confirms this association and further notes that poor outcomes can be significant in both frequent and infrequent online gamblers (Petry and Weinstock 2007). Other studies of undergraduate students ($n = 1430$) in the US have found a significant statistical correlation ($p < 0.01$) between pathological levels of gambling, problematic alcohol consumption and depression (Martin et al. 2014). Further research shows depression severity was predicted by gamblers involved in multiple online games and, to a lesser degree, but still significant, online sports betting and casino play (Lloyd et al. 2010b). Early research on the relationship between substance use and online gambling has also noted strong connections between multiple online game activities, the use of nicotine and illicit drugs and problem gambling (Lloyd et al. 2010b; McBride and Derevensky 2009). Some large prevalence studies have strengthened this field of research, which has been typically cross-sectional to date. For instance, analysis of the British Gambling Prevalence Survey data confirms that binge alcohol consumption is significantly associated with problem gambling and that the risk of gambling problems is statistically higher among those who gambled online (Griffiths et al. 2010, 2011). Notably, this representative data has also suggested that a large proportion of online gamblers also gamble in-person, and therefore relates gambling risk with profiles of mixed and multiple game players described previously (Wardle et al. 2011). With regard to cannabis use and online gambling, specifically, the literature is more limited, but some evidence highlights an emergent connection between problem gambling and depression (Potenza et al. 2011). Examinations of online poker players have also found anxiety and depression to be predictive of gambling problems (Barrault et al. 2017; Hopley et al. 2012; Mitrovic and Brown 2009).

Despite the research evidence, our holistic understanding of the intersection of risky gambling behaviours, financial crisis and stress, negative mental health outcomes and substance use has yet to consider the specific effects of online gambling during a time of increased social isolation and significant economic instability.

Methods

This paper presents findings from an online survey of gamblers ($n = 2005$) in the Canadian province of Ontario and a sub-sample of online gamblers ($n = 1081$). The survey was

administered approximately 6 weeks after the province declared a state of emergency for COVID-19 (March 17, 2020). The declaration resulted in the closure of all recreational centres, public parks and playgrounds, schools, public libraries, bars, restaurants, movie theatres, concert venues and places of worship, land-based gambling venues, and extended further restrictions on non-essential work and public gatherings of 5 or more people (Office of the Premier 2020).

Study Rationale

The purpose of this study was to understand the emerging impact of COVID-19 in the first 6 weeks since provincial emergency measures were declared. The focus of inquiry was on gambling behaviours, mental health concerns, substance use and online behavioural risk factors. Findings from the study were intended to rapidly advance knowledge in these areas, support follow-up research and inform the adaptation and improvement of community outreach and prevention programming.

Data Source and Collection

Data was collected from 2005 Ontarian gamblers, 18 years or older between April 21 and 28, 2020. Of the total sample, 1081 respondents confirmed their online gambling participation based off of the question: *Over the past 6 weeks, have you gambled online?* Respondents were recruited by *Delvinia*, an online survey vendor located in Toronto, Ontario, Canada. The vendor utilized the *AskingCanadians* panel population of over 1 million Canadians who are registered to receive survey recruitment notifications, if they meet basic inclusion criteria. As an incentive, *Delvinia* compensated participants through consumer point programs, such as *Hudson Bay Company (HBC) Rewards*, *Aeroplan*, *VIA Preference*, *Petro Points* as well as their internal program points that can be redeemed for *Amazon* e-gift cards and various prizes.

Using background information on panel members, respondents were sampled based on their age (18 years and older), if they were permanent residents of Ontario, and if they had gambled at least once in the past 12 months. Respondents were then presented with an informed consent statement outlining the question topics and their right to opt out of any or all questions at any time. The first few questions of the survey screened for the inclusion criteria again before advancing to other questionnaire items. A quota-based sampling strategy was employed to match age and gender distribution with official census data and produce a balanced sample reflective of the population (Statistics Canada 2018). During data collection, the survey vendor monitored the completion rate by quota-based sampling categories to ensure the final sample was balanced. Based on a 95% confidence level, the survey is estimated to have a $\pm 2.2\%$ margin of error.

The survey consisted of demographic questions related to age, gender and the highest level of education completed. Age was recorded as a specific discrete number (e.g. 23 years) and later coded into a categorical variable (e.g. 18–24 years). Gender included response options for *male*, *female*, *transgender*, *other* and *prefer not to answer*. Educational attainment included the options *no high school or General Educational Development (GED)*, *high school or GED*, *trade or technical certification*, *bachelor's degree*, *master's degree*, *professional degree* (e.g. *law*, *medicine*, *dentistry*) and *doctoral degree*. Respondents were also asked if their employment status and household income had been affected by COVID-19 on a 7-point Likert scale of *strongly agree* to *strongly disagree*, *neither agree nor disagree* and *do not know*.

Mental health concerns were captured using the Patient Health Questionnaire (PHQ-9) for depression screening and the General Anxiety Disorder (GAD-7) questionnaire (Homans 2012; Lowe et al. 2008; Spitzer et al. 2006). Both instruments are prompted by the same question: *Over the last 2 weeks, how often have you been bothered by any of the following problems?* The PHQ-9 is the depression sub-scale of the PHQ, which is itself a self-administered version of the Primary Care Evaluation of Mental Disorders (PRIME-MD) diagnostic instrument for common mental disorders (Homans 2012; Kroenke et al. 2001). This sub-scale includes 9 items from the *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition (DSM-IV) criteria for depression (e.g. *little interest or pleasure in doing things, feeling tired or having little energy, feeling down, depressed or hopeless*) that are scored from 0 to 3 and totally 0 to 27. The total scores are interpreted based on depression severity including *non-minimal* (0–4), *mild* (5–9), *moderate* (10–14), *moderately severe* (15–19) and *severe* (20–27). This tool has been thoroughly validated, demonstrating high sensitivity (88%) and specificity (88%) for major depressive symptoms and high internal consistency (Cronbach's $\alpha = 0.86\text{--}0.89$) (American Psychiatric Association 2011).

The GAD-7 assesses symptoms of anxiety using 7 items from the DSM-IV for generalized anxiety disorder (e.g. *feeling nervous, anxious or on edge, not being able to stop or control worrying, trouble relaxing*) (Homans 2012; Spitzer et al. 2006). The scale is scored in a range from 0 to 21 and interpreted by the categories *non-minimal* (0–4), *mild* (5–9), *moderate* (10–14) and *severe* (15–21). At the threshold score of 10, the GAD-7 has a sensitivity of 89% and a specificity of 82% (Kroenke et al. 2007).

In addition, respondents were asked if they had experienced a mental health concern any time prior to COVID-19, be it self-diagnosed or diagnosed by a professional clinician. This question included several response options reflecting mental health disorders commonly associated with problem gambling, including *depression, stress and anxiety, impulse control issues and addiction*—another option was also included that could be filled with further details (Coman et al. 1997; Hounslow et al. 2011; Lightsey and Hulsey 2002). Additional response options allowed respondents to answer with “I’m not sure” and “No, I have not”.

Substance use was assessed through three questions, including one on the consumption of alcohol and cannabis during the period of emergency measures (i.e. *In the past 6 weeks, have you used any of the following substances?*). Two other questions asked if substance use had increased as compared with the period before emergency measures (i.e. *Please respond to the following statement: In the past 6 weeks, I have consumed more substances than I did before this time period.*) and, lastly, if individuals had gambled online under the influence of a substance (i.e. *In the past 6 weeks, have you ever gambled under the influence of the following substances?*).

Various questions were also posed on the topic of gambling behaviours, including typical participation, recent online participation and if COVID-19 had any influence in decisions to gamble online (e.g. *Please respond to the following statement: Emergency measures implemented due to COVID-19 influenced my decision to gamble online over the past 6 weeks*). Key items were pulled from the Gambling Motives Questionnaire, including (1) *because it helps when feeling nervous or depressed* and (2) *to win back money lost gambling* (Lambe et al. 2015; Stewart and Zack 2008). A third motive, *to earn income*, was also assessed based on its strong monetary focus and distinct association with risky gambling (Lee et al. 2007; Nower and Blaszczynski 2010) and risky online gambling in particular (Mulkeen et al. 2017). These items were selected to reflect additional emphasis and characteristics of gambling under the influence of mental health concerns (i.e. depression and anxiety), as noted previously, as well as escape from and desired relief of financial stress (Wood and Griffiths 2007).

Finally, various questions were posed to capture gambling risk, including the validated nine-item Problem Gambling Severity Index (PGSI) (Currie et al. 2013; Ferris and Wynne 2001a, b; Lopez-Gonzalez et al. 2018). This tool scores total responses in a range of 0 to 27 and interprets them according to four categories, including *non-problem gambling* (0), *low-risk gambling* (1–2), *moderate-risk gambling* (3–7) and *high-risk gambling* (8–27). The PGSI has shown satisfactory reliability (Cronbach's $\alpha = 0.84$) (Ferris and Wynne 2001a, b), though its non-problem gambling and high-risk gambling categories have the most predictive values (Currie et al. 2013).

Data Analysis

A general descriptive analysis was conducted and included frequencies, proportions and other summary statistics for key variables. A series of cross-tabulated chi-square tests, odds ratios and 95% confidence intervals were also carried out to compare relevant discrete, dichotomous variables. The level of statistical significance was set at $p < 0.05$. Key comparisons included those who engaged in online gambling during the 6 weeks since emergency measures were instituted, and those who did not gamble online. Additional analysis was carried out on the sub-sample of online gamblers ($n = 1081$) comparing high-risk gamblers to non-high-risk gamblers as well as an examination of high-risk gambling motives.

Results

Demographic Characteristics

Males and females in the sample were equally distributed at approximately 50% each with 0.2% reporting as "other". The average age was 48 (17.2-year standard deviation) and ranged from 18 to 89 years. Educational achievement consisted of no high school or GED diploma (1.5%), high school or GED diploma (20.6%), trade or technical certification (19.4%), bachelor's degree (36.7%), master's degree (12.6%), professional degree (e.g. law, medicine, dentistry, pharmacy) (7.5%) and doctoral degree (7.5%).

Gambling Behaviours and Risk

Among the entire sample of 2005 gamblers, approximately 54% had gambled online during the period of emergency measures. In contrast, typical gambling behaviour reported for the past 12 months was predominantly land-based only (76.7%), followed by a mix of land-based and online (13.6%) and online only (9.7%).

Within the full sample, the majority of respondents were classified as non-problem gamblers (71.7%) and low-risk gamblers (14.2%), according to the PGSI scale. Moderate-risk gamblers (6.5%) and high-risk gamblers (7.6%) made up the remainder of respondents. Tests of reliability for the nine items of the PGSI scale revealed high internal consistency (Cronbach's $\alpha = 0.95$).

Impact of COVID-19

Nearly half of the sample (47%) reported some form of employment disruption attributed to COVID-19. Among this cohort, 16% reported lost employment, 7.6% reported reduced work

hours, 19.3% reported a shift to working full-time from home and 4.1% reported a shift to working part-time from home. Approximately one-quarter reported no changes in their full-time (19.3%) or part-time (3.2%) employment or work. One-fifth (20.1%) indicated they were not employed or looking for employment—over 50% of these individuals were retirement aged (65 years or older).

Exactly half of the total sample reported their household income had been negatively affected by COVID-19.

Mental Health

Approximately one-third of gamblers noted they had experienced a mental health concern any time prior to COVID-19—19.5% self-diagnosed and 13% diagnosed by a professional clinician. Anxiety and depression were the most reported conditions among self-diagnosed (85.2%, 54.7%) and clinically diagnosed (71.3%, 67.8%) respondents, respectively.

The GAD-7 questionnaire revealed 43.6% of the sample did not have notable symptoms of anxiety. The remaining respondents were classified as having mild anxiety (30.7%), moderate anxiety (16.1%) and severe anxiety (9.6%). Among the total sample of gamblers ($n = 2005$), this scale instrument demonstrated excellent internal consistency (Cronbach's $\alpha = 0.93$).

The PHQ-9 questionnaire found that 44.2% had no serious symptoms of depression. The balance of the sample was characterized by mild depression (29.1%), moderate depression (14.5%), moderately severe depression (8.4%) and severe depression (3.8%). Scale reliability for this instrument demonstrated high internal consistency (Cronbach's $\alpha = 0.91$).

Substance Use

The majority of gamblers reported consuming alcohol (68.7%) during the first 6 weeks after provincial emergency measures. Among these respondents, 40.7% confirmed that their alcohol consumption had increased during this period of time, as compared with the time preceding emergency measures.

Cannabis use (16.4%) was less prevalent among gamblers, relative to alcohol consumption. However, of those reporting cannabis use, 48.6% reported increased consumption compared with the time preceding emergency measures.

Online Gambling Compared with Non-online Gambling

Several significant differences emerged between those who gambled online during emergency measures and those who did not (as shown in Table 1). Males were more likely to gamble online ($n = 598$, 55.3%; OR = 1.62, $p < 0.001$) than females ($n = 477$, 44.1%; OR = 0.61, $p < 0.001$). Younger adults were much more likely to have gambled online, including 18–24-year-olds ($n = 138$, 12.8%; OR = 1.34, $p = 0.041$) and 25–44-year-olds ($n = 392$, 36.3%; OR = 1.32, $p = 0.004$), whereas seniors (65+ years) had much lower odds of online gambling ($n = 196$, 18.1%; OR = 0.69, $p = 0.001$).

Gamblers who typically played only at land-based venues were less likely to gamble online during the period of emergency measures ($n = 666$, 61.6%; OR = 0.10, $p < 0.001$), though they made up the majority of online gamblers. Typical online only gamblers ($n = 173$, 16%; OR = 8.19, $p < 0.001$) and those reporting a mix of land-based and online plays in the past 12 months

Table 1 Odds ratios for online gambling status based on selected key factors ($N = 2005$)

Key factors	Online gambling ($n = 1081$)		No online gambling ($n = 924$)		OR	95% CI
	n	%	n	%		
Gender ^a						
Male	598	55.3	400	43.3	1.62***	1.36–1.94
Female	477	44.1	520	56.3	0.61***	0.51–0.73
Age (years)						
18–24	138	12.8	91	9.8	1.34*	1.01–1.77
25–44	392	36.3	279	30.2	1.32**	1.09–1.59
45–64	355	32.8	330	35.7	0.88	0.73–1.06
65+	196	18.1	224	24.2	0.69***	0.56–0.86
Typical gambling platform						
Online only	173	16.0	21	2.3	8.19***	5.16–13.01
Land-based only	666	61.6	871	94.4	0.10***	0.07–0.13
Mix of land and online	242	22.4	31	3.4	8.31***	5.65–12.22
PGSI						
Non-problem	709	65.6	728	78.8	0.51***	0.42–0.63
Low risk	145	13.4	139	15.0	0.88	0.68–1.13
Moderate risk	89	8.2	42	4.5	1.88***	1.29–2.75
High risk	138	12.8	15	1.6	8.87***	5.17–15.23
GAD-7						
No anxiety	437	40.4	437	47.3	0.76**	0.63–0.90
Mild anxiety	335	31.0	280	30.3	1.03	0.85–1.25
Moderate anxiety	193	17.9	130	14.1	1.33*	1.04–1.69
Severe anxiety	116	10.7	77	8.3	1.32	0.98–1.79
PHQ-9						
No depression	435	40.2	451	48.8	0.71***	0.59–0.84
Mild depression	321	29.7	262	28.4	1.07	0.88–1.30
Moderate depression	158	14.6	133	14.4	1.02	0.73–1.31
Moderately severe depression	110	10.2	58	6.3	1.69**	1.22–2.35
Severe depression	57	5.3	20	2.2	2.52***	1.50–4.22
COVID-19 impact						
Lost employment	187	17.3	133	14.4	1.24	0.98–1.59
Reduced work hours	90	8.3	62	6.7	1.26	0.90–1.77
Household income negative effect	564	52.2	438	47.4	1.21*	1.02–1.44
Substance use						
Alcohol use	740	68.5	637	68.9	0.98	0.81–1.18
Cannabis use	193	17.9	136	14.7	1.26	0.99–1.60
Increased alcohol use	320	43.2	241	37.8	1.25*	1.01–1.55
Increased cannabis use	99	51.3	61	44.9	1.30	0.83–2.01

The $n/\%$ values are all in reference to totals for online gambling and no online gambling

OR odds ratio (for online gambling status), CI confidence interval, PGSI Problem Gambling Severity Index, GAD-7 General Anxiety Disorder questionnaire, PHQ-9 Patient Health Questionnaire

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

^a Three individuals self-identified as transgender, four opted not to report gender and three reported “other” (two non-binary and one as none). Males and females represented 99.5% of the total sample ($n = 2005$). Non-m/f gender responses were excluded from analysis

($n = 242$, 22.4%; OR = 8.31, $p < 0.001$) had similarly high likelihood of online gambling during the 6 weeks of emergency measures.

Non-problem gamblers were half as likely to gamble online than other risk categories ($n = 709$, 65.6%; OR = 0.51, $p < 0.001$). Moderate-risk gamblers had about twice the odds of

gambling online during the period of emergency measures ($n = 89$, 8.2%; OR = 1.88, $p = 0.001$), and high-risk gamblers had nearly 9 times the odds ($n = 138$, 12.8%; OR = 8.87, $p < 0.001$).

Those with no symptoms of anxiety (GAD-7: $n = 437$, 40.4%; OR = 0.76, $p = 0.002$) and no symptoms of depression (PHQ-9: $n = 435$, 40.2%; OR = 0.71, $p < 0.001$) had decreased odds of gambling online. In contrast, those with moderate anxiety (GAD-7: $n = 193$, 17.9%; OR = 1.33, $p < 0.022$) had slightly greater odds of online gambling. Those with symptoms of moderately severe depression (PHQ-9: $n = 110$, 10.2%; OR = 1.69, $p = 0.002$) and severe depression (PHQ-9: $n = 57$, 5.3%; OR = 2.52, $p < 0.001$) were even more likely to have gambled online during emergency measures.

Comparative analysis of those who gambled online and those who did not failed to reveal extensive differences in COVID-19 financial impacts or substance use. Among the limited significant findings, negative impact on household income attributed to COVID-19 featured a positive association with online gambling ($n = 564$, 52.2%; OR = 1.21, $p = 0.033$). Respondents who reported increased alcohol use during the first 6 weeks of emergency measures also had slightly increased likelihood of online gambling ($n = 320$, 43.2%; OR = 1.25, $p = 0.042$).

However, young adults (18–24 years) did experience greater and more significant financial impacts from COVID-19, overall and among those who gambled online, relative to older cohorts. Overall, 37.6% of young adults reported lost employment ($n = 229$; OR = 396, 95% CI = 2.93–5.35, $p < 0.001$) and 65.5% experienced negative impact on household income (OR = 2.06, 95% CI = 1.54–2.75). Among young adults who gambled online, 40.6% reported lost employment ($n = 138$; OR = 4.23, 95% CI = 2.88–6.23, $p < 0.001$) and 68.1% experienced negative impact on household income (OR = 2.15, 95% CI = 1.47–3.14, $p < 0.001$).

High-Risk Gambling Among Online Gamblers

Within the sub-sample of respondents who gambled online during emergency measures ($n = 1081$), several significant associations with high-risk gambling status emerged (as shown in Table 2). Males had a higher likelihood of being high-risk gamblers ($n = 91$, 65.9%; OR = 1.67, $p = 0.007$) while females had a lower likelihood ($n = 44$, 31.9%; OR = 0.55, $p = 0.002$). Respondents aged 25–44 had the greatest odds of high-risk gambling status ($n = 86$, 62.3%; OR = 3.44, $p < 0.001$), whereas those aged 45–64 years ($n = 25$, 18.1%; OR = 0.41, $p < 0.001$) and 65+ years ($n = 6$, 4.3%; OR = 0.18, $p < 0.001$) had much lower odds of high-risk gambling.

Assessments of both anxiety and depression shared a positive linear relationship with gambling risk. Respondents who were screened as having no symptoms of anxiety (GAD-7: $n = 9$, 6.5%; OR = 0.084, $p < 0.001$) or depression (PHQ-9: $n = 11$, 8.0%; OR = 0.11, $p < 0.001$) had the lowest likelihood of high-risk gambling status. Those presenting moderate anxiety (GAD-7: $n = 55$, 39.9%; OR = 3.87, $p < 0.001$) and severe anxiety (GAD-7: $n = 33$, 23.9%; OR = 3.26, $p < 0.001$) had over 3 times the odds of being classified as high-risk gamblers. Similarly, those screened with moderately severe depression (PHQ-9: $n = 38$, 27.5%; OR = 4.60, $p < 0.001$) and severe depression (PHQ-9: $n = 22$, 15.9%; OR = 4.92, $p < 0.001$) had nearly 5 times the odds of being high-risk gamblers.

Negative financial impacts attributed to COVID-19 were significant features of high-risk gamblers in the online cohort. Those who reported losing their employment ($n = 35$, 25.4%; OR = 1.77, $p = 0.007$) or having work hours reduced ($n = 22$, 15.9%; OR = 2.44, $p = 0.001$) had greater odds of high-risk gambling status than other respondents whose employment was

Table 2 Odds ratios for PGSI high-risk gambling and associated factors among online players ($N = 1081$)

Key factors	High-risk gambler ($n = 138$)		Non-high-risk gambler ($n = 943$)		OR	95% CI
	<i>n</i>	%	<i>n</i>	%		
Gender ^a						
Male	91	65.9	507	53.8	1.67**	1.15–2.42
Female	44	31.9	433	45.9	0.55	0.38–0.81
Age (years)						
18–24	21	15.2	117	12.4	1.27	0.77–2.10
25–44	86	62.3	306	32.4	3.44***	2.38–4.99
45–64	25	18.1	330	35.0	0.41***	0.26–0.65
65+	6	4.3	190	20.1	0.18***	0.08–0.42
GAD-7						
No anxiety	9	6.5	428	45.4	0.08***	0.04–0.17
Mild anxiety	41	29.7	294	31.2	0.93	0.63–1.38
Moderate anxiety	55	39.9	138	14.6	3.87***	2.63–5.69
Severe anxiety	33	23.9	83	8.8	3.26***	2.07–5.11
PHQ-9						
No depression	11	8.0	424	45.0	0.11***	0.06–0.20
Mild depression	25	18.1	296	31.4	0.48***	0.31–0.76
Moderate depression	42	30.4	116	12.3	3.12***	2.07–4.71
Moderately severe depression	38	27.5	72	7.6	4.60***	2.95–7.17
Severe depression	22	15.9	35	3.7	4.92***	2.79–8.68
COVID-19 impact						
Lost employment	35	25.4	152	16.1	1.77**	1.16–2.69
Reduced work hours	22	15.9	68	7.2	2.44***	1.45–4.10
Household income negative effect	80	58.0	484	51.3	1.31	0.91–1.88
Emergency measures influence online gambling decision	70	50.7	276	29.3	2.49***	1.73–3.57
Substance use						
Alcohol use	88	63.8	652	69.1	0.79	0.54–1.14
Cannabis use	46	33.3	147	15.6	2.71***	1.82–4.02
Increased alcohol use	52	59.1	268	41.1	2.07***	1.32–3.26
Increased cannabis use	25	54.3	74	50.3	1.17	0.60–2.28
Gambling under the influence of alcohol ^b	53	44.9	72	8.5	8.81***	5.70–13.62
Gambling under the influence of cannabis ^b	21	17.8	19	2.2	9.47***	4.92–18.23
Gambling motives						
Because it helps when feeling nervous or depressed	46	33.3	22	2.3	20.93***	12.06–36.33
To win back money I lost gambling	58	42.0	31	3.3	21.33***	13.04–34.90
To earn income	56	40.6	62	6.6	9.70***	6.34–14.86

The *n*/*%* values are all in reference to the totals for high-risk gambler and non-high-risk gambler

OR odds ratio (for high-risk gambler), *CI* confidence interval, *PGSI* Problem Gambling Severity Index, *GAD-7* General Anxiety Disorder questionnaire, *PHQ-9* Patient Health Questionnaire

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

^a Three individuals self-identified as transgender, four opted not to report gender and three reported “other” (two non-binary and one as none). Males and females represented 99.5% of the total sample ($n = 2005$). Non-m/f gender responses were excluded from analysis

^b Sample total differ for those who gamble online under the influence of substances ($n = 968$) as they must first confirm online gambling and general substance use as pre-conditions

not so affected. Respondents who reported that emergency measures influenced their decision to gamble online also had a higher likelihood of high-risk gambling ($n = 70$, 50.7%; $OR = 2.49$, $p < 0.001$).

Cannabis use was associated with high-risk gambling among online players ($n = 46$, 33.3%; OR = 2.71, $p < 0.001$). Those reporting gambling online while under the influence of cannabis had over 9 times the odds of being high-risk gamblers ($n = 21$, 17.8%; OR = 9.47, $p < 0.001$).

Alcohol use among online gamblers was not significantly associated with high-risk gambling, though increased alcohol consumption during the first 6 weeks following the declaration of emergency measures was ($n = 52$, 59.1%; OR = 2.07, $p = 0.001$). Most notable, those gambling online under the influence of alcohol had nearly 9 times the odds of being classified as high-risk gamblers ($n = 53$, 44.9%; OR = 8.81, $p < 0.001$).

Three self-reported gambling motives stood out as being most predictive of high-risk gambling status among online gamblers. Gambling *to earn income* ($n = 56$, 40.6%; OR = 9.70, $p < 0.001$), *to win back money lost gambling* ($n = 58$, 42.0%; OR = 21.33, $p < 0.001$) and *because it helps when feeling nervous or depressed* ($n = 46$, 33.3%; OR = 20.93, $p < 0.001$) all had the highest odds for high-risk gambling status. Further analysis of these gambling motives revealed significant associations with elevated forms of anxiety and depression, negative financial impacts due to COVID-19 and problematic gambling under the influence of substances (as shown in Table 3). Tests of scale reliability for these three gambling motives demonstrated good internal consistency (Cronbach's alpha = 0.83).

Discussion

COVID-19 has had a turbulent effect on the lives of Canadians, including gamblers in Ontario and especially those who play online. This research has contributed new insights into the

Table 3 Association of elevated anxiety and depression, COVID-19 financial impacts and problematic substance use and high-risk gambling motives among online gamblers ($N = 1081$)

Key factors	High-risk gambling motives								
	Because it helps when feeling nervous or depressed ($n = 68$)			To win back money lost gambling ($n = 89$)			To earn income ($n = 118$)		
	<i>n</i>	OR	95% CI	<i>n</i>	OR	95% CI	<i>n</i>	OR	95% CI
GAD-7 moderate anxiety	27	3.36***	2.01–5.62	35	3.42***	2.16–5.41	37	2.36***	1.55–3.61
GAD-7 severe anxiety	19	3.66***	2.07–6.47	22	3.14***	1.85–5.31	35	4.59***	2.91–7.24
PHQ-9 moderately severe depression	20	4.27***	2.43–7.52	27	4.77***	2.88–7.90	36	5.27***	3.34–8.34
PHQ-9 severe depression	13	5.21***	2.65–10.23	12	3.28***	1.67–6.46	17	3.88***	2.12–7.10
Lost employment	15	1.38	0.76–2.51	23	1.78*	1.06–2.91	39	2.72***	1.78–4.14
Reduced work hours	15	3.54***	1.91–6.58	11	1.63	0.83–3.19	17	2.05*	1.17–3.62
Negative impact on household income	41	1.42	0.86–2.45	54	1.46	0.94–2.27	81	2.18***	1.45–3.28
Gambled online under influence of alcohol	30	9.19***	5.27–16.05	36	7.71***	4.70–12.67	35	4.36***	2.75–6.92
Gambled online under influence of cannabis	11	7.11***	3.35–15.11	16	9.31***	4.70–18.44	16	6.36***	3.26–12.43

Statistics are cases (n), odds ratio and 95% confidence intervals

GAD-7 General Anxiety Disorder questionnaire, PHQ-9 Patient Health Questionnaire

* $p < 0.05$; *** $p < 0.001$

effects of public health emergency measures, including increased isolation and the closure of multiple services and businesses. It has also reinforced many of the emerging findings on the secondary effects of COVID-19.

Discourse on the secondary impacts of COVID-19 has focused on the effects of isolation, substance use, online gambling and other online behaviours (Douglas et al. 2020; Marsden et al. 2020). Only very recently has evidence begun to reflect these concerns, primarily as they relate to increased alcohol consumption and Internet use and dependence (Sun et al. 2020). Similarly, Martin et al. (2014) point to a pronounced relationship between problematic alcohol consumption and disordered gambling in their study of college students ($n = 1430$) in the US. The evidence presented herein adds additional weight to this discourse by reporting increased alcohol as well as cannabis consumption during the period of study and establishing a significant comorbid relationship between co-occurring substance use, online gambling and high-risk gambling status. Specifically, gambling under the influence of alcohol or cannabis increased the odds of high-risk gambling status by approximately 9 times ($p < 0.001$). This appears to be a novel finding as the extant literature has to date featured limited examination of online gambling under the influence of alcohol and other substances. Though, the effects of pathological gambling and substance use have been compared and show similarities with respect to impulsivity and compulsivity in decision-making tasks (Leeman and Potenza 2012; Settles et al. 2012).

The impact of COVID-19 on mental health has also been a topic of considerable interest and current research activity. Recent evidence has largely highlighted the associations that anxiety and depression appear to have with fear, uncertainty, pre-existing history of addiction and substance use (Ahorsu et al. 2020; Bakioğlu et al. 2020; Gritsenko et al. 2020). In the present study, those screened for moderate and severe forms of anxiety (25.7%) and depression (12.6%) were more likely to gamble online during the first 6 weeks of emergency measures and be classified as high-risk gamblers. This finding is a confirmation of past studies that have established the relationship between anxiety and depression and problematic gambling (Barrault et al. 2017; El-Guebaly et al. 2006). Among Ontarians who had gambled online, high-risk gambling was even more strongly tied to severe forms of anxiety and depression, financial disruption, co-occurring substance use and risky gambling motives. Conversely, the absence of symptoms of anxiety and depression appeared to have a protective effect on high-risk gambling among those who had gambled online. Recent evidence from China have presented potential mediators of severity relating to mental health concerns, such as anxiety, including urban living, income stability and cohabitation (Cao et al. 2020). Financial stress, in particular, has been found to be a catalyst for mental health concerns and problematic gambling in previous representative population studies from the US (Ronzi et al. 2017). In the present study, those who gambled online appeared more deeply affected by COVID-19's financial impact.

Research on the financial effects impacting gamblers during COVID-19, specifically, is still emerging. Although, the findings of this study support past research on the 2008 global economic crisis that have noted a strong relationship between risky gambling and financial hardship (Olason et al. 2015). In the current study, approximately half of all respondents reported disruptions to employment and negative impact on household income attributed to COVID-19. In both cases, online gamblers felt this impact more substantially, although only greater negative effect on household income was significant ($p = 0.033$). However, young adults (18–24 years) who gambled online were 2 to 4 times as likely to have experienced negative impact on household income and lost employment than older cohorts, respectively.

Past studies also point out that young adults experiencing financial hardship are more susceptible to problematic gambling and substance use (Colell et al. 2015; Gili et al. 2013; Harhay et al. 2014; Olason et al. 2015). Negative impact on household income was also correlated with online gambling ($p < 0.05$) as well as being influenced to gamble online due to COVID-19 ($p < 0.001$). Those who were influenced by COVID-19 to gamble online also had up to 2 times the odds of being either moderate- or high-risk gamblers. Economou et al.'s (2019) study of the effects of economic crisis in Greece also reflects the association between financial hardship and problem gambling. The authors also note that the odds of experiencing problem gambling can be increased for those who started gambling during the economic crisis. While the present study did not measure this phenomenon exactly, findings show that a substantial proportion of online gamblers (61.6%) had typically only played in-person over the past 12 months, indicating a partial migration of land-based players to a new, unfamiliar online environment. However, these players had much lower odds of being high-risk gamblers ($n = 666$, 8%; OR = 0.34, 95% CI = 0.23–0.49, $p < 0.001$), indicating that experience with land-based play may have a protective effect, even if online gambling is a less familiar platform, or perhaps participation was characterized by less risky games, such as lottery.

Broadly speaking, this research has reaffirmed relationships articulated in past research on risky online gambling and comorbidities, including mental health concerns and substance use (Awaworyi Churchill and Farrell 2018; Gainsbury 2015; Hing et al. 2014; LaPlante et al. 2009; Lloyd et al. 2010a; Scholes-Balog and Hemphill 2012; Wardle et al. 2011). Notably, this research adds to the limited evidence showing significant associations between cannabis use, online gambling and mental health concerns—particularly depression (Potenza et al. 2011). For instance, evidence presented herein separately show that high-risk gambling was predicted by moderately severe and severe depression as well as cannabis use and gambling under the influence of cannabis. In addition, previous prevalence study analysis showing a typical mix of land-based and online plays among individuals indicating online gambling behaviours was evident in the current study (Wardle et al. 2011). In this case, over 60% of the sample had technically migrated from self-reported land-based-only play in the past 12 months to gambling online during the period of emergency measures. Further study is required to understand if respondents understood typical land-based-only gambling as being strictly exclusive or simply a general distinction as well as the number of games played and its relationship with gambling risk.

Finally, those indicating they gambled online *because it helps when feeling nervous or depressed, to win back money lost gambling* and *to earn income* had increased odds of high-risk gambling status between 9- and 21-times that of gamblers who did not endorse these motives ($p < 0.001$). These findings compliment past research highlighting the risk of problem gambling among those endorsing these motives (Lambe et al. 2015; Nower and Blaszczynski 2010). As mentioned previously, these motives were intended to reflect key mental health factors (i.e. anxiety and depression) as well as escape from and relief of financial stress (Wood and Griffiths 2007). For example, the 2008 economic crisis in Iceland saw increased likelihood of gambling if individuals had experienced financial difficulties (Olason et al. 2015). The present study has linked these motives to comorbid mental health concerns, substance use while gambling and financial vulnerabilities due to COVID-19. For instance, all three of these motives featured strong predictive relationships with moderate and severe symptoms of anxiety and depression. Various, these motives were also associated with COVID-19-related financial impacts, including reduced work hours, lost employment and negative impact on household income. These motives also significantly increased the odds of gambling under

the influence of alcohol and cannabis, an association that has typically been highlighted in adolescent gambling and not online gambling among a general population (Hammond et al. 2014; Welte et al. 2004).

Limitations

As a cross-sectional online panel survey, the data is not able to provide causal assessment of the key associations identified. Self-reported behaviours are also prone to a degree of response bias which is a typical limitation of survey methods and designs. Although questions assessing anxiety and depression as well as gambling risk have been validated and shown to be reliable, other questions relating to COVID-19's impact on financial well-being and substance use have not been previously vetted. In addition, the inclusion of selected questions from the Gambling Motives Questionnaire, instead of the entire validated instrument, limits the broader understanding of gambling motives and may give the impression negative gambling bias. The intention in this case was to reflect the influence of mental health concerns and financial stress that are a focus on this study. As such, the inclusion of the motive *to earn income*, added a monetary distinction not represented in the full Gambling Motives Questionnaire and is particularly relevant to risky online gambling (Mulkeen et al. 2017).

Despite these limitations, this survey has rapidly delivered key insights during a critical moment in human history on social dynamics and public health determinants that clearly merit further study. As such, this study will soon be followed up by another linking the same respondents at a future time. Follow-up research will carefully examine potential changes in behaviours and comorbidities as the pandemic evolves and as gambling changes with the resumption of professional sports and the widespread re-opening of land-based venues.

Conclusion

This study has confirmed many of the risk associations presented in past research on global economic crisis, gambling risk, mental health concerns and substance use. However, unlike many past studies, the present paper takes note of all of these elements together and provides a clear emphasis on online gambling. Together, the strength of high-risk gambling motives in predicting problematic gambling status, mental health concerns, financial difficulties and risky substance use among online gamblers was a novel insight worth further exploration. Overall, COVID-19's unique effect of creating significant population health impacts, financial disruptions and changes in social interaction and recreation adds importance to this study's findings and raises key questions. For instance, future studies may benefit from observing changes in online gambling behaviours and associated risk factors during the pandemic or how the eventual re-opening of land-based venues may affect gambling sentiments and behaviours. Further examination of government and industry response to COVID-19 and gambling harm prevention will also be critical to understanding these complex phenomena. Knowledge from this and other studies of the impact of COVID-19 on online gambling and various comorbidities should also serve to inform decision-makers on harm prevention and mitigation efforts, as already indicated by some experts in the field (Király et al. 2020).

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Compliance with Ethical Standards

Conflict of Interest The author is employed by the Responsible Gambling Council (RGC), a not-for-profit organization, as a Senior Researcher, which administered funding for this project. The author is also a member of the Ontario Gambling Research Society and has received funding from Carleton University in Ottawa, Ontario, Canada, to conduct follow-up research on this study as a co-investigator.

Ethical Approval All procedures performed in this study involving human participants were in accordance with the ethical standards of Carleton University's Research Ethics Board and with the 1975 Helsinki Declaration.

Informed Consent Informed consent was obtained from all participants.

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