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Changes to the playing field: A contemporary study of actual European online sports betting

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FULL-LENGTH REPORT



ABSTRACT

Background and aims: Online sports wagering is a popular and still growing gambling activity around the world. Like other types of gambling, it can lead to problems that include devastating financial, social, and health-related harms. The first analysis of actual online sports wagering activity (LaBrie et al., 2007) suggested that levels of financial and time involvement were more moderate than anticipated from earlier self-report studies. However, these findings are now more than a decade old. **Methods:** The current study examined actual online sports wagering activity of a similar cohort of 32,262 gamblers who subscribed to a European online betting platform in February 2015 to understand how sports betting might have changed in ten years. Measures included subscriber characteristics, betting activities, and transactional activities. **Results:** Players placed a median of 15 bets during the 8-month study period, made a median of 2.5 bets per betting day, had a median bet size of 6.1 euros, and experienced a median net loss of 25 euros. We were able to distinguish highly involved bettors in the top 2% of total wagered, net loss, and number of bets, whose behavior differed from that of the rest of the sample. **Discussion and Conclusions:** Sports wagering behavior has remained relatively stable over time despite legislative changes and an increase in popularity, with a small subset of subscribers exhibiting disproportionately high engagement, transactional activity, and in-game betting. Further investigation of individual trajectories of wagering behavior and engagement with different types of sports wagering products is merited.

KEYWORDS

gambling, gaming, sports betting, sports wagering, online, internet

INTRODUCTION

During 2007, LaBrie, LaPlante, Nelson, Schumann, and Shaffer (2007) published the first comprehensive description of actual online sport gambling behavior among a large population of *bwin.party* service subscribers. Prior to this publication, research about online gambling only included commentaries and studies that relied upon self-reported online gambling behavior (e.g., Griffiths & Parke, 2002; Ladd & Petry, 2002; Mitka, 2001; Petry & Mallya, 2004). Many such studies identified online gambling as a disproportionately risky type of gambling. In contrast with those earlier studies, LaBrie et al. (2007) observed that online sports gambling among new service subscribers was more moderate than might have been expected. Specifically, they found that fixed-odds (i.e., sports gambling propositions that are selected prior to the start of a contest where the odds are set at the time the bet is placed) bettors made about 2.5 bets of 4 euros every fourth day, and most bettors were active for about 4 months, from their first to their last bet. Live action, also known as “in-game” (i.e., sports gambling propositions that can only be selected once a contest begins and whose odds can change throughout the contest) bettors made about 2.8 bets of 4 euros every fourth day, and were active for about 6 weeks from first to last bet. Notably, LaBrie et al. (2007)

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distinguished highly involved subgroups of bettors whose betting activities were discontinuously higher than the remaining 99% of the sample. Although these findings remain important, the data from that study is now more than ten years old. The current study sought to update our understanding of online sports gambling by assessing the actual gambling behavior of a contemporary sample of online sports gamblers.

Understanding internet gambling

Internet gambling includes a variety of online activities such as casino games, sports betting, backgammon, bingo, and poker. Recent research related to internet gambling continues to highlight its risk potential, but the reality of online gambling is complicated. For example, in Spain, researchers observed an increase in young individuals experiencing gambling disorder during the two years following legalization of internet gambling (Choliz, 2016). Similarly, a national survey of Italian adolescents found problem gambling rates to be five times higher among online gamblers compared to non-online gamblers (Canale, Griffiths, Vieno, Siciliano, & Molinaro, 2016). In the UK, comparisons of samples of individuals who sought treatment for problem gambling in 2015 and 2002 indicated that significantly more individuals in 2015 reported internet gambling compared to individuals surveyed in 2002 (Sharman, Murphy, Turner, & Roberts, 2019). Although these findings are suggestive, it is important to consider that Gainsbury (2015) concluded from a systematic review of the literature that, "internet gambling does not cause gambling problems in, and of, itself. However, use of internet gambling is more common among highly involved gamblers, and for some internet gamblers, this medium appears to significantly contribute to gambling problems." (pp. 189–190). This suggests that more research is needed to better understand the factors that make internet gambling a durable public health concern and gamblers' complex relationship with the medium.

Much research on internet gambling relies upon self-report methodology (Shaffer, Peller, LaPlante, Nelson, & LaBrie, 2010). However, studies that compare self-reported and actual gambling behavior find important divergence between these sources of information (e.g., Braverman, Tom, & Shaffer, 2014; Wohl, Davis, & Hollingshead, 2017), indicating that self-report alone might not be a reliable measure of online gambling activity. Indeed, studies of actual online gambling behavior suggest a more moderate pattern of activity than some self-report studies imply (Gray, Jonsson, LaPlante, & Shaffer, 2015; LaPlante, Kleschinsky, LaBrie, Nelson, & Shaffer, 2009). Nonetheless, given the important clinical observations of shifting gambling habits (e.g., Sharman et al., 2019), more research attention is needed. This might be especially true for sports betting, which as described below, is expanding.

Internet sports betting

As with online gambling more generally, internet sports betting has increased during the last decade as technological

advances have been made, including widespread high-speed internet access, ubiquitous smartphone use, and advances in computing power (Lawn et al., 2020). In fact, online sports betting was the most popular form of online gambling in Europe in 2018 (European Gaming and Betting Association, 2019), and opportunities for sports betting have expanded substantially in the U.S. following the Supreme Court ruling in 2018 that removed Federal restrictions on sports wagering (Legal Sports Report, 2020). Researchers also have observed this rise in online sports betting within gambling treatment settings, with more gambling treatment seekers than before reporting difficulties controlling their online sports betting (Blaszczynski & Hunt, 2011).

The nature of online sports betting itself also has been changing. For instance, the addition of new features to online gambling websites potentially makes it easier for individuals to keep placing bets. Some of these new features include additional live in-play betting options, cash out features, instant deposits, request-a-bet options, and micro-betting (Lopez-Gonzalez, Estévez, & Griffiths, 2019; Newall, Walasek, Kiesel, Ludvig, & Meyer, in press; Winters & Derevensky, 2019). Such features have important consequences. In a survey of online sports bettors, gamblers felt that online betting is riskier than in-venue sports betting because of the features of online gambling websites (Parke & Parke, 2019). A recent experimental study found that certain sports betting incentive features lead bettors to select riskier bets (Rockloff, Browne, Russell, Hing, & Greer, 2019). Unfortunately, bettors who have gambling-related problems might be more likely to use these novel internet sports betting options (see Lopez-Gonzalez et al., 2019; Newall, Cassidy, Walasek, Ludvig, & Meyer, 2021).

But, as with online gambling more generally, the online sports betting landscape is more varied than it would initially seem. Work investigating daily fantasy sports (DFS), a relatively new, rapid-cycling fantasy sports option, provides some evidence about how populations of subscribers respond to new sports-related offerings. A study looking at DFS players' activity on the DraftKings website during the 2014 football season found that individuals spent a median of \$87 in entry fees and had a median net loss of \$30.7. However, there was a small subgroup, 1% of players, whose engagement as measured by number of contest entries, total entry fees, and net loss, was disproportionately higher (Nelson et al., 2019). These findings demonstrate that engagement in online DFS is moderate for the vast majority of players, but potentially extreme among others. The nature of today's online sports betting remains an open question.

Current study

The goal of this paper is to replicate and extend the 2007 study of sports gambling among a large cohort of online gamblers (LaBrie et al., 2007). Given the expansion in online sports gambling and changes in regulations, offerings, and providers since the data for that paper were collected in 2005, the current paper will provide a narrative comparison of that original sample to the overall playing trends of a sample of



sports bettors who subscribed to the same provider during 2015 – ten years later. For this reason, our analyses examine data over an 8-month study period to replicate the study period from the 2007 LaBrie and colleagues paper. In addition to comparing the playing behavior of the more recent sample to the original sample, we also extend the original paper's analysis by examining (a) more detailed information about types of bets placed, and (b) additional information about the transactional patterns (i.e., deposit and withdrawal behavior) of the 2015 sample. Three primary research questions guide this work. Below we list each question and, where applicable, our hypotheses based on prior work:

1. What are the actual online sports betting behaviors of a contemporary cohort of new subscribers to a European internet sports betting site across an 8-month time period?

Hypothesis 1: Our sample will exhibit online sports betting behaviors that are on the same order of magnitude as those exhibited by the original 2005 online sports gambling cohort.

2. What are the transactional patterns (i.e., deposits and withdrawals) of our sample across an 8-month time period?
3. Is it possible to distinguish sub-groups of highly involved sports bettors whose betting and/or losses across 8 months of play are discontinuously high?

Hypothesis 2: We will be able to distinguish subgroups of highly involved sports bettors whose activity across 8 months is discontinuously high.

Hypothesis 3: Approximately 1% of our sample will exhibit discontinuously high number of bets, 1% will exhibit discontinuously high amount wagered, and 1% will exhibit discontinuously high net loss.

Hypothesis 4: The overlap between these highly involved subgroups will be higher for the net loss and amount wagered subgroups than for the number of bets subgroup with either the net loss or amount wagered subgroup.

Hypothesis 5: Highly involved subgroups will be more likely to place in-game, combo, and system bets¹ than the less involved subgroups, and will be more likely to be engaged in other types of betting such as playing poker or casino.

METHODS

Participants

To use similar procedures to the 2007 study of online sports gambling (LaBrie et al., 2007), we obtained the population of

¹In-game bets refer to bets placed once a game has already begun. Combo bets refer to bets that include multiple single bets, all of which have to be correct to win. System bets refer to bets that include multiple single and/or combo bets, only some of which have to be correct to win.

all individuals who subscribed to the *bwin* online gambling platform between February 1st, 2015 and February 28th, 2015, inclusive. In all, 72,494 individuals subscribed to the *bwin* online gambling platform during this time. Consistent with LaBrie et al. (2007), we excluded: (a) individuals who did not place a sports bet during the first 7 months of the study period (to allow for at least a month of potential betting activity to inform the betting activity variables)²; (b) individuals who did not make a deposit into their accounts during the first 7 months of the study period; and (c) individuals who did not place a sports bet after having deposited money into their accounts within the first 7 months of the study period. These exclusions resulted in a final analytic sample of 32,262 individuals. Figure 1 provides a diagram of the sample.

Measures

This study included variables from four separate data tables provided by Entain (formerly GVC Holdings PLC, *bwin*'s parent company), covering the time period from February 1st, 2015 through September 30th, 2015: (a) a bettor characteristics file with demographic information and betting

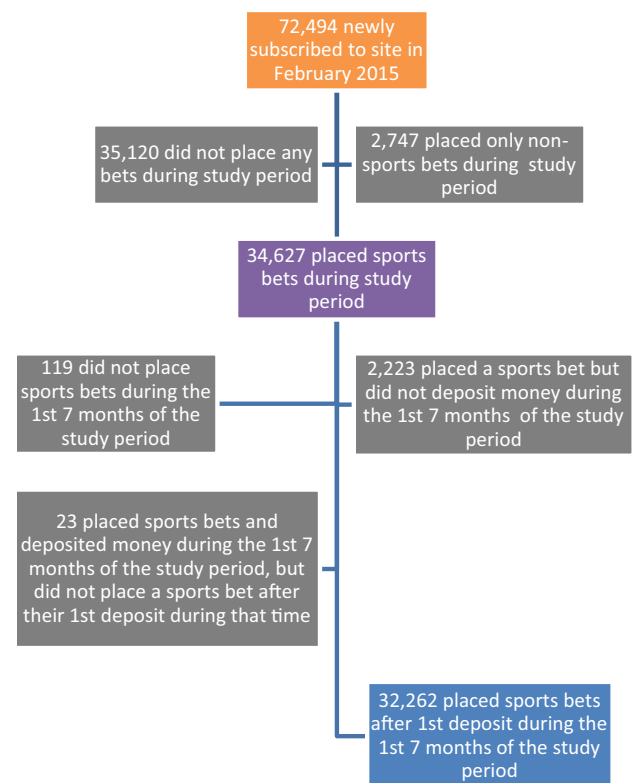


Fig. 1. Sample diagram

²This initial exclusion reduced the sample from 72,494 to 34,627, as Fig. 1 shows. Most of those excluded did not place any bets during the study period. We do not know for certain why this was the case for such a large proportion of subscribers, but it is possible that these subscribers only placed promotional free bets which were not registered by the platform as actual bets because they did not involve actual money.

snapshot information (e.g., date of registration, date of first bet on different products) about each individual in our sample; (b) a raw sports betting file that includes a row for every sports wager made by each individual in our sample; (c) a deposit file, including all deposit activity for our sample; and (d) a withdrawal file, including all withdrawal activity for our sample. The subsections below detail the variables available in each data table and the variables we created from each file. Table 1 includes definitions for the variables used in the current paper.

Bettor characteristics file. The individual-level variables available for the sample included gender, age, and country, as well as date of registration (i.e., the date the bettor opened an account on *bwin*), date of first deposit, and date of first play on each game type. From these variables, we also created two transformed variables. *Country group* coded individual countries as their own category if they comprised at least 5% of the sample, and coded them within an “other countries” group if they comprised less than 5% of the sample. *Number of games played* summed the different types of gambling that a subscriber had played. Scores ranged from ‘1’ (for individuals who only placed sports bets) to ‘3’ (for individuals who placed sports bets, played poker, and played casino games).

Sports betting file. The sports betting file included details about each sports bet placed by individuals in our sample during the study period, detailing the type of sports wager, date placed, date resolved, stakes, and winnings. Type of sports wager indicated whether the bet was a single pre-match bet, a single in-game bet (i.e., a bet placed after a game has already begun), a combo bet (i.e., a combination of single pre-match and/or in-game bets, all of which have to be correct in order to win), or part of a system bet (i.e., a combination of single and/or combo pre-match and/or in-game bets, only some of which have to be correct to win)³. For combo bets, the file also included information about whether the individual paid for bet protection⁴. We used these variables to create the following transformed variables for each individual, as defined in Table 1: *duration*, *frequency*, *number of bets*, *in-game bet percentage*, *combo bet percentage*, *system bet percentage*, *bets per betting day*, *total wagered*, *in-game percent wagered*, *combo percent wagered*, *system percent wagered*, *average bet size*, *net loss*, and *percent lost*. For *total wagered* and *net loss*, we included bet protection fees paid in our calculations. All currencies are in euros.

Deposit activity file. The deposit activity file included five measured variables about every deposit made by individuals

in our sample during the study period, including deposit date (i.e., date on which deposit was placed), deposit payment method (e.g., Visa, PayPal), deposit payment type (e.g., credit card, debit card), deposit amount, and deposit status (i.e., whether the deposit was completed or failed). From these variables, we created the following transformed variables, defined in Table 1: *total deposit amount*, *number of deposits*, *number of deposit days*, *deposits per deposit day*, *average deposit amount*, *number of failed deposits*, *percent failed deposits*, *number of unique payment methods*, and *number of unique credit cards*.

Withdrawal activity file. The withdrawal activity file included three measured variables about every withdrawal made by individuals in our sample during the study period, including withdrawal date (i.e., date on which the withdrawal was made), withdrawal amount, and withdrawal status (i.e., whether the withdrawal was completed or reversed). From these variables, we created the following transformed variables, defined in Table 1: *total withdrawal amount*, *number of withdrawals*, *number of withdrawal days*, *withdrawals per withdrawal day*, *average withdrawal amount*, *number of reversed withdrawals*, and *percent reversed withdrawals*.

Procedure

During 2016, the original provider of LaBrie et al.’s (2007) online sports gambling data, *bwin*, was acquired by the European online gambling operator, GVC Holdings, PLC, which has since changed its name to Entain. The 2015 sample therefore came from the data warehouse of *bwin* records now maintained by Entain. We worked with Entain to obtain 8 months of betting activity and transactional records for all individuals who subscribed to *bwin* in February 2015.

Statistical analyses

Consistent with LaBrie et al. (2007), and because we conducted multiple comparisons and had a large sample size, we used a significance level of $\alpha = 0.001$ as our criterion for statistically significant results. All reported *p*-values reflect two-tailed tests of significance. Because the distributions of many of the variables are skewed, when reporting results in the text, we provide medians as our measures of central tendency.

Research question 1. Our first research question, investigating the betting activity of subscribers in the sample, involved descriptive analyses. For all numerical bettor characteristic and betting activity variables, we provide a five-number summary (minimum, lower quartile, median, upper quartile, maximum), mean, and standard deviation. For all categorical variables, we provide counts and percentages. These analyses were pre-registered and address Hypothesis 1, examining whether betting activity differed substantially from the activity observed a decade ago by LaBrie et al. (2007).

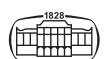
³Pre-match bets were referred to as “fixed odds” bets, and in-game bets were referred to as “live action” bets in earlier publications (i.e., LaBrie et al., 2007).

⁴Bet protection is a type of bet “insurance”. Individuals can pay an additional amount when placing combo bets to “insure” some of their pre-match picks. Then, if these picks lose, leading to the loss of their combo bet, they still receive a partial refund for that bet.



Table 1. Variable definitions

File	Variable name	Variable definition
Bettor characteristic file	Age	Subscriber's age in years on their initial registration date
	Gender	Male or female
	Country	The subscriber's country of residence
	Country group	Country of residence; countries w/ less than 5% of the sample labelled as "other"
Sports betting file	Number of games played	Number of game types (i.e., sports, poker, casino) on which the subscriber placed at least one bet during the study period
	Duration	The difference (in days) between a subscriber's last sports betting day and a subscriber's first sports betting day, inclusive
	Frequency	Percent of days within a subscriber's duration on which the subscriber placed at least one sports bet
	Number of bets	Total number of sports bets a subscriber placed
	In-game bet percentage	Percent of a subscriber's sports bets that are in-game bets (i.e., number of in-game bets divided by total number of bets, multiplied by 100)
	Combo bet percentage	Percent of a subscriber's sports bets that are combo bets (i.e., number of combo bets divided by total number of bets, multiplied by 100)
	System bet percentage	Percent of a subscriber's sports bets that are system bets (i.e., number of system bets divided by total number of bets, multiplied by 100)
	Bets per betting day	Total number of sports bets divided by the number of days on which the subscriber placed at least one sports bet
	Total wagered	Total amount wagered by a subscriber on sports bets
	In-game percent wagered	Percent of a subscriber's total wagered on sports bets that is wagered on in-game bets (i.e., amount wagered on in-game bets divided by total amount wagered on sports bets, multiplied by 100)
	Combo percent wagered	Percent of a subscriber's total wagered on sports bets that is wagered on combo bets (i.e., amount wagered on combo bets divided by total amount wagered on sports bets, multiplied by 100)
	System bet percent wagered	Percent of a subscriber's total wagered on sports bets that is wagered on system bets (i.e., amount wagered on system bets divided by total amount wagered on sports bets, multiplied by 100)
	Average bet size	Total wagered on sports bets divided by the total number of sports bets placed
	Net loss	Total amount wagered on sports bets minus the total winnings on sports bets
Percent lost	Net loss on sports bets divided by total amount wagered on sports bets, multiplied by 100	
Deposit activity file	Total deposit amount	Sum of amount successfully deposited
	Number of deposits	Number of deposits denoted as completed
	Number of deposit days	Number of days on which the subscriber made a completed deposit
	Deposits per deposit day	Number of completed deposits divided by number of days on which the subscriber made a completed deposit
	Average deposit amount	Sum of amount successfully deposited divided by number of completed deposits
	Number of failed deposits	Number of deposits denoted as failed
	Percent failed deposits	Number of deposits denoted as failed divided by total number of attempted deposits, multiplied by 100
	Number of unique payment methods	Count of unique value combinations for deposit payment method and deposit payment type
Number of unique credit cards	Count of unique values for deposit payment method that correspond to credit card payment type	
Withdrawal activity file	Total withdrawal amount	Sum of amount successfully withdrawn
	Number of withdrawals	Number of withdrawals denoted as completed
	Number of withdrawal days	Number of days on which the subscriber made a completed withdrawal
	Withdrawals per withdrawal day	Number of completed withdrawals divided by number of days on which the subscriber made a completed withdrawal
	Average withdrawal amount	Sum of amount successfully withdrawn divided by number of completed withdrawals
	Number of reversed withdrawals	Number of withdrawals denoted as reversed
	Percent reversed withdrawals	Number of withdrawals denoted as reversed divided by total number of attempted withdrawals, multiplied by 100



We also examined correlations between betting variables using Spearman's ρ , and examined whether betting activity differed by gender or age, using Mann-Whitney U tests and Spearman's ρ , respectively. We used these techniques (i.e., Spearman's ρ and Mann-Whitney U tests) to account for the anticipated skew in our variables. These correlations and analyses by gender and age were pre-registered; we include their results in an [online supplement](#).

Research question 2. Our second research question, investigating the transactional activity of subscribers in the sample, also involved descriptive analyses, including five-number summaries, counts and percentages. These analyses were pre-registered, but we did not have specific hypotheses about them. In an [online supplement](#), we also include correlations between deposit variables and withdrawal variables using Spearman's ρ , as well as differences in these variables by gender and age, using Mann-Whitney U tests and Spearman's ρ , respectively. These analyses were also pre-registered.

Research question 3. To investigate the presence of highly involved subgroups with disproportionate levels of betting activity, we replicated the methods used by LaBrie et al. (2007). We created centile plots for *total wagered*, *net loss*, and *number of bets*. Similar to examination of a scree plot in factor analysis, we visually inspected these plots to determine whether there was discontinuity in the top percentiles compared to the rest of the plot. We identified the point of discontinuity for each plot and created groups of highly involved sports bettors for each of those variables based on that point of discontinuity. These pre-registered analyses address Hypotheses 2 and 3.

We examined overlap between these groups (e.g., the number of subscribers who belong to both *total wagered* and *net loss* highly involved subgroups, the number of subscribers who belong to both *total wagered* and *number of bets* highly involved subgroups, etc.) using Fisher's exact tests to determine whether there were differences in overlap between each group pairing. We employed Mann-Whitney U tests for comparing *age*, *number of games played*, and all betting behavior and transactional activity variables between each highly involved subgroup and the rest of the sample. We also compared *gender*, *country group*, the number of individuals with failed deposits, the number of individuals with reversed withdrawals, the number of individuals who placed bets on games other than sports, and the number of individuals who placed in-game, combo, and system bets between the highly involved subgroups and the rest of the sample using Fisher's exact tests. These pre-registered analyses address Hypothesis 5.

Unregistered analyses. We conducted one additional set of analyses that we did not pre-register, based on examination of the data. When examining centile plots to create the highly involved subgroups, we noticed that there was a group that was disproportionately low on net loss, in addition to the disproportionately high group. Therefore, we

created a fourth highly involved group (i.e., high net winners). We compared that group to the other highly involved groups in terms of overlap (using Fisher's exact tests), and also compared it to individuals who did not belong to any of the highly involved groups on betting, withdrawal, and deposit activity. These analyses are presented in an [online supplement](#).

Ethics

The Cambridge Health Alliance Institutional Review Board evaluated our study plans and confirmed that the study did not qualify as human subjects research because all data were de-identified. We preregistered this study on the Open Science Framework (https://osf.io/2356v/?view_only=7a058166e91f437f8c269fa066b1802a).

RESULTS

Bettor characteristics

Among the 32,262 subscribers in our sample, 90.6% were male with a median age of 27 ($M = 30.1$; $SD = 10.3$; $Min = 14$; lower quartile [LQ] = 22; upper quartile [UQ] = 35; $Max = 95$). Almost one third (32.1%) were from Germany, 16.8% were from Spain, 15.1% were from the United Kingdom, and 11.4% were from France. The remaining quarter (24.8%) resided in a country that comprised less than 5% of the sample.

Betting activity – Research question 1

Table 2 provides information about the sports betting behavior of our sample during the 8-month study period. Subscribers in our sample had a median 19 days between their first and last bet within the study period, inclusive. They placed bets on a median 46% of the days within their duration active, and placed a median of 15 bets total, for a median 2.5 bets per active betting day. For a median subscriber, 16% of their bets were in-game bets, and 26% were combo bets. The median subscriber did not place any system bets. Overall, 15% of subscribers placed only single pre-match bets, 65.5% placed at least one in-game bet, 69.8% placed at least one combo bet, and 11.9% placed at least one system bet. Three quarters of subscribers (74.7%) only bet on sports (as opposed to betting on online casino games or playing poker) during the study period; the remaining 25.3% also participated in one or both of these other forms of gambling. Considering financial involvement, subscribers in our sample wagered a median total of 100 euros during the study period, with a median bet size of 6.1 euros and a median total *net loss* of 25.0 euros. The median *percent lost* was 36%. The distribution of the median amount of money spent on each type of bet was similar to the distribution of the number of bets: 15% of money wagered was on in-game bets, 25% was on combo bets, and 0% was on system bets. An [online supplement](#) provides additional information about correlations between these variables, as well as gender



Table 2. Sports betting activity ($N = 32,262^a$)

Variable	Mean	SD	Min	Lower quartile	Median	Upper quartile	Max
Duration	62.24	79.12	1.00	3.00	19.00	98.00	242.00
Frequency	53.06	36.65	1.00	18.18	45.70	100.00	100.00
# of bets	92.80	374.12	1.00	4.00	15.00	62.00	16,406.00
In-game bet %	31.18	35.20	0.00	0.00	16.38	57.14	100.00
Combo bet %	36.64	36.65	0.00	0.00	25.62	68.57	100.00
System bet %	4.65	16.49	0.00	0.00	0.00	0.00	100.00
Bets per betting day	4.37	6.74	1.00	1.43	2.50	4.67	223.30
# of games played	1.29	0.54	1.00	1.00	1.00	2.00	3.00
Total wagered	1,093.86	7,361.54	0.00	30.00	100.00	355.02	404,422.55
In-Game % wagered	31.16	35.70	0.00	0.00	14.98	57.81	100.00
Combo % wagered	36.52	36.87	0.00	0.00	25.03	68.96	100.00
System % wagered	2.89	12.02	0.00	0.00	0.00	0.00	100.00
Average bet size	18.30	42.04	0.00	2.68	6.10	14.20	1,930.87
Net loss	71.44	590.90	-12,340.00	7.41	25.00	85.59	31,282.82
% lost	33.72	110.27	-12,130.00	7.74	35.83	92.57	100.00

^a For 13 bettors, none of their bets had yet resolved, so they are not included in the descriptives for *net loss* or *percent lost*. For these two variables, the sample size is $n = 32,249$.

and age differences. As noted in that supplement, effect sizes tended to be small. Older subscribers wagered and lost more on the platform than younger subscribers, but younger subscribers placed more of their wagers on combo bets and played more game types than older players. Men played for a longer duration on the platform, had greater overall losses, and placed more of their wagers on combo bets than women, but women played more frequently and wagered more per bet than men.

Deposit and withdrawal activity – Research question 2

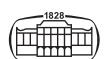
Table 3 provides information about the transactional activity of our sample during the 8-month study period. Subscribers in our sample deposited a median of 50 euros and made 2 deposits during the study period. Median *average deposit*

amount was 20 euros, and the median subscriber used only one payment method and no credit cards for their deposits, and had no failed deposits. Only 29.5% of subscribers had any withdrawal activity during the study period. Among those who made withdrawals, subscribers withdrew a median 125 euros and made one withdrawal during the study period. Among those who made withdrawals, median *average withdrawal amount* was 81.3 euros, and the majority of subscribers had no reversed withdrawals. Overall, 42.5% of subscribers had at least one failed deposit, and 14.7% who made withdrawals reversed at least one withdrawal. An [online supplement](#) provides additional information about correlations between these variables, as well as gender and age differences. As noted in that supplement, effect sizes were small for these analyses. Older subscribers deposited more, used more unique credit cards to place their deposits,

Table 3. Transactional activity ($N = 32,262$ for deposit variables; $n = 9,529$ for withdrawal variables)

Variable	Mean	SD	Min	Lower quartile	Median	Upper quartile	Max
Total deposit ^a amount	266.15	1,216.16	3.66	20.00	50.00	130.00	50,315.00
# of deposits	6.02	16.54	1.00	1.00	2.00	4.00	502.00
# of deposit days	4.54	9.35	1.00	1.00	2.00	4.00	202.00
Deposits per deposit day	1.14	0.46	1.00	1.00	1.00	1.00	22.00
Average deposit amount	42.20	91.08	2.80	12.00	20.00	43.88	5,000.00
# of failed deposits	2.35	9.03	0.00	0.00	0.00	2.00	383.00
% failed deposits	17.52	24.97	0.00	0.00	0.00	33.33	99.00
# of payment methods	1.27	0.62	1.00	1.00	1.00	1.00	10.00
# of unique credit cards	0.25	0.46	0.00	0.00	0.00	0.00	3.00
Total withdrawal amount	495.27	1,454.24	0.00	40.44	125.00	375.00	37,889.25
# of withdrawals	2.44	4.90	0.00	1.00	1.00	2.00	151.00
# of withdrawal days	2.19	3.59	0.00	1.00	1.00	2.00	82.00
Withdrawals per withdrawal day	1.02	0.39	0.00	1.00	1.00	1.00	19.00
Average withdrawal amount	199.66	433.04	0.00	30.00	81.33	200.00	13,575.60
# of reversed withdrawals	0.47	3.82	0.00	0.00	0.00	0.00	294.00
% reversed withdrawals	7.83	22.29	0.00	0.00	0.00	0.00	100.00

^a Unless stated otherwise, references to deposits and withdrawals indicate completed deposits and withdrawals (as opposed to including those that failed or were reversed).



and withdrew more than younger subscribers, but younger subscribers had more failed deposits than older players. Men made more deposits and used more unique credit cards to place those deposits than women, but women deposited and withdrew a greater amount than men.

Highly involved sports bettors – Research question 3

We examined whether there were subgroups of subscribers whose betting activity was disproportionately different from that of other subscribers by examining centile plots for *total wagered*, *net loss*, and *number of bets*, as presented in Fig. 2a–c. As shown in the figure, there is clear discontinuity in at least the top 2% (though arguably in the top 3% for *total wagered*). To have comparably sized groups, we chose to distinguish the top 2% on each of the three variables. We designated each of these 2% groups as “Most Involved Bettors” (MIBs) on the given variable.⁵

Table 4 includes information about the overlap between these MIB groups. As the table shows, more than 60% of the subscribers in the *total wagered* MIB group also belonged to another MIB group. Approximately half of the subscribers in the *number of bets* and *net loss* MIB groups also belonged to other MIB groups. The lowest overlap between MIB groups (10%) was between the *number of bets* MIB group and the *net loss* MIB group. Overlap between the other groups was approximately 20%–22%. One hundred twenty-two (8.9%) of the 1,370 subscribers who belonged to at least one MIB group belonged to all three. Though these overlaps are considerable, Fisher’s exact tests demonstrated that in all cases, MIB subscribers were more likely to belong to one MIB group than two (all Fisher’s exact tests, $p < 0.001$).

We compared subscribers who belonged to each of these MIB groups to subscribers who did not belong to any of these MIB groups (i.e., less-involved bettors: LIBs) on demographics and all betting behavior and transactional activity variables. Tables 5 and 6 display these comparisons. Subscribers in the MIB groups were older than other subscribers, less likely to reside in the UK or Germany, and more likely to reside in Spain or other countries accounting for fewer than 5% of subscribers. Subscribers in the MIB group for *total wagered* also were more likely to be female than other subscribers.

As the tables show, subscribers in the MIB groups had significantly higher levels of betting and transactional activity than LIBs across all transactional activity variables and almost all betting activity variables. There are a few notable exceptions. Subscribers who were in the MIB groups for *total wagered* and *net loss* did not exhibit significantly greater *frequency* of betting than LIBs. Subscribers who were in the MIB group for *total wagered* also did not exhibit significantly greater *net loss* than LIBs and did not differ on *number of games played*. Subscribers who were in the *number of bets* MIB group had lower *average bet sizes* than

LIBs. All MIB groups had significantly lower *percent lost* than other subscribers.

Though all MIB groups placed a greater percentage of their bets on in-game propositions than other subscribers, the difference for *combo bet percentage* was in the opposite direction for the *total wagered* and *number of bets* MIB groups (i.e., these MIB subscribers had a lower percentage of their bets that were combo bets than subscribers who weren’t in MIB groups) and was not significant for the *net loss* MIB group. System bets were rare across the groups, but more common among those in the *number of bets* and *net loss* MIB groups. However, when examining whether subscribers had placed *any* combo, or system bets, we found that both the *number of bets* and *net loss* MIB groups had greater proportions of subscribers who had placed these types of bets than the group of subscribers who did not belong to any MIB groups.

The [online supplement](#) provides information about an additional set of exploratory unregistered analyses that we conducted after examination of centile plots, investigating an MIB group defined by high net winnings. As noted in that supplement, subscribers in the net winnings MIB group had significantly higher levels of betting and transactional activity than LIBs across almost all betting and transactional activity variables. However, they placed fewer of their bets on combo bets than other subscribers. These net winnings MIB group members were older and more likely to be female than other subscribers.

DISCUSSION

This study examined the betting and transactional activity of a cohort of 32,262 sports wagering subscribers to a large online betting platform and compared that activity between small subgroups of subscribers who exhibited discontinuously high betting activity and the rest of the cohort. To facilitate a narrative comparison, these analyses largely replicated those conducted on a similar cohort of subscribers to the same platform ten years earlier (see LaBrie et al., 2007). The inclusion of transactional activity and multiple types of sports bets, as well as analyses that examine the betting and transactional activity of net winners, provided in the [online supplement](#), represent an extension of this work.

Key findings – overall cohort characteristics and activity

Demographically, the current cohort was very similar to that from ten years earlier – both were predominantly male and had an average age of approximately 30 years old. Regional distribution was slightly different – though Germany was the most prevalent country of residence for both cohorts, the current cohort had many more subscribers from the UK, Spain, and France than the prior cohort. These regional differences likely relate to changes in the betting platform itself (e.g., *bwin* was acquired by GVC Holdings PLC, now Entain, which has a wider customer base).

⁵In addition, for a later exploratory analysis, we also created a bottom 2% group for *net loss* because of the discontinuity at the bottom of the distribution.



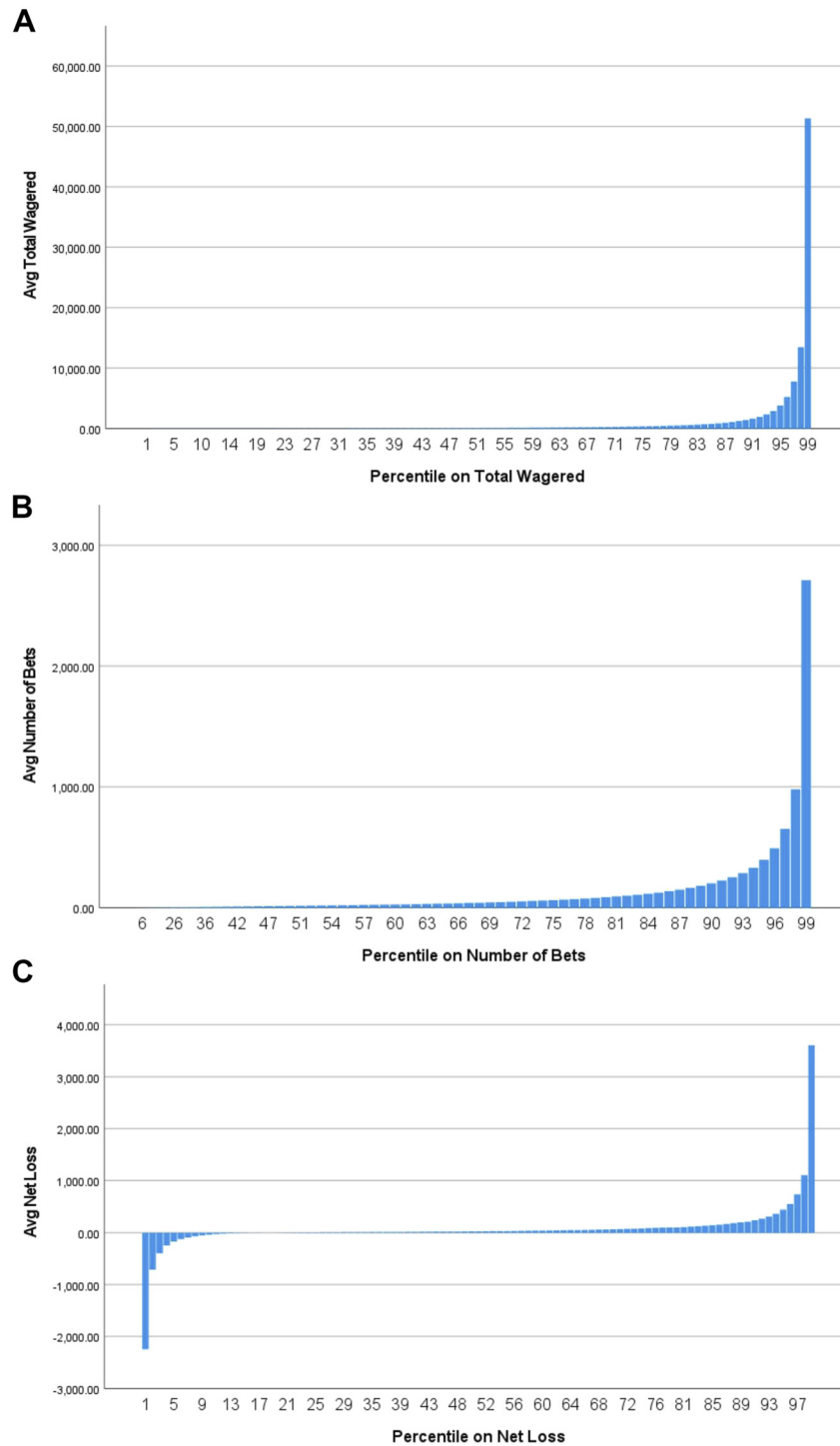


Fig. 2. a–c. Percentile distributions for *Total Wagered*, *Number of Bets*, and *Net Loss*.

For 13 bettors, none of their bets had yet resolved, so they are not included in the *net loss* percentile calculation; therefore, $n = 32,249$ for this variable

As far as overall cohort betting behavior, findings were similar to those for the earlier cohort. Median bets per betting day, net loss, percent loss, and engagement with in-game betting were similar across cohorts – approximately 2.5 bets per betting day, 25 euros total lost, accounting for 36% of monies wagered, and 60–66% engaging with in-game

(previously called live action) betting. In fact, all betting variables that were measured in both studies were within the same order of magnitude, supporting Hypothesis 1 that the two cohorts would not differ in any fundamental way on their betting behavior. There were, however, a few minor differences between this cohort and the earlier cohort.

Table 4. Overlap between Top 2% MIB groups

MIB Group	MIB _{TW} Only	MIB _{NB} Only	MIB _{NL} Only	MIB _{TW&NB}	MIB _{TW&NL}	MIB _{NB&NL}	MIB _{TW&NB&NL}
MIB _{TW} (<i>n</i> = 651)	254 (39.0%)	–	–	131 (20.1%)	144 (22.1%)	–	122 (18.7%)
MIB _{NB} (<i>n</i> = 652)	–	334 (51.2%)	–	131 (20.1%)	–	65 (10.0%)	122 (18.7%)
MIB _{NL} (<i>n</i> = 651)	–	–	320 (49.2%)	–	144 (22.1%)	65 (10.0%)	122 (18.7%)

NL = Net loss; TW = Total wagered; NB = Number of bets.

Although we could not directly compare the cohorts statistically, the current cohort's median frequency of play (i.e., percent of days on which they placed a bet, within their available duration), placing bets on close to half of the days available to them, was higher than the previous cohort, but their median duration (i.e., the number of days between their first and last bet within the study period, inclusive), less than a month, was shorter. The current cohort also made fewer overall bets, approximately 15 per subscriber, but wagered more per bet, a little over 6 euros.

As hypothesized, the similarities between these two cohorts suggest that sports wagering behavior, at least on this platform, has remained relatively stable over time despite changes in the legislative and popular landscape. In both cohorts, the overall behavior of the sample can also arguably be described as modest to moderate. For example, if we consider the lower risk gambling limit recommendations of betting 8 days or less per month and wagering 75 Canadian dollars (i.e., approximately 48 euros) or less per month put forth by Currie and colleagues (see Currie et al., 2017), the current cohort's behavior falls within those limits. The median bettor bet on the site every other day (i.e., 46% of possible days) over a median duration of 19 days within the 8 month study period, which equates to 4 days per month. The median amount wagered of 100 euros, when divided over the 8 months of the study, equates to 12.5 euros per month. That said, during the duration they were active (i.e., the median 19 day duration), individuals in the current cohort were betting more frequently than advised by Currie and colleagues. In addition, our analyses of MIBs clearly indicate that a subset of individuals in our sample were gambling at levels well above those lower risk limits.

The minor differences that do exist between the current and earlier cohort, namely the shorter duration and the negative correlations between frequency and other metrics identified in the online supplement, suggest that the availability of more options for online sports wagering might be leading to a reduction in "stickiness" among consumers, with sports gamblers shopping around more for the best site or experience (see Xu & Liu, 2010).

As noted earlier, two thirds of the current cohort had engaged in in-game betting during the study period; in the entire cohort, a median 16% of a subscriber's betting activity (and 15% of total wagered) was on in-game betting. Combo bets, often known as parlays, accounted for a median 26% of a subscriber's betting activity (and 15% of total wagered); 70% of subscribers placed at least one combo bet during the study period. By contrast, only 12% placed a system bet (i.e., a combination of combo and single bets where only some of

the bets need to be correct to win), and system bets accounted for a median 0% of subscribers' betting activity (and 0% of total wagered). Most of the cohort engaged only in sports wagering. These findings suggest that among sports gamblers, utilization of multiple types of sports wagers is relatively common, but engaging in other types of gambling on this platform is not.

Transactional activity was minimal in the overall cohort. Subscribers made a median two deposits during the 8-month study period, totaling 50 euros across deposits. Those who withdrew made a median one withdrawal for a median 125 euros. Less than half of subscribers had any failed deposits, and 15% of subscribers who withdrew reversed a withdrawal. Most subscribers used one payment method to make deposits, and did not use credit cards.

Age and gender analyses presented in the online supplement found that overall, age and gender effects are small. However, these analyses suggest that older players tend to be more involved in online sports wagering, but younger players are more likely to be involved in alternate types of betting (e.g., casino or poker) and riskier forms of betting, such as combo bets. The gender analyses suggest that while men were engaged with online sports wagering for longer periods of time, women tended to play more intensely, wagering on a greater number of days within their time active and placing larger bets.

Most involved bettors

One of the greatest similarities between the current cohort of online sports gamblers and the cohort from a decade earlier is the discontinuity in their behavior. As can be seen clearly in Tables 2 and 3, as well as Fig. 2, there is a small handful of subscribers whose betting and transactional behavior is fundamentally different from the rest of the sample. For example, the maximum number of bets is 16,406, even though the median number is 15. This is also evident in transactional behavior, with a maximum total deposited of 50,315 euros despite a median deposit total of 50 euros. Consequently, we were able to distinguish groups of subscribers, each accounting for 2% of the study sample, whose behavior on total wagered, number of bets, and net loss, respectively, was notably different from the rest of the sample. Thus, Hypothesis 2 was supported.

These most involved groups each represented 2% of our sample instead of the 1% identified by LaBrie et al. (2007). There are two possibilities for this difference. First, it is quite possible that the difference is not consequential and due instead to the error inherent in "eyeballing" the centile plot



Table 5. Median and mean (SD) betting and transactional behaviors by MIB group

Variable	MIB _{TW} (n = 651)		MIB _{NB} (n = 652)		MIB _{NL} (n = 651)		LIB (n = 30,892) ^c	
	Median	Mean (SD)	Median	Mean (SD)	Median	Mean (SD)	Median	Mean (SD)
Duration	121.00 ^a	128.57 (80.73)	204.00 ^b	168.71 (0.59)	193.00 ^c	150.69 (82.14)	17.00 ^{a,b,c}	58.67 (77.10)
Frequency	56.88	57.40 (26.94)	59.40 ^b	59.14 (22.97)	41.23	46.52 (26.63)	45.00 ^b	53.05 (37.03)
# of bets	533.00 ^a	1,130.15 (1,872.59)	1,273.50 ^b	1,845.92 (1,803.51)	326.00 ^c	850.48 (1,473.59)	14.00 ^{a,b,c}	51.72 (96.79)
In-game bet %	96.77 ^a	78.91 (31.64)	82.28 ^b	65.35 (36.51)	68.75 ^c	59.49 (35.37)	14.29 ^{a,b,c}	29.68 (34.38)
Combo bet %	2.52 ^a	15.44 (23.67)	7.83 ^b	22.16 (28.19)	30.92	36.77 (32.15)	26.78 ^{a,b}	37.08 (36.82)
System bet %	0.00	3.08 (12.60)	0.00 ^b	16.36 (29.76)	0.00 ^c	7.55 (19.37)	0.00 ^{b,c}	4.44 (16.09)
Bets per betting day	12.88 ^a	19.20 (24.00)	17.62 ^b	25.18 (25.04)	7.54 ^c	13.32 (17.69)	2.33 ^{a,b,c}	3.81 (4.67)
Total wagered	18,632.55 ^a	32,378.86 (40,395.46)	6,338.14 ^b	20,887.87 (39,911.61)	7,275.29 ^c	17,496.45 (33,023.60)	96.62 ^{a,b,c}	368.60 (887.54)
# of games played	1.00	1.28 (0.52)	1.00 ^b	1.39 (0.60)	1.00 ^c	1.45 (0.62)	1.00 ^{b,c}	1.29 (0.53)
In-Game % wagered	97.97 ^a	79.91 (31.77)	84.00 ^b	67.74 (35.20)	71.46 ^c	60.68 (35.85)	13.16 ^{a,b,c}	29.60 (34.86)
Combo % wagered	1.30 ^a	14.90 (24.08)	10.26 ^b	22.95 (27.56)	31.20	37.25 (32.84)	25.98 ^{a,b}	36.95 (37.05)
System % wagered	0.00	1.03 (5.80)	0.00 ^b	9.98 (21.48)	0.00 ^c	3.16 (11.09)	0.00 ^{b,c}	2.77 (11.79)
Average bet size	43.46 ^a	85.60 (136.07)	4.28 ^b	12.49 (24.19)	27.46 ^c	63.64 (108.41)	5.93 ^{a,b,c}	16.59 (34.70)
Net loss	302.59	797.92 (3,611.93)	354.93 ^b	838.78 (2,788.49)	1,397.00 ^c	2,351.38 (2,636.35)	23.72 ^{b,c}	37.90 (221.43)
% lost	1.42 ^a	2.62 (12.58)	8.33 ^b	9.33 (15.98)	21.97 ^c	29.75 (23.49)	38.08 ^{a,b,c}	34.55 (112.51)
Total deposit ^d amount	1,940.00 ^a	3,766.15 (5,150.65)	800.31 ^b	2,227.29 (4,329.98)	2,080.00 ^c	3,720.97 (4,745.31)	48.00 ^{a,b,c}	167.39 (797.71)
# of deposits	18.00 ^a	40.01 (55.29)	26.00 ^b	44.94 (57.06)	37.00 ^c	54.86 (55.88)	2.00 ^{a,b,c}	4.59 (11.52)
# of deposit days	12.00 ^a	23.70 (27.88)	21.00 ^b	30.36 (30.14)	26.00 ^c	33.73 (29.34)	1.00 ^{a,b,c}	3.63 (6.42)
Deposits per deposit day	1.35 ^a	1.60 (0.87)	1.15 ^b	1.32 (0.49)	1.39 ^c	1.65 (0.90)	1.00 ^{a,b,c}	1.13 (0.44)
Average deposit amount	95.14 ^a	175.44 (240.23)	33.20 ^b	67.62 (113.17)	69.05 ^c	141.46 (202.08)	20.00 ^{a,b,c}	38.39 (80.20)
# of failed deposits	3.00 ^a	13.55 (26.54)	4.00 ^b	13.85 (30.96)	7.00 ^c	18.79 (31.54)	0.00 ^{a,b,c}	1.91 (7.11)
% failed deposits	14.29 ^a	19.51 (19.00)	13.64 ^b	18.92 (18.40)	16.67 ^c	21.66 (18.60)	0.00 ^{a,b,c}	17.41 (25.19)
# of payment methods	1.00 ^a	1.61 (1.01)	1.00 ^b	1.64 (1.01)	2.00 ^c	1.90 (1.19)	1.00 ^{a,b,c}	1.25 (0.59)
# of unique credit cards	0.00 ^a	0.35 (0.56)	0.00 ^b	0.39 (0.58)	0.00 ^c	0.47 (0.58)	0.00 ^{a,b,c}	0.25 (0.45)
Total withdrawal amount	1,913.97 ^a	3,006.81 (3,545.91)	652.00 ^b	1,688.83 (2,595.40)	850.00 ^c	1,753.74 (2,930.55)	105.00 ^{a,b,c}	331.56 (1,042.60)
# of withdrawals	5.00 ^a	8.59 (14.03)	4.00 ^b	7.87 (13.56)	4.00 ^c	7.99 (15.00)	1.00 ^{a,b,c}	1.96 (3.11)
# of withdrawal days	4.00 ^a	6.85 (9.33)	4.00 ^b	6.59 (9.15)	3.00 ^c	6.35 (9.68)	1.00 ^{a,b,c}	1.82 (2.48)
Withdrawals per withdrawal day	1.00 ^a	1.24 (1.03)	1.00 ^b	1.08 (0.28)	1.00 ^c	1.07 (0.39)	1.00 ^{a,b,c}	1.01 (0.30)
Average withdrawal amount	356.56 ^a	688.70 (1020.78)	151.17 ^b	332.59 (653.42)	200.00 ^c	322.94 (408.06)	73.52 ^{a,b,c}	168.33 (349.60)
# of reversed withdrawals	0.00 ^a	1.47 (5.27)	0.00 ^b	1.23 (5.21)	0.00 ^c	1.53 (5.46)	0.00 ^{a,b,c}	0.39 (3.75)
% reversed withdrawals	0.00 ^a	10.77 (21.83)	0.00 ^b	7.76 (17.32)	0.00 ^c	14.23 (26.60)	0.00 ^{a,b,c}	7.56 (22.27)
Age	30.00 ^a	32.76 (11.03)	33.00 ^b	35.23 (11.15)	30.00 ^c	32.17 (9.92)	27.00 ^{a,b,c}	29.98 (10.27)

Note. MIB groups are not exclusive – as noted in Table 4, some individuals belong to more than one MIB group.

^a Significant difference between MIB_{TW} and LIB, $P < 0.001$, according to Mann-Whitney U Tests.

^b Significant difference between MIB_{NB} and LIB, $P < 0.001$, according to Mann-Whitney U Tests.

^c Significant difference between MIB_{NL} and LIB, $P < 0.001$, according to Mann-Whitney U Tests.

^d Unless stated otherwise, references to deposits and withdrawals indicate completed deposits and withdrawals (as opposed to including those that failed or were reversed).

^e For 13 bettors, none of their bets had yet resolved, so they are not included in analyses of the *net loss* or *percent lost* variables; therefore, $n = 32,249$ for these variables, and n for LIB for these variables = 30,879. Only 9,529 individuals in the sample placed withdrawals during the study period; therefore, $n = 9,529$ for analyses that include withdrawal variables (n for LIB for these variables = 8,616; n for MIB_{TW} for these variables = 539; n for MIB_{NB} for these variables = 419; n for MIB_{NL} for these variables = 387).



Table 6. Count and percentages for demographic variables and betting and transactional behaviors by MIB group

Variable	MIB _{TW} (n = 651)		MIB _{NB} (n = 652)		MIB _{NL} (n = 651)		LIB (n = 30,892)	
	#	%	#	%	#	%	#	%
Gender ^a								
Female	92	14.1%	86	13.2%	59	9.1%	2,860	9.3%
Male	559	85.9%	566	86.8%	592	90.9%	28,032	90.7%
Country group ^{a,b,c,d}								
Germany	83	12.7%	143	21.9%	159	24.4%	10,058	32.6%
Spain	160	24.6%	167	25.6%	137	21.0%	5,093	16.5%
UK	35	5.4%	17	2.6%	32	4.9%	4,802	15.5%
France	75	11.5%	72	11.0%	141	21.7%	3,471	11.2%
Other country	298	45.8%	253	38.8%	182	28.0%	7,468	24.2%
Played 2+ game types ^{b,c}	158	24.3%	213	32.7%	246	37.8%	7,734	25.0%
Placed only single pre-match bets ^{a,b,c}	9	1.4%	3	0.5%	4	0.6%	4,824	15.6%
Placed any in-game bets ^{a,b,c}	639	98.2%	645	98.9%	632	97.1%	19,797	64.1%
Placed any combo bets ^{b,c}	441	67.7%	552	84.7%	587	90.2%	24,421	69.3%
Placed any system bets ^{b,c}	93	14.3%	281	43.1%	184	28.3%	3,435	11.1%
Placed any failed deposits ^{a,b,c}	497	76.3%	526	80.7%	582	89.4%	12,623	40.9%
Reversed any withdrawals ^{a,b,c,e}	171	31.7%	107	25.5%	136	35.1%	1,138	13.2%

Note. MIB groups are not exclusive – as noted in Table 4, some individuals belong to more than one MIB group.

^a Significant difference between MIB_{TW} and LIB, $P < 0.001$, according to Fisher's Exact Test.

^b Significant difference between MIB_{NB} and LIB, $P < 0.001$, according to Fisher's Exact Test.

^c Significant difference between MIB_{NL} and LIB, $P < 0.001$, according to Fisher's Exact Test.

^d For the analyses by country group, Fisher's Exact Test could not be used, so the Chi Square Test was employed instead.

^e Only 9,529 individuals in the sample placed withdrawals during the study period; therefore, $n = 9,529$ for analyses that include withdrawal variables (n for LIB for these variables = 8,616; n for MIB_{TW} for these variables = 539; n for MIB_{NB} for these variables = 419; n for MIB_{NL} for these variables = 387).

or random fluctuations. However, it is also possible that the proportion of subscribers who exhibit disproportionately high engagement with online sports gambling has increased in the past decade. This second possibility would be more likely if we had found that the MIB groups encompassed 5% of our sample, rather than just 2%, since the difference between 5% and 1% is less easily explained by observer error than the difference between 2% and 1%. We can, however, conclude that Hypothesis 3, that 1% of the sample would fall into each MIB group, was basically supported: a very small percentage of the sample (i.e., 2% for each betting activity variable) had betting activity on total wagered, number of bets, and net loss that was disproportionately higher than the rest of the sample.

Hypothesis 4 predicted that the overlap between MIB groups for net loss and total wagered would be higher than the overlap between the MIB group for number of bets and either the net loss MIB group or total wagered MIB group. This hypothesis was not fully supported. The overlap between the number of bets MIB group and the total wagered MIB group (i.e., 20.1%) was similar to that between the net loss and total wagered MIB groups (i.e., 22.1%). However, there was less overlap between the number of bets and net loss MIB groups (i.e., 10.0%). This suggests that those subscribers who lost the most money did so not through a disproportionately high number of bets but instead by placing especially large bets.

Comparison of gambling behaviors among these MIB groups and the LIB group revealed a few interesting findings.

As observed in the prior LaBrie et al. (2007) study, though these subscribers' engagement was excessive in terms of financial and time involvement, their percent lost was less than other subscribers. In addition, the percent of their bets that were placed on combo bets, which might be considered the riskiest propositions for sports gamblers, was similar or lower than other subscribers. Those who were most involved in terms of money (i.e., total wagered and net loss) had similar frequencies of betting to other subscribers, and those who were most involved in terms of betting (i.e., number of bets), had lower average bet sizes than other subscribers. One common denominator among these top 2% groups was engagement with in-game betting. For each of these groups, in-game bets constituted a majority of their bets and amount wagered (97%/98% for the total wagered MIB group, 82%/84% for the number of bets MIB group, and 69%/71% for the net loss MIB group), compared to only 14%/13% for less involved bettors. Another common denominator is high levels of transactional activity and engagement in transactional behaviors that might be considered markers of risk, including failed deposits, reversed withdrawals, and unique payment methods. Finally, subscribers in the net loss and number of bets MIB groups were more likely than less involved subscribers to engage in online poker and/or casino gambling, but subscribers in the total wagered MIB group were not. Thus, Hypothesis 5, that MIB groups would be more likely than the LIB group to place combo, in-game, and system bets, and more likely to also play casino and poker, was partially supported. All of the highly involved



subscribers were more engaged in-game betting than other subscribers, as predicted, and some highly involved groups were more likely to also be engaged in casino and/or poker, but these groups were less engaged in combo betting than other subscribers. (System betting was too rare in this cohort to draw any strong conclusions.)

These findings suggest a few things. First, these groups are deeply involved in sports betting, as evidenced by their activity, transactions, and participation in in-game betting. Second, these groups are possibly heterogeneous and should not be equated with gambling disorder or problematic play necessarily. These are very involved gamblers, but their percent loss is not high compared to other subscribers. That, coupled with the lack of combo betting, suggests that many of these bettors are experienced and potentially more savvy gamblers than others. Finally, groups defined by financial involvement and those defined by level of activity should not be equated. There was less overlap between the MIB group based on number of bets and the other two MIB groups, suggesting that there is a distinct subgroup of players who spend very large amounts of time but might not be distinguishable by their financial involvement. This is important because many interventions use monetary metrics to identify subscribers who might be excessively involved; it is possible that some individuals who don't trigger those monetary flags might still be excessively involved or at risk of problems based on the time they spend (see Nelson et al., 2008).

In exploratory analyses, we also identified a group whose net winnings were disproportionately high compared to the rest of the sample. This group is important to examine because their winnings might be indicative of playing especially long odds, or experiencing at least one "big win", which some speculate can be a trigger for gambling problems (see Kassinove & Schare, 2001; Turner, Zangeneh, & Littman-Sharp, 2006). However, in our sample, this group looked similar to those in the total wagered MIB group. They had very high monetary involvement, but their frequency of betting was not different from LIBs and they were less likely to engage in combo betting. Their in-game betting involvement was very high, with in-game betting accounting for a median 95% of these subscribers' betting activity. Compared to other MIB groups, net winners had a considerably shorter duration of play. The shorter duration and low frequency suggest the possibility that some of these subscribers might have hit it big but did not continue playing after that. Alternatively, some of these individuals might be specialists in a particular sport, betting only during that sport's season, leading to shorter overall durations.

Future directions

Additional research is needed to further investigate these groups of MIBs and determine their risk for gambling problems. As noted, there is possibly considerable heterogeneity within these MIB groups, with some subscribers at high risk for or experiencing gambling problems and others who prioritize gambling as a primary pastime but are gambling within their means and not experiencing

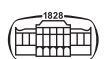
problems. That research could include additional proxies for gambling problems (e.g., self exclusion), or combine behavioral data with surveys to screen for gambling problems.

In addition, future research needs to examine patterns of behavior across time. Prior work has shown that variability and failure to adapt are potential markers of harm among online gamblers (Braverman, LaPlante, Nelson, & Shaffer, 2013; Braverman & Shaffer, 2012; LaPlante, Schumann, LaBrie, & Shaffer, 2008). A gambler who bets on sports at a stable level across time, even if that level is high, likely has different motivations and experiences than one who escalates his or her behavior or bets reactively.

Finally, more work needs to investigate different types of sports betting and ways in which subscribers engage with these types of bets across time. We know from recent work that there is an association between engaging in custom sports bets and experiencing gambling problems (Newall, Cassidy et al., 2021). We found that in-game bets were very popular among MIBs, but combo betting was not. Combo betting is potentially the riskiest activity for sports gamblers because it involves longer odds than other bet types (see Golec & Tamarkin, 1995). Further investigation of subscribers who engage with combo betting might yield additional insights about risky sports gambling behavior. Similarly, little is known about differences in betting patterns and outcomes for online gamblers who engage with single sports versus combinations of sports or for fan bettors (i.e., those who bet only on their preferred teams) versus specialists. It is possible that involvement effects (see LaPlante, Nelson, & Gray, 2014) might apply within sports gambling, in that those who gamble on a greater variety of sports are more likely to experience gambling problems. However, some evidence also suggests those who wager on less popular sports have better outcomes (Gainsbury & Russell, 2015), but it is unclear whether this is due to the skill of the gambler who selects these bet types or, as the authors of this study suggest, the knowledge of the bookmakers. In addition, examining the odds of the propositions subscribers choose and how that changes over time might also point to markers of potential problems.

Limitations

The current work has several limitations. First, though actual behavioral gambling data provides information that is more accurate and robust than self-report surveys, our ability to identify whether subscribers are experiencing problems is limited by the nature of these data. Without surveys or measures of income, it is difficult to determine whether a given level of play represents problematic play. Second, though our betting activity measures were specific to online sports gambling, our transactional activity variables (i.e., deposit and withdrawal information) were not. Therefore, if a subscriber engaged in sports wagering and other types of gambling on this platform, we were not able to determine what proportion of their deposit and withdrawal behavior was specific to online sports wagering. Third, these data are



5–6 years old. We used the data to be able to investigate what might have changed across a decade on a single platform. However, it is possible that other changes have occurred within the past few years that might affect sports wagering patterns. Finally, this work is constrained to a single platform. We were not able to account for subscribers' activity on other gambling platforms with other gambling operators.

CONCLUSIONS

This study provides a comprehensive investigation of online sports gambling behavior among a large cohort of subscribers to a major online gambling operator that specializes in sports gambling. Comparison to prior work from a decade ago suggests that the overall level of engagement within online sports gamblers has not changed substantially. Most subscribers engage at an arguably modest to moderate level, but a small subset can be distinguished whose engagement is disproportionately high. Transactional data reveals the same picture, with most subscribers engaging in few deposit and withdrawal behaviors while the most involved have greater transactional activity, including potential markers of risk such as failed deposits, reversed withdrawals, and multiple unique payment methods. Future research should delve deeper into individual sports wagering trajectories across time, as well as patterns of engagement with different types of sports gambling products, such as combo bets and in-game wagering.

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SUPPLEMENTARY MATERIALS

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REFERENCES

- Blaszczyński, A., & Hunt, C. (2011). *Online sports betting has created new generation of problem gamblers*. Retrieved from <https://medicalxpress.com/news/2011-03-online-sports-problem-gamblers.html>.



- Braverman, J., LaPlante, D. A., Nelson, S. E., & Shaffer, H. J. (2013). Using cross-game behavioral markers for early identification of high-risk internet gamblers. *Psychology of Addictive Behaviors*, 27(3), 868–877. <https://doi.org/10.1037/a0032818>.
- Braverman, J., & Shaffer, H. J. (2012). How do gamblers start gambling: identifying behavioural markers for high-risk internet gambling. *The European Journal of Public Health*, 22(2), 273–278. <https://doi.org/10.1093/eurpub/ckp232>.
- Braverman, J., Tom, M. A., & Shaffer, H. J. (2014). Accuracy of self-reported versus actual online gambling wins and losses. *Psychological Assessment*, 26(3), 865–877. <https://doi.org/10.1037/a0036428>.
- Canale, N., Griffiths, M., Vieno, A., Siciliano, V., & Molinaro, S. (2016). Impact of internet gambling on problem gambling among adolescents in Italy: findings from a large-scale nationally representative survey. *Computers in Human Behavior*, 57, 99–106. <https://doi.org/10.1016/j.chb.2015.12.020>.
- Choliz, M. (2016). The challenge of online gambling: the effect of legalization on the increase in online gambling addiction. *Journal of Gambling Studies*, 32(2), 749–756. <https://doi.org/10.1007/s10899-015-9558-6>.
- Currie, S. R., Hodgins, D. C., Casey, D. M., El-Guebaly, N., Smith, G. J., Williams, R. J., et al. (2017). Deriving low-risk gambling limits from longitudinal data collected in two independent Canadian studies. *Addiction*, 112(11), 2011–2020. <https://doi.org/10.1111/add.13909>.
- European Gaming and Betting Association (2019). European online gambling key figures 2018. <https://www.egba.eu/uploads/2019/12/European-Online-Gambling-Key-Figures-2018.pdf>.
- Gainsbury, S. M. (2015). Online gambling addiction: the relationship between internet gambling and disordered gambling. *Current Addiction Reports*, 2(2), 185–193. <https://doi.org/10.1007/s40429-015-0057-8>.
- Gainsbury, S. M., & Russell, A. (2015). Betting patterns for sports and races: a longitudinal analysis of online wagering in Australia. *Journal of Gambling Studies*, 31(1), 17–32. <https://doi.org/10.1007/s10899-013-9415-4>.
- Golec, J., & Tamarkin, M. (1995). Do bettors prefer long shots because they are risk-lovers, or are they just overconfident? *Journal of Risk and Uncertainty*, 11, 51–64. <https://doi.org/10.1007/BF01132730>.
- Gray, H. M., Jonsson, G. K., LaPlante, D. A., & Shaffer, H. J. (2015). Expanding the study of internet gambling behavior: trends within the Icelandic lottery and sportsbetting platform. *Journal of Gambling Studies*, 31(2), 483–499. <https://doi.org/10.1007/s10899-013-9427-0>.
- Griffiths, M. D., & Parke, J. (2002). The social impact of internet gambling. *Social Science Computer Review*, 20(3), 312–320. <https://doi.org/10.1177/08939302020003008>.
- Kassinove, J. I., & Schare, M. L. (2001). Effects of the “near miss” and the “big win” on persistence at slot machine gambling. *Psychology of Addictive Behaviors*, 15(2), 155–158. <https://doi.org/10.1037/0893-164X.15.2.155>.
- LaBrie, R. A., LaPlante, D. A., Nelson, S. E., Schumann, A., & Shaffer, H. J. (2007). Assessing the playing field: a prospective longitudinal study of internet sports gambling behavior. *Journal of Gambling Studies*, 23(3), 347–362. <https://doi.org/10.1007/s10899-007-9067-3>.
- Ladd, G. T., & Petry, N. M. (2002). Disordered gambling among university-based medical and dental patients: a focus on internet gambling. *Psychology of Addictive Behaviors*, 16(1), 76–79. <https://doi.org/10.1037/0893-164x.16.1.76>.
- LaPlante, D. A., Kleschinsky, J. H., LaBrie, R. A., Nelson, S. E., & Shaffer, H. J. (2009). Sitting at the virtual poker table: A prospective epidemiological study of actual internet poker gambling behavior. *Computers in Human Behavior*, 25(3), 711–717. <https://doi.org/10.1016/j.chb.2008.12.027>.
- LaPlante, D. A., Nelson, S. E., & Gray, H. M. (2014). Breadth and depth involvement: understanding internet gambling involvement and its relationship to gambling problems. *Psychology of Addictive Behaviors*, 28(2), 396–403. <https://doi.org/10.1037/a0033810>.
- LaPlante, D. A., Schumann, A., LaBrie, R. A., & Shaffer, H. J. (2008). Population trends in internet sports gambling. *Computers in Human Behavior*, 24(5), 2399–2414. <https://doi.org/10.1016/j.chb.2008.02.015>.
- 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>.
- Legal Sports Report (2020). Legislative tracker: Sports betting. <https://www.legalsportsreport.com/sportsbetting-bill-tracker/>.
- Lopez-Gonzalez, H., Estévez, A., & Griffiths, M. (2019). Internet-based structural characteristics of sports betting and problem gambling severity: Is there a relationship? *International Journal of Mental Health and Addiction*, 17(6), 1360–1373. <https://doi.org/10.1007/s11469-018-9876-x>.
- Mitka, M. (2001). Win or lose, internet gambling stakes are high. *Journal of the American Medical Association*, 285(8), 1005. <https://doi.org/10.1001/jama.285.8.1005-JMN0228-2-1>.
- Nelson, S. E., Edson, T. C., Singh, P., Tom, M., Martin, R. J., LaPlante, D. A., et al. (2019). Patterns of daily fantasy sport play: Tackling the issues. *Journal of Gambling Studies*, 35(1), 181–204. <https://doi.org/10.1007/s10899-018-09817-w>.
- Nelson, S. E., LaPlante, D. A., Peller, A. J., Schumann, A., LaBrie, R. A., & Shaffer, H. J. (2008). Real limits in the virtual world: self-limiting behavior of internet gamblers. *Journal of Gambling Studies*, 24(4), 463–477. <https://doi.org/10.1007/s10899-008-9106-8>.
- Newall, P. W. S., Cassidy, R., Walasek, L., Ludvig, E. A., & Meyer, C. (2021). Who uses custom sports betting products? *Addiction Research & Theory*, 29(2), 148–154. <https://doi.org/10.1080/16066359.2020.1792887>.
- Newall, P. W. S., Walasek, L., Kiesel, R. V., Ludvig, E. A., & Meyer, C. (Online First). Request-a-bet sports betting products indicate patterns of bettor preference and bookmaker profits. *Journal of Behavioral Addictions*. <https://doi.org/10.1556/2006.2020.00054>.
- Parke, A., & Parke, J. (2019). Transformation of sports betting into a rapid and continuous gambling activity: a grounded theoretical investigation of problem sports betting in online settings. *International Journal of Mental Health and Addiction*, 17(6), 1340–1359. <https://doi.org/10.1007/s11469-018-0049-8>.



- Petry, N. M., & Mallya, S. (2004). Gambling participation and problems among employees at a university health center. *Journal of Gambling Studies*, 20(2), 155–170.
- Rockloff, M. J., Browne, M., Russell, A. M. T., Hing, N., & Greer, N. (2019). Sports betting incentives encourage gamblers to select the long odds: an experimental investigation using monetary rewards. *Journal of Behavioral Addictions*, 8(2), 268–276. <https://doi.org/10.1556/2006.8.2019.30>.
- Shaffer, H. J., Peller, A. J., LaPlante, D. A., Nelson, S. E., & LaBrie, R. A. (2010). Toward a paradigm shift in internet gambling research: from opinion and self-report to actual behavior. *Addiction Research & Theory*, 18(3), 270–283. <https://doi.org/10.3109/16066350902777974>.
- Sharman, S., Murphy, R., Turner, J. J. D., & Roberts, A. (2019). Trends and patterns in UK treatment seeking gamblers: 2000–2015. *Addictive Behaviors*, 89, 51–56. <https://doi.org/10.1016/j.addbeh.2018.09.009>.
- Turner, N. E., Zangeneh, M., & Littman-Sharp, N. (2006). The experience of gambling and its role in problem gambling. *International Gambling Studies*, 6(2), 237–266. <https://doi.org/10.1080/14459790600928793>.
- Winters, K. C., & Derevensky, J. L. (2019). A review of sports wagering: prevalence, characteristics of sports bettors, and association with problem gambling. *Journal of Gambling Issues*, 43, 102–127. <https://doi.org/10.4309/jgi.2019.43.7>.
- Wohl, M. J., 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>.
- Xu, J., & Liu, Z. (2010). *Study of online stickiness: Its antecedents and effect on repurchase intention*. Paper Presented at the 2010 International Conference on e-Education, e-Business, e-Management and e-Learning. <https://doi.org/10.1109/IC4E.2010.42>.

