**Auer, M., Hopfgartner, N. & Griffiths, M.D. (2020). The effects of voluntary deposit limit-setting on long-term online gambling behavior. *Cyberpsychology, Behavior and Social Networking*, DOI: 10.1089/cyber.2019.0202**

## Abstract

Online gambling has become increasingly popular but for a small minority of players can be problematic (approximately 5%). Many socially responsible online gambling operators have introduced responsible gambling tools to help their players stay in control of their gambling such as monetary limit-setting (in which gamblers predetermine the amount of money they want to spend per day/week/month on gambling). Despite the widespread introduction of such tools, few studies have evaluated their efficacy. The present study comprised an anomymized dataset of 49,560 players who had placed at least one wager with the online gambling operator *Kindred*. The primary aim of the study was to examine whether the setting of voluntary monetary limits (independent variable) had any effect on online gambling expenditure over a one-year period (dependent variable). The secondary aim was to examine whether there were any differences in gambling expenditure by gender, age, or gambling intensity ('gambling intensity' was simply operationalized as the total amount of money wagered during a three-month period). Results demonstrated there were no differences with regard to age and gender but that among the most gambling-intense players, those who had voluntarily set limits gambled significantly less money a year later compared to those who had not. Given that those individuals with the highest gambling intensity are more likely to comprise problem gamblers, limit-setting appears to be an effective responsible gambling tool because the top 10% of most gambling intense individuals in the present study significantly reduced their gambling expenditure over a one-year period.

**Keywords:** online gambling; internet gambling; responsible gambling; problem gambling; behavioral tracking; limit-setting

## Introduction

Online gambling has become increasingly popular since its inception in the mid-1990s. Due to increasing legalization in many countries, it has been estimated that the market will grow to $279.8 billion by 2023[1]. Generally, the types of games offered on online gambling websites are similar to those offered in offline (i.e., land-based) gambling operators. Like individuals who engage in offline gambling, a small minority of online gamblers can also develop problematic behavior (approximately 5% are problem gamblers endorsing three or more of the DSM-IV criteria for pathological gambling[2]) based on findings using nationally representative samples[3-5]. Problem gambling can lead to a variety of consequences that can compromise relationships, disrupt education/occupation (depending upon age), affect mental health, and/or lead to criminal activity to fund the activity[6].

Consequently, many socially responsible gambling operators now offer their clientele a variety of responsible gambling tools[7] to help players keep in control of the amount of time and money they spend online, and include such tools as limit setting (allowing gamblers to predetermine the amount of time and/or money they want to spend in a given time period [day/week/month]), self-exclusions (allowing gamblers to exclude themselves from gambling on the website for predetermined amounts of time), pop-up messaging (providing in-play information as to how much time and/or money gamblers have spent in-session), and personalized messaging (providing information to gamblers about various aspects of their gambling behavior and/or recommendations about what they can do to stay in control)[7,8].

One of the most popular types of responsible gambling tools is limit setting[7,8]. A recent study carried out among 50 of the world's most popular online gambling sites found that the majority of them (90%) offered players voluntary limit-setting tools[9]. Despite the widespread use of limit-setting tools among popular gambling websites, very little research has examined their effectiveness. In a study of 5000 online players (taken from a random sample of 100,000 players) at *win2day*, Auer and Griffiths[10] reported that limit-setting was an effective responsible gambling tool and that limit-setting helped the most gambling-intense players. More specifically they reported that the voluntary setting of monetary spending limits helped casino and lottery players the most whereas the voluntart setting of time spending limits helped poker players the most. In a more recent study, Auer, Hopfgartner and Griffiths[8] reported that information sent to Norwegian gamblers via a smartphone text message or email

notifying them that they had spent 80% of their monthly spending limits significantly decreased monetary gambling intensity in consecutive months.

*The present study*

Given the lack of research on limit-setting efficacy among online gamblers, the primary goal of the present study was to examine the effects of voluntary limit-setting on long-term behavioural change in relation to monetary gambling expenditure based on real world data. Very few studies have investigated the effects of limit-setting with real world gamblers[7] and the majority of previous studies were laboratory based[11]. The present study's population was from a private European online gambling operator which has a broad customer base in seven countries. Players do not have to set limits if they do not want to and players are not restricted by the amount of money and time they can spend gambling. The primary aim of the study was to examine whether the setting of voluntary monetary limits (independent variable) had any effect on online gambling expenditure over a one-year period (dependent variable). The secondary aim was to examine whether there were any differences in gambling expenditure by gender, age, or gambling intensity ('gambling intensity' was simply operationalized as the total amount of money wagered during a three-month period – further details in the 'Method' section). The authors did not have access to any data regarding perceived consequences of gambling or any data concerning problem gambling status. Consequently, the present study simply focused on change in gambling expenditure over time as a consequence of voluntary limit-setting.

## Method

*Paricipants and procedure:* The authors were given access to an anomymized dataset of 49,560 players (45,000 males [90.03%]; 4,560 females [9.07%] who had placed at least one wager between January and March 2017 with the online gambling operator *Kindred*. Furthermore, none of the selected players had a voluntary self-exclusion at any time between January an March 2017. The selected players also had to have placed at least one wager between January and March 2018 to be included for analysis. The average age of the players was 33 years (SD=12 years). The dataset comprised a representative sample of the total player population of *Kindred* from seven different countries (i.e., Belgium, Denmark, Netherlands, Norway, Romania, Sweden, United Kingdom). *Kindred* offers a variety of online games including sports betting, bingo, slots, table games, live casino, and other games (e.g., keno, scratchcards, videogame-type games). In addition to information about the number of

bets/gambles made by each individual and their wins/losses, the authors were also given information about each individual's voluntary desposit limit-setting behaviour. *Kindred* provide the option for players to voluntarily set daily, weekly, and monthly deposit limits and can be changed at any time. Deposit limit decreases are effective immediately whereas deposit limit increases are implemented after seven days. Gambling intensity was assessed using the total amount of money wagered in a three-month period between January and March 2017 as well as between January and March 2018, In order to evaluate the effect of the limit-setting, players were split into ten almost equally sized groups according to the deciles of the total amount bet between January and March 2017 (Group 1 being the lowest spending group and Group 10 being the highest spending group – see Table 1). Each of the ten groups comprised of approximately 4,956 players.

*Statistical analysis:* Mann Whitney U-Tests and Z-tests were used to compare group differences (reported in the last two columns of Table 1 for each of the ten groups) because the amounts wagered were not normally distributed. The normal distribution of the money wagered was tested with a Shapiro-Wilk normality test which demonstrated a significant deviation from the normal distribution ($W=0.0825$, $p<0.001$). Given the many statistical tests that were carried out, the significance level was set at 1% (i.e., $p<.01$). For descriptive statistics, the median was chosen rather than the arithmetic mean. This is because of the skewed distribution of the total amount of money wagered (i.e., a few very high spending gamblers can seriously distort the results when using mean expenditure values).

*Ethics:* The present study was given ethical approval by the research team's university Ethics Committee.

## Results

*Gambling behavior*

On average, the 49,560 players played on 20 different days between January to March 2017 (SD=21). Half of the players (50%) bet more than €300 in the same time period and 25% of the players bet more than €1,700. Given an estimated 5% overall house advantage, it can be estimated that the two latter reported values represent a theoretical loss of €15 and €85 (theoretical loss is a measure of 'gambling intensity' and is calculated by multiplying the amount of money wagered with the house advantage[12,13].

Table 1

*Effects of limit-setting (age and gender)*

Out of the 49,560 players, 649 players (1.31%) set a voluntary monetary limit for the first time between January and March 2017. Out of the 4,956 players in Group 1, nine players (0.2%) set a voluntary monetary limit between January and March 2017. Out of the 4,956 in Group 10, 144 players (2.9%) set a voluntary monetary limit between January and March 2017. The median amount of money wagered in Group 1 was €8.20 among the players who did not choose a limit (range: €0-€16) and €6.30 among the players who did (range: €0-€15). The median bet in Group 10 was €21,963 among the players who did not choose a limit (range: €8,531-€585,943) and €22,179 among the players who did (range: €8,656-€283,005). Assuming a house advantage of 5%, 50% of players in Group 10 lost less than (approximately) €1,000 in a three-month period. There were no significant differences between the players who chose a deposit limit and players who did not with respect to the amount of money wagered in any of the ten groups. Table 2 reports age and gender for each of the ten gambling intensity groups. For each group a Mann-Whitney U-Test and a Z-Test were computed. None of the groups showed significant differences with respect to age and gender.

*Effects of limit-setting over time*

Table 3 reports the median amount wagered between January and March 2017 and between January and March 2018 for the players who chose a deposit limit and players who did not between January and March 2017. For each player, the ratio of the amount wagered in the first three months in 2017 and in the first three months in 2018 was then computed. A ratio of '1' means that the gambling intensity stayed the same. A ratio smaller than '1' means that the gambling intensity decreased, and a ratio greater than '1' means that the gambling intensity increased. The reliability of the ratio reported in Table 3 depends on the number of players who chose limits in each group as reported in Table 2. Out of 4,596 players, only nine players in Group 1 and six players in Group 2 chose a limit. Table 3 also shows that the median wager in Group 3 increased 2.4-fold from €66 to €159 for players who choose a deposit limit. The median wager in Group 3 increased 1.1-fold from €59 to €66 for players who did not choose a deposit limit. The ratios were then compared using a Mann-Whitney U-Test between the players who had chosen a deposit limit and those who did not for each gambling intensity group. In Groups 5, 8, 9 and 10, players who chose a deposit limit decreased the amount of

money they wagered more than players who did not choose a deposit limit. However, the difference was only statistically significant in Groups 8 and 10.

Tables 2 and 3

**Discussion**

The goal of the present study was to investigate the effects of voluntary limit-setting on long-term online gambling expenditure. Results demonstrated there were no differences with regard to age and gender but that among the most gambling-intense players, those who had voluntarily set limits gambled significantly less money a year later compared to those who had not. In order to study the consequences of voluntary deposit limit-setting on monetary gambling intensity one year later, the present study classified all the active players into groups with equal gambling intensity. The 10% most gambling-intense players lost approximately €1000 in a three-month period. The authors chose to use the median amount wagered rather than the mean as well as non-parametric tests because the wagered amounts were not normally distributed. Gambling intensity slightly increases with age and this is to be expected as the older an individual gets, the more income that they typically have. The 10% most gambling-intense players were (on mean average) 37 years old and the 10% least gambling-intense players were 33 years old. In a previous study, out of a total 49,560 players, Nelson and colleagues[14] reported that out of 47,134 players who subscribed to the *bwin.com* gambling website in February 2005, 567 players (1.2%) utilized a voluntary deposit-limit feature. The present study also found a similar proportion of players who set voluntary money spending limits (i.e., 1.3% in total; 0.2% among the least gambling intense players and 2.9% among the most gambling intense players).

In total, 9.07% of players were female. The overall low percentage of females is in line with previous research findings that males are more likely to engage in gambling than females (see Calado and Griffiths[15] for a review of gambling prevalence rates worldwide). There was no clear pattern regarding the relationship between gender and gambling intensity. In each of the ten equally sized groups, players who had not set a voluntary deposit limit were not significantly different from players who had with respect to amount wagered, age, or gender. This supports the chosen methodology and allowed for a comparison of players who chose a deposit limit to players who did not regarding their change in play over time in each of the ten gambling intensity groups.

In each of the ten groups, the median wager between January and March 2017 was compared to the median wager between January and March 2018. The ratio for players who did not choose a limit was larger than '1' in the first three groups and smaller than '1' in Groups 4 to 10. This means that using the median average, low-spending players tend to wager more money a year later, and higher spending players tend to wager less money one year later. This a typical example of the regression towards the mean, where subsequent observations are less extreme than previous ones[16]. However, less than 1% of the players chose a desposit limit in the first five gambling intensity groups (Table 2) where players lose very little. Given a house-advantage of 5%, the median wager of €231.1 in Group 5 for players who chose a deposit limit represents a loss of €11.

It should be noted that there is a difference between players who place just one bet and those who place hundreds. This is why players were classified into one of ten similar groups according to the amount wagered. This is also the reason the study examined differences in gambling intensity. One of the secondary aims was to examine whether limit-setting was more effective the more individuals gambled. The most gambling intense group is the group most likely to include problem gamblers. Therefore, it is this group of players that gambling operators want to stay in control of their gambling. The present study found that among the 10% most intense gamblers, there was a significant decrease in the amount of money they spent over the one-year period.

Based on the results of a previous limit-setting study by Auer and Griffiths[10], no differences were expected among the lower gambling intensity groups. The found that limit-setting was most effective among the 10% highest intensity gamblers. This was perceived by the authors to be the best result for both the player and the operator because it was the highest intensity group that most needs to keep their gambling under control (due to the fact that this group was the most likely to contain problem gamblers). The findings of the present study are highly similar and from a responsible gambling perspective are arguably the most important. This is because the group that needs most protection are the high intensity gamblers. Results showed that the three highest gambling intensity groups (8, 9 and 10) who voluntarily chose a monetary limit decreased the amount of money they wagered more than players who did not choose a deposit limit (but was only statistically significant in Groups 8 and 10). Again, based on the findings of Auer and Griffiths' study[10], significant differences were only expected

among the most gambling intense groups because low intensity gamblers rarely reach their voluntarily limits and typically spend so little that they do not need to set limits.

More specifically, players in two of the ten gambling intensity groups (Groups 8 and 10) who chose a voluntary deposit limit decreased their monetary gambling intensity significantly more compared to players who did not choose a deposit limit. Assuming a house-advantage of 5%, the 10% most intense players who chose limits in the first three months of 2018 lost approximately €400 between January and March 2018 (compared to €1,108 in January and March 2017). The reduction in gambling intensity among the most intense players who chose a deposit-limit is in line with the study by Auer and Griffiths[10] who found that that the most gambling intense players who set a deposit limit significantly reduced their time and money spent gambling 30 days later. However, the study by Auer and Griffiths was conducted at an online gambling website at which players maximum deposit amount was limited to €800 per week and each player had to choose a loss limit at registration. The present study's players did not have to choose a limit and players were not limited with respect to the maximum amount they could wager. Overall, the results of the present study underlines the effectiveness of voluntary limit-setting among players who have a very high gambling intensity.

There are a number of implications that arise from the results of the present study. If voluntary limit-setting is to be classed as being effective, it should prevent overspending among the most gambling-intense players. The present study demonstrated that the amount of money spent gambling by the most gambling-intense players significantly decreased over a one-year period. This suggests that limit-setting is a good responsible gambling tool for online gambling operators to include in their portfolio of responsible gambling tools to help gambling-intense players keep better control of their gambling expenditure. The finding in the present study also complements the findings of another recent study of over 175,000 online gamblers (also using data provided by *Kindred*) that players who voluntarily set spending limits for gambling are more loyal to the company one year later (i.e., gamblers who voluntarily set their own spending limits are more likely to generate repeat custom)[17]. Taken together, the findings of the two studies suggest that gambling operators can simultaneously help the most gambling-intensive players to keep control of their expenditure and retain more of them as repeat long-term customers. Findings from the present study also suggested that voluntary limit setting does not appear to be necessary for players in the five lowest intensity groups because they lost very little money overall and there were no significant differences

between gamblers who had set a limit and those who did not. It may be that these players are responsible gamblers to begin with and have little use of limit-setting features. However, it may also be the case that low intensity gamblers simply have less money to spend on gambling than the high intensity gamblers and/or that the low intensity gamblers may be gambling more on other gambling websites than the high intensity gamblers.

The present study is not without its limitations. The present study was conducted with players from one gambling operator with players from seven countries countries. However, gaming operators often have specific responsible gambling policies that are specified (at least in part) by regulators of particular jurisdictions. The authors also focused on a specific time period for which the data were provided. All these factors somewhat limit the external validity as well as the reliability of the results in terms of generalizability to other gambling websites with other countries' populations. Only 1.3% of the players in the present study actually set a voluntary limit which means the findings should be treated with some caution. It should also be noted that among the 10% least gambling intense players only 0.2% set a voluntary monetary whereas among the 10% most gambling intense players 2.9% set a voluntary monetary. The likelihood of setting a limit might be increased by the higher frequency of visits to the online gambling site. Regardless of the reasons for the difference, it appears that intense players are more likely to have a set voluntary deposit limit and this might have influenced the findings. The most significant problem concerning voluntary responsible gambling tools is the impossibility of an experimental approach. Players who choose to set deposit limits might be different from other players who do not set such limits. This means that operators might not be able to persuade players to choose limits if they do not want to do so. Future studies should combine actual gambling behaviour with self-reported data in order to shed more light into the cognitive aspects of voluntary limit-setting.

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Table 1. Median amount of money wagered between January and March 2017 for ten equally sized gambling intensity groups split into players who set a deposit limit and those who did not

| Group | N | N with limit | % with limit | Median wager of non-limit setting players (€) | Range wager of non-limit setting players (€) | Median wager of limit-setting players (€) | Range wager of limit-setting players (€) | Mann-Whitney U-test | *p*-value |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4,956 | 9 | 0.2% | 8.2 | 0-16 | 6.3 | 0-15 | 17,370.0 | 0.3 |
| 2 | 4,956 | 6 | 0.1% | 26.1 | 16-41 | 25.0 | 19- 37 | 14,699.0 | 1.0 |
| 3 | 4,956 | 20 | 0.4% | 59.0 | 41-85 | 65.8 | 42-83 | 59,315.0 | 0.1 |
| 4 | 4,956 | 24 | 0.5% | 117.2 | 85-160 | 125.0 | 86-159 | 62,031.5 | 0.7 |
| 5 | 4,957 | 40 | 0.8% | 217.8 | 160-295 | 231.1 | 163-291 | 114,093.0 | 0.1 |
| 6 | 4,955 | 68 | 1.4% | 405.6 | 295-558 | 418.0 | 298-549 | 173,356.5 | 0.5 |
| 7 | 4,956 | 72 | 1.5% | 782.0 | 558-1,128 | 742.2 | 564-1,120 | 168,976.0 | 0.6 |
| 8 | 4,956 | 97 | 2.0% | 1,697.8 | 1,128-2,674 | 1,741.9 | 1,134-2,643 | 233,253.5 | 0.9 |
| 9 | 4,956 | 169 | 3.4% | 4,505.5 | 2,674-8,530 | 4,555.5 | 2,735-8,531 | 416,846.0 | 0.5 |
| 10 | 4,956 | 144 | 2.9% | 21,963.2 | 8,531-585,943 | 22,179.1 | 8,656-283,005 | 329,473.0 | 0.3 |

Table 2. Age and gender and test statistics for players who set a deposit limit and those who did not in ten equally sized gambling intensity groups

| Group | Age with no limit setting | Age with limit setting | % male no limit setting | % male with limit setting | Mann-Whitney U-test age | *p*-value age | Z-test gender | *p*-value gender |
|---|---|---|---|---|---|---|---|---|
| 1 | 33 | 32 | 89% | 89% | 20,932 | 0.76 | 0.00 | 1.00 |
| 2 | 32 | 32 | 91% | 100% | 15,065 | 0.95 | 0.01 | 0.94 |
| 3 | 32 | 31 | 91% | 90% | 49,404 | 1.00 | 0.00 | 1.00 |
| 4 | 32 | 29 | 91% | 100% | 53,262 | 0.40 | 1.37 | 0.24 |
| 5 | 32 | 32 | 92% | 88% | 104,127 | 0.52 | 0.37 | 0.54 |
| 6 | 32 | 31 | 92% | 94% | 167,919 | 0.88 | 0.21 | 0.65 |
| 7 | 33 | 32 | 92% | 85% | 177,305 | 0.90 | 4.07 | 0.04* |
| 8 | 33 | 34 | 92% | 89% | 257,987 | 0.11 | 0.69 | 0.41 |
| 9 | 34 | 35 | 91% | 88% | 439,825 | 0.05 | 2.22 | 0.14 |
| 10 | 37 | 37 | 87% | 89% | 341,570 | 0.77 | 0.21 | 0.65 |

Table 3. Change in wager between 2017 and 2018 for players who chose a deposit limit and those who did not among ten gambling intensity groups

| Group | Median wager 2017 players setting limit | Median wager 2018 players setting limit | Wager ratio players setting limit | Median wager 2017 players not setting limit | Median wager 2018 players not setting limit | Wager ratio players not setting limit | Mann Whitney U-Test wager ratio | *p*-value |
|---|---|---|---|---|---|---|---|---|
| 1 | 6 | 1,074 | 170.5 | 8 | 26 | 3.2 | 37,640 | 1.0 |
| 2 | 25 | 359 | 14.4 | 26 | 44 | 1.7 | 21,912 | 1.0 |
| 3 | 66 | 159 | 2.4 | 59 | 66 | 1.1 | 58,970 | 0.9 |
| 4 | 125 | 334 | 2.7 | 117 | 99 | 0.8 | 76,874 | 1.0 |
| 5 | 231 | 89 | 0.4 | 218 | 149 | 0.7 | 90,223 | 0.2 |
| 6 | 418 | 348 | 0.8 | 406 | 247 | 0.6 | 185,299 | 0.9 |
| 7 | 742 | 561 | 0.8 | 782 | 444 | 0.6 | 190,025 | 0.9 |
| 8 | 1,742 | 509 | 0.3 | 1,698 | 901 | 0.5 | 203,940 | <0.001* |
| 9 | 4,556 | 1,538 | 0.3 | 4,505 | 2,102 | 0.5 | 392,381 | 0.3 |
| 10 | 22,179 | 8,042 | 0.4 | 21,963 | 10,986 | 0.5 | 315,467 | <0.001* |

(Note: Group 1 comprised only nine players, therefore the median was computed based on very few observations. With such a high median it appears that at least 4 or 5 players spent more than €1040 in 2018. With a bigger number of players, the values are simply more distributed and the medians are therefore lower).