



# Reasons for Gambling and Problem Gambling Among Norwegian Horse Bettors: A Real-World Study Utilizing Combining Survey Data and Behavioral Player Data

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Accepted: 13 November 2020/Published online: 04 January 2021  
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## Abstract

Despite the popularity of horserace gambling around the world, there is surprisingly little in-depth research on the topic. Additionally, studies suggest that motives for gambling are an important proximal factor related to problematic gambling among young people and adults. The present study investigated reasons for gambling among Norwegian horse bettors utilizing questions based on the Reasons for Gambling Questionnaire. The Norwegian gambling operator *Rikstoto* tracks all players' behavior across all game types on the internet as well as land-based gambling and provided the data for the study. Consequently, the responses to the questions were correlated with actual gambling behavior. The authors were given access to an anonymized dataset of 3627 players (934 females and 2693 males) from the Norwegian horse betting operator *Rikstoto* who all completed a short survey. The reasons for gambling most endorsed by horserace bettors were to win big prizes and for excitement. The least endorsed reasons for gambling were to impress other people and to decrease tension. Gambling for money and gambling for recreation and coping were the most highly correlated with self-reported problem gambling. Age was significant and negatively correlated with self-reported gambling problems. The number of bets made, the amount of money consciously bet (i.e., players choosing the horse(s) compared to letting a random generator choose), as well as the monthly loss limit were significant and positively correlated. To the best of the authors' knowledge, the present study is the first to investigate (i) motivations to gamble combining self-report data with data from a real-world setting, (ii) horserace betting with actual player data, and (iii) correlations between self-reported information about gambling problems with actual gambling behavior and self-reported motivation to play. Consequently, the findings are of high existential value to the gambling studies field.

**Keywords** Online gambling · Internet gambling · Problem gambling · Behavioral tracking · Gambling motivation · Horserace betting · Horserace gambling

## Introduction

Despite the popularity of horserace gambling around the world going back over a half a century, there is surprisingly little in-depth research on horserace gambling. In 2016, horserace betting accounted for 0.04% of the annual land-based revenue of the Spanish gambling operator *Sociedad Estatal Loterías y Apuestas del Estado* (Muñiz et al. 2018). In the UK, betting on horseraces is a popular gambling activity among a minority of the population. For instance, 4% of 4001 participants of a survey conducted by the UK Gambling Commission in 2017 said that they had bet on a horserace in the past four weeks. Only football betting was a more popular betting activity (Barnfield-Tubb and Harris 2017). In an Australian study by Gainsbury et al. (2015), it was reported that a significantly higher proportion of internet gamblers engaged in horserace and dog race betting compared to non-internet gamblers.

A study by Holtgraves (2009) analyzed all data from population-based surveys conducted in Canada between 2001 and 2005 comprising 21,374 participants (including 12,229 who had gambled in the past year). Using the Problem Gambling Severity Index to assess problem gambling, the study found that horserace gamblers had the lowest prevalence rates of problem gambling along with those that played bingo and bought raffle tickets (3%). The 2010 British Gambling Prevalence Survey (Wardle et al. 2011) reported that the prevalence of past-year betting on horseraces was 16%. The same study also found that horserace gamblers had one of the lower prevalence rates for problem gambling (2.7%). A study of Swedish gamblers between 2008 and 2010 by the Swedish Public Health Agency found that 27% of men and 20% of women participated in horserace betting (Statens Folkhälsoinstitut 2010).

In an analysis of eighteen national prevalence surveys examining problem gambling (PG), most of them from Europe, Binde (2011) assessed the relative harmfulness of various forms of gambling. They found that horserace betting along with sports pools, bingo, and sports betting was only relatively moderately associated with PG. In Finland, the national helpline for problem gamblers [*Peluurit*] reported that only 1% of the telephone calls they received concerned horserace betting (European Pari Mutuel Association 2012). Analysis of a French national prevalence survey by Costes et al. (2011) reported that horserace betting was fourth in a list of six gambling activities that were most associated with problem gambling. In a survey of 4991 past-year gamblers, Binde et al. (2017) found that the proportion of problem gamblers among those betting regularly on horses was lowest of all, except for those who gambled either only on horses or on horses and four or more additional forms of gambling. This preceding literature illustrates that although horserace betting is popular among a minority of individuals, little is known about the psychology of the activity including motivations and reasons for engaging in the behavior.

## Gambling Motives

Studies suggest that motives for gambling are an important proximal factor related to problematic gambling among young people and adults (e.g., Griffiths 2011; Stewart et al. 2008). Despite the existence of some psychometric instruments developed to assess gambling motives and related constructs—such as the Gambling Motivation Scale (GMS, Chantal et al. 1994) and the Gambling Motives Questionnaire (GMQ, Stewart and Zack 2008)—the Reasons for Gambling Questionnaire (RGQ, Wardle et al. 2011) was the first standardized measure of gambling motives to be included in a large-scale national prevalence survey. The 15-item RGQ was specifically designed to reflect broad motivations for gambling evident among

gamblers in general, after determining that the available scales at the time (i.e., GMS and GMQ) had some gaps in the range of motives identified in previous studies.

For example, the GMQ fails to capture motives related to money, because items are derived from the alcohol literature (Dechant and Ellery 2011). While people generally do not drink alcohol for monetary gain, winning money has frequently been reported among the primary reasons for gambling (e.g., Hodgins 2008). Based on these considerations, Wardle et al. (2011) developed the RGQ to assess the five gambling motives: social motives (e.g., something that is engaged in with friends and family), monetary motives (e.g., for the chance of winning large amounts of money), enhancement motives (e.g., for the excitement), recreational motives (e.g., to fill time), and coping motives (e.g., to relieve tension). Canale et al. (2015) confirmed the five-dimensional structure of the RGQ in a sample of British players and among gender and age subgroups. They concluded that the RGQ is a valid instrument to assess gambling motives among the general population.

Flack and Stevens (2019) recruited 4945 adults from Northern Territory (in Australia) for a population survey. A total of 1207 participants completed the Gambling Outcomes Expectancies Scale. The study found that excitement, escape, and monetary expectancies increased in conjunction with gambling risk for both men and women, although only escape differentiated the low-risk and at-risk gamblers when other expectancies were controlled for. Horserace/sports bettors rated excitement (but not escape) more favorably than lottery players. Flack and Stevens (2019) suggest that problem gambling severity should be considered when examining motivation difference by gender and that gambling motivation depends, in part, on preferred activity.

In a study by Sundqvist et al. (2016), a random sample of 19,350 Swedish residents were screened for risk gambling using the Lie/Bet questionnaire. Of these, 607 participants screened positive for problem gambling. This subsample of players completed a postal questionnaire about gambling and motives for gambling. Sundqvist et al. (2016) found among the 607 players that motives for gambling had no association with gender, whereas younger individuals gambled for the challenge more often than older participants.

In a study of 118 current gamblers who gambled twice or more per year on either horse racing or electronic gaming machines (EGMs), Balodis et al. (2014) compared motivation and personality factors between these two types of gambler. Horserace gambling frequency was independently predicted by male gender and sensitivity to reward, while the significant independent predictors of EGM gambling were escape motivation and sensitivity to punishment. From the analysis of an individual-level dataset of 5217 individual horse bettors with 167,816 betting-related transactions, Saastamoinen and Suhonen (2018) concluded that inexperienced bettors took on more risk than experienced bettors do after they won. They also found some indication that experienced bettors became more risk averse than inexperienced ones after incurring monetary losses.

## The Present Study

The present study investigated reasons for gambling among Norwegian horse bettors. The questions were based on the Reasons for Gambling Questionnaire (Wardle et al. 2011) which was also validated by Canale et al. (2015). The operator which provided the data for the study tracks all players' behavior across all game types on the internet as well as land-based gambling. Consequently, the responses to the questions can be correlated with actual gambling behavior. Players were also asked a series of questions regarding their readiness to change.

among others “My gambling is a problem sometimes.” Therefore, the study also provided the opportunity to correlate reasons for gambling with potential problematic play as well as actual gambling behavior.

In Norway, the majority of regulated gambling is offered by *Norsk Tipping* and *Rikstoto*. Both companies are government-owned and offer their products online as well as offline. *Norsk Tipping* offers lottery, casino games online, as well as land-based. *Norsk Tipping* additionally offers land-based video lottery terminal (VLT) gambling. All games, except for land-based scratchcards, can only be played with a personalized player card or a personalized verification via smartphone. *Rikstoto*, which provided the data for this study has a much smaller product portfolio which is restricted to online as well as land-based horse betting. All betting is identified, except for betting at racetracks (at the time this study was conducted). *Norsk Tipping's* annual report from 2018 estimated that *Rikstoto* and other smaller operators accounted for 18% of the market share and 18% is generated by unregulated operators (Norsk Tipping 2018).

To the best of the authors' knowledge, the present study is the first to investigate motivations to gamble utilizing data from a real-world setting. No other previous study has ever correlated gambling motives with actual player data. Furthermore, the present study is also the first real-world investigation concerning horserace betting with actual player data. The study's goal was to examine horserace bettors' reasons to gamble and how they correlated with actual betting behavior as well as self-reported problematic betting. Because this was an exploratory study, no specific hypotheses were formulated.

## Method

### Participants and Procedure

The authors were given access to an anonymized dataset of 3627 players (934 females [25.8%]; 2693 males [74.2%]) from the Norwegian horse betting operator *Rikstoto* who all completed a survey. The survey contained 18 questions (including their reasons for gambling and readiness to change—see “[Materials](#)” section below), which were answered between December 5 and December 17 (2018). The response rate was 80%. Players could answer the survey's question after they logged into their online account at *Rikstoto* in a dedicated “Responsible Gambling” section where they also receive feedback about money lost, betting frequency, number of tickets bought, and money deposited. These features are well-known to players and were not specifically created for the survey. Because the questions were answered within an online session in the *Rikstoto* account, it is safe to assume that the answers related to their horse betting behavior. The average age of the players was 52.8 years ( $SD = 12.8$ ). *Rikstoto* offers online and offline horserace betting on both Norwegian and international horseraces. With the exception of betting directly at racetracks, all horserace bets are identified. Online players have to log into their player account and offline (land-based) players are required to use a personalized player card with a pin code. *Rikstoto* players also have to choose a daily, weekly, and monthly monetary loss limit and they also receive personalized feedback via the behavioral tracking and personalized communication tool *mentor* (Auer and Griffiths 2016).

The authors were given access to the players' 30-day gambling behavior before each player completed the survey (i.e., if they completed the survey on December 8, we looked at their

gambling behavior 30 days prior to December 8, and if they completed the survey on December 16, we looked at their gambling data 30 days prior to December 16). Playing behavior was assessed via the amount of money bet, amount of money won, number of playing days, number of games played, amount of money bet online, and amount of money bet on Norwegian horseraces. The authors were also given access to players' personal monthly loss limit at the time of the survey. At *Rikstoto*, players can either choose horses themselves or let a random number generator (RNG) choose horses across the various types of games that *Rikstoto* offers. The operator refers to bets where horses are chosen by players as *conscious betting* and to bets where horses are selected by RNG as *luck betting*. The amount of money bet consciously was also among the behavioral variables examined. Given the a priori knowledge of the factor structure, a confirmatory factor analysis (CFA) was used to test the structure of the 13 questions on the RGQ. The R program (R Core Team 2013) was used with the "lavaan-package" (Rosseel 2012). After evaluating the goodness of fit statistics of the confirmatory factor analysis, it was found that the previous factor structure was a poor fit. Consequently, this was followed up with an exploratory factor analysis where a varimax rotation was computed. Goodness of fit was evaluated via the root mean square error of approximation (RMSEA), comparative fit index (CFI), and Tucker-Lewis index (TLI). For a good fit, those values should be  $< 0.05$ ,  $> 0.95$ , and  $> 0.95$ , respectively (Hu and Bentler 1999).

## Materials

The 18-question survey comprised 13 items from the Reasons For Gambling (RGQ; e.g., "I play to make money," "I play to compete with others"; with the majority taken from Wardle et al. [2011]) and five items relating to "readiness to change" questions (e.g., "There is no need for me to think about changing my gambling," "Sometimes I think I should cut down on my gambling"; taken from Neighbors et al. [2002]). Based on Wardle et al. (2011) and Canale et al. (2015), for the present study, RGQ items 1–2 assess monetary motives, items 4–6 assess enhancement motives, items 7–9 assess recreational motives, items 10–11 assess social motives, and items 12–13 assess coping motives. All items were rated on an 11-point Likert scale ranging from *strongly disagree* (1) to *strongly agree* (11). Please see Appendix Table 6 for a complete list of the 18 items used.

## Ethics

The study was approved by the research team's university ethics committee and was carried out according to the ethical guidelines of the British Psychological Society.

## Results

Table 1 reports the distribution of the responses to the 13 reasons to gamble questions by the 3627 players. The higher the Likert rating value, the more respondents agreed to the statement concerning a specific item. Each cell reports the number of times a specific Likert rating was chosen for a specific item. Across all 13 items, Item 1 ("I play because of the chance of winning big prizes") has the largest number of players who selected Likert rating 11. Item 4 ("I play because it is exciting") has the second largest number of players who chose Likert rating 11. The lowest number of participants which chose Likert rating 11 occurred for Item 13 ("To

**Table 1** Distribution of responses to the 13 reasons to gamble questions on the RGQ across the 11 Likert ratings

Reasons to gamble questions	1	2	3	4	5	6	7	8	9	10	11
Item 1: I play because of the chance of winning big prizes	107	84	157	176	163	394	412	498	434	304	898
Item 2: I play to make money	580	265	337	364	249	458	419	298	181	98	378
Item 3: I play because of the thrill	299	131	173	206	205	483	602	578	399	188	363
Item 4: I play because it is exciting	130	73	97	111	119	386	650	697	553	273	538
Item 5: I play to compete with others	1849	481	384	260	173	215	115	70	27	24	29
Item 6: I play because of the achievement when I win	291	102	135	169	174	595	705	560	347	146	403
Item 7: I play to pass some time	2078	407	369	256	186	132	101	58	11	12	17
Item 8: I play to relax	1822	345	338	289	212	235	188	110	35	19	34
Item 9: I play because it's fun	239	65	76	88	115	424	628	773	496	232	491
Item 10: I play because it is something I do with my friends or family	1574	324	225	182	143	220	258	247	163	74	217
Item 11: I play to be sociable	2046	363	277	205	164	197	130	103	57	28	57
Item 12: Because it helps me when I am feeling tense	2363	376	278	197	114	145	72	42	16	6	18
Item 13: To impress other people	2680	368	228	147	77	70	30	9	2	7	9

impress other people”). The largest number of players ( $n = 898$ ) who fully agreed (i.e., rating 11 on the Likert scale) was for Item 1 statement (“I play because of the chance of winning big prizes”). Additionally, 538 players fully agreed with item 4 (“I play because it is exciting”). Only nine players chose Likert rating 11 for Item 13 (“I play to impress other people”) and only 17 players did so for Item 7 (“I play to pass some time”). Item 13 displayed the largest number of players who chose Likert rating 1 ( $N = 2680$ ) and therefore fully disagreed. The second largest number of players ( $n = 2363$ ) who chose Likert rating 1 and therefore fully disagreed was for Item 12 (“Because it helps me when I am feeling tense”).

A confirmatory factor analysis with the aforementioned latent factor structure resulted in the following goodness of fit statistics: RMSEA = 0.13, CFI = 0.73, and TLI = 0.63. According to Hu and Bentler (1999), this does not reflect a good fit and it can be concluded that the assumed factor structure is not reflected in the data. The CFA’s estimated loadings are reported in Table 2. Given the poor fit of the CFA, a scree test (i.e., scree plot) was computed in order to determine the number of latent factors. One rule of thumb is that factors with an eigenvalue of  $> 1$  should be retained (Yong and Pearce 2013; Kaiser 1960). Horn’s parallel analysis (Horn 1965) compares the eigenvalues generated from the data to the eigenvalues generated from Monte-Carlo simulated data. Non-graphical approaches to determine the number of factors are the acceleration factor and optimal coordinates (Raiche et al. 2006). Both methods are meant to find the point in the scree plot where the slope of the curve changes most abruptly. Figure 1 shows that three out of the four evaluation criteria indicate four factors underlying the 13 items. Subsequently, an exploratory factor analysis (EFA) with four underlying factors was computed.

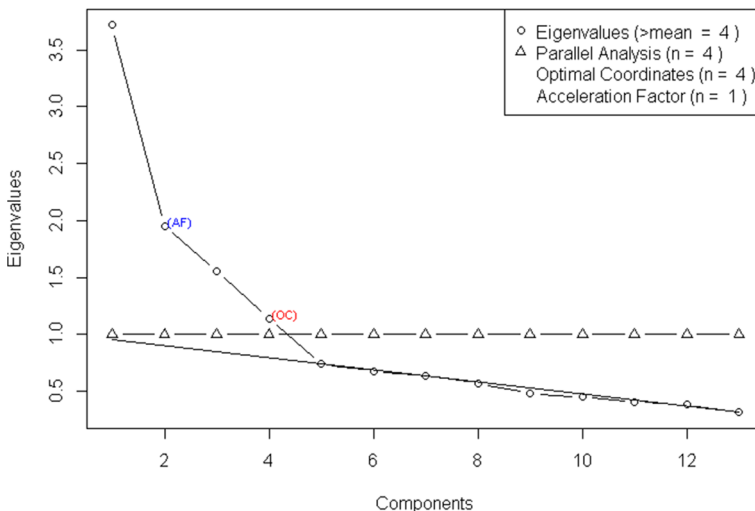
Table 3 reports the factor loadings for the 13 items and four factors. The column “H2” is the communality (explained variance) for each item. Factor loadings  $> 0.4$  are printed in bold. The four factors explained 49% of the variance of the 13 items and Factor 1 (recreation/coping) had the highest eigenvalue (2.15). Item 11 (“I play to be sociable”) had the highest communality (70%). Item 5 (“I play to compete with others”) did not load clearly on one of the four factors as none of the loadings were greater than 0.4.

**Table 2** Estimated loadings on the RGQ using confirmatory factor analysis (all loadings are significant  $p < 0.001$ )

	F1 (money)	F2 (enhancement)	F3 (recreation)	F4 (social)	F5 (coping)
Big prizes	0.57	–	–	–	–
Winning money	0.51	–	–	–	–
Thrill	–	0.82	–	–	–
Excitement	–	0.78	–	–	–
Competition	–	0.25	–	–	–
Achievement	–	0.44	–	–	–
Passing time	–	–	0.72	–	–
Relaxation	–	–	0.77	–	–
Fun	–	–	0.30	–	–
Something to do	–	–	–	0.58	–
Being sociable	–	–	–	0.98	–
Tension relief	–	–	–	–	0.80
Impressing others	–	–	–	–	0.61

The goodness of fit statistics for the four-factor solution are as follows: RMSEA: 0.05 (0.045–0.054); TLI: 0.949;  $\chi^2 = 175.4$  ( $p < 0.001$ ,  $df = 32$ ). Stevens (1992) suggests using a cutoff for factor loadings of 0.4, irrespective of sample size, for interpretative purposes. When the items have different frequency distributions, which is not the case in this study, Tabachnick and Fidell (2007) follow Comrey and Lee (1992) in suggesting using more stringent cutoffs going from 0.32 (poor), 0.45 (fair), 0.55 (good), 0.63 (very good), or 0.71 (excellent). Given the pattern of factor loadings and following Stevens' (1992) rule, the following interpretations can be derived:

### Non Graphical Solutions to Scree Test



**Fig. 1** Scree plot displaying the four goodness of fit criteria for determining the number of factors. Line with “dots” displays eigenvalues. Line with “triangles” represents parallel analysis. Cut off for acceleration factor and optimal coordinate is indicated in the figure

**Table 3** Factor loadings for the exploratory factor analysis on the RGQ including communalities and eigenvalues

Assumed factor		F1 recreation/ coping	F2 enhancement	F3 social	F4 money	H2
Money	<i>I play because of the chance of winning big prizes</i>	-0.09	-0.03	-0.06	<b>0.53</b>	0.3
Money	<i>I play to make money</i>	0.15	-0.01	0.02	<b>0.57</b>	0.35
Enhancement	<i>I play because of the thrill</i>	0.16	<b>0.77</b>	0.13	-0.07	0.63
Enhancement	<i>I play because it is exciting</i>	0.05	<b>0.82</b>	0.09	0.11	0.69
Enhancement	<i>I play to compete with others</i>	0.37	0.09	0.35	0.11	0.28
Enhancement	<i>I play because of the achievement when I win</i>	0.13	<b>0.41</b>	0.04	<b>0.5</b>	0.44
Recreation	<i>I play to pass some time</i>	<b>0.76</b>	0.07	0.06	0.02	0.58
Recreation	<i>I play to relax</i>	<b>0.68</b>	0.23	0.08	-0.05	0.52
Recreation	<i>I play because it's fun</i>	0.06	<b>0.69</b>	0.14	0.01	0.49
Social	<i>I play because it is something I do with my friends or family</i>	0.08	0.19	<b>0.67</b>	-0.05	0.5
Social	<i>I play to be sociable</i>	0.34	0.12	<b>0.75</b>	-0.07	0.7
Coping	<i>Because it helps me when I am feeling tense</i>	<b>0.70</b>	0.07	0.17	0.09	0.54
Coping	<i>To impress other people</i>	<b>0.53</b>	-0.03	0.29	0.08	0.37
	Eigenvalues	2.15	2.01	1.31	0.91	

F1 = factor 1; F2 = factor 2; F3 = factor 3; F4 = factor 4; H2 = communalities. Bold numbers indicate factor loadings which are significant and larger than 0.4

- F1 (recreation/coping): This factor loaded on two items regarding recreation and the two items assessing coping.
- F2 (enhancement): This factor loaded on three items assessing enhancement and one item assessing recreation.
- F3 (social): This factor loaded on the two items assessing social motivation.
- F4 (money): This factor loaded on the two items assessing money motives and one item assessing enhancement.
- Item 5 (“I play to compete with others”) which assesses enhancement motives did not load on any of the four factors higher than 0.4.

For the four extracted factors, scores for each player were computed. The factors were then correlated with the behavioral variables and a Spearman correlation was used (Table 4). Except for four correlations (not printed in bold), all correlations were significant. Enhancement (F2) displayed the highest correlations with variables assessing gambling intensity. The correlations between F2 and amount of money bet, amount of money bet online, amount of money bet offline on Norwegian races, amount of money won, number of different playing days, number of bets, amount of money bet consciously, and the monthly loss limit were 0.21, 0.20, 0.21, 0.19, 0.18, 0.20, 0.25, and 0.19 respectively. Recreation/coping (F1) displayed the highest correlation with gender. The correlation with age was highest for social motives (F3) and money motives (F4).

In addition to the 13 questions assessing reasons to play, players were also asked whether they felt that they sometimes had a gambling problem on an 11-point Likert scale. The distribution across the 11 categories (ranging from 1 [*strongly disagree*] to 11 [*strongly agree*]) was as follows: 1: 2461 (68%); 2: 399 (11%); 3: 217 (6%); 4: 14 (4%); 5: 89 (2%); 6: 113 (3%); 7: 83 (2%); 8: 49 (1%); 9: 21 (1%); 10: 17 (0%); and 11: 32 (1%).



**Table 4** Spearman correlation of factors with behavioral correlations

	Female	Age	Bet	Bet Internet	Bet Norwegian races	Win	Number of playing days	Number of Tickets	Bet Conscious play	Monthly limit	F1	F2	F3	F4
Female	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Age	<b>-0.16</b>	<b>1.00</b>	-	-	-	-	-	-	-	-	-	-	-	-
Bet	<b>-0.25</b>	<b>0.20</b>	<b>1.00</b>	-	-	-	-	-	-	-	-	-	-	-
Bet internet	<b>-0.25</b>	<b>0.19</b>	<b>0.98</b>	<b>1.00</b>	-	-	-	-	-	-	-	-	-	-
Bet Norwegian races	<b>-0.23</b>	<b>0.20</b>	<b>0.94</b>	<b>0.91</b>	<b>1.00</b>	-	-	-	-	-	-	-	-	-
Win	<b>-0.20</b>	<b>0.16</b>	<b>0.83</b>	<b>0.81</b>	<b>0.79</b>	<b>1.00</b>	-	-	-	-	-	-	-	-
Number of playing days	<b>-0.20</b>	<b>0.22</b>	<b>0.90</b>	<b>0.88</b>	<b>0.87</b>	<b>0.79</b>	<b>1.00</b>	-	-	-	-	-	-	-
Number of tickets	<b>-0.21</b>	<b>0.21</b>	<b>0.92</b>	<b>0.89</b>	<b>0.88</b>	<b>0.80</b>	<b>0.97</b>	<b>1.00</b>	-	-	-	-	-	-
Bet conscious play	<b>-0.27</b>	<b>0.14</b>	<b>0.77</b>	<b>0.75</b>	<b>0.76</b>	<b>0.67</b>	<b>0.70</b>	<b>0.75</b>	<b>1.00</b>	-	-	-	-	-
Monthly limit	<b>-0.23</b>	<b>-0.02</b>	<b>0.41</b>	<b>0.39</b>	<b>0.40</b>	<b>0.38</b>	<b>0.30</b>	<b>0.33</b>	<b>0.44</b>	<b>1.00</b>	-	-	-	-
F1 (recreation)/- coping)	<b>-0.13</b>	<b>0.04</b>	<b>0.12</b>	<b>0.12</b>	<b>0.12</b>	<b>0.14</b>	<b>0.14</b>	<b>0.15</b>	<b>0.15</b>	<b>0.14</b>	<b>1.00</b>	-	-	-
F2 (enhancement)	<b>-0.07</b>	<b>-0.06</b>	<b>0.21</b>	<b>0.20</b>	<b>0.21</b>	<b>0.19</b>	<b>0.18</b>	<b>0.20</b>	<b>0.25</b>	<b>0.19</b>	<b>-0.06</b>	<b>1.00</b>	-	-
F3 (social)	<b>-0.04</b>	<b>-0.14</b>	<b>0.11</b>	<b>0.09</b>	<b>0.13</b>	<b>0.10</b>	<b>0.06</b>	<b>0.08</b>	<b>0.17</b>	<b>0.20</b>	<b>0.08</b>	<b>-0.05</b>	<b>1.00</b>	-
F4 (money)	<b>0.10</b>	<b>-0.20</b>	<b>-0.07</b>	<b>-0.07</b>	<b>-0.08</b>	<b>-0.06</b>	<b>-0.06</b>	<b>-0.07</b>	<b>-0.11</b>	<b>-0.03</b>	<b>0.01</b>	<b>0.06</b>	<b>-0.01</b>	<b>1.00</b>

Significant correlations are marked in bold ( $p < .01$ )

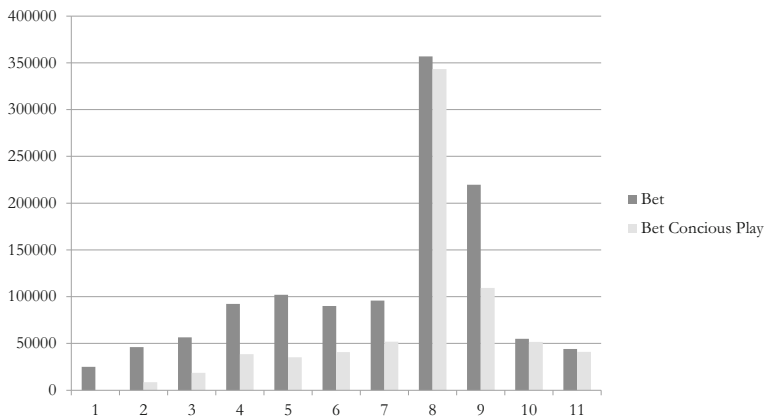
**Table 5** Linear model in response to “My gambling is a problem sometimes” as a dependent variable and demographic, behavioral, and latent factors as independent variables

	Estimate	Std. Error	<i>t</i> test	<i>p</i> -value significance
(Intercept)	-0.61	3.29E-01	-1.839	0.066
Female	-0.13	7.03E-02	-1.875	0.061
Age	-0.01	2.43E-03	-6.061	< 0.001*
Bet	-0.09	3.75E-02	-2.406	0.016
Bet Internet	-0.01	2.48E-02	-0.331	0.741
Bet Norwegian races	-0.00	1.21E-02	-0.3	0.765
Win	0.00	2.01E-08	0.58	0.562
Number of playing days	0.00	9.27E-02	0.048	0.962
Number of tickets	0.22	6.38E-02	3.498	< 0.001*
Bet conscious play	0.03	7.51E-03	3.609	< 0.001*
Monthly limit	0.10	2.19E-02	4.608	< 0.001*
F1 (recreation/coping)	1.83	7.54E-02	24.239	< 0.001*
F2 (enhancement)	-0.02	1.13E-01	-0.208	0.835
F3 (social)	0.07	3.54E-02	1.851	0.114
F4 (money)	0.31	3.87E-02	8.056	< 0.001*

Table 5 reports the results of a multivariate linear regression between Item 16 which asked players whether they thought that their gambling was a problem sometimes and a number of independent variables. The independent variables comprised gender, age, gambling behavior (e.g., amount bet, amount won, number of playing days), as well as the four latent motivation factors extracted above. The variables assessing gambling behavior were highly skewed and were thus log-transformed. This was done for everything except for the amount won, because this variable can be negative as well as positive and the logarithm is not defined for negative values. The Wilk-Shapiro test for normal distribution was computed: amount of money bet ( $W = 0.77$ ,  $p < 0.001$ ), amount of money bet online ( $W = 0.77$ ,  $p < 0.001$ ), amount of money bet on Norwegian horseraces ( $W = 0.68$ ,  $p < 0.001$ ), number of playing days ( $W = 0.94$ ,  $p < 0.001$ ), number of bets made ( $W = 0.89$ ,  $p < 0.001$ ), amount of money bet consciously ( $W = 0.75$ ,  $p < 0.001$ ), and monthly loss limit ( $W = 0.93$ ,  $p < 0.001$ ). The Wilk-Shapiro test was also significant for the extracted factors which were subsequently also log-transformed (F1 ( $W = 0.87$ ,  $p < 0.001$ ), F2 ( $W = 0.88$ ,  $p < 0.001$ ), F3 ( $W = 0.97$ ,  $p < 0.001$ ), and F4 ( $W = 0.99$ ,  $p < 0.001$ )).

Age was significant and negatively correlated with self-reported gambling problems. The number of bets made, the amount of money consciously bet, and the monthly loss limit were significant and positively correlated with self-reported gambling problems. Furthermore, latent factors F1 and F4 were positively correlated with self-reported gambling problems. The  $R^2$  was 25% meaning that 75% of the variance concerning gambling problems was not explained by actual gambling behavior or the reasons for gambling.

Based on the results of the multivariate model, the correlation between gambling problems and monetary gambling intensity was investigated. Figure 2 shows the distribution of the amount of money bet and the amount of money bet consciously for the 11 responses to the item “My gambling is a problem sometimes.” The median bet was highest in categories 8 and 9 and decreases in categories 10 and 11. Less than 4% of players selected category 8 and above.



**Fig. 2** Median amount of money bet and median amount of money bet consciously for the 11 responses to the item “My gambling is a problem sometimes”

## Discussion

The response patterns to the 13 gambling motivation statements on an 11-point Likert scale (Table 1) show that the agreement to the statements “I play because of the chance of winning big prizes,” “I play because it is exciting,” “I play because it’s fun,” and “I play because of the achievement when I win” were the most endorsed motivations. Gambling because it is fun and because there is the chance of winning big money also had high agreement in the study by Canale et al. (2015) who also used the Reasons for Gambling Questionnaire (RGQ) among a nationally representative sample of British gamblers. Unsurprisingly, winning money has also frequently been reported among the primary reasons for gambling (e.g., Hodgins 2008). The agreement to the statements “To impress other people,” “I play to pass some time,” “Because it helps me when I am feeling tense,” “I play to compete with others,” and “I play to relax” were the least endorsed reasons for gambling on the 11-point scale among the studied Norwegian horse bettors. The latter five statements also had the lowest endorsement by gamblers in Canale et al.’s (2015) validation study.

Based on previous research (i.e., Canale et al. 2015; Wardle et al. 2011), the present authors assumed five factors underlay the responses to the 13 gambling motive statements (i.e., money, enhancement, recreation, social, and coping). However, a confirmatory factor analysis (CFA) did not support this which led the authors to conduct an exploratory factor analysis (EFA). A scree test (Yong and Pearce 2013; Kaiser 1960) in which the principal component’s eigenvalues were plotted supported a four-factor solution which was subsequently extracted via a varimax rotation. A varimax rotation tries to identify factors which load on specific items. Factor 1 loaded high on items assessing recreation and coping. This meant in this particular sample of Norwegian horserace bettors that these two reasons to gamble were correlated and not differentiated as found in previous studies. In the present study, horserace bettors who said they gambled for recreational reasons also appeared to play for largely coping reasons. The second factor loaded highly on all (bar one) items assessing enhancement and on one item assessing recreation. However, it could be argued that the latter recreational item (i.e., “I play because it’s fun”) is closely related to enhancement and explains the importance of this item as an additional enhancement factor. The third factor loaded high on the social motivation to gamble items. The fourth factor loaded high on the two items assessing monetary motives to gamble and one item assessing enhancement. The latter enhancement item

(i.e., “I play because of the achievement when I win”) is also related to winning money which likely explains why it also loaded on money motives to gamble.

Based on the eigenvalues of the factors identified, recreation/coping motives explained the highest percentage of variance followed by enhancement motives, social motives, and money motives. The largest difference with respect to Canale et al.’s (2015) validation study lays in the interdependence of recreational and coping motives which were differentiated in Canale et al.’s study. The two money motive statements “I play because of the chance of winning big prizes” and “I play to make money” had low communalities (i.e., they did not possess much explanatory power in the four-factor EFA—see “H2” in Table 3). The communality statistic reports the explanatory power of a variable in factor analysis. It is the sum of the squared factor loadings for one variable. The low explanatory power of the two money motive statements can be explained by the low correlation between those two motives. Players who agree with the first motive statement do not necessarily agree with the second motive statement. The two statements “I play to compete with others” and “To impress other people” also had low communalities. These latter two statements had little agreement among the horserace bettors.

Additionally, there was a negative correlation between age and money motives as well as social motives which meant that younger players scored higher on the money motivation factor and social factor compared to older players. This is in line with Canale et al.’s (2015) conclusion that the prospect of winning money represents a more important determinant of motivation in younger (rather than in older) gamblers. Recreation/coping and enhancement were not meaningfully correlated with age. According to the correlation matrix in Table 4, females scored lower on the factor recreation/coping motive but higher on the money factor motive. Enhancement motives and social motives were not meaningfully correlated with gender.

Players were also asked to rate the statement “My gambling is a problem sometimes” on an 11-point Likert scale. The majority of players (85%) chose a score of three or less on the scale. Previous research utilizing self-report data has found that coping motives predict gambling severity (Schellenberg et al. 2016; Sundqvist et al. 2016). This is in line with the multivariate regression model in the present study which predicted gambling problems alongside demographic information, gambling behavior, and the latent motivation factors as independent variables. The recreation/coping motive factor and money motive factor contributed significantly to the statement “My gambling is a problem sometimes.” Clarke (2004) reported that tension release, which is related to the recreation/coping motive factor, uniquely predicted scores on the revised version of the South Oaks Gambling Screen. Nower and Blaszczynski (2010) also found that Australian problem gamblers were more likely than non-problem gamblers to play EGMs to earn income or escape their problems rather than for fun and enjoyment. This has also been reported by Griffiths in a series of studies among British adolescent slot machine gamblers (summarized in Griffiths [1995]). Social motives and enhancement motives did not contribute significantly to the statement “My gambling is a problem sometimes.” Shinaprayoon et al.’s (2017) study examined gambling motivation among 525 US psychology students and reported six latent motives extracted from a questionnaire (intellectual challenge, excitement, socialization, social, monetary, and motivation). Excitement and socialization motives displayed the highest correlation with problem gambling. This is in contrast to the present study’s findings and is most likely explained by the very different samples (i.e., psychology students vs. confirmed horserace bettors).

The number of playing days, number of bets, and the amount of money consciously bet were also significant predictors of self-reported gambling problems. However, Fig. 2 shows that the horserace bettors who scored highly on the 11-point Likert scale (i.e., 10 or 11) gambled very little and it was horserace bettors who selected 8 and 9 (out of 11) bet the most money. Auer and Griffiths (2017)

compared self-reported gambling intensity survey data with actual gambling intensity using player account data and found that (on average) players underestimated their losses and overestimated their wins. The bias between actual behavior and estimated behavior was positively correlated with gambling intensity. Therefore, it could be the case that horserace bettors are not aware of their losses which lowers the reliability of the self-reported problem gambling statement. However, it should also be noted that gambling behavior and the motivation factors only explained 25% of the variance which means that 75% of the variance remains unexplained. This supports Griffiths' (2009; Griffiths and Whitty 2010) argument that player tracking data alone cannot predict problem gambling using current screening criteria, because most problem gambling criteria that define problem gambling assess the consequences of problem gambling (e.g., modifying mood via gambling, lying about gambling, committing illegal acts to finance gambling, compromising education/occupation due to gambling, etc.) and not the gambling behavior itself. It is also an important finding with respect to studies which entirely rely on self-reported data concerning problem gambling.

Another reason for the unexpected pattern in Fig. 2 could be that players who reported having a gambling problem might in fact play more types of games on other platforms. *Rikstoto's* product portfolio is restricted to horse race betting, and for that reason, the data do not deliver a full picture of the totality of an individual's actual gambling behavior. This hypothesis is supported by empirical research showing that problematic players tend to play different types of games compared to non-problematic players (Braverman et al. 2013). However, this limitation applies to all studies which rely on behavioral tracking data from a single gambling platform because the data will never deliver a full picture of an individual's gambling behavior.

The strengths of the present study are the use of objective gambling behavior with a relatively large sample size alongside the mixture of subjective and objective data rather than just one type. Also, tracking data from a single type of gambler (i.e., horserace bettors) has never previously been examined using player account data in any previously published study. Despite these strengths, there are some limitations that should be noted when interpreting the findings. The data were collected from one gambling operator only (so may not have the totality of a player's gambling behavior because gamblers are not necessarily loyal to one operator) and from one type of gambling only (i.e., horserace gambling) although the latter limitation was deliberate because this group of gamblers has been relatively under-researched from a psychological perspective. Another limitation is that problem gambling was not examined using any validated psychometric instrument and was based on a single self-report item. Furthermore, some of the data were self-report and are therefore subject to well-known method biases which may have influenced the results. However, few of the questions asked relied on memory recall, and socially desirable answers are likely only to have had an influence on those items associated with problem gambling.

Despite these limitations, the present investigation is the first real-world study to examine (i) horse bettors' actual gambling behavior using player account data such as amount of money bet, amount of money won, number of playing days, and number of bets; (ii) motivations to gamble combining self-report data with data from a real-world setting, and (iii) correlations between self-reported information about gambling problems with actual gambling behavior and self-reported motivation to play. Consequently, the findings are of high existential value to the gambling studies field and also suggest innovative methodological ways of combining different types of data that could be used in future studies examining different types of gambler as well as trying to replicate and confirm the findings reported here.

## Compliance with Ethical Standards

**Funding Information** This study was funded by *Rikstoto* awarded to the first author's company (*neccoton*). The second author was subcontracted by *neccoton*. The second author's university currently receives funding from *Norsk Tipping* (the gambling operator owned by the Norwegian Government) for gambling-related research. The second author has received funding for a number of research projects in the area of gambling education for young people, social responsibility in gambling, and gambling treatment from Gamble Aware (formerly the Responsibility in Gambling Trust), a charitable body which funds its research program based on donations from the gambling industry. Both authors undertake consultancy for various gaming companies in the area of social responsibility in gambling.

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

**Informed Consent** Informed consent was obtained from all participants.

## Appendix

**Table 6** Reasons For Gambling Questionnaire items and "Readiness to change" items

Item number	Item	Category
1	I play because of the chance of winning big prizes	Reason to play
2	I play to make money	
3	I play because of the thrill	
4	I play because it is exciting	
5	I play to compete with others	
6	I play because of the achievement when I win	
7	I play to pass some time	
8	I play to relax	
9	I play because it's fun	
10	I play because it is something I do with my friends or family	Readiness to change
11	I play to be sociable	
12	Because it helps me when I am feeling tense	
13	To impress other people	
14	There is no need for me to think about changing my gambling	
15	Sometimes I think I should cut down on my gambling	
16	My gambling is a problem sometimes	
17	I am actually changing my gambling habits right now	
18	I have just recently changed my gambling habits	

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