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FULL-LENGTH REPORT

Effectiveness of a web-based self-help tool to reduce problem gambling: A randomized controlled trial

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ABSTRACT

Background and Aims: Problem gambling constitutes a public health concern associated with psychopathological comorbidity, substance use, and financial difficulties. Most individuals with gambling problems avoid counseling services due to perceived stigma and their preference for self-reliance. Treatment accessibility could be improved through web-based interventions. *Methods:* We recruited 360 individuals with gambling problems and randomized them to a web-based intervention (n = 185) or an active control group consisting of a self-help manual for problem gambling (n = 175). The primary outcome was the number of days of gambling in the last 30 days. Secondary outcomes included money spent in the last 30 days, time gambling in the last 7 days, gambling-related problems, consumption of alcohol and cigarettes, and psychopathological comorbidity measured at posttreatment and 6-month follow-up. *Results:* The primary outcome decreased significantly for both groups, with no significant difference between the groups. There were significant group × time interactions according to the Gambling Symptom Assessment Scale (F = 8.83, p <0 .001), the Problem Gambling Severity Index (F = 3.54, p = 0.030), for cigarettes smoked in the last 7 days (F = 26.68, p < 0.001), the Patient Health Questionnaire-9 (F = 19.41, p <0 .001), and the Generalized Anxiety Disorder-7 (F = 41.09, p <0 .001) favoring the intervention group. We experienced an overall high dropout rate (76%). *Conclusions:* Win Back Control seems to be an effective low-threshold treatment option for individuals with gambling problems that might otherwise be unapproachable for outpatient treatment services. Nevertheless, the high dropout rate should be considered when interpreting the study results, as they may have introduced a degree of variability.

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KEYWORDS

problem gambling, comorbidity, self-help tool, online, web, randomized controlled trial

INTRODUCTION

Problem gambling, defined as the urge to gamble despite harmful negative consequences (Jazaeri & Bin Habil, 2012), is a significant public health concern (Wardle, Reith, Langham, & Rogers, 2019) that has been causally linked to mental illnesses, substance use, and financial difficulties (Brewer, Potenza, & Desai, 2010). The past-year problem gambling prevalence estimates are between 0.12 and 5.8% worldwide and between 0.12 and 3.4% in Europe (Calado & Griffiths, 2016). The standardized average global prevalence estimate of problem gambling is around 2.3% (Williams, Volberg, & Stevens, 2012). Studies of prevalence are relevant to understanding the harm and assessing the extent of necessary treatment options. According to the literature, certain subpopulations are more likely to gamble problematically, i.e., males, younger age, lower educated, unemployed, and migrant populations (Allami et al., 2021; Eichenberger & Rihs-Middel, 2014; Kalke, Buth, Thon, & Wurst, 2018; Williams et al., 2012). The numerous and readily available gambling opportunities mean that avoiding gambling is difficult for people with gambling problems (LaBrie et al., 2007; St-Pierre, Walker, Derevensky, & Gupta, 2014; Thomas et al., 2009), and as gambling has migrated to the internet, it has become readily accessible via mobile devices (Abbott, 2020; Blaszczynski, Ladouceur, & Shaffer, 2004). Consequently, many people who problem gamble suffer from related economic, social, and health burdens (Browne et al., 2016; Calado & Griffiths, 2016; Tabri, Philander, Wood, & Wohl, 2021; Wardle et al., 2019).

Evidence suggests that less than 10% of individuals with gambling problems seek professional help (Carlbring, Degerman, Jonsson, & Andersson, 2012; Cunningham, 2005; Ladouceur, 2005; Slutske, 2006; Slutske, Blaszczynski, & Martin, 2009) or attend self-help groups, such as the Gamblers Anonymous (Slutske, 2006), with the majority seeking treatment only after a significant life crisis such as financial problems, negative consequences on marriages, families, and children, or humiliating events (Clarke, Abbott, DeSouza, & Bellringer, 2007). Barriers to seeking professional help are, among others: low accessibility, stigma, cost of services, uncertainty, and avoidance (Cunningham, Hodgins, Toneatto, & Cordingley, 2008; Rodda, Lubman, Dowling, Bough, & Jackson, 2013; Thomas et al., 2009). Another reason might be that gamblers prefer self-help strategies to avoid the shame and embarrassment of face-to-face treatments (Gainsbury, Hing, & Suhonen, 2014). Indeed, the dropout rate is high even when individuals access therapy (Melville, Casey, & Kavanagh, 2007).

From the large number of unreachable individuals with gambling problems and the substantial associated economic, social, and health burdens, it can be deduced that a continuum of evidence-based treatment and harm reduction strategies, i.e., intensive, brief, and self-help interventions (Cunningham, 2005) might be required to increase the reach of psychological interventions (Ledgerwood & Arfken, 2017). The low threshold use of the internet might enable the effectiveness of responsible gambling strategies, brief interventions, and treatment services (Van Der Maas et al., 2019). As using the internet is no longer a barrier for most people, it is purposeful to develop online problem gambling services to reach as many affected individuals as possible and support them to minimize and reduce gambling-related problems (Gainsbury & Blaszczynski, 2011). Results from randomized controlled trials (RCTs) have shown varying results (Boumparis et al., 2022; Bui et al., 2023; Sagoe et al., 2021), indicating that the evidence on the effects of internet-based support for gambling is promising but inconsistent.

It is noteworthy that the dropout rate of participants is high for both face-to-face therapy (Ladouceur, Gosselin, & Laberge, Myriam Blaszczynski, 2001) and internet-based therapy (Hodgins, Cunningham, Murray, & Hagopian, 2019; Melville, Casey, & Kavanagh, 2010; Rodda, 2021). Understanding differences in help-seeking behavior of individuals with gambling problems can assist in developing interventions to address gambling-related problems (Clarke et al., 2007). Once gamblers are motivated to seek professional help, many are willing to try a range of treatment services (Hing, Nuske, & Gainsbury, 2012).

Psychopathological comorbidity in individuals with gambling problems is known to be associated with increased gambling severity (Ford & Hakansson, 2020) and is suggested to affect access and adherence to treatment and may therefore influence the effectiveness of psychological interventions (Winters & Kushner, 2003). Moreover, different treatment strategies might be more suitable for problem gamblers with certain comorbid disorders as well as between online and offline gamblers, highlighting the need for tailored online interventions (Khazaal, Chatton, et al., 2017). Cognitive-behavioral therapies (CBT), including motivational interviewing, possess the most evidence for effectively treating gambling problems and comorbid conditions (Barak, Hen, Boniel-Nissim, & Shapira, 2008; Challet-Bouju, Bruneau, Victorri-Vigneau, & Grall-Bronnec, 2017; Gooding & Tarrier, 2009; Toneatto & Ladouceur, 2003).

However, the availability of publicly funded treatment options is still limited. Only a few institutions specialize in treating problem gambling and its psychopathological comorbidities (Håkansson, Karlsson, & Widinghoff, 2018). For these reasons, we propose that tailored online CBT interventions are needed (Khazaal, Monney, Richter, & Achab, 2017; Rodda, 2021) that could potentially be integrated in primary care settings as an essential step toward increasing access to treatment for gambling disorders (Achab et al., 2014). Thus, the objective of the present RCT was to evaluate the effectiveness of a web-based self-help tool to support individuals with gambling problems to reduce gambling, gambling-related problems, and potential comorbid symptoms.

METHODS

Trial registration: https://doi.org/10.1186/ISRCTN16339434.

Design

We evaluated a web-based self-help intervention (Win Back Control) through a two-arm RCT, comparing the effectiveness of Win Back Control and an active control group that consisted of an evidence-based self-help manual aimed at reducing problem gambling (Hodgins, Currie, Currie, & Fick, 2009; Hodgins, Currie, & El-Guebaly, 2001). After participants completed the baseline assessment, they were randomly allocated to one of the two study arms. Follow-up assessments were conducted at 8 weeks, and 6 months after baseline (Fig. 1). Due to the nature of the study design, blinding group allocation was not possible. The study was approved by the ethics committee of the canton of Zurich on 18. December, 2018 (BASEC 18 December 2018 (BASEC-Nr. 2018–01989) and registered with the ISRCTN registry (ISRCTN16339434). A detailed study protocol has been published elsewhere (Baumgartner et al., 2019).

Participants

We recruited participants from March 2019 until April 2021 via the Win Back Control website (winbackcontrol.ch). Advertisements were placed via Facebook and Google in relevant internet forums and newspapers for potential participants that were interested to reduce or stop gambling. All participants who completed the 6-month follow-up assessment received a voucher for 30 Swiss francs or the ability to donate that amount to charity. Inclusion criteria were: a) minimum age of 18 years, b) gambling activity at least once weekly over the last 30 days, c) a Problem Gambling Severity Index (PGSI) (Ferris & Wynne, 2001) score above

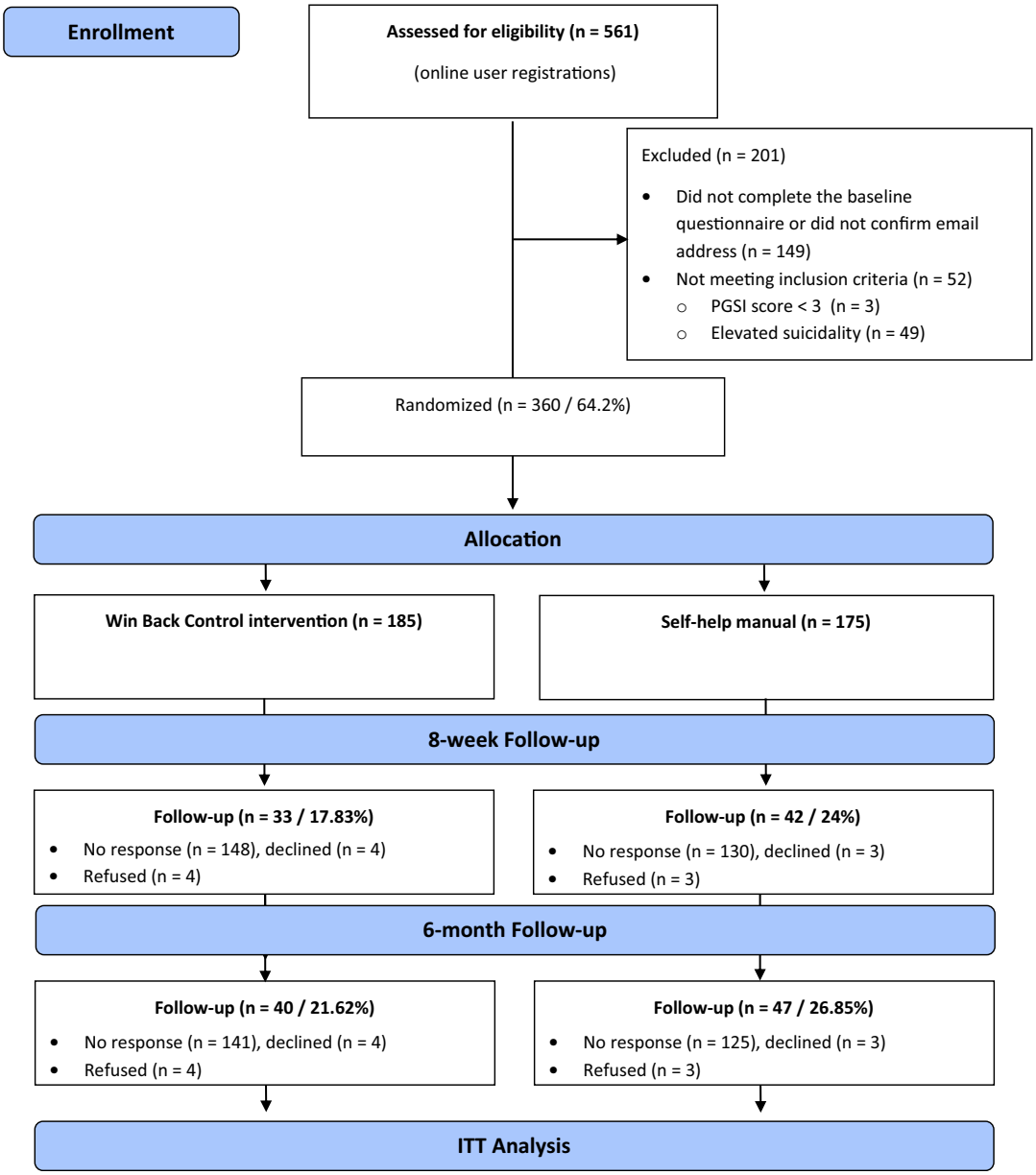

Fig. 1. Flowchart of the study

three, d) at least once weekly internet access, and a valid email address and e) proficiency in German or French. Participants were excluded if they fulfilled any of the following exclusion criteria: 1) self-reported engagement in other psychosocial treatments for problem gambling, 2) last 90-day psychosis or mania, 3) presence of a severe substance use disorder via the Drug Abuse Screening Test (DAST-10) (Bohn, Babor, & Kranzler, 1991) or the Alcohol Use Disorders Identification Test (AUDIT) (Saunders, Aasland, Babor, De la fuente, & Grant, 1993) (DAST score >5 and AUDIT score >20) or 4) elevated suicidality (scoring greater than 'minimal risk' on the P4 Suicidality Screener (Dube, Kroenke, Bair, Theobald, & Williams, 2010)).

Procedures

Participants could register online by providing their email address, phone number, and basic demographic information (age, gender, level of education, household income). Participants were randomized if deemed eligible according to the inclusion and exclusion criteria after providing informed consent.

Randomization

Participants were randomized to receive the Win Back Control intervention or the active control group. The allocation sequence was automatically generated via a computerized system using a 1:1 allocation ratio.

Win Back Control (Intervention)

Win Back Control is an automated web-based self-help tool for problem gambling developed by the Swiss Research Institute for Public Health and Addiction (ISGF, www.isgf.ch). The intervention contains a dashboard, a gambling diary, and nine modules that were designed to reduce gambling, relying on the principles of motivational interviewing (Rollnick & Miller, 1995), self-control practices, and CBT (Meichenbaum, 1977). The modules are based on previously developed web-based interventions for cannabis and alcohol use (Schaub et al., 2013, 2016) and the self-help manual 'Becoming a Winner' (Hodgins & Makarchuk, 2002). The core modules (1–5) are meant to be completed in their intended sequence, meaning that finishing a core module unlocks the subsequent one. The complementary modules address common comorbidities (e.g., substance use, anxiety disorders, and depression). Complimentary modules are shown and recommended based on the baseline evaluation. Additionally, participants are encouraged to repeat any module that is perceived as helpful. A detailed description of Win Back Control can be found in the published study protocol (Baumgartner et al., 2019).

Self-help manual (Control)

Participants in the active control group received a copy of the self-help manual 'Becoming a Winner: Defeating Problem Gambling' via our website and email. The manual was translated into German and French. The efficacy of this manual in reducing gambling-related outcomes has been previously documented (Hodgins et al., 2001, 2009).

Assessments

Primary outcome. The primary outcome of interest was the number of days of gambling over the last 30 days as assessed via the Timeline Follow-Back (TLFB) method (Robinson, Sobell, Sobell, & Leo, 2014).

Secondary outcomes. Secondary outcomes included money spent over the last 30 days and gambling time in the last 7 days and were assessed via the TLFB method. Gambling severity was assessed via the PGSI. Gambling symptoms were assessed via the Gambling Symptom Assessment Scale (G-SAS) (Suck Won Kim, Grant, Potenza, Blanco, & Hollander, 2009). Alcohol and cigarette use were assessed using the TLFB method (Robinson et al., 2014). Depressive symptoms were assessed via the Patient Health Questionnaire-9 (PHQ-9) (Kroenke, Spitzer, & Williams, 2001). Anxiety symptoms were assessed via the Generalized Anxiety Disorder 7 (GAD-7) (Löwe et al., 2008). Satisfaction with the received intervention was measured with the Client Satisfaction Questionnaire, adapted to internet-based interventions (CSQ-I) (Boß et al., 2016). Furthermore, the occurrence of any adverse effects due to our intervention was assessed (Rozental, Boettcher, Andersson, Schmidt, & Carlbring, 2015). Treatment adherence in the intervention group was assessed based on the number of completed modules.

Screening

Attention deficit and hyperactivity symptoms were assessed via the six-item short version of the ADHD Self-Report Scale-V1.1 (ASRS-v1.1) (Daigre et al., 2009). Lifetime history of Posttraumatic stress disorder was assessed via the short screening scale for DSM-IV posttraumatic stress disorder (PTSD-7) (Siegrist & Maercker, 2010). The AUDIT and the DAST-10 were used to screen for the exclusion criterion of a severe substance use disorder, while the P4 Suicidality Screener was used to assess for the exclusion criterion of potential suicide risk. A detailed description of all outcome measures is reported in the study protocol (Baumgartner et al., 2019).

Preregistered hypotheses

We previously described our detailed study hypotheses with respect to the primary and secondary outcomes in our study protocol (Baumgartner et al., 2019). Our hypotheses were as follows:

- Win Back Control will be more effective than the self-help manual condition at reducing gambling at the 8-week and 6-month follow-up assessments.
- Win Back Control will be more effective than the self-help manual condition at reducing the severity of gambling

and gambling related problems at the 8-week and 6-month follow-up assessments.
- Win Back Control will be more effective than the self-help manual condition at reducing symptoms of psychopathological comorbidity at the 6-month follow-up assessment.
- Win Back Control will be more effective than the self-help manual condition at reducing alcohol and cigarette use at the 8-week and 6-month follow-up assessments.
- Participants in the Win Back Control condition will be more satisfied with the received intervention than those in the self-help manual condition at the 8-week follow-up assessment.

Sample size

Based on the literature and our previous research (Schaub et al., 2013), we determined that an effect size of Cohen's $d = 0.30$ was appropriate for our primary outcome (number of days of gambling in the last 30 days). With an $\alpha = 0.05$ and 1-$\beta = 0.80$, these estimations resulted in a sample size of 176 per study arm ($N = 352$).

Statistical analyses

All data were analyzed according to the intention-to-treat (ITT) principle. Missing data for the ITT analyses were addressed via multiple imputation procedures using the multivariate imputation by chained equations software package (van Buuren & Groothuis-Oudshoorn, 2011) in R (version 4.1.2; (R Core Team, 2021)). We performed the imputations for each group separately to preserve within-group homogeneity and potential intervention effects. Continuous outcomes were imputed using predictive mean matching. As recommended, 20 imputation sets were employed (van Buuren & Groothuis-Oudshoorn, 2011). No systematic bias in convergence was revealed. The results from the imputed dataset were crosschecked with the non-imputed data. The baseline characteristics of participants in both groups were contrasted descriptively. We assessed differences in primary and secondary continuous outcome variables between the two study arms at baseline and the follow-up points using linear mixed models (LMMs) using the lme4 package (Bates, Mächler, Bolker, & Walker, 2015). To account for attrition bias, we added the respective baseline variables as covariates to the LMMs. Effect sizes (Cohen's d) were calculated using the estimated means and pooled standard deviations (Morris, 2007).

Ethics

The study procedures were carried out in accordance with the Declaration of Helsinki; the consort eHealth Guidelines for studies on medical devices; the European Directive on medical devices 93/42/EEC, Swiss Law and Swiss Regulatory Authority requirements. The study was approved by the ethics committee of the Canton of Zurich on the 18. December 2018 (BASEC-Nr. 2018–01989). All subjects were informed about the study and all provided informed consent.

RESULTS

Participants

Of the 360 participants, 246 (68.3%) were male, and the average age was 33.4 years (SD = 10.2). The majority $n = 194$ (53.8%) were from Germany, followed by 114 (31.6%) from Switzerland, 46 (12.7%) from Austria, 2 (0.5%) from Liechtenstein, while four individuals did not specify their country of residence. The average participant gambled 16.28 Days (SD = 8.41) during the last 30 days. At posttreatment 75 participants (20.8%) filled out the assessment, and 87 (24.2%) filled out the 6 months follow-up. Baseline characteristics are summarized in Table 1.

Primary outcome

Table 2 shows the means, standard deviations, and within-group effect sizes of the primary and secondary outcomes. The number of days of gambling over the last 30 days reduced significantly for both groups at posttreatment ($F = 15.02$, $p < 0.001$). However, there was no significant difference between the two groups (interaction effect group × time: ($F = 2.15$, $p = 0.117$)). The means and standard deviations in the intervention group correspond to a large within-group effect size of $d = 1.17$ at posttreatment and $d = 1.26$ at 6-month follow-up. Similarly, the control group also showed a large within-group effect size of $d = 1.04$ at posttreatment and $d = 1.00$ at 6-month follow-up.

Secondary outcomes

The results of the secondary outcomes favored the intervention group. Specifically, we found significant group × time interactions according to the G-SAS ($F = 8.83$, $p < 0.001$), gambling problem severity according to the PGSI ($F = 3.54$, $p = 0.030$), for cigarettes smoked in the last 7 days ($F = 26.68$, $p < 0.001$), for depressive symptoms according to the PHQ-9 ($F = 19.41$, $p < 0.001$), and anxiety symptoms according to the GAD-7 ($F = 41.09$, $p < 0.001$) favoring the intervention group. A detailed description of the estimated main and interaction effects is displayed in Table 3. Client satisfaction was significantly higher in the intervention group according to the CSQ-I $t(358) = 5.25$, $p < 0.001$. Participants in the intervention completed an average of 2.27 (SD = 2.40) modules. These results suggest that intervention group participants improved overall more than participants in the control group.

Adverse effects

At posttreatment, 63 participants completed the questionnaire on adverse intervention effects. Of these, 50 (79.4%) reported no adverse effects during the study, while 11 (17.5%) answered that an adverse effect had affected them "somewhat negatively," 1 (1.6%) answered that an adverse effect had affected them "quite negatively," and 1 (1.6%) answered that an adverse effect had affected them "to a great extent." There was no significant difference in

Table 1. Baseline participant data

Characteristics	Win Back Control $N = 185$	Self-help manual $N = 175$	P[a]
Gender, n			0.144[b]
Female	66 (35.7%)	48 (27.4%)	
Male	119 (64.3%)	127 (72.6%)	
Age, mean (SD)	33.5 (10.5)	33.3 (10)	
Country of residence			0.361[b]
Germany	100 (54.1%)	94 (53.7%)	
Switzerland	63 (34.1%)	51 (29.1%)	
Austria	18 (9.73%)	28 (16.0%)	
Liechtenstein	1 (0.54%)	1 (0.57%)	
Not specified	3 (1.62%)	1 (0.57%)	
Education			0.149[b]
Special needs school	2 (1.08%)	1 (0.57%)	
Primary school/ General secondary school	30 (16.2%)	32 (18.3%)	
Secondary school	60 (32.4%)	61 (34.9%)	
Higher education entrance qualification	58 (31.4%)	36 (20.6%)	
University/ University of applied sciences	31 (16.8%)	36 (20.6%)	
Not specified	4 (2.16%)	9 (5.14%)	
Outcomes, mean (SD)			
Gambling days last 30 days	15.92 (8.58)	16.68 (8.24)	0.394[c]
Money spent last 30 days	3,680.96 (7,789.91)	4,156.40 (7,651.70)	0.560[c]
Gambling time last 7 days	679.89 (667.23)	701.29 (667.74)	0.555[c]
Cigarettes smoked last 7 days	84.05 (111.79)	87.32 (86.33)	0.702[c]
Drinking days last 7 days	4.24 (7.44)	5.29 (8.74)	0.256[c]
PHQ-9	8.73 (4.40)	9.01 (4.75)	0.578[c]
GAD-7	9.81 (5.03)	10.06 (4.80)	0.645[c]
ASRS-v1.1	9.19 (5.28)	9.23 (4.99)	0.956[c]
PTSD-7	9.38 (5.90)	8.89 (5.9)	0.855[c]
PGSI	16.52 (4.96)	16.97 (4.68)	0.352[c]
G-SAS	32.21 (7.95)	32.50 (7.24)	0.675[c]
AUDIT	5.35 (6.37)	5.52 (5.99)	0.810[c]
DAST-10	1.17 (1.72)	1.25 (1.68)	0.904[c]

[a]*p* values for the comparison of the two intervention conditions.
[b]χ^2 test.
[c]*t*-test.

adverse effects between the treatment arms ($\chi 2 = 1.13$, $p = 0.89$). Adverse effects that were mentioned included boredom, cravings, stress, guilt, and anxiety about a potential relapse.

Dropout analyses

Regarding the posttreatment assessment, male participants (82.93%) were significantly more likely to drop out compared to female participants (71.06%), $X^2(1, N = 360) = 5.96$, $p = 0.015$ and participants who dropped out were significantly older ($T_{358} = 2.56$, $p = 0.011$). Moreover, participants who dropped out scored significantly higher on the PGSI ($T_{358} = -2.16$, $p = 0.032$), the GAD-7 ($T_{358} = -2.42$, $p = 0.016$), the PTSD-7 ($T_{99} = -3.62$, $p < 0.001$), and smoked significantly more cigarettes over the last 7 days ($T_{358} = -2.11$, $p = 0.036$) compared to those who filled out the posttreatment assessment. Moreover, participants in the intervention group that dropped out completed significantly fewer modules ($T_{169} = 9.29$, $p < 0.001$). Regarding the follow-up assessment, participants who dropped out drank significantly less alcohol over the last 7 days ($T_{358} = 2.01$, $p = 0.046$), scored significantly higher on the PGSI ($T_{358} = -2.51$, $p = 0.013$), the G-SAS ($T_{358} = -3.07$, $p = 0.002$), the GAD-7 ($T_{358} = -2.68$, $p = 0.008$), the PTSD-7 $T_{99} = -2.53$, $p = 0.013$. Moreover, participants in the intervention group that dropped out completed significantly fewer modules ($T_{169} = 7.93$, $p < 0.001$). The dropout analyses are summarized in Appendix A.

These baseline differences could potentially have influenced the results by acting as confounders. It's plausible that certain changes attributed to the intervention may have been, at least in part, a consequence of these pre-existing differences. However, our statistical analyses accounted for these baseline differences, thereby helping to mitigate potential bias. Nevertheless, the presence of such baseline differences underscores the importance of cautious interpretation.

DISCUSSION

Many individuals with gambling problems do not seek formal treatment. Therefore, low-threshold evidence-based treatment and harm reduction strategies are needed. It stands to reason that a web-based self-help intervention can fill this gap. This two-armed RCT aimed to examine the effectiveness of reducing problem gambling with the support of a web-based self-help intervention compared to a self-help manual. The study provides insight into how the provision of a fully automated web-based self-help intervention affects the recovery process for problem gambling.

The intervention group showed a significant within-group reduction in the number of days of gambling over the last 30 days at 8-week and 6-month follow-up assessments. These results coincide with the findings of previous RCTs for problem gambling which reported large and sustained within-group treatment effects (Carlbring et al., 2012; Carlbring & Smit, 2008; Cunningham et al., 2019; Hodgins et al., 2019).

However, in contrast to those previous RCTs, we found significant between-group differences in, gambling symptoms

Table 2. Intention-to-treat analyses

Group and measure	Baseline mean (SD)	Posttreatment mean (SD)	Follow-up mean (SD)	Baseline to posttreatment Cohen's d (within-group)	Baseline to follow-up Cohen's d (within-group)
Win Back Control					
Gambling days last 30 days	15.92 (8.58)	6.92 (6.74)	5.24 (8.43)	1.17	1.26
Money spent last 30 days	3,680.96 (7,789.91)	596.74 (713.08)	358.80 (855.09)	0.56	0.60
Gambling time last 7 days	679.89 (667.23)	192.53 (244.49)	129.34 (301.35)	0.97	1.06
Cigarettes smoked last 7 days	84.05 (111.79)	81.92 (89.72)	45.46 (64.60)	0.02	0.42
Drinking days last 7 days	4.24 (7.44)	5.38 (10.87)	5.17 (12.26)	−0.12	−0.09
PHQ-9	8.73 (4.40)	N/A	3.42 (3.37)	N/A	1.36
GAD-7	9.81 (5.03)	N/A	3.52 (3.22)	N/A	1.49
ASRS-v1.1	9.19 (5.28)	N/A	6.91(4.40)	N/A	0.47
PTSD-7	9.38 (5.90)	N/A	6.66 (3.37)	N/A	0.57
PGSI	16.52 (4.96)	5.21 (3.96)	4.95 (4.98)	2.52	2.33
G-SAS	32.21 (7.95)	22.51 (10.03)	16.60 (11.21)	1.07	1.61
AUDIT	5.35 (6.37)	N/A	4.29 (6.22)	N/A	0.17
DAST-10	1.17 (1.72)	N/A	0.68 (1.15)	N/A	0.34
CSQ-I	N/A	25.80 (5.99)	N/A	N/A	N/A
Self-help manual					
Gambling days last 30 days	16.68 (8.24)	7.97(8.48)	8.04 (9.04)	1.04	1.00
Money spent in last 30 days	4,156.40 (7,651.70)	1,402.12 (4,072.38)	1,570.81 (3,424.09)	0.45	0.44
Gambling time last 7 days	701.29 (667.74)	337.09 (534.00)	322.42 (618.29)	0.60	0.59
Cigarettes smoked last 7 days	87.32 (86.33)	71.01 (60.05)	89.43 (84.86)	0.22	0.03
Drinking days last 7 days	5.29 (8.74)	4.48 (6.92)	4.49 (6.81)	0.10	0.10
PHQ-9	9.01 (4.75)	N/A	6.08 (3.88)	N/A	0.67
GAD-7	10.06 (4.80)	N/A	7.51 (5.02)	N/A	0.52
ASRS-v1.1	9.23 (4.99)	N/A	7.96 (4.01)	N/A	0.28
PTSD-7	8.89 (5.9)	N/A	8.93 (3.35)	N/A	0.01
PGSI	16.97 (4.68)	7.08 (5.59)	6.99 (5.53)	1.92	1.95
G-SAS	32.50 (7.24)	22.43 (12.83)	21.42 (12.95)	0.97	1.06
AUDIT	5.52 (5.99)	N/A	6.48 (7.10)	N/A	−0.15
DAST-10	1.25 (1.68)	N/A	1.43 (2.15)	N/A	−0.01
CSQ-I	N/A	20.64 (7.07)	N/A	N/A	N/A

ASRS-v1.1, Adult ADHD Self-Report Scale; AUDIT, Alcohol Use Disorders Identification Test; CSQ-I, Client Satisfaction Questionnaire; DAST-10, Drug Abuse Screening Test; GAD-7, General Anxiety Disorder; G-SAS, Gambling Symptom Assessment Scale; PGSI, Problem Gambling Severity Index; PHQ-9, Patient Health Questionnaire; PTSD-7, Posttraumatic Stress Disorder.

Table 3. Estimated main and interaction effects

Outcome[a]	Beta estimates	CI	Main effect (time)			Interaction effect (group * time)		
			F	df	*p*	F	df	*p*
Gambling days last 30 days	15.02	12.64–17.39	202.81	712	<0.001	2.15	712	0.117
Gambling time last 7 days	401.34	250.98–551.70	93.47	712	<0.001	2.20	712	0.111
Money spent last 30 days	3,792.02	2,252.37–5,331.67	52.31	712	<0.001	0.62	712	0.539
PGSI	12.22	11.15–13.29	728.73	712	<0.001	3.54	712	0.030
G-SAS	18.31	15.28–21.33	229.61	712	<0.001	8.83	712	<0.001
Cigarettes smoked last 7 days	30.96	−0.08–62.01	10.73	712	<0.001	26.68	712	<0.001
Drinking days last 7 days	2.67	−0.62–5.96	0.78	712	0.460	3.92	712	0.060
PHQ-9	8.72	8.12–9.32	229.47	356	<0.001	19.41	356	<0.001
GAD-7	2.71	1.29–4.12	227.79	356	<0.001	41.09	356	<0.001

[a]Linear mixed model with a random effect for individual subjects, group as a fixed factor, follow-up scores as outcomes, and baseline variables that predicted missing data as covariates. GAD-7, General Anxiety Disorder; G-SAS, Gambling Symptom Assessment Scale; PGSI, Problem Gambling Severity Index; PHQ-9, Patient Health Questionnaire.

according to the G-SAS, gambling severity according to the PGSI, and co-occurring psychopathological symptom reduction regarding depression (PHQ-9) and anxiety (GAD-7). Our expectation that participants in the intervention group would decrease the number of gambling days over the last 30 days more effectively compared to the control group could not be demonstrated. However, the fact that individuals in both active intervention arms spent considerably less days, time, and money gambling might hint towards an effective harm reduction approach given that many affected individuals avoid treatment due to the fear that it might require them to cease all gambling activities (Dąbrowska, Moskalewicz, & Wieczorek, 2017). Given our findings, the results might indicate that participants in the intervention group followed safer gambling practices (Price, Hilbrecht, & Billi, 2021). Such safer gambling practices might include a) ceasing gambling activities when individuals stop enjoying their gambling session, b) having a dedicated gambling budget, and c) planning non-gambling-related leisure activities (Hing et al., 2019). Moreover, one of the proven safer gambling recommendations from regulators and operators is to deliver informational messages about the risks of gambling and how to minimize harm, which Win Back Control utilized through personalized messages according to individuals' needs and gambling patterns (Auer, Malischnig, & Griffiths, 2014; Gambling Commission, 2022).

Given that individuals with gambling problems commonly present high rates of psychiatric comorbidities, including substance use disorders, depressive disorders, and anxiety disorders (Allami et al., 2021; Billieux et al., 2016; Buth, Wurst, Thon, Lahusen, & Kalke, 2017), we believe that our approach of offering optional complementary modules for psychiatric comorbidities was particularly relevant to our target group. The positive results in terms of significant reductions in terms of cigarette use, depression, and anxiety symptoms seem to confirm this intervention strategy. A noteworthy finding was the high proportion of individuals who had to be excluded from participation in our study due to their elevated suicidality at the baseline assessment (8.7%). These results suggest that many gamblers who seek anonymous help via the internet seem to be prone to suicidal thoughts (Andreeva, Audette-Chapdelaine, & Brodeur, 2022). In these instances, we alerted the individuals and directed them to relevant resources for immediate help. Therefore, we strongly recommend existing and future programs for problematic gambling to screen for suicidality at intake and refer them to appropriate services if necessary (Håkansson & Karlsson, 2020).

Strengths of this RCT include the large sample size, exclusion criteria being reduced to a minimum, and the intervention being fully automated, requiring little to no human support that in turn, decreases associated costs when implemented on a large scale.

The study had a few noteworthy limitations. We experienced an overall high dropout rate (76%) that has the potential to threaten the validity of results. To reduce attrition bias, we applied multiple imputations, which is reported to reduce bias even when the proportion of attrition is high (Madley-Dowd, Hughes, Tilling, & Heron, 2019). While multiple imputation is based on the MAR assumption, it has been demonstrated to produce less biased results than listwise deletion even under NMAR conditions (van Ginkel, Linting, Rippe, & van der Voort, 2020). Nevertheless, we acknowledge that we cannot guarantee unbiased results given the high attrition rate that was likely missing not at random. Although our study applied multiple imputation to address missing data, we acknowledge that our sample size calculation did not account for potential attrition. This omission might have affected the statistical power of our results. In light of the relatively high attrition rate, which threatens the integrity of study results further research should investigate possible predictors to prevent attrition. We propose that future research should focus on individual patient data meta-analyses (IPDMAs). IPDMAs utilize raw data from each study, which allows for in-depth analysis and examination of potential predictors, including treatment outcomes and attrition (Karyotaki et al., 2015). In addition, it would be important to assess other potential ways to increase user engagement, such as additional telephone motivational interviewing sessions (Brazeau, Hodgins, Cunningham, Bennett, & Bennett, 2021). However, it's noteworthy that our attrition rate is comparable with other studies examining fully-automated web-based self-help interventions for problem gambling (Cunningham et al., 2019; Dowling et al., 2021; Luquiens et al., 2016), suggesting a common challenge in this field of research. Moreover, we used incentives to motivate participants to complete the follow-up assessments, which might have resulted in the inclusion of participants uninterested in changing their gambling behavior. To increase engagement, we set up automatic email reminders that were sent to participants that did not access the first intervention module after one week of participation. Subsequently, another reminder was sent at week four if they had accessed less than three modules. However, participants in the intervention group completed an average of only 2.27 modules out of the five core modules. Interestingly, these completion rates align with those reported for other web-based self-help interventions (Baumgartner et al., 2021), suggesting that low engagement in digital self-help programs is generally common. The observed completion rates, underscore the need to enhance participant engagement to ensure maximum benefit from digital self-help programs. Moreover, the limited statistical power constrains our ability to evaluate the effects of the specific complementary modules for psychiatric comorbidities. While we cannot definitively attribute these results to the inclusion of the complimentary modules, the robust design of our RCT supports the likelihood that the observed significant differences in outcomes related to psychopathological comorbidity are attributable to our intervention as a whole. Finally, all measurements were self-reported and not validated externally, though there is evidence that self-reported data in regard to gambling behavior is a valid and reliable method for collecting data on individuals with gambling problems (Hodgins & Makarchuk, 2003).

CONCLUSIONS

Despite the result of the intervention not significantly affecting gambling-related outcomes compared to the active control group, we observed that participants in the intervention group reported significantly fewer gambling-related symptoms, smoked significantly fewer cigarettes in the last 7 days, and achieved a significant reduction in depression and anxiety symptoms. Given that the program is fully automated and requires little human support, it might be a cost-effective addition to general healthcare systems. Future studies might consider exploring the potential value of adding Win Back Control to clinical care settings.

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Appendix A

Table A1. Dropout analysis for total sample at posttreatment

	Followed-up $n = 75$	Dropped out $n = 285$	Statistical analysis *(Chi-Square or t-test)*
Gender, *n* (%)			$X^2(1, N = 360) = 5.96, p = 0.015^{*}$
Female	33 (44.0)	81 (28.4)	
Male	42 (56.0)	204 (71.6)	
Age, *M (SD)*	36.07 (11.57)	32.68 (9.78)	$T_{358} = 2.56, p = 0.011^{*}$
Highest education, *n* (%)			$X^2(5, N = 360) = 6.055, p = 0.301$
Country of origin, *n* (%)			$X^2(4, N = 360) = 4.60, p = 0.331$
Gambling days last 30 days, M(SD)	16.12 (8.58)	16.33 (8.39)	$T_{358} = -0.20, p = 0.846$
Money spent last 30 days, M(SD)	4,807.36 (8,895.57)	3,439.57 (6,230.35)	$T_{358} = 1.53, p = 0.126$
Gambling time last 7 days, M(SD)	741.91 (775.16)	667.18 (635.58)	$T_{358} = 0.86, p = 0.389$
Cigarettes smoked last 7 days, M(SD)	64.23 (86.68)	91.52 (102.78)	$T_{358} = -2.11, p = 0.036^{*}$
Drinking days last 7 days, M(SD)	5.16 (8.19)	4.67 (8.11)	$T_{358} = 0.46, p = 0.643$
PGSI, M(SD)	15.68 (4.37)	17.02 (4.91)	$T_{358} = -2.16, p = 0.032^{*}$
G-SAS, M(SD)	31.69 (7.35)	32.53 (7.69)	$T_{358} = -0.85, p = 0.398$
PHQ-9, M(SD)	8.56 (4.23)	8.95 (4.68)	$T_{358} = -0.65, p = 0.516$
GAD-7, M(SD)	8.71 (4.44)	10.24 (5.00)	$T_{358} = -2.42, p = 0.016^{*}$
ASRS-v1.1, M(SD)	8.64 (4.61)	9.36 (5.27)	$T_{358} = -1.09, p = 0.278$
PTSD-7, M(SD)	5.24 (3.06)	10.19 (6.04)	$T_{99} = -3.62, p < 0.001^{***}$
AUDIT, M(SD)	4.96 (5.02)	5.56 (6.48)	$T_{358} = -0.75, p = 0.453$
DAST-10, M(SD)	1.03 (1.27)	1.24 (1.76)	$T_{358} = -0.95, p = 0.341$
Adherence intervention groups			
Completed modules (intervention group), M(SD)	5.23 (2.45)	1.62 (1.83)	$T_{169} = 9.29, p < 0.001^{***}$

ASRS-v1.1, Adult ADHD Self-Report Scale; AUDIT, Alcohol Use Disorders Identification Test; DAST-10, Drug Abuse Screening Test; GAD-7, General Anxiety Disorder; G-SAS, Gambling Symptom Assessment Scale; PGSI, Problem Gambling Severity Index; PHQ-9, Patient Health Questionnaire; PTSD-7, Posttraumatic Stress Disorder.

Table A2. Dropout analysis for total sample at follow-up

	Followed-up $n = 87$	Dropped out $n = 273$	Statistical analysis *(Chi-Square or t-test)*
Gender, *n* (%)			$X^2(1, N = 360) = 0.27, p = 0.606$
Female	30 (34.5)	84 (30.8)	
Male	57 (65.5)	189 (69.2)	
Age, *M (SD)*	34.85 (10.82)	32.92 (10.04)	$T_{358} = 1.53, p = 0.127$
Highest education, *n* (%)			$X^2(5, N = 360) = 2.57, p = 0.766$
Country of origin, *n* (%)			$X^2(4, N = 360) = 4.45, p = 0.391$
Gambling days last 30 days, M(SD)	15.54 (8.29)	16.53 (8.46)	$T_{358} = -0.95, p = 0.341$
Money spent last 30 days, M(SD)	3,992.96 (8,144.29)	3,642.49 (6,448.70)	$T_{358} = 0.41, p = 0.681$
Gambling time last 7 days, M(SD)	683.40 (751.06)	682.54 (638.85)	$T_{358} = 0.01, p = 0.991$
Cigarettes smoked last 7 days, M(SD)	75.03 (89.07)	89.27 (103.36)	$T_{358} = -1.16, p = 0.249$
Drinking days last 7 days, M(SD)	6.31 (9.52)	4.29 (7.58)	$T_{358} = 2.01, p = 0.046^{*}$
PGSI, M(SD)	15.62 (4.72)	17.10 (4.82)	$T_{358} = -2.51, p = 0.013^{*}$
G-SAS, M(SD)	30.20 (6.71)	33.04 (7.77)	$T_{358} = -3.07, p = 0.002^{**}$
PHQ-9, M(SD)	8.01(4.13)	9.14 (4.70)	$T_{358} = -2.01, p = 0.046$
GAD-7, M(SD)	8.70 (4.72)	10.31 (4.93)	$T_{358} = -2.68, p = 0.008^{**}$
ASRS-v1.1, M(SD)	8.62 (5.02)	9.40 (5.18)	$T_{358} = -1.24, p = 0.217$
PTSD-7, M(SD)	6.25 (4.95)	9.88 (5.93)	$T_{99} = -2.53, p = 0.013^{*}$
AUDIT, M(SD)	6.23 (6.29)	5.18 (6.16)	$T_{358} = -1.37, p = 0.173$
DAST-10, M(SD)	1.10 (1.26)	1.22 (1.80)	$T_{358} = -0.56, p = 0.575$
Adherence intervention groups			
Completed modules (intervention group), M(SD)	4.56 (2.54)	1.60 (1.86)	$T_{169} = 7.93, p < 0.001^{***}$

ASRS-v1.1, Adult ADHD Self-Report Scale; AUDIT, Alcohol Use Disorders Identification Test; DAST-10, Drug Abuse Screening Test; GAD-7, General Anxiety Disorder; G-SAS, Gambling Symptom Assessment Scale; PGSI, Problem Gambling Severity Index; PHQ-9, Patient Health Questionnaire; PTSD-7, Posttraumatic Stress Disorder.

Table A3. Baseline data of participants that responded to the posttreatment assessment

	Win Back Control $n = 33$	Self-help manual $n = 42$	Statistical analysis (*Chi-Square or t*-test)
Gender, *n* (%)			$X^2(1, N = 75) = 0.861, p = 0.353$
Female	17 (51.5)	16 (38.09)	
Male	16 (48.48)	26 (61.90)	
Age, *M (SD)*	37.85 (12.91)	34.67 (10.34)	$T_{73} = 1.19, p = 0.239$
Highest education, *n* (%)			$X^2(3, N = 75) = 1.968, p = 0.579$
Country of origin, *n* (%)			$X^2(2, N = 75) = 0.646, p = 0.724$
Gambling days last 30 days, M(SD)	18.33 (8.91)	14.38 (7.98)	$T_{73} = 2.022, p = 0.047^*$
Money spent last 30 days, M(SD)	3,009.15 (3,479.02)	6,220.24 (11,345.83)	$T_{73} = -1.57, p = 0.121$
Gambling time last 7 days, M(SD)	835.58 (823.18)	668.31 (736.90)	$T_{73} = 0.927, p = 0.357$
Cigarettes smoked last 7 days, M(SD)	53.15 90.17)	72.93 (83.89)	$T_{73} = -0.980, p = 0.33$
Drinking days last 7 days, M(SD)	5.65 (10.58)	4.81 (5.97)	$T_{73} = 0.43, p = 0.669$
PGSI, M(SD)	14.67 (4.15)	16.48 (4.42)	$T_{73} = -1.81, p = 0.007$
G-SAS, M(SD)	31.94 (7.10)	31.5 (7.61)	$T_{73} = -0.25, p = 0.799$
PHQ-9, M(SD)	8.21 (4.11)	8.83 (4.36)	$T_{73} = -0.63, p = 0.532$
GAD-7, M(SD)	7.94 (3.61)	9.31 (4.95)	$T_{73} = -1.34, p = 0.186$
ASRS-v1.1, M(SD)	7.82 (4.68)	9.29 (4.51)	$T_{73} = -1.38, p = 0.173$
PTSD-7, M(SD)	4.63 (1.77)	5.62 (3.67)	$T_{73} = -0.71, p = 0.486$
AUDIT, M(SD)	4.82 (5.38)	5.07 (4.78)	$T_{73} = -0.22, p = 0.829$
DAST-10, M(SD)	0.73 (0.91)	1.26 (1.47)	$T_{73} = -0.1.83, p = 0.071$

ASRS-v1.1, Adult ADHD Self-Report Scale; AUDIT, Alcohol Use Disorders Identification Test; DAST-10, Drug Abuse Screening Test; GAD-7, General Anxiety Disorder; G-SAS, Gambling Symptom Assessment Scale; PGSI, Problem Gambling Severity Index; PHQ-9, Patient Health Questionnaire; PTSD-7, Posttraumatic Stress Disorder.

Table A4. Baseline data of participants that responded to the follow-up assessment

	Win Back Control $n = 40$	Self-help manual $n = 47$	Statistical analysis (*Chi-Square or t*-test)
Gender, *n* (%)			$X^2(1, N = 87) = 1.501, p = 0.221$
Female	17 (42.5)	13 (27.66)	
Male	23 (57.50)	34 (72.34)	
Age, *M (SD)*	36.03 (12.29)	33.85 (09.41)	$T_{73} = 0.35, p = 0.353$
Highest education, *n* (%)			$X^2(5, N = 87) = 5.287, p = 0.382$
Country of origin, *n* (%)			$X^2(2, N = 87) = 1.083, p = 0.582$
Gambling days last 30 days, M(SD)	15.83 (8.58)	15.30 (8.11)	$T_{85} = 0.29, p = 0.770$
Money spent last 30 days, M(SD)	2,369.28 (2,566.55)	5,340.28 (10,631.74)	$T_{85} = -1.70, p = 0.092$
Gambling time last 7 days, M(SD)	651.18 (776.50)	710.83 (736.02)	$T_{85} = 0.37, p = 0.714$
Cigarettes smoked last 7 days, M(SD)	74.00 (87.65)	75.91 (91.20)	$T_{85} = -0.09, p = 0.921$
Drinking days last 7 days, M(SD)	6.08 (9.09)	6.49 (9.96)	$T_{85} = 0.20, p = 0.845$
PGSI, M(SD)	14.93 (4.84)	16.21 (4.60)	$T_{85} = -1.27, p = 0.207$
G-SAS, M(SD)	29.43 (6.26)	30.85 (7.07)	$T_{85} = -0.99, p = 0.326$
PHQ-9, M(SD)	7.55 (3.72)	8.40 (4.44)	$T_{85} = -0.96, p = 0.339$
GAD-7, M(SD)	8.03 (4.27)	9.28 (5.06)	$T_{85} = -1.23, p = 0.221$
ASRS-v1.1, M(SD)	7.75 (5.08)	9.36 (4.90)	$T_{85} = -1.50, p = 0.136$
PTSD-7, M(SD)	6.00 (6.16)	6.41 (4.25)	$T_{85} = -0.18, p = 0.860$
AUDIT, M(SD)	5.68 (5.48)	6.70 (6.93)	$T_{85} = -0.76, p = 0.451$
DAST-10, M(SD)	0.98 (1.23)	1.21 (1.28)	$T_{85} = -0.88, p = 0.383$

ASRS-v1.1, Adult ADHD Self-Report Scale; AUDIT, Alcohol Use Disorders Identification Test; DAST-10, Drug Abuse Screening Test; GAD-7, General Anxiety Disorder; G-SAS, Gambling Symptom Assessment Scale; PGSI, Problem Gambling Severity Index; PHQ-9, Patient Health Questionnaire; PTSD-7, Posttraumatic Stress Disorder.