



HHS Public Access

Author manuscript

Curr Addict Rep. Author manuscript; available in PMC 2024 June 01.

Published in final edited form as:

Curr Addict Rep. 2023 June ; 10(2): 178–186. doi:10.1007/s40429-023-00479-2.

Smartphone Apps for Problem Gambling: A Review of Content and Quality

Li Yan McCurdy, PhD^{a,b,#}, Jennifer M Loya, PhD^{b,#}, Victoria R Hart-Derrick, BA^{d,^}, Griffin C Young, MS^{e,^}, Brian D Kiluk, PhD^b, Marc N Potenza, MD, PhD^{b,d,f,g,h,*}

^aDivision of Prevention and Community Research, Yale University School of Medicine, New Haven, CT 06511, USA

^bDepartment of Psychiatry, Yale University School of Medicine, New Haven, CT, 06510, USA

^dChild Study Center, Yale University School of Medicine, New Haven, CT 06520, USA

^eDepartment of Computer Science, Stanford University School of Engineering, Stanford, CA 94305

^fDepartment of Neuroscience, Yale University School of Medicine, New Haven, CT 06510, USA

^gThe Connecticut Council on Problem Gambling, Wethersfield, CT 06109, USA

^hThe Connecticut Mental Health Center, New Haven, CT 06519, USA

Abstract

Purpose of review: Problem gambling can have profound consequences for affected individuals, yet only a small proportion of people with problem gambling seek treatment. Mobile phone applications (apps) may provide an effective and scalable therapeutic option. The purpose of this study was to evaluate publicly available mobile apps aimed at improving problematic gambling behavior.

^{*}Corresponding author name, street address, and email address: Marc N. Potenza, MD, PhD, 1 Church Street, Room 726, New Haven, CT 06510, Tel: 203-737-3553, marc.potenza@yale.edu.

[#]These authors contributed equally to this manuscript.

[^]These authors contributed equally to this manuscript.

Author Contributions

All authors contributed to the study conception and design. Data collection and analysis were performed by LYM, JML, VHD, and GCY. All authors contributed to the manuscript and have approved the final version of the submitted manuscript.

Compliance with Ethical Standards

Conflict of Interest

The authors declare no competing interests with respect to the content of this manuscript. BDK has received personal fees from CBT4CBT, LLC outside the submitted work; and has received research support from the Mohegan Sun Casino. MNP has consulted for Opiant Therapeutics, Game Day Data, Baria-Tek, the Addiction Policy Forum, AXA and Idorsia Pharmaceuticals; been involved in a patent application with Yale University and Novartis; received research support from the Mohegan Sun Casino and the Connecticut Council on Problem Gambling; consulted for legal and gambling entities on issues related to impulse-control disorders and addictions; has edited journals and journal sections; has given academic lectures in grand rounds, CME events and other clinical or scientific venues; and has generated books or book chapters for publishers of mental health texts. The other authors report no disclosures.

Human and Animal Rights

This article does not contain any studies with human or animal subjects performed by any of the authors. Since this work involved collection and analysis of data regarding phone apps and not individual persons, this work does not meet criteria for Human Subjects Research, so ethics approval was not necessary.

Recent findings: To date, there are no published studies that have evaluated the quality of publicly available smartphone apps for problem gambling in the US. There is thus a significant gap in knowledge of existing apps for addressing problem gambling.

Summary: This study included a review of 14 problem-gambling-specific apps. Apps that incorporated cognitive-behavioral therapy concepts and in-app communities were associated with better aesthetics and information quality scores. Additionally, in-app communities were associated with better engagement scores. Our results highlight the importance of evidence-based and engaging features in apps designed to help people with problem gambling.

Keywords

Gambling disorder; addictive behaviors; mHealth; smartphone apps; Mobile App Rating Scale; cognitive-behavioral therapy

Introduction

Problem gambling refers to engagement in betting behaviors that generate significant levels of distress or harm, with more severe problem gambling often meeting criteria for gambling disorder (GD), a formally recognized psychiatric disorder [1, 2]. Current estimates of the prevalence of lifetime GD are at approximately 0.5% of adults in the US [1]. Problem gambling may also include less severe levels of harmful/distressing gambling, which may include hazardous gambling, a new entity in the 11th revision of the International Classification of Diseases (ICD-11), which is defined as a pattern of gambling that appreciably increases the risk of physical or mental health consequences to the individual or others [3]. Problem gambling can have profound financial, legal, and interpersonal consequences for affected individuals and their families. It is also associated with psychiatric and physical comorbidities such as substance use disorders (SUDs), mood disorders, suicidal ideation and attempts [4, 5], as well as cardiovascular disease and other medical concerns [6]. Although some characteristics are unique to problem gambling, it shares many similarities to SUDs, such as repeated unsuccessful attempts to cut back or stop, symptoms of tolerance and withdrawal, and impairments in major areas of life [7, 8].

Current psychological treatment options are similar to those for SUDs, which include non-clinical support groups such as 12-step meetings (i.e., Gamblers Anonymous) and SMART Recovery [9], and behavioral treatments such as cognitive-behavioral therapy (CBT) that are typically delivered by trained clinicians [10, 11]. CBT is the most commonly used treatment for individuals with GD and has been found to reduce gambling-related symptoms and behaviors such as number of days spent gambling and amount of money lost [10, 12–14]. Unfortunately, only a small proportion (3–10%) of people with GD seek treatment [15, 16]. Multiple barriers may impact treatment engagement, such as personal factors (e.g., denial, shame, stigma) and various other constraints (e.g., finances, time, distance, and limited professionals with expertise in treating GD) [17, 18]. For those who do seek treatment, retention is also an issue as indicated by high drop-out rates [19]. Moreover, efficacy of CBT in clinical practice is impacted by inter-therapist variability and limited adherence to treatment fidelity [20], which require substantial time and training resources to address [21].

Mobile health (mHealth) interventions such as mobile phone applications (apps) may provide effective, low-cost, and scalable therapeutic options that circumvent several of these barriers. They may also have the advantage of intervening in natural contexts and can be personalized based on individuals' feedback. Given these advantages, there has been a proliferation of app development in several mental health contexts such as depression and anxiety, as well as SUDs and eating disorders. However, evaluations of efficacy are relatively scarce [22, 23], and existing data of the effect sizes suggest modest impacts [24, 25]. Most apps to date are not evidence-based or theoretically grounded, and lack expert involvement in their development [23, 26, 27]. The lack of empirically supported evidence can lead to apps providing incorrect and even damaging information and feedback [28], (e.g., using stigmatizing language in SUD treatment), which can have harmful effects [29]. For example, smoking-cessation apps were found to rarely adhere to medical treatment guidelines [30]. Limited engagement on apps may also impair efficacy. Minimally guided, and unguided apps in particular, have notably high and rapid rates of disengagement [31, 32]. Overall, research is necessary to identify what app features are associated with positive app use experiences and high app usage.

While several problem-gambling apps have been developed by research labs [33–37], most are not publicly available across jurisdictions, including in the US. On the other hand, several apps that aim to help people with problem gambling are freely available on app stores, and some of these apps have been downloaded over 10,000 times. Despite their popularity, little is known about the quality of these apps. Two studies examining problem-gambling apps have been conducted [38, 39], but they were focused on apps available in Australia, and only a subset of these apps is available outside Australia. Furthermore, though those studies characterized the apps' functions and features, the quality of the apps using standardized rating scales was not evaluated. As a first step towards understanding if and how these commercially available apps may be useful to individuals with problem gambling, the goal of this study was to review existing publicly available mobile apps aimed at decreasing problematic gambling behavior. In reviewing the apps, we also aimed to review and evaluate their quality. In this initial foray, we elected to have our research team (none of whom have lived experience of problem gambling) evaluate the objective measures of app quality. While this has the potential benefit of limiting possible burdens on vulnerable populations (i.e., individuals with lived experience of problem gambling), it also has limitations, and directly involving such individuals is warranted in subsequent studies.

Methods

App Selection

This review focused on commercially-available mobile apps without costs to download that aimed to help people with gambling problems, which were found in the app stores for Android (Google Play: <https://play.google.com/store/>) and iPhone (iOS App Store: <https://www.apple.com/app-store/>) devices in August 2022. The app selection flow diagram is available in Supplementary Figure S1. App stores were systematically searched using the following keywords: “gambling addiction,” “gambling disorder,” “gambling help,” “gambling problem,” “gambling treatment,” “pathological gambling,” “problem gambling,”

“quit gambling,” and “stop gambling.” Despite using key words with an emphasis on receiving help for gambling problems, a disproportionate number of hits were apps that *promote* gambling (i.e., gambling apps); these apps were excluded. This search provided an initial list of 49 apps. We then filtered the apps based on exclusion criteria: we excluded 11 apps because their primary functionality was app/website-blocking (i.e., apps designed to block a user from accessing apps or websites where one can gamble), three apps because there was no free trial available, and one app because it did not work on either rater’s phone. Thus, a total of 34 apps were included in this study; since nine of these apps were available on both Android and iPhone, there was a total of 25 unique apps.

Rating Scales

The Mobile Application Rating Scale (MARS) [40] was used to evaluate the apps. It is composed of six sections: A) Engagement (e.g., “Is the app fun/entertaining to use?”); B) Functionality (e.g., “How accurately/fast do the app features (functions) and components (buttons/menus) work?”); C) Aesthetics (e.g., “How good does the app look?”); D) Information (e.g., “Is app content correct, well-written, and relevant to the goal/topic of the app?”, “Does the app come from a legitimate source?”); E) Subjective quality, which assessed subjective opinions of the app (e.g., “Would you recommend this app to people who might benefit from it?”); and F) App-specific, which assessed the perceived impact of the app (e.g., “This app is likely to increase awareness of the importance of addressing [insert target health behavior].”). Each question in each subscale is rated on a scale of 1–5, where 5 is the best score. Mean quality score was calculated as an average of objective subscales A through D; subjective subscales E and F were examined separately. In addition to the subscales, the MARS provides a list of features related to app functionality (e.g., assessment, monitoring/tracking, in-app community) and of features related to strategies and theoretical frameworks (e.g., cognitive-behavioral therapy, mindfulness, gratitude). We coded in binary the absence or presence of each feature.

User star ratings for each app were included as an additional indicator of the app’s “likeability” among end-users, which were based on data collected from each phone platform’s respective stores in January 2023. We excluded user ratings that had fewer than 10 total ratings to minimize bias.

Rating plan

Two pairs of raters independently rated either Android or iPhone apps using compatible phones (GCY: Google Pixel 2, JML: Galaxy S8 Active; LYM: iPhone 7, VHD: iPhone 11). Each week, two apps were downloaded by each pair of raters and used for one week. If a difference in subscale score between two raters was greater than two points (out of five), a discussion was held involving all four raters until a consensus was achieved. The final score for each app was calculated as the average score of the two raters. Intra-class correlations (ICCs) between each pair of raters were between “moderate” and “good” (Android ICC mean = 0.74; iPhone ICC mean = 0.71). Since the MARS contains subjective elements, it is reasonable that inter-rater correlations are not exceedingly high.

Since the focus was on apps aiming to help people with problem gambling specifically, we first rated the 19 problem-gambling-specific apps that were on Android and/or iPhone; five of these apps were on both Android and iPhone, resulting in 14 unique problem-gambling-specific apps (listed in Supplementary Table S1). We also rated 15 (11 unique) general-addiction apps to compare quality ratings with the problem-gambling apps (Supplementary Table S3). MARS quality scores of unique problem-gambling-specific apps were classified into tertiles, which provided a cut-off point for an app to be considered a “best-rated” app, as has been defined in other studies [41, 42]. This cut-off value was then applied to unique general-addiction apps.

Data Analysis

Rating results reported in tables are of unique apps. In other words, in cases where an app existed on both Android and iPhone, these ratings were averaged together to create one value.

To identify whether individual app features were associated with significant differences in ratings scores, multivariate general linear models were used. A multivariate analysis of covariance (MANCOVA) was conducted with each feature as a fixed factor (e.g., tracking, community, psychoeducation, skills training, assessment, motivational quotes) and four dependent variables (MARS subscales A, B, C, and D). Phone platform (i.e., Android or iPhone) was included as a covariate to control for differences attributable to phone platform; duplicates were included for apps that existed on both Android and iPhone, meaning that there was one rating score for the Android version of the app and a second rating score for the iPhone version. Simple *t*-tests were performed to identify differences in MARS scores between Android and iPhone, and between problem-gambling-specific and general-addiction apps.

Pearson’s correlations (i.e., *r*) were calculated to determine relationships between variables. All analyses were conducted in SPSS v23, and graphs were plotted in Prism 9.

Results

Summary of app features

A summary of the features found in the 14 unique problem-gambling-specific phone apps is presented in Table 1. The most common features were tracking features that monitor individuals’ self-reported recovery progress (e.g., days gamble-free, money spent/saved, mood), psychoeducation about problem gambling, and assessment of problem-gambling severity, all of which were found in 64% of apps. Other features included providing feedback (e.g., regarding the severity of one’s gambling; 36%), community (e.g., discussion forums for people to share their recovery stories and comment on others’ posts; 29%), an “SOS” or emergency function which included useful resources for those in crisis (e.g., helplines, websites; 29%), and distractions such as games or visuals to help manage urges to gamble (14%). One rare feature (“Other”) was subliminal messaging (*Quit Gambling*). In terms of skills and theoretical frameworks, mindfulness and cognitive-behavioral (CBT)

approaches were the most prevalent (36%), and twelve-step approaches were uncommon (7%).

Summary of app rating scores

A summary of MARS scores for each unique problem-gambling-specific app is presented in Supplementary Table S2. The average quality MARS score across all apps was 3.25, with a range from 1.98 (*Quit Gambling*) to 4.05 (*QuitGamble*) on a scale of 1 to 5. By definition, approximately a third of these apps (36%) were considered “best-rated” i.e., were in the top tertile; the minimum quality score cut-off was 3.73. On average, Functionality had the highest ratings with an average of 4.28, followed by Aesthetics (3.35), Information (2.95), and Engagement (2.44).

Association between problem-gambling-specific app features and rating scores

There were no significant correlations between number of features of each app (Table 1) and any of the MARS subscales (Table 2). All MARS subscales with the exception of Functionality were strongly correlated with each other, indicating the strong relationship between objective and subjective MARS metrics.

We next identified whether individual app features were associated with significant differences in ratings scores. Since average MARS quality scores for iPhone ($n = 10$) apps were significantly higher than Android ($n = 9$) apps ($t_{17} = -2.69, p = 0.02$), we included phone platform as a covariate in these analyses. Apps with CBT and community features had higher MARS quality scores as compared to apps that did not have these features (CBT: $F_{1,16} = 11.4, p = 0.004$; community: $F_{1,16} = 7.34, p = 0.02$). Specifically, apps with CBT and community features were associated with higher Aesthetics (CBT: $F_{1,16} = 9.16, p = 0.008$; community: $F_{1,16} = 4.84, p = 0.04$) and Information (CBT: $F_{1,16} = 4.96, p = 0.04$; community: $F_{1,16} = 5.85, p = 0.03$) ratings (Figure 1). Additionally, the community feature was associated with higher Engagement ratings ($F_{1,16} = 11.5, p = 0.004$).

Comparison of problem-gambling-specific apps with general-addiction apps

To determine how problem-gambling-specific apps compare with apps that help people with addictions more generally, we also rated 11 unique general-addiction apps listed in Supplementary Table S3. In general, the most common features among these general-addiction apps were tracking (91%), motivational quotes (55%), and community (45%; Supplementary Table S4). Among strategies and theoretical frameworks, mindfulness approaches were most common (36%), followed by gratitude (27%) and relaxation exercises (27%). Cognitive-behavioral approaches were uncommon (9%). One rare feature (“Other”) was the ability to superimpose one’s face onto images depicting negative consequences of addictions (*Addiction Avert Plus*).

There were no significant differences between problem-gambling-specific and general-addiction apps in rating scores for all MARS subsets except for the Engagement subscale ($t_{23} = 2.64, p = 0.015$), where problem-gambling-specific apps were less engaging than general-addiction apps (Supplementary Table S5). Based on the cut-off for “best-rated” apps (quality score ≥ 3.73), 27% (3/11) of general-addiction apps were considered “best-rated” (I

Am Sober, nomo – Sobriety Clock, and Turn: Addiction Recovery), which was comparable to the number of problem-gambling-specific apps (36%; 5/14).

Correlations with user ratings

Finally, we examined whether user ratings on app stores were associated with number of features or with our rating scores. Due to the limited number of ratings, we combined problem-gambling-specific and general-addiction apps. This provided a total of nine Android apps with user star ratings and nine iPhone apps. User ratings were not significantly correlated with number of features for Android ($r_7 = 0.22, p = 0.57$), iPhone ($r_7 = 0.28, p = 0.46$) or combined Android and iPhone apps ($r_{16} = 0.33, p = 0.19$). There were also no significant correlations between user ratings and any MARS mean or subscale score.

Discussion

This is the first study to evaluate the objective and subjective characteristics of available apps that have been designed to help people with problem gambling (i.e., identified in app stores using keywords such as “gambling addiction”). Two broad categories of apps were rated: apps that have imagery and content tailored specifically to help people address problem gambling, and apps to help people with addictions more generally. Among problem-gambling-specific apps, Functionality was most highly rated, followed by Aesthetics, Information and Engagement. Overall, there was wide variability in the quality ratings of these commercially available apps, but there were a few select apps that were highly-rated (e.g., *QuitGamble* and *RecoverMe*). CBT was associated with positive ratings on Aesthetics and Information quality subscales. In-app communities were associated with positive ratings on those same metrics, with the addition of Engagement. Problem-gambling-specific apps had rating scores that were comparable to general-addiction apps on all metrics except Engagement, where problem-gambling-specific apps had lower ratings.

Cognitive behavioral therapy for problem gambling

Although CBT is the most common treatment approach for problem gambling, only a minority of problem-gambling-specific apps reviewed here featured content consistent with CBT (29%). In this study, the presence of CBT in problem-gambling-specific apps was associated with higher Information scores. This may be because apps that featured CBT were considered to be created by “legitimate” sources (as defined in the MARS) such as governmental agencies, universities, or non-governmental organizations (NGOs). According to their respective websites, *Gambling Therapy* was created by an NGO (The Gordon Moody Association, a UK-based non-profit organization that provides treatment to individuals affected by gambling addiction), *RecoverMe* was created by UK-based doctors through “discussions with gambling addicts, psychologists, and psychiatrists,” and *Gambless* was created by “expert psychologists.” This suggests that incorporating evidence-based approaches can improve aspects of app quality and working alliance. However, one limitation is that the CBT content on these apps was not presented in a particularly engaging way, often through text or audio recordings. Future app developers might consider strategies to enhance engagement when providing CBT content, such as having interactive features and by creating high-quality video-based content.

Improving app engagement and working alliance

Maintaining engagement with apps is arguably one of the biggest issues app developers face. This is a particularly salient issue for mHealth apps, as even highly popular apps (in terms of number of downloads) have relatively few active users [43]. A number of reasons have been proposed for low engagement with mental health apps, including that many apps are found to be too difficult or unenjoyable to use [43]. Consistent with this notion, in this study, Engagement (e.g., “Is the app fun/entertaining to use?”) was the lowest rated component of the MARS for the apps reviewed in this study. We also found that problem-gambling-specific apps had significantly lower Engagement scores than general-addiction apps (2.44 versus 3.23 out of 5, respectively). Interestingly, the total number of features was not significantly correlated with Engagement scores, suggesting that presence of specific features may be more important than the absolute number of them. In particular, we found that problem-gambling-specific apps with community features (e.g., discussion forums and other ways of interacting with other app users) were associated with higher Engagement scores. These communities can be a powerful source of motivation to engage with the app, both by giving and receiving social support from peers in similar situations. Social connections are particularly important in addiction recovery [44, 45], including from GD. Studies have found that lack of social support is a risk factor for developing GD, and that social support can enhance therapeutic benefits. For example, having fewer close social relationships predicted treatment discontinuation of an online CBT program for problem gambling [46]. Thus, providing social interaction via in-app communities may be a potent way to improve engagement, app usage, and treatment outcomes.

Of note, because the community variable was coded as binary, we did not quantify the *quality* of these communities: some had active discussion forums with multiple people posting per day, while others seem to have stagnated over time. Some communities provided filters, so one could see posts from people who have similar amounts of abstinent time as the user, which seemed to foster solidarity. A potentially useful feature would be to be able to filter based on content (e.g., only uplifting posts about reaching recovery milestones), to avoid feeling triggered by other posts (e.g., posts that express suicidal ideation). Future studies should further identify whether specific content of these communities may be a predictor of users’ mood (from mood-tracking features) and app engagement.

Existence of gambling-promotion apps

We would like to note, as others have [38], that multiple, highly colorful and salient apps that *promote* gambling appeared during the app search phase, despite using keywords explicitly associated with problem gambling (e.g., “pathological,” “addiction,” and “treatment”). This is an important and unfortunate consideration when recommending people with problem gambling to find treatment-supporting apps on the app store. Seeing apps that promote gambling may be triggering and promote gambling instead of seeking help. This further emphasizes the importance of creating mHealth apps that are eye-catching and engaging to compete with gambling-promotion apps, and to increase engagement with help-promoting apps.

Limitations

One limitation is that we excluded ‘blocking’ apps from this study. There is value to such apps, as physical and virtual self-exclusion have been found to be helpful for those with GD [47]. However, the rating assessments used in this study were more relevant to the subjective experience of using apps, whereas blocking apps often run in the background and do not involve much user interaction or engagement. This study was also limited by a review of freely available apps only. We identified three apps that were excluded from this review due to requiring purchase to download. Also, there were eight free apps included in this review for which we did not pay to upgrade to access premium content. We chose to only rate apps that were freely available as most individuals who access health apps are unlikely to pay for them, consistent with other studies that identified app cost as a significant barrier to use [48]. Nonetheless, future studies should explore these paid features and apps, as they may provide high quality content, albeit being limited in their accessibility.

Another important limitation is that none of the raters of these apps have lived experience with gambling problems. While we intentionally used the apps as though we were individuals who had problems with gambling (e.g., reporting low affect and gambling behavior in apps with tracking features, liking and posting messages within community chat rooms), it should be acknowledged that our ratings may not be similar to those from individuals seeking help with gambling problems. This may in part explain why we did not find correlations between any of our metrics and user ratings. Nonetheless, the majority of MARS measures (Engagement, Functionality, Aesthetics, Information, and the mean quality score) are relatively objective, and our ratings can still be used as an evaluation of the quality of each of these components. Future studies should involve individuals with lived experience with gambling problems to rate these apps, to gain a more relevant perspective into the usability and quality of these apps.

Conclusions

mHealth technology is changing many aspects of how healthcare is provided, but more can be done to increase engagement to maximize public health benefits. mHealth treatment of problem gambling is still relatively nascent compared to other mental health conditions, including SUDs. Understanding the mechanisms that maximize engagement, retention and efficacy of these apps is important. Although problem-gambling-specific apps incorporate a diversity of features to promote behavioral change, only a minority incorporate CBT despite the evidence in support of its efficacy in traditionally delivered interventions. This review may inform development and evaluation of new effective apps to support problem-gambling treatment. Our recommendation for researchers and developers of mobile apps that target GD and/or problem gambling is to create apps using high-quality content based on evidence-based interventions, and to include features that are enjoyable and engaging. Further research on apps for problem gambling should involve individuals with lived experiences of problem gambling, to get a better understanding of app engagement and subjective experience among people for whom these apps are most relevant.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Funding

This work was supported in part through a gift from the Mohegan Sun Casino to Yale University. Mohegan Sun Casino had no involvement in any component of this manuscript, including the conception, design, or analysis of this work. LYM and JML were supported by T32-funded postdoctoral training fellowships from the National Institutes of Health (NIDA grants T32DA019426 and T32DA007238, respectively). The views presented in this manuscript are those of the authors and do not necessarily reflect those of the funding agencies.

References

Papers of particular interest, published recently, have been highlighted as:

- Of importance
 - Of major importance
1. Potenza MN, Balodis IM, Derevensky J, et al. Gambling disorder. *Nat Rev Dis Primers* 2019;5:51. doi:10.1038/s41572-019-0099-7 [PubMed: 31346179] •• This provides a comprehensive overview on gambling disorder: its prevalence, genetic, neurobiological and environmental aetiology, and treatment.
 2. Potenza MN, Fiellin DA, Heninger GR, et al. Gambling. *Journal of General Internal Medicine* 2002;17:721–32. doi:10.1046/j.1525-1497.2002.10812.x [PubMed: 12220370]
 3. Organization WH. ICD-11: International classification of diseases (11th revision) Retrieved from <https://icd.who.int/>. 2019.
 4. Bruneau M, Grall-Bronnec M, Vénisse J-L, et al. Gambling transitions among adult gamblers: A multi-state model using a Markovian approach applied to the JEU cohort. *Addictive Behaviors* 2016;57:13–20. [PubMed: 26827154]
 5. Kessler RC, Hwang I, LaBrie R, et al. DSM-IV pathological gambling in the National Comorbidity Survey Replication. *Psychological medicine* 2008;38:1351–60. [PubMed: 18257941]
 6. Pilver CE, Potenza MN. Increased incidence of cardiovascular conditions among older adults with pathological gambling features in a prospective study. *J Addict Med* 2013;7:387–93. doi:10.1097/ADM.0b013e31829e9b36 [PubMed: 24104190]
 7. Potenza M, Koran L, Pallanti S. The relationship between obsessive-compulsive and impulse control disorders: a current understanding and future research directions. *Psychiatry Res* 2009;170:22–31. [PubMed: 19811840]
 8. Potenza MN. Should addictive disorders include non-substance-related conditions? *Addiction* 2006;101:142–51. [PubMed: 16930171]
 9. Horvath AT, Yeterian J. SMART recovery: Self-empowering, science-based addiction recovery support. *Journal of Groups in Addiction & Recovery* 2012;7:102–17.
 10. Cowlshaw S, Merkouris S, Dowling N, et al. Psychological therapies for pathological and problem gambling. *Cochrane Database of Systematic Reviews* 2012. doi:10.1002/14651858.CD008937.pub2 • This summarizes existing behavioral therapies for problem and pathological gambling.
 11. Yau YH, Potenza MN. Gambling disorder and other behavioral addictions: recognition and treatment. *Harv Rev Psychiatry* 2015;23:134–46. doi:10.1097/hrp.000000000000051 [PubMed: 25747926]
 12. Menchon JM, Mestre-Bach G, Steward T, et al. An overview of gambling disorder: from treatment approaches to risk factors. *F1000Research* 2018;7.
 13. Carlbring P, Smit F. Randomized trial of internet-delivered self-help with telephone support for pathological gamblers. *J Consult Clin Psychol* 2008;76:1090. [PubMed: 19045977]

14. Petry NM, Ammerman Y, Bohl J, et al. Cognitive-behavioral therapy for pathological gamblers. *J Consult Clin Psychol* 2006;74:555. [PubMed: 16822112] • This provides evidence-based guidelines on using CBT for problem and pathological gambling.
15. Potenza MN, Steinberg MA, McLaughlin SD, et al. Gender-related differences in the characteristics of problem gamblers using a gambling helpline. *American Journal of Psychiatry* 2001;158:1500–5. [PubMed: 11532738]
16. Slutske WS. Natural recovery and treatment-seeking in pathological gambling: Results of two US national surveys. *American Journal of Psychiatry* 2006;163:297–302. [PubMed: 16449485]
17. Gainsbury S, Hing N, Suhonen N. Professional help-seeking for gambling problems: awareness, barriers and motivators for treatment. *J Gambl Stud* 2014;30:503–19. doi:10.1007/s10899-013-9373-x [PubMed: 23494244]
18. Suurvali H, Cordingley J, Hodgins DC, et al. Barriers to seeking help for gambling problems: a review of the empirical literature. *J Gambl Stud* 2009;25:407–24. doi:10.1007/s10899-009-9129-9 [PubMed: 19551495]
19. Petry NM, Ginley MK, Rash CJ. A systematic review of treatments for problem gambling. *Psychology of Addictive Behaviors* 2017;31:951. [PubMed: 28639817]
20. Toomey E, Hardeman W, Hankonen N, et al. Focusing on fidelity: narrative review and recommendations for improving intervention fidelity within trials of health behaviour change interventions. *Health Psychol Behav Med* 2020;8:132–51. doi:10.1080/21642850.2020.1738935 [PubMed: 34040865]
21. Sholomskas DE, Syracuse-Siewert G, Rounsaville BJ, et al. We don't train in vain: a dissemination trial of three strategies of training clinicians in cognitive-behavioral therapy. *J Consult Clin Psychol* 2005;73:106–15. doi:10.1037/0022-006x.73.1.106 [PubMed: 15709837]
22. Oikonomidi T, Vivot A, Tran V-T, et al. A Methodologic Systematic Review of Mobile Health Behavior Change Randomized Trials. *American Journal of Preventive Medicine* 2019;57:836–43. doi:10.1016/j.amepre.2019.07.008 [PubMed: 31753266]
23. Tofighi B, Chemi C, Ruiz-Valcarcel J, et al. Smartphone Apps Targeting Alcohol and Illicit Substance Use: Systematic Search in in Commercial App Stores and Critical Content Analysis. *JMIR Mhealth Uhealth* 2019;7:e11831. doi:10.2196/11831 [PubMed: 31008713]
24. Iribarren SJ, Akande TO, Kamp KJ, et al. Effectiveness of Mobile Apps to Promote Health and Manage Disease: Systematic Review and Meta-analysis of Randomized Controlled Trials. *JMIR Mhealth Uhealth* 2021;9:e21563. doi:10.2196/21563 [PubMed: 33427672]
25. Rathbone AL, Prescott J. The Use of Mobile Apps and SMS Messaging as Physical and Mental Health Interventions: Systematic Review. *J Med Internet Res* 2017;19:e295. doi:10.2196/jmir.7740 [PubMed: 28838887]
26. Anthes E Mental health: There's an app for that. *Nature* 2016;532:20–3. doi:10.1038/532020a [PubMed: 27078548]
27. Grundy Q A Review of the Quality and Impact of Mobile Health Apps. *Annual Review of Public Health* 2022;43:117–34. doi:10.1146/annurev-publhealth-052020-103738 •• This review highlights the consequences of having untested, non-evidence-based mHealth apps.
28. Swire-Thompson B, Lazer D. Public Health and Online Misinformation: Challenges and Recommendations. *Annual Review of Public Health* 2020;41:433–51. doi:10.1146/annurev-publhealth-040119-094127
29. Aronowitz S, Meisel ZF. Addressing Stigma to Provide Quality Care to People Who Use Drugs. *JAMA Network Open* 2022;5:e2146980-e. doi:10.1001/jamanetworkopen.2021.46980
30. Abroms LC, Padmanabhan N, Thaweethai L, et al. iPhone apps for smoking cessation: a content analysis. *Am J Prev Med* 2011;40:279–85. doi:10.1016/j.amepre.2010.10.032 [PubMed: 21335258]
31. Amagai S, Pila S, Kaat AJ, et al. Challenges in Participant Engagement and Retention Using Mobile Health Apps: Literature Review. *J Med Internet Res* 2022;24:e35120. doi:10.2196/35120 [PubMed: 35471414]
32. Druce KL, Dixon WG, McBeth J. Maximizing Engagement in Mobile Health Studies: Lessons Learned and Future Directions. *Rheumatic Disease Clinics of North America* 2019;45:159–72. doi:10.1016/j.rdc.2019.01.004 [PubMed: 30952390]

33. Hawker CO, Merkouris SS, Youssef GJ, et al. A Smartphone-Delivered Ecological Momentary Intervention for Problem Gambling (GamblingLess: Curb Your Urge): Single-Arm Acceptability and Feasibility Trial. *J Med Internet Res* 2021;23:e25786. doi:10.2196/25786 [PubMed: 33769294]
34. Humphrey G, Chu JT, Ruwhiu-Collins R, et al. Adapting an Evidence-Based e-Learning Cognitive Behavioral Therapy Program Into a Mobile App for People Experiencing Gambling-Related Problems: Formative Study. *JMIR Form Res* 2022;6:e32940. doi:10.2196/32940 [PubMed: 35108213]
35. Pfund RA, Whelan JP, Meyers AW, et al. The Use of a Smartphone Application to Complete Therapeutic Homework in Cognitive-Behavioral Therapy for Gambling Disorder: a Pilot Study of Acceptability and Feasibility. *Journal of Technology in Behavioral Science* 2020;5:156–63. doi:10.1007/s41347-019-00123-9
36. Khazaal Y, Monney G, Richter F, et al. «Jeu-contrôle», rationnel d'une application de soutien aux limites de jeux. [mHealth app for gambling disorder: Rational and description.]. *Journal de Thérapie Comportementale et Cognitive* 2017;27:129–37. doi:10.1016/j.jtcc.2017.05.003
37. So R, Furukawa TA, Matsushita S, et al. Unguided Chatbot-Delivered Cognitive Behavioural Intervention for Problem Gamblers Through Messaging App: A Randomised Controlled Trial. *J Gambl Stud* 2020;36:1391–407. doi:10.1007/s10899-020-09935-4 [PubMed: 32162075]
38. Ridley KW, Amy, Coleman, Mathew. Win big fast! An evaluation of mobile applications available in Australia for problem gambling. *Journal of Gambling Issues* 2020;45. doi:10.4309/jgi.2020.45.6
- This summarizes features identified in 42 existing mHealth apps for problem gambling in Australia.
39. Brownlow L A Review of mHealth Gambling Apps in Australia. *Journal of Gambling Issues* 2021.
- This summarizes 17 existing mHealth problem-gambling-specific apps available in Australia.
40. Stoyanov SR, Hides L, Kavanagh DJ, et al. Mobile App Rating Scale: A New Tool for Assessing the Quality of Health Mobile Apps. *JMIR mHealth uHealth* 2015;3:e27. doi:10.2196/mhealth.3422 [PubMed: 25760773]
41. Moseley I, Roy A, Deluty A, et al. Evaluating the Quality of Smartphone Apps for Overeating, Stress, and Craving-Related Eating Using the Mobile Application Rating Scale. *Current Addiction Reports* 2020;7. doi:10.1007/s40429-020-00319-7
42. Salazar A, de Sola H, Failde I, et al. Measuring the Quality of Mobile Apps for the Management of Pain: Systematic Search and Evaluation Using the Mobile App Rating Scale. *JMIR Mhealth Uhealth* 2018;6:e10718. doi:10.2196/10718 [PubMed: 30361196]
43. Torous J, Bucci S, Bell IH, et al. The growing field of digital psychiatry: current evidence and the future of apps, social media, chatbots, and virtual reality. *World Psychiatry* 2021;20:318–35. doi:10.1002/wps.20883 [PubMed: 34505369]
44. Best D, Sondhi A, Brown L, et al. The Strengths and Barriers Recovery Scale (SABRS): Relationships Matter in Building Strengths and Overcoming Barriers. *Frontiers in Psychology* 2021;12. doi:10.3389/fpsyg.2021.663447
45. Pettersen H, Landheim A, Skeie I, et al. How Social Relationships Influence Substance Use Disorder Recovery: A Collaborative Narrative Study. *Subst Abuse* 2019;13:1178221819833379. doi:10.1177/1178221819833379 [PubMed: 30886519]
46. Palomäki J, Lind K, Heiskanen M, et al. Predicting online problem gambling treatment discontinuation: New evidence from cross-validated models. *Psychology of Addictive Behaviors* 2022;No Pagination Specified-No Pagination Specified. doi:10.1037/adb0000875
47. Gainsbury SM. Review of self-exclusion from gambling venues as an intervention for problem gambling. *J Gambl Stud* 2014;30:229–51. doi:10.1007/s10899-013-9362-0 [PubMed: 23338831]
48. König LM, Attig C, Franke T, et al. Barriers to and Facilitators for Using Nutrition Apps: Systematic Review and Conceptual Framework. *JMIR Mhealth Uhealth* 2021;9:e20037. doi:10.2196/20037 [PubMed: 34254938]

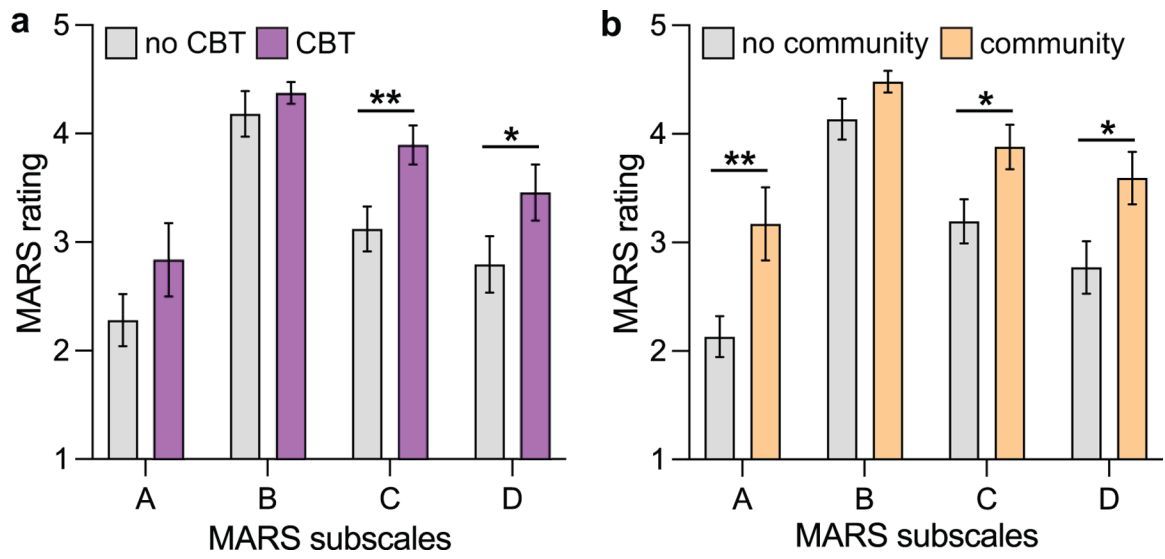


Figure 1. Associations between CBT and community features, and MARS subscales. Rating scores on MARS subscales Engagement (A), Functionality (B), Aesthetics (C), and Information (D), categorized based on absence or presence of **a)** CBT and **b)** community features. Error bars indicate standard error of the mean. * $p < 0.05$, ** $p < 0.01$

Table 1:

Summary of features of problem-gambling-specific apps included in this review

App functionalities	12-step Gamblers Anonymous	888-ADMIT-IT	Better Time Gambling Control	Gambless	Gambling Addiction	Gambling Addiction Calendar	Gambling Addiction Test	Gambling Therapy	playR/GHT	Quit Gambling	QuitGamble	RecoverMe	Stay on Track SA	Stop Addiction: Gambling	Total problem-gambling-specific apps (/14)
Tracking	✓		✓	✓		✓	✓		✓			✓	✓	✓	9
Psychoeducation	✓	✓		✓	✓		✓	✓			✓	✓		✓	9
Assessment	✓	✓		✓			✓	✓			✓	✓		✓	9
Feedback			✓				✓	✓				✓		✓	5
Community						✓	✓	✓			✓	✓			4
SOS		✓		✓		✓	✓	✓							4
Motivational quotes						✓	✓	✓				✓			3
Distraction					✓	✓									2
Total # functionalities (/8)	3	3	3	4	2	5	4	6	1	0	3	6	1	4	-
App strategies															
Mindfulness	✓			✓				✓				✓			4
CBT				✓				✓				✓			4
Gratitude	✓										✓				2
Relaxation	✓										✓				1
Strengths-based											✓				1
Twelve step	✓														1
Other										✓					1
Total # strategies (/7)	4	0	0	2	0	0	0	2	0	1	3	2	0	0	-
Total # features (/15)	7	3	3	6	2	5	4	8	1	1	6	8	1	4	-

Table 2:

Correlations between number of features and MARS rating scores

	1	2	3	4	5	6	7	8
1. Number of features	--							
2. Engagement (A)	0.46	--						
3. Functionality (B)	0.18	0.48	--					
4. Aesthetics (C)	0.27	0.78**	0.57*	--				
5. Information (D)	0.23	0.62*	0.52	0.66*	--			
6. Quality score (A-D)	0.34	0.87**	0.73**	0.90**	0.85**	--		
7. Subjective quality (E)	0.42	0.86**	0.41	0.83**	0.77**	0.88**	--	
8. Impact (F)	0.51	0.82**	0.48	0.70**	0.87**	0.87**	0.88**	--

*
 $p < 0.05$

**
 $p < 0.01$

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript