JGI
Journal of Gambling Issues
CDS PRESS

Open Access Original Research

Characteristics That Differentiate Online From Land-based Gamblers: Results From A National Longitudinal Study of Gambling

Carrie A. Shaw, Ph.D.[1,3*], Robert Williams, Ph.D.[2,4]

Citation: Shaw, C.A., Williams, R. (2024). Characteristics That Differentiate Online From Land-based Gamblers: Results From A National Longitudinal Study of Gambling. Journal of Gambling Issues.

Editor-in-Chief: Nigel E. Turner, PhD

ISSN: 1910-7595

Received: 04/23/2023
Accepted: 11/13/2023
Published: 01/05/2024

[1]Independent Scientist, Canada
[2]Lethbridge University, Canada
[3]**ORCiD**: 0000-0002-1949-0084
[4]**ORCiD**: 0000-0002-9558-9588
*Corresponding author: Carrie A. Shaw, carrieann.shaw1@gmail.com

Abstract: *Objective*: The current research aimed to examine the biopsychosocial characteristic profile of online gamblers, relative to land-based exclusive gamblers, both concurrently and prospectively in a large national cohort of Canadian adults. *Method*: This cohort was recruited from Leger Opinion's registered panel of online participants. In addition to demographic information, the survey battery included assessment of comorbidities of disordered gambling (substance use disorder and other behavioral addictions), level of stress, past year life events, presence of mental health disorders, impulsivity, gambling engagement, gambling fallacies, family history of problem gambling, past year problem gambling and gambling-related harm. The 1-year follow-up survey was completed by 55.9% of this cohort. *Results*: Significant differences between online and land-based exclusive gamblers were detected on all gambling engagement measures at baseline. For example, those who gamble via online platforms spend more time gambling than land-based exclusive gamblers (M = 58.86 versus M = 20.13 hours respectively), engage in more types of gambling (M = 4.10 versus M = 2.46) and incur greater gambling losses (M = $-960.56 versus M = $-382.84). Both the concurrent and prospective predictive analyses indicate that access to legal online gambling, increased frequency of engagement, higher impulsivity, younger age, and being male are variables that robustly and significantly predict gambling engagement via an online platform. *Conclusions*: The results of this study indicate while there are some robust factors that distinguish online from land-based exclusive gamblers, online gamblers are psychosocially a heterogenous group that does tend to engage in gambling to a greater extent than land-based exclusive gamblers. Additional longitudinal research is required examining the individual characteristics of online gamblers as this sub-population does appear to differ from that of land-based exclusive gamblers.

Keywords: online gambling, internet gambling, problem gambling, longitudinal.

For the vast majority, gambling is an activity that provides recreation and entertainment. For a significant minority however, engagement with this activity yields harms. Moreover, gambling in an online platform has been associated with increases in gambling, gambling related harms and problem gambling (Gainsbury et al., 2012; Wood & Williams, 2011). This may in part be attributed to the availability, accessibility, affordability, anonymity and convenience of internet gambling (McCormack et al., 2013; Williams et al., 2015). In Canada, gambling opportunities are regulated by each provincial government. Thus, there are differences between provinces with respect to availability of both land-based and online opportunities. Williams (2023) provides a succinct historical timeline of online gambling in each of the Canadian provinces. To summarize, since its debut in 2004 in British Columbia, legal online gambling has been introduced in all other provinces (Williams, 2023), and expanded in the scope of available game types offered online (Stevens, 2023; Williams, 2023). It has also been demonstrated that while gambling online remains relatively uncommon in Canada, gambling via an online platform has increased across time (Williams et al., 2021). Yet, while the current trend in the gambling landscape includes an expansion of online gambling opportunities, not all gamblers will engage in this platform. As noted by Lawn et al. (2020) however, what characteristics delineate those who gamble online from land-based exclusive gamblers is not yet well established.

Among treatment seeking populations, it has been found that online gamblers tended to have started gambling at a younger age, be younger when seeking treatment and be male (Sancho et al., 2021, Estévez et al., 2017). Treatment seeking online gamblers also tended to be single (Estévez et al., 2017), have higher attained level of education (Sancho et al., 2021), be employed (Sancho et al., 2021), have higher household income (Estévez et al., 2017), and greater household debt (Estévez et al., 2017). Although López-Torres et al., 2021 found that online gamblers had lower debt than land-based exclusive gamblers. Relative to land-based exclusive gamblers, online gamblers had higher sensation seeking or impulsivity scores (Sancho et al., 2021, López-Torres et al., 2021), but no difference in the Illusion of Control (Sancho et al., 2021). López-Torres et al., 2021 also found that online gamblers did not differ from land-based exclusive gamblers in levels of anxiety or depression.

Within samples of problem or pathological gamblers who have not sought treatment, there are some conflicting findings. While being young and male were predictive of online gambling engagement in most studies (Hing et al., 2017; Hing et al., 2015; Hubert & Griffiths, 2018; Ukhov et al., 2021), Ukhov et al. (2021) suggest that these demographic characteristics were weak predictors of problematic online gambling. Furthermore, contrasting with studies of treatment seekers, amongst pathological gamblers those who gamble online were more likely to be unemployed

(Hubert & Griffiths, 2018). Hing et al., 2015 also found that online problem gamblers experienced *lower* psychological distress and were less likely to seek help. However, Hing et al. (2017) found that problems with online gambling were associated with *greater* psychological distress, lower household income, greater substance use/abuse, and more negative attitudes towards gambling. Hubert and Griffiths (2018) found that online gamblers were more likely to engage in online video gaming, including social networking games, and to also reject responsible gambling tools compared with land-based exclusive gamblers.

For the studies where a general population samples have been examined, online gambling has been associated with being male in some studies and female in others (Edgren et al., 2017; Gainsbury et al., 2012; Wood & Williams, 2011). Online gamblers tend to be younger (Edgren et al., 2017; Gainsbury et al., 2012; Whelan et al., 2021; Wood & Williams, 2011), single or common-law but not legally married (Edgren et al., 2017; Wood & Williams, 2011), employed full time (Edgren et al., 2017; Wood & Williams, 2011) or have the status of "full time student" (Gainsbury et al., 2012; Wood & Williams, 2011), have higher household income (Edgren et al., 2017; Gainsbury et al., 2012; Wood & Williams, 2011) but also greater household debt (Estévez et al., 2017). Online gamblers report greater substance abuse/dependence and other addictions compared to land-based exclusive gamblers (Gainsbury et al., 2012; Wood & Williams, 2011) and greater engagement in computer gaming (Edgren et al., 2017). It has also been shown that compared to land-based exclusive gamblers, online gamblers have greater gambling enagement and more problematic gambling behaviors (Edgren et al., 2017; Gainsbury et al., 2012; Wood & Williams, 2011). There is some evidence that suggests online gamblers have different motivations for gambling compared to land-based exclusive gamblers, being motivated by relaxation rather than to win money (Whelan et al., 2021), and that online gamblers have a more positive attitude towards gambling (Gainsbury et al., 2012; Weidberg et al., 2018).

It is possible that some of inconsistencies highlighted in the reviewed literature may be a result of the differing samples and/or different data collection periods. It is also possible that the inconsistencies are due to the cross-sectional in nature of the reviewed literature. As such, the current study sought to examine the factors that delineate online gamblers from land-based exclusive gamblers in a large, nationally representative, longitudinal cohort.

A1: The current research aimed to examine whether there are significant differences in gambling engagement between online and land-based exclusive gamblers.

A2: The second aim of this study was to examine the concurrent biopsychosocial characteristic profile of online gamblers, relative to land-based exclusive gamblers

A2: The third aim of this study was to examine the baseline characteristic profile that is predictive of gambling online prospectively.

Method

The data used in this study were collected as part of the Alberta Gambling Research Institute (AGRI) National Study on Gambling and Problem Gambling (ANP) Online Panel project. The ANP Online Panel study received approval from the University of Lethbridge Human Ethics Review Board (protocol #2018-063). The full survey used in this project can be viewed at: https://www.ucalgary.ca/research/national-gambling-study/.

Sample

The national cohort was recruited from Leger Opinion's (LEO) registered panel of online participants. Leger's participant pool is structured to be demographically and geographically representative of the adult Canadian population (aged 18+, see: https://leger360.com). Email recruitments were sent to LEO panelists and between August 16 to October 10, 2018, and those who reported gambling at least once per month or more in the past year were directed to the online survey. Recruitment continued until at least 10,000 surveys were completed by an equal number of respondents per province or region. A Baseline sample of 10,199 was obtained, however, n = 145 respondents were eliminated as they reported zero gambling engagement during the year prior to the baseline survey. Thus, the baseline sample size was n = 10052, with n = 7729 of these engaging in exclusively land-based gambling platforms and n = 2325 engaging in online gambling platforms. Then, between August 20 and November 30, 2019, baseline participants who had agreed to be recontacted (n = 8318) were re-recruited for the follow-up survey. A total of 4,707 completed the follow-up survey, which represents 56.59% of those who had agreed to be re-contacted. Participants received $10 CAD plus the standard LEO remuneration for each, the baseline and the follow-up, survey completed.

Measures

In addition to demographic information, the survey battery included assessment of comorbidities of disordered gambling (substance use disorder and other behavioral addictions), level of stress, past year life events, presence of mental health disorders, impulsivity, gambling engagement, gambling fallacies, family history of problem gambling, past year problem gambling and gambling-related harm. Specific to the current study, the following instruments were used:

Problem Gambling Severity Index **(PGSI) (Ferris & Wynne, 2001).** The 9 item PGSI provides a summed total score indicating past year severity as well as interpretive categories, 0 = *non-problem gambling*, scores of 1-2 = *low risk*, scores of 3-7 = *moderate risk*, and scores of, 8 or higher = *problem gambling* (Ferris & Wynne, 2001). The internal consistency was high (.94) in this sample.

Gambling Participation Instrument **GPI (Williams et al., 2017)**. The GPI assesses past year gambling engagement. Test re-test reliability for the GPI range from poor to good (.46 to .84) depending on domain (Williams et al., 2017). The validity coefficients are good to excellent, ranging from .67 to .89 in the current sample. The current study utilized the following domains from the GPI:

Number of Types. The total number of different gambling types engaged in during the past 12-months including: lottery/raffle tickets, instant win tickets, electronic gambling machines (EGMs), casino table games, sports betting (including horse racing), bingo, speculative market activities, and 'other types (i.e., those not listed). Minimum possible = 0, maximum possible = 8.

Frequency. Participants indicate how often in the past 12-months they engaged in each gambling type. Response options: 0 = Never, 1 = Less than once a month, 2 = Once a month, 3 = Two to three times a month, 4 = Once a week, 5 = Several times a week, 6 = four or more times a week. Total frequency is derived by summing frequency of engagement on all reported types of gambling which yields a range of 0 – 48.

Total Losses. Net expenditures reported for each type of gambling were summed. Total losses then recoded any reported total wins to +1 so as to improve validity of expenditure estimates (Williams et al., 2017; Wood & Williams, 2007).

Time. The sum of all time spent on all types of gambling, with values at and above 500 being reset to a maximum of 16 hours per day for 31 days.

Platform. Derived from respondents reports of their means of access for each type of gambling game (e.g., bought a lottery ticket at a local store, bought lottery tickets online, played poker online). Responses were coded to indicate access to gambling by way of land-based exclusive platform(s) or online platform. Thus, land-based exclusive gamblers are juxtaposed with gamblers who engage in any online gambling; regardless of online platform exclusivity or in addition to land-based activities.

Biggest Win. Respondents were asked to report the largest win they recall from the past 12-months by selecting from one of eight categories: 1 = $0, 2 = $1-$199, 3 = $200-$499, 4 = $500-$999, 5 = $1000-$1999, 6 = $2000-$4999, 7 = $5000-$9999, 8 = $10000 or more.

Family History of Problem Gambling. At baseline, participants reported any known familial history of problem gambling.

Gambling Fallacies Measure (GFM) **(Leonard et al., 2015)**. The GFM is a 10-item multiple-choice instrument. High scores (maximum = 10)

indicate greater resistance to gambling fallacies, and low scores indicate endorsement thereof (minimum = 0). The internal consistency of this instrument is very good (omega = .89) (Leonard et al., 2020). The overall one-month test-retest reliability of the instrument is good (0.70).

Legal Online Gambling Access. A variable was created to account for interprovincial differences in access to legal online gambling during each data collection period. At the time of data collection for this study, legal online gambling was available in all provinces except Alberta and Saskatchewan. So, based on the participants provincial location legal online gambling was coded with '1' and no provincial legal gambling was coded as '0'.

Comorbidities. Past year use of tobacco, alcohol, cannabis, and illicit drugs; spending on cannabis; alcohol and drug help seeking; and past year presence of a behavioral addiction. Past year substance use disorder, generalized anxiety, panic disorder and major depression were assessed using the DSM-5 criteria(American Psychiatric Association et al., 2013). For brevity, the reader is referred to the above link to the full survey for instruments/items assessing comorbidities.

Stress. Past year level of stress was assessed via an item adopted from the annual Canadian Community Health Survey (CCHS; *1 = Not at all stressful* to *5 = Extremely stressful*) (Government of Canada, 2018).

Personality. The *NEO Personality Inventory - Revised (NEO PI-R)* (Costa & McCrae, 1992) was used to assess impulsivity. Internal reliabilities of the NEO-PI-R domain scores are known to be high, ranging from .86 to .92 (Costa & McCrae, 1992). The concurrent and discriminant validity of the NEO has been well established in both normal and clinical populations (Costa & McCrae, 1992).

Past Year Negative Life Events. Participants were asked to respond to an adapted version of the Life Events Questionnaire (Vuchinich et al., 1986) to examine negative life events experienced. A summed score of all negative life event items was derived with a minimum score of zero and a maximum score of 39.

Analysis Plan

Data Handling

The survey administration required a participant response for each applicable item and therefore sample size differences are due largely to the non-applicability of items for some respondents. As previously noted, there were n = 145 respondents removed from analyses as they reported no past year gambling at baseline, as such, the included sample at baseline was n = 10054. Cases with non-applicable responses were excluded from analyses. All variables were checked for skewness (skew $\geq \pm$ 0.4) and univariate outliers ($z > \pm$ 3.29). Skew was detected in the gambling engagement variables time spent and money spent (total losses) and outliers were detected in the total gambling loss variables at both time points. Skew was not corrected by transformation, however, planned analyses included tests

robust to skew in large samples. Because of the multiple planned analysis necessary to address the study aims and their exploratory nature, alpha level was set at .01 a priori with Bonferroni corrections for multiple comparisons used where appropriate. Variables capturing a continuous constructs, even if collected in via an ordinal item such as household income, will be included in concurrent and predictive models as continuous. In recognition of the difference between statistical and clinical significance, any associations at or below .17 are interpreted as weak (Hemphill, 2003).

Analysis

All analyses were conducted in SPSS version 28. Paired t-Tests were calculated for between group continuous measure comparisons as paired t-Tests are robust against skew with large samples. The baseline cross-sectional characteristic profiles of individuals engaging in online gambling versus land-based exclusive gambling were examined using binary logical regression. Then, individual characteristic variables that were significantly associated with our dependent variable (online gambling at follow-up) were included in the longitudinal examination using binary logistic regression model.

Prior to completing analyses to address the aims of the current study, logistic regression was used to investigate characteristics that differentiated respondents who completed the follow-up survey ($n = 4676$ after exclusions noted above) from those who did not ($n = 5378$). All demographic and problem gambling variables examined in this study were included, and variable entry was forward stepwise. Variable entry order was determined by Wald statistic with a minimum entry of $p = .05$ and removal level of $p = .10$, with a cut point of .5. Optimal model fit occurred with only five significant variables: age, PGSI score, marital status, family history of problem gambling, and sex. Individuals who did not complete the follow-up survey were more likely to be younger, male, not married or in a common-law relationship, have lower PGSI scores, and were less likely to have a family history of problem gambling. A test of the full model against a constant only model was significant, $\chi 2$ $(10, N = 9626) = 313.95$, $p < .001$. The variance accounted for was moderate, Nagelkerke R squared = .04, and the overall prediction success was also moderate (56.90%) with 50.90% of completers successfully classified correctly and 62.40% of non-completers correctly classified. The interpretation of all findings should take these group differences into account.

Results

The demographic profile of the sample at baseline and follow-up are presented in Table 1. Also, as seen in Table 1, only 23.10% ($n = 2325$) of the sample engaged in gambling using an online platform at baseline, the majority (76.90%, $n = 7729$) were land-based exclusive gamblers. At

follow-up, the percentage of land-based exclusive and online gamblers was similar: 79.40% (n = 2711) and 20.60% (n = 965).

Table 1. Demographics

	Baseline (n = 10054)	Follow-up (n = 4676)
Sex		
Male	46.40%	48.60%
Female	53.60%	51.40%
Age		
Between 18 and 24	4.30%	1.90%
Between 25 and 34	13.00%	10.10%
Between 35 and 44	15.00%	13.60%
Between 45 and 54	19.60%	19.90%
Between 55 and 64	24.50%	27.70%
Between 65 and 74	18.40%	21.10%
75 or older	5.20%	5.70%
Age (continuous)	52.42 (15.39)	54.80 (14.31)
Marital Status		
Single	20.40%	19.60%
Married / Common-law	62.40%	63.30%
Separated (still legally married)	2.90%	2.70%
Divorced	8.20%	8.30%
Widowed	4.60%	5.30%
Prefer not to answer	1.50%	0.80%
Highest level of Education		
Primary	2.30%	
Some Secondary	4.90%	
Secondary	16.70%	
Some Vocational	2.90%	
Vocational	8.80%	
Some post-secondary	14.20%	
Post-secondary certificate	19.00%	
Bachelor’s or equivalent	19.90%	
Professional degree	2.90%	
Master’s or Doctorate	6.40%	
Prefer not to answer	2.00%	
Employment Category		
Full-time	43.60%	42.50%
Part-time	11.50%	11.10%
Sick leave, maternity, strike, disability	3.60%	3.10%
Homemaker (not working for money)	4.00%	3.40%

Unemployed	4.40%	3.20%
Student (not working for money)	1.40%	0.50%
Retired (not working for money)	29.40%	34.80%
Prefer not to answer	2.10%	1.40%
Household Income		
Less than $20,000	6.80%	5.50%
$20,000 - $39,000	14.80%	14.70%
$40,000 – 59,000	16.80%	17.10%
$60,000 - $79,000	14.10%	15.40%
$80,000 - $99,000	12.10%	13.30%
$100,000 - $119,000	9.00%	8.80%
$120,000 - $139,000	5.00%	5.60%
>$140,000	8.50%	8.50%
Uncertain	1.00%	0.70%
I prefer not to answer	11.90%	10.40%
Household Debt		
No debt	27.80%	32.20%
Less than $39,000	24.90%	23.40%
$40,000 – $79,000	9.20%	8.60%
$80,000 - $119,000	6.00%	5.70%
$120,000 - $159,000	5.00%	5.10%
$160,000 - $199,000	4.00%	4.10%
$200,000 - $239,000	3.10%	3.10%
$240,000 - $299,000	3.30%	3.20%
>$300,000	4.70%	4.40%
Uncertain	2.90%	2.70%
I prefer not to answer	9.10%	7.50%
Impulsivity	14.65 (4.96)	14.24 (4.96)
Online		
Yes	23.10%	20.60%
No	76.90%	79.40%
Types	2.84 (1.65)	2.50 (1.53)
Time	29.09 (67.56)	24.98 (61.44)
Frequency	7.06 (5.06)	6.33 (5.08)
Total Losses	-516.43 (2546.44)	-625.53 (5435.62)
Biggest Win		
$0	8.30%	13.80%
$1 - $199	64.20%	62.90%
$200 – $499	11.00%	8.70%
$500 - $999	6.90%	5.80%
$1000 - $1999	5.20%	5.20%
$2000 - $4999	2.80%	2.30%
$5000 - $9999	1.00%	0.70%
$10000+	0.60%	0.60%

PGSI	2.05 (4.44)	1.54 (3.67)
GFM	6.36 (1.86)	6.75 (1.65)
Family history of PG	14.00%	11.70%

Note: Means with standard deviations in parentheses. Age = Age collapsed into categories for demographic representation, Age (continuous) = Mean and standard deviation of continuous variable Age.

To examine the first research question, paired t-Tests were conducted to identify differences between online and land-based exclusive gamblers on all measures of gambling engagement and problem gambling scores at baseline. As seen in Table 2, Online gamblers engaged in significantly more types of gambling (t = -34.83, df = 2786.44, p < .001, d = 1.50), spent more time (hours) gambling (t = -17.68, df = 2661.49, p < .001, d = 65.56), gambled more frequently (t = -29.81, df = 2641.05, p < .001, d = 4.65), and experienced greater gambling losses (t = 7.39, df = 2829.44, p < .001, d = 2535.07). Online gamblers also had significantly higher PGSI scores compared to land-based exclusive gamblers (t = -24.77, df = 2786.79, p < .001, d = 4.22).

Table 2. Baseline gambling engagement differences between online and land-based exclusive gamblers.

	Online (n = 2325)	Land-based (n = 7729)	Independent t-Test
Types	4.10 (2.17)	2.46 (1.23)	-34.83, df = 2786.44, p < .001, d = 1.50
Time (hours)	58.86 (102.07)	20.13 (49.57)	-17.68, df = 2661.49, p < .001, d = 65.56
Frequency (days)	10.66 (7.34)	5.98 (3.46)	-29.81, df = 2641.05, p < .001, d = 4.65
Total Losses	-960.56 (3584.34)	-382.84 (2120.01)	7.39, df = 2829.44, p <.001, d = 2534.87
PGSI	4.57 (6.10)	1.29 (3.45)	-24.77, df = 2786.79, p < .001, d = 4.22

Note: Means with standard deviations in parentheses presented, t-Test results obtained with equal variances not assumed, d = Cohen's d. Types = types of gambling, Time = time spent gambling in hours, Frequency = frequency of gambling in days, Total Losses = total financial gambling losses, PGSI = Problem Gambling Severity Index scores.

With significant differences detected between land-based exclusive and online gamblers at baseline, binary logistic regression was employed to identify the characteristics that best distinguished these two groups. Variables that were significantly associated with online gambling at baseline were included in this model. No multivariate outliers were detected, variable entry was determined by Wald statistic, minimum entry and removal level were p = .05 and p = .10 respectively, and classification

cutoff was set to .20. A total of $n = 9626$ cases were included, with $n = 428$ cases eliminated for missing values. Maximal discrimination between online and land-based exclusive gamblers occurred with 12 significant variables. In order of descending Wald statistic, these variables were: number of types of gambling, having access to legal online gambling, gambling frequency, age (continuous variable), sex, PGSI scores, tobacco use, marital status, gambling time, impulsivity, video game addiction, and alcohol use. As seen in Table 3, online gamblers engaged in more gambling game types, did have access to legal online gambling opportunities, gambled more frequently (days per month), were younger, more likely to be male, had higher problem gambling scores, had less tobacco use, were less likely to have a marital status of married/common-law, or separated but still legally married, or divorced, spend greater amounts of time (hours) in each gambling session, have higher impulsivity scores, report having concurrent video game behavioral addiction, and have greater alcohol use. A test of the full model against a constant only model was significant, $\chi 2$ (17, $N = 9626$) = 1835.64, $p < .001$. The variance accounted for was moderate, Nagelkerke R squared = .26, and the overall prediction success was also good (70.50%) with 71.20% of land-based exclusive gamblers successfully classified correctly and 68.50% of online gamblers correctly classified.

Table 3. Binary logistic regression predicting gambling online at baseline.

				95% CI	
	B	*Wald*	*OR*	Lower	Upper
Gambling Types	0.31	131.84***	1.36	1.29	1.43
Legal online	0.55	72.45***	1.74	1.53	1.97
Gambling Frequency (days)	0.07	52.12***	1.07	1.05	1.09
Age	-0.01	37.33***	0.99	0.98	0.99
Sex (Male)	0.77	26.79***	2.16	0.20	23.30
PGSI total	0.04	26.40***	1.04	1.02	1.05
Tobacco use	-0.05	21.26***	0.95	0.94	0.97
Marital status		19.92***			
Married/ Common Law	-0.68	6.01**	0.51	0.30	0.87

Separated (but legally married)	-0.70	4.86*	0.50	0.27	0.93
Divorced	-0.821	7.861**	0.440	0.248	0.781
Gambling Time (hours)	0.00	15.25***	1.00	1.00	1.00
Impulsivity	0.02	9.75**	1.02	1.01	1.03
B. A. Video games	-0.399	7.378**	0.671	0.503	0.895
Alcohol use	0.036	6.882**	1.036	1.009	1.064

Note: *B* = regression coefficient, *Wald* = Wald statistic, *OR* = Odds ratio, *95% CI* = 95% Confidence interval of the Odds ratio, Lower and Upper bounds. Legal Online = Access to legal online gambling. PGSI = Problem Gambling Severity Index, B. A. Video Games = Behavioral Addiction to Video Games. *** = p < .001, ** p < .01, * p < .05

The final aim of the study was to examine the baseline biopsychosocial variables that best predict gambling online at follow-up. Any baseline variable that was significantly associated with online gambling at follow-up was included in the forward stepwise binary logistic regression. No multivariate outliers were detected, variable entry was determined by Wald statistic, minimum entry and removal level were p = .05 and p = .10 respectively, and classification cutoff was set to .20. A total of n = 4550 cases were included, with n = 126 cases eliminated for missing values. Maximal discrimination between online and land-based exclusive gamblers occurred with 7 significant variables. As seen in Table 4 in order of descending Wald statistic, those who gambled online at follow-up were more likely to have gambled online at baseline, to have had access to legal online gambling at baseline, be younger, male, engage in gambling more frequently, have lower household debt, and have higher impulsivity. A test of the full model against a constant only model was significant, $\chi 2$ (8, N = 4550) = 1194.05, p < .001. The variance accounted for was moderate, Nagelkerke R squared = .36, and the overall prediction success was also good (84.10%) with 89.40% of land-based exclusive gamblers successfully classified correctly and 63.50% of online gamblers correctly classified.

Table 4. Binary logistic regression predicting gambling online at follow-up.

				95% CI	
	B	*Wald*	*OR*	Lower	Upper
Past year online gambling	2.50	707.66***	12.128	10.091	14.577
Legal Online	.66	34.09***	1.942	1.554	2.427
Age	-.02	25.61***	.984	.978	.990
Sex (Male)	-.40	19.27***	.672	.563	.803
Gambling Frequency (days)	.04	13.64***	1.035	1.016	1.055
Household debt	-.004	4.68*	.996	.993	1.00
Impulsivity	.02	5.41*	1.02	1.003	1.041

Note: *B* = regression coefficient, *Wald* = Wald statistic, *OR* = Odds ratio, *95% CI* = 95% Confidence interval of the Odds ratio, Lower and Upper bounds. Legal Online = Access to legal online gambling. *** = $p < .001$, ** $p < .01$, * $p < .05$

Discussion

This study had three aims, the first of which was to examine whether online gamblers engage with gambling to a greater extent than land-based exclusive gamblers and to assess whether they also have more problems with gambling. The results did indicate that online gamblers do engage in significantly more types of gambling and at a greater frequency. Online gamblers also spend significantly more time gambling and experience significantly greater losses compared to land-based exclusive gamblers. While the effect sizes for comparisons of types and frequency are small to moderate, the effect sizes for differences between these two groups on time spent gambling and total gambling losses were large. In addition, online gamblers did have significantly higher problem gambling scores compared to land-based exclusive gamblers. Future studies should examine whether preventative measure enforcement such as, online time and spending limits, can effectively reduce harms and problematic gambling behavior among gamblers who engage in online gambling activities.

The second aim of this study was to examine the characteristics that predict gambling online in a concurrent/cross-sectional analysis. Consistent with previous literature, the variables that characteristic of online gamblers were: greater gambling engagement (days per month and time per gambling session), higher problem gambling scores, younger age, a marital status of not married, separated, or divorced, greater impulsivity, more engagement with alcohol and video gaming (Edgren et al., 2017; Gainsbury et al., 2012; Whelan et al., 2021; Wood & Williams, 2011). Unlike Gainsbury et al. (2012), but consistent with other research (e.g., Edgren et al., 2017; Whelan et al., 2012; Wood & Williams, 2011) being male was a variable that significantly contributed to the prediction of online gambling in the current study. Furthermore, consistent with and extending previous literature (Sancho et al., 2021), gambling fallacy susceptibility did not distinguish online from land-based exclusive gamblers. It is also interesting to note that consistent with other studies (Edgren et al., 2017; Estévez et al., 2017; Gainsbury et al., 2012; Wood & Williams, 2011), there were significant concurrent univariate associations between online gambling and both household income and debt. However, neither income nor debt were variables that contributed to the cross-sectional/concurrent prediction of online gamblers. Having access to legal online gambling opportunities on the other hand, did significantly contribute to this classification model.

The final aim of this study was to examine what baseline variables predict future online gambling engagement: a prospective analysis. It was found that those who gambled online at follow-up were more likely to have gambled online at baseline, to have had access to legal online gambling at baseline, be younger, male, engage in gambling more frequently, have lower household debt, and have higher impulsivity. When we examine robust predictors, those variables that were significant in both the concurrent and the prospective analysis, we identify several variables that distinguish online from land-based exclusive gamblers. Having access to legal online gambling, being younger, male, having higher impulsivity scores, and gambling more frequently (days per month) are all robust predictors of future online gambling.

Future longitudinal research is required to replicate and extend these results. However, these results may indicate that some cross-sectional findings such as the association between online gambling and increased alcohol use, may be an artifact of the cross-sectional design. One possible extension of this study could include examining differences between online and land-based exclusive gamblers who engage in specific game types (e.g., EGMs/slots, lotteries, etc.). Future research should also seek to examine the characteristics that predict the uptake of online gambling as the majority of the current sample maintained gambling activities – rather than started –via an online platform.

Conclusion

The results of this study indicate that online gamblers are psychosocially a heterogenous group that does engage in gambling to a greater extent than land-based gamblers. Robust variables distinguishing between online and land-based exclusive gamblers include having access to legal online gambling opportunities, gambling more frequently, higher impulsivity scores, the tendency to be younger and male. Additional longitudinal research is required to examine gambling motivations, behaviors and outcomes of online gamblers as it is possible that the trajectory of problems in this sub-population differ from that of land-based exclusive gamblers. Access to legal online gambling was one factor that delineated online gambling from land-based in both currently and prospectively. Online gambling is a relatively uncommon platform in Canada, but engagement is growing, and this is likely to increase even more as the online gambling landscape continues to converge with online gaming. This may multiply the risk for problematic behaviors and harm for younger people. More longitudinal research is necessary to monitor the impact of both availability and the convergence of gaming and gambling on use and disordered use.

Declaration of conflict of interest
None declared.

Statement of Competing Interests
The authors declare that there are no conflicts of interest that would have any bearing on the current research study content or conclusions

Ethics approval
The data used in this study were collected as part of the Alberta Gambling Research Institute (AGRI) National Study on Gambling and Problem Gambling (ANP) Online Panel project. The ANP Online Panel study received approval from the University of Lethbridge Human Ethics Review Board (protocol #2018-063).

Author's contributions
All authors contributed to this study equally.

Funding
The data used in this study were collected as part of the Alberta Gambling Research Institute (AGRI) National Study on Gambling and Problem Gambling (ANP) Online Panel project, however, no funding was received for this study.

Research Promotion

The current research aimed to examine the biopsychosocial characteristic profile of online gamblers, relative to land-based exclusive gamblers in a large national longitudinal cohort of Canadian adults. The literature comparing online and land-based exclusive gamblers is largely cross-sectional and lack longer-term perspective. The results of this study indicate that there are some robust biopsychosocial factors that distinguish online from land-based exclusive gamblers, and that online gamblers engage in gambling activities to a greater extent than land-based exclusive gamblers.

References

American Psychiatric Association, American Psychiatric Association, & DSM-5 Task Force. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5*. American Psychiatric Association.

Costa, P. T., & McCrae, R. R. (1992). *NEO PI-R. Professional manual.* Psychological Assessment Resources, Inc.

Edgren, R., Castrén, S., Alho, H., & Salonen, A. H. (2017). Gender comparison of online and land-based gamblers from a nationally representative sample: Does gambling online pose elevated risk? *Computers in Human Behavior*, *72*, 46–56. https://doi.org/10.1016/j.chb.2017.02.033

Estévez, A., Rodríguez, R., Díaz, N., Granero, R., Mestre-Bach, G., Steward, T., Fernández-Aranda, F., Aymamí, N., Gómez-Peña, M., Pino-Gutiérrez, A. d., Baño, M., Moragas, L., Mallorquí-Bagué, N., López-González, H., Jauregui, P., Onaindia, J., Martín-Romera, V., Menchón, J. M., & Jiménez-Murcia, S. (2017). How do online sports gambling disorder patients compare with land-based patients? *Journal of Behavioral Addictions*, *6*(4), 639–647. https://doi.org/10.1556/2006.6.2017.067

Ferris, J., & Wynne, H. (2001). *The Canadian Problem Gambling Index: User Manual*.

Gainsbury, S., Wood, R., Russell, A., Hing, N., & Blaszczynski, A. (2012). A digital revolution: Comparison of demographic profiles, attitudes and gambling behavior of Internet and non-Internet gamblers. *Computers in Human Behavior*, *28*(4), 1388–1398. https://doi.org/10.1016/j.chb.2012.02.024

Government of Canada, S. C. (2018). *Canadian Community Health Survey (CCHS) Annual component: User Guide 2018 Microdatat file*.

Hemphill, J. F. (2003). Interpreting the magnitudes of correlation coefficients. *American Psychologist*, *58*(1), 78–79. https://doi.org/10.1037/0003-066X.58.1.78

Hing, n., Russell, A. M., & Browne, M. (2017). Risk factors for gambling problems on online electronic gaming machines, race betting and sports betting. *Frontiers in Psychology*, *8*, 779. https://doi.org/10.3389/fpsyg.2017.00779

Hing, N., Russell, A. M. T., Gainsbury, S. M., & Blaszczynski, A. (2015). Characteristics and help-seeking behaviors of Internet gamblers based on most problematic mode of gambling. *Journal of Medical Internet Research*, *17*(1), e13. https://doi.org/10.2196/jmir.3781

Hubert, P., & Griffiths, M. D. (2018). A comparison of online versus offline gambling harm in Portuguese pathological gamblers: An empirical study. *International Journal of Mental Health and Addiction*, *16*(5), 1219–1237. https://doi.org/10.1007/s11469-017-9846-8

Lawn, S., Oster, C., Riley, B., Smith, D., Baigent, M., & Rahamathulla, M. (2020). A literature review and gap analysis of emerging technologies and new trends in Gambling. *International Journal of Environmental Research and Public Health*, *17*(3), 744. https://doi.org/10.3390/ijerph17030744

Leonard, C. A., Williams, R. J., & McGrath, D. S. (2020). Gambling fallacies: Predicting problem gambling in a national sample. *Psychology of Addictive Behaviors, 35*(8):939-947. doi: 10.1037/adb0000673.

Leonard, C. A., Williams, R. J., & Vokey, J. (2015). Gambling fallacies: What are they and how are they best measured? *Journal of Addiction Research & Therapy*, *06*(04). https://doi.org/10.4172/2155-6105.1000256

McCormack, A., Shorter, G. W., & Griffiths, M. D. (2013). An examination of participation in online gambling activities and the relationship with problem gambling. *Journal of Behavioral Addictions*, *2*(1), 31–41. https://doi.org/10.1556/JBA.2.2013.1.5

Sancho, M., Bonnaire, C., Costa, S., Casalé-Salayet, G., Vera-Igual, J., Rodríguez, R. C., Duran-Sindreu, S., & Trujols, J. (2021). Impulsivity, emotion regulation, cognitive distortions and attentional bias in a Spanish sample of gambling disorder patients: Comparison between online and land-based gambling. *International Journal of Environmental Research and Public Health*, *18*(9), 4869. https://doi.org/10.3390/ijerph18094869

Stevens, R. M. G. (2023, March). *Statistics Update: Provincially Regulated Online Gambling in Canada*. Alberta Gambling Research Institute 22nd Annual Meeting, Banff, Alberta, Canada. https://prism.ucalgary.ca/server/api/core/bitstreams/10c6a3df-70ca-4537-9ca9-dc241a78976e/content

Ukhov, I., Bjurgert, J., Auer, M., & Griffiths, M. D. (2021). Online problem gambling: A comparison of casino players and sports bettors via predictive modeling using behavioral tracking Data. *Journal of Gambling Studies*, *37*(3), 877–897. https://doi.org/10.1007/s10899-020-09964-z

Vuchinich, R. E., Tucker, J. A., & Harllee, L. M. (1986). *Individual differences in the reliability of alcoholics' report on drinking.* Poster presented at the 94th Annual Convention of the American Psychological Association, Washington, DC, Washington, DC.

Weidberg, S., González-Roz, A., Fernández-Hermida, J. R., Martínez-Loredo, V., Grande-Gosende, A., García-Pérez, Á., & Secades-Villa, R. (2018). Gender differences among adolescent gamblers. *Personality and Individual Differences*, *125*, 38–43. https://doi.org/10.1016/j.paid.2017.12.031

Whelan, E., Laato, S., Islam, A. K. M. N., & Billieux, J. (2021). A casino in my pocket: Gratifications associated with obsessive and harmonious passion for mobile gambling. *PLOS ONE*, *16*(2), e0246432. https://doi.org/10.1371/journal.pone.0246432

Williams, R. J. (2023, March). *Online Gambling in Canada*. Alberta Gambling Research Institute 22nd Annual Meeting, Banff, Alberta, Canada. https://prism.ucalgary.ca/server/api/core/bitstreams/f218977c-b4ee-4732-8579-7f67cae5d363/content

Williams, R. J., Hann, R. G., Schopflocher, D., West, B., McLaughlin, P., White, N., King, K., & Flexhaug, T. (2015). *Quinte Longitudinal Study of Gambling and Problem Gambling*. Report prepared for the Ontario Problem Gambling Research Centre. http://hdl.handle.net/10133/3641

Williams, R. J., Leonard, C. A., Belanger, Y. D., Christensen, D. R., el-Guebaly, N., Hodgins, D. C., McGrath, D. S., Nicoll, F., & Stevens, R. M. G. (2021). Gambling and Problem Gambling in Canada in 2018: Prevalence and Changes Since 2002. *The Canadian Journal of Psychiatry*, *66*(5), 485–494. https://doi.org/10.1177/0706743720980080

Williams, R. J., Volberg, R. A., Stevens, R. M. G., Williams, L. A., & Arthur, J. N. (2017). *The definition, dimensionalization, and assessment of gambling participation. Report for the Canadian Consortium for Gambling Research.* https://www.uleth.ca/dspace/handle/10133/4838

Wood, R. T., & Williams, R. J. (2007). 'How much money do you spend on Gambling?' The comparative validity of question wordings used to assess gambling expenditure. *International Journal of Social Research Methodology*, *10*(1), 63–77. https://doi.org/10.1080/13645570701211209

Wood, R. T., & Williams, R. J. (2011). A comparative profile of the Internet gambler: Demographic characteristics, game-play patterns, and problem gambling status. *New Media & Society*, *13*(7), 1123–1141. https://doi.org/10.1177/1461444810397650