Digital Psychosocial Interventions Tailored for People with Opioid Use Disorder: Scoping Review

Madison Scialanca, Karen Alexander, Babak Tofighi

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Madison Scialanca[1] MPH, BS; Karen Alexander[1] PhD, RN; Babak Tofighi[1] MD, MS

[1]Friends Research Institute Baltimore US

Corresponding Author:
Madison Scialanca MPH, BS
Friends Research Institute
1040 Park Ave, Suite 103
Baltimore
US

Abstract

Background: Sixty percent of patients with opioid use disorder (OUD) leave treatment early. Psychosocial interventions can enhance treatment retention by addressing behavioral and mental health needs related to early treatment discontinuation, but engagement is key. If well-designed, digital platforms can increase the engagement, reach, and accessibility of psychosocial interventions.

Objective: This scoping review aims to document and describe recent digital psychosocial interventions for patients in medication-based OUD (MOUD) treatment.

Methods: Predefined search terms were used to search Ovid, CINAHL, and PubMed databases for peer-reviewed literature published in the last ten years. The database search resulted in 1381 relevant articles, and 16 of them remained after applying the inclusion criteria. Studies were included if they: 1) evaluated a digital intervention with behavioral, psychosocial, or counseling components for people with OUD; and 2) were published in English in peer-reviewed journals.

Results: The 16 articles reviewed comprised six randomized controlled trials, six pilot studies, two qualitative studies, and two retrospective cohort studies. Smartphone applications (n=8) were the most prevalent intervention delivery method, with other studies using telemedicine (n=3), virtual reality (n=1), telephone calls (n=1), or text messaging (n=3) to deliver psychosocial interventions in either a synchronous (n=7) or asynchronous (n=9) manner. The digital interventions reviewed predominately delivered cognitive behavioral therapy education and increased contact with providers.

Conclusions: Participants in the studies reviewed indicated a preference for digital, flexible, patient-centered psychosocial interventions that emphasized improved patient-provider relationships. Further studies are needed to establish an evidence base for digital psychosocial intervention efficacy through fully-powered randomized controlled trials to reduce early termination of OUD treatment.

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Digital psychosocial interventions tailored for people with opioid use disorder

Scialanca, Madison[1*]; Tofighi, Babak[1]; Alexander, Karen[1]

[1]Friends Research Institute, 1040 Park Ave., Suite 103, Baltimore, MD 21201

*corresponding author: kalexander@friendsresearch.org, Friends Research Institute, 1040 Park

Ave., Suite 103, Baltimore, MD 21201

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Keywords: *opioid use disorder, digital intervention, counseling, treatment, psychosocial,*

behavioral intervention, technology, smartphone

INTRODUCTION

In 2020, 2.7 million people ages 12 years and older reported having an opioid use disorder (OUD).[1] Sixty percent of people in OUD treatment discontinue treatment early, often due to substance use cravings, negative mood, and drug cues in the environment.[2] Psychosocial support within OUD treatment can address these internal and external factors to increase treatment retention.[3,4] Several psychosocial intervention approaches exhibit a strong evidence base, including cognitive behavioral therapy (CBT)[5-7], mindfulness oriented recovery enhancement (MORE)[8], contingency management (CM)[9], and motivational interviewing (MI).[10-12] However, effectiveness is limited by organizational (e.g., insufficient staffing, resources, space) and patient-level barriers (e.g., time, transportation, limited awareness, stigma).[3] Recently, personalized approaches for psychosocial support utilizing digital methods have emerged, overcoming the multi-level constraints of in-person psychosocial services.

Substance use treatment programs have rapidly adopted digital methods to improve healthcare delivery, particularly during the COVID-19 pandemic and the implementation of social distancing measures.[13] Digital delivery methods, such as websites, smartphone apps, telemedicine, and text messaging, can directly address physical barriers to receiving OUD services (e.g. distance and lack of transportation) and extend the reach of psychosocial support services. In addition, digital healthcare delivery potentially addresses individual reasons for not engaging in treatment, especially among people with stigmatized conditions such as OUD, who could benefit from increased privacy and anonymity through digital platforms.[14]

While previous reviews exist that characterize the digital health landscape for people who use opioids or who have OUD[15-18], the rising number of digital interventions focus on OUD treatment outcomes rather than clarifying the underlying behavior change principles

and associated mechanisms that influence specific outcomes. Few commercially available apps evaluated in a prior review adopted behavior change principles, and a concerning number of apps promoted harmful drinking and illicit substance use.[19,20] To overcome this "black box dilemma," standardized descriptions of behavior change strategies guiding intervention design are required and proposed in this review. The existing literature on digital interventions insufficiently synthesizes components related to underlying psychosocial approaches, particularly in light of the recent surge of digital innovation in OUD treatment. This scoping review aims to document and describe recent digital psychosocial interventions for people in OUD treatment. We conducted a scoping review of the literature to answer the following question: What recent evidence (in the last ten years) exists regarding the intersection of digital interventions, counseling or psychosocial interventions, and people with OUD?

METHODS

Data Sources and Search Strategy

We determined the study's objective, the research question, inclusion/exclusion criteria, and methods a priori. The five-stage process outlined by Arksey and O'Malley of the Joanna Briggs Institute was used to conduct the scoping review: 1) identify the research question, 2) identify the relevant studies, 3) select studies, 4) chart the data, and 5) organize the results.[21-23] PubMed, the Cumulative Index for Nursing and Allied Health Literature (CINAHL), and OVID Medline were searched with dates restricted from 2015-2024: (mHealth OR ecological momentary OR real-time OR mobile health technology OR digital health OR telemedicine OR text messaging OR mobile) AND (counseling OR behavioral OR psychosocial OR therapy) AND (opioid use disorder OR opioid use disorder treatment OR methadone OR buprenorphine OR naltrexone). The search term list was compiled by study team members (K.A., M.S). The Preferred Reporting Items for

Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) guidelines and checklist.[24]

Study Selection

Studies identified in the search process were screened by title and abstract by two researchers (K.A. and M.S) and selected for full review if the studies: 1) described a digital health intervention during OUD treatment, 2) also described a counseling, behavioral therapy or psychosocial component, 3) were written in English, and 4) were original, empirical research published in peer-reviewed journals within the last ten years. Reviews, opinion articles, and commentaries were excluded, but as this is a scoping review, no exclusion occurred due to the study design. Duplicates were removed across the databases after importing all results into a common Excel spreadsheet. The screening process was refined prior to initiation by two research team members (K.A., M.S.), and any protocol irregularities were discussed as an entire research team. Articles eligible for full text review were cross-checked by two reviewers, and disagreements were discussed until consensus was achieved. The search process is reflected in a PRISMA diagram (see **Figure 1**). The search yielded 1381 articles for title and abstract review. Of the 37 articles reviewed in full-text, 21 did not meet the eligibility criteria and were excluded. In all, 16 articles were included in the results (See **Figure 1**).

Data Extraction

Data were extracted and rendered into table format with the following headers: author, year, country, journal, study aim, study design, intervention characteristics, and outcome findings (See **Table 1**). This allowed for comparison across studies according to study characteristics. The results were then categorized in the following manner: description of studies, digital health mode of delivery and behavior change, the feasibility and acceptability of digital psychosocial interventions, and digital psychosocial interventions

outcomes.

Table 1. Study descriptions.

Authors (Year)	Study Purpose	Study Design	Sample Size/Setting (Country)	Digital Health Method	Type of Interaction	Key Findings
Ashrafioun et al. (2024)	To report the feasibility , acceptability, and efficacy of CBT for people experiencing loneliness and OUD compared to health education	RCT	125/ Community (United States)	Telehealth	Synchronous sessions with counselor	There were significant reductions in loneliness and increases in perceived social support across both groups. The treatment group had significantly less overall opioid use and substance use from baseline to 2 months.
Cooperman et al. (2024)	To evaluate the efficacy of MMT as usual (usual care) vs telehealth Mindfulness-Oriented Recovery Enhancement (MORE) plus usual care among people with an OUD and pain.	RCT	154/MMT (United States)	Telehealth	Synchronous sessions with counselors	There were significant reductions in returning to drug use among MORE participants compared to treatment as usual.
Day et al. (2022)	To describe clinical outcomes from Alberta's Virtual Opioid Dependency Program	Cohort	440/OAT (Canada)	Telehealth	Synchronous counselors and providers	Participants reported high satisfaction (90%) with telehealth delivery, and overall reductions in drug use and social functioning.
Garland et al. (2024)	To assess the feasibility of virtual reality	Pilot	34/Community (United States)	Virtual Reality	Synchronous sessions with interventionist	Participants reported high usability and

	based Mindfulness-Oriented Recovery Enhancement (MORE-VR) for patients with OUD					acceptability of MORE-VR, and opioid use decreased significantly post-treatment.
Guarino et al. (2016)	To pilot an interactive, mobile phone-based psychosocial intervention based in the Therapeutic Education System	Pilot	25/MMT (United States)	mHealth app	Asynchronous, not on-demand	Participants reported using the mobile intervention in a range of settings, including during times of heightened risk for substance use, and finding it helpful in managing drug cravings. Participants endorsed its usefulness and ease of use.
Gustafson et al. (2024)	To test a behavioral intervention to promote retention in medication treatment for OUD (A-CHESS)	RCT	414/OTP (United States)	mHealth app	Asynchronous, access to on-demand content	A-CHESS did not increase opioid abstinence compared to medication treatment as usual for OUD.
Hodges et al. (2022)	To pilot test a mHealth application (HOPE) to improve retention and mental health outcomes	Pilot	25/OTP (United States)	mHealth app	Asynchronous, bi-directional messaging	Participants had average retention rates at the OTP, and engaged consistently and positively with the mHealth app.
Kiburi et al. (2023)	To describe the experiences of participants with OUD enrolled in a text-messaging intervention	Qualitative	24/MMT (Kenya)	Text-messaging	Asynchronous, uni-directional messaging back to counselors	Participants described a stronger therapeutic alliance with their counselors as a result of the text

						message interactions.
King et al. (2024)	To describe the feasibility and acceptability of an mHealth app to improve treatment retention for people with OUD	Pilot	15/MMT (United States)	mHealth app	Synchronous, uni-directional messaging back to counselors	Participants rated their experience with the app (KIOS) as favorable overall. The app was able to accurate predict craving, and is designed to provide feedback to the user to have an impact on substance use.
Monico et al. (2024)	To evaluate the feasibility and acceptability of a digital therapeutic that combines CBT and buprenorphine telehealth treatment	Pilot	27/Online recruitment (United States)	mHealth app	Synchronous telehealth visits and asynchronous content	Participants reported increased opioid abstinence days from baseline to 12 weeks.
Moore et al. (2019)	To test the efficacy of a phone-based adjunct treatment to methadone treatment for OUD	RCT	82/OTP (United States)	Telephone	Asynchronous, on-demand content	Days of self-reported drug abstinence improved for participants in the intervention compared to treatment as usual.
Ranjit et al. (2023)	To examine the content of communication between participants in OUD recovery and their online coaches through text messaging intervention	Qualitative	70/OTP (United States)	mHealth app	Synchronous, bi-directional messaging	A content analysis of texts sent within the uMAT-R mHealth app. Most texts were initiated by coaches, and mainly provided emotional support. Participants did engage in support seeking

						behavior.
Stidham et al. (2024)	To examine whether treatment related outcomes differ for young adults in treatment for OUD based on app engagement	Cohort	35/OTP (United States)	mHealth app	Asynchronous, plus contingency management rewards	There were no differences in mental health outcomes, but engagers with reSET-O were more likely to be retained in care at the end of the 12-week prescription as compared to non-engagers.
Tofighi et al. (2023)	To assess the feasibility of integrating text-messaging into primary care initiated buprenorphine treatment	RCT	128/OBOT patients (United States)	Text-messaging	Asynchronous, uni-directional messaging	The intervention was feasible and acceptable to participants, and retention in the intervention group compared to the treatment as usual group did not differ significantly.
Tofighi et al. (2022)	To assess the feasibility of integrating text-messaging into primary care initiated buprenorphine treatment	RCT	50/OBOT patients (United States)	Text-messaging	Asynchronous, uni-directional messaging	Most participants responded to at least one text query over an average of 24 days, to respond to CBT queries, confirm appointments or ask questions about insurance.
Waselewski et al. (2021)	To develop and pilot test a mHealth app (HOPE) to support patients in an OTP	Pilot	25/OTP (United States)	mHealth app	Asynchronous, bi-directional messaging	Participants demonstrated engagement with the app and qualitative analysis highlighted

						the value of self-monitoring to the participants.

CBT = Cognitive Behavioral Therapy; RCT = Randomized Controlled Trial; Office-based Buprenorphine Treatment = OBOT; OUD = Opioid Use Disorder; OTP = Opioid Treatment Program; MMT = Methadone Maintenance Treatment

RESULTS

Description of Studies

The 16 articles ranged in publication dates from 2016 to 2024, with most studies published in the last two years (n=10). Six studies were RCTs, with sample sizes ranging from 34 to 414. There were six non-randomized pilot studies that prospectively assigned participants to an intervention with sample sizes ranging from 15 to 50. The remainder of the studies were qualitative (n=2) or retrospective cohort studies (n=2). The participants in the reviewed studies were all adults ages 18 years and older. Specific inclusion criteria for the studies varied, but all studies had a common inclusion criterion of people diagnosed with OUD and treated with opioid agonist medication. Most studies were conducted in conjunction with a treatment clinic, but several studies used online, national recruitment methods. All but two studies were conducted in the United States.

Mode of Delivery

Smartphone applications (n=8) were the most prevalent intervention type, with other studies using telemedicine (n=3), virtual reality (n=1), a phone (n=1) or text messaging (n=3) to deliver psychosocial interventions. Telemedicine and virtual reality interventions included synchronous participation by counselors and participants. The remaining interventions, inclusive of a telephone-based study, smartphone apps and text-messaging interventions, used asynchronous content delivered to participants with either the ability to interact back and forth with counselors (bi-directional messaging) or a one-way method of

communication only (uni-directional messaging).

Behavior Change Techniques

The most commonly used behavior change techniques (n=9) was cognitive behavioral therapy (CBT) education delivered to participants through a phone call (n=1), a text message (n=2), smartphone app (n=5) or tele-counseling (n=1). The predominant CBT strategies implemented were self-monitoring, cue awareness, and providing instruction. A few interventions mentioned the use of coping planning and goal setting. One intervention reviewed use the evidence base of mindfulness-oriented recovery enhancement (MORE). Stress management, while not explicitly described as such, was a focus of the CBT-based interventions. The MORE intervention was explicit about using mindfulness techniques to increase coping with high-risk situations of returning to use. However, few interventions provided bi-directional feedback on performance, a cornerstone of evidence-based behavior change.

Feasibility, Acceptability and Usability of Digital Counseling Interventions

Eleven studies assessed the feasibility, acceptability, or usability of their respective intervention. Some of the measures used to determine these factors included: whether the intervention was interesting and enjoyable to use, and whether the material was relevant, accessible, and understandable, and how many times the intervention was accessed. When surveyed or interviewed about their preferences regarding digital interventions, participants were receptive to personalized counseling interventions to support OUD recovery via virtual reality, phone-based intervention, telemedicine, smartphone and text-based interventions.[25-29] Participants in a smartphone adaptation of the Therapeutic Education System (a precursor to reSET-O[30]) reported the intervention feasibility in various settings, including at high-risk times of drug use to manage cravings.[31] Guarino et al. reported that participants found it feasible and acceptable to use a smartphone application to address drug cravings.[32] In a formative study of the KIOS app, cravings were successfully predicted with self-reported symptoms. Participants (N=15) received specific

behavioral feedback addressing patterns of symptoms and rated the app overall favorably.[33]

The usefulness and ease of using a smartphone app for delivery of psychosocial interventions were reported among all age groups and educational backgrounds in the studies reviewed.[34] In qualitative interviews, participants in Project HOPE felt that the smartphone app improved the connection to care and communication between patients and their providers.[35] Participants were given access to the app 24 hours per day and used it on average 3 times per week. The most used features were symptom reporting and behavioral counseling messaging. In a retrospective cohort analysis of a digital therapeutic, reSET-O, participants were either highly engaged (30% of participants completing over 90% of lessons) or disengaged (70% of participants completing less than 25% of lessons).[36] In a text-messaging intervention used to reinforce retention in buprenorphine treatment, most participants (n=50) responded to at least one text message that centered on the manualized medical management model (e.g., self-management, CBT appointment reminders).[28]

Three studies included a community or social support interaction with a therapist or coach. Project HOPE participants (n=25) could engage bi-directionally with their counselors within the app, and the messaging feature was the most used of all the features.[37] Project HOPE implemented a community board, but it was used infrequently, likely due to the low number of participants at any one time in the app.[37] Kiburi et al. implemented a CBT module sent to participants as homework, with the results being sent back to a therapist. Participants expressed developing an enhanced therapeutic alliance with their therapist through the intervention.[16] Qualitative interviews highlighted that the interaction within the intervention as important for developing the therapeutic alliance. Although not able to interact physically with the therapist (all interaction occurred over text messages), participants felt connection and support, and the text-messaged content helped them develop coping skills to handle cravings.[16] Another study used social support messages (the uMAT-R app) to develop a therapeutic relationship between participants and 'e-coaches'. A qualitative content analysis of the in-app messages demonstrated that emotional support was the greatest

need.[38]

Digital Psychosocial Intervention Outcomes

Three clinical trials reviewed reported decreases in opioid use compared to treatment as usual.[27,39,40] In an RCT (N=154), Mindfulness-Oriented Recovery Enhancement (MORE) delivered via telemedicine significantly reduced returning to drug use and early cessation of treatment for participants enrolled in methadone maintenance treatment compared to treatment as usual.[25,40] In an RCT of a telephone-based intervention, Recovery Line, participants in the intervention group (n=40) demonstrated a significant increase in self-report days of abstinence from drugs compared to the treatment-as-usual group (n=42).[27] Intervention participants were given access to a phone number connected to CBT-based educational content. Text message reminders prompted participants to call the hotline, but fewer than 25% of participants accessed the Recovery Line more than 10 times and demonstrated limited engagement. However, participants that called the Recovery Line self-reported greater drug abstinence days. Significant reductions in drug use also occurred from baseline to 3-, 6- and 12-month follow-up in a telemedicine buprenorphine clinic.[29]

An RCT of a CBT intervention for perceived loneliness also demonstrated effectiveness in decreasing opioid use and substance use from baseline to 2 months.[39] However, in an RCT (n=414) of a smartphone application, A-CHESS, rates of opioid abstinence were not improved relative to OTP treatment as usual.[41] A-CHESS content and features were based on self-determination theory and addressed social support and intrinsic motivation to reduce returning to use. Finally, in a pilot study of a virtual outpatient treatment program (Pelago-Opioid) that combined buprenorphine treatment with behavioral therapy, participants (N=27) reported increased abstinence from opioids from baseline to 12 weeks ($p<.001$).[42] Virtual meetings with counselors were also complementary to CBT educational modules, and tracking of symptoms and progress.

Most RCTs assessed treatment retention as an outcome with findings similar to standard care. Generally, participants who demonstrated greater engagement with digital interventions were more likely to be retained in care.[36] Of note, in the HOPE study, participants lost to in-person clinic

follow up continued to engage with one or more app features.[37] In a text message-based intervention as an adjunct to buprenorphine treatment, retention in treatment did not differ between participants randomized to the intervention or treatment as usual groups (p=.676).[43]

DISCUSSION

This scoping review describes recent digital psychosocial interventions for patients receiving MOUD and yielded 16 articles, predominantly focused on research in the United States in the last two years. We collected and organized data from these studies based on the type of digital intervention employed, behavior change techniques, and the evaluated outcomes. Overall, this scoping review characterized recent efforts to incorporate digital psychosocial intervention delivery methods into outpatient OUD treatment settings. The heterogeneity of delivery methods, behavior change techniques, and the minority of studies incorporating two-way communication was noted.

The digital interventions reviewed predominately delivered CBT education and increased contact with providers. The evidence base of CBT as a behavior change technique is clear in the literature, as the primary targets of CBT (stress, coping and problem solving) are key mechanisms involved in returning to use. CBT aims to help patients identify situations that may present an opportunity to return to use and learn to cope with these situations. However, longitudinal engagement with CBT-based digital interventions remains a persistent challenge. Here, the merging of evidence-based behavior change strategies offers a tailored approach to improve engagement with digital interventions. For instance, the MORE approach merges efficacious elements of mindfulness, cognitive behavioral therapy, and positive psychology to improve treatment retention by targeting conditions (e.g., cravings, physical pain, emotional distress) that drive illicit opioid reuse and early cessation of buprenorphine. Patient engagement with behavior change interventions early in treatment may also be enhanced using contingency management or motivational enhancement therapy driven tools.

The digital psychosocial interventions reviewed appeared feasible and acceptable for patients receiving MOUD. A preference among participants for telemedicine over in-person counseling was seen and participants agreed that the digital material was more interesting and

applicable than standard counseling.[27] This finding resonates with other literature reviews, which found that patients in general medical populations and with SUD are more interested in engaging with telemedicine vs in-person visits.[44,45] Telemedicine is preferred as a method that can increase the usability of psychosocial interventions as it overcomes multi-level barriers to in-person visits (e.g., lack of transportation, availability and flexible scheduling of sessions, discrimination experienced in healthcare settings).[46] Numerous reviews have established patient preferences and clinical data supporting the need for "hybrid" digital strategies that extend or enhance provider counseling. However, the interventions included in this review did not elaborate on strategies to reduce cognitive burden among patients exposed to digital platforms with multiple components. Digital tools with multiple components may often appear to be redundant or impersonal for patients and reduce engagement, thus reducing retention in treatment. Using personalized menu options, natural language processing, or graded approaches (i.e., adjusting the frequency or content of prompts per specific patient inputs) may offer a more personalized strategy to engage patients across various stages of OUD treatment. Importantly, applying user experience methods ensures patient input with intervention design and delivery to improve usability and longitudinal engagement.[47] The Technology Acceptance Model also reinforces a theoretically-driven approach to applying patient feedback to inform intervention design and iterative refinement (e.g., perceived usefulness, ease of use, relevance, intrusiveness) that may further enhance adoption.[48]

Interestingly, participants in one study continued the use of the HOPE app even after in-person disengagement with treatment, indicating that digital approaches may be a needed adjunct to treatment when barriers exist to in-person clinic attendance.[35] These findings suggest the need for more personalized approaches to support patients across the OUD care cascade in the event of illicit opioid reuse and preferences to receiving harm reduction content or opting medication-free approaches to treating OUD. Three RCTs reported decreased opioid use compared to treatment as usual groups among patients prescribed MOUD, and one pilot study reported decreased opioid craving while using a smartphone app based on cognitive behavioral therapy. A-CHESS, which was based on self-determination theory, did not result in increased opioid abstinence. This suggests that

further research is needed into the specific content or design features that effectively reduce substance use.

Only two of the digital interventions (KIOS and A-CHESS) reviewed used real-time data to impact substance use or treatment retention outcomes.[41,49,50] Treatment incorporating real-time data has provided an avenue for tailored counseling sessions.[30] Visualization of data on a web or mobile-based dashboard enables counselors to focus sessions on specific triggers of drug use.[51] Counseling sessions that incorporate real-time data to respond to the unique symptoms and triggers of a particular behavior can personalize treatment.[52-54] For instance, leveraging ecological momentary assessments and passively captured biofeedback data through a growing array of sensors provides innovative strategies to evaluate complex, temporally dynamic psychological and physiological factors that influence treatment outcomes. However, few of the interventions reviewed were able to offer real-time support involving patient-provider communications apart from asynchronous, bi-directional messaging with counselors. Patients rated messaging favorably and engaged most often with the digital tools that enhanced their patient-provider relationship, but real-time response was rare. Real-time support is an important aspect of digital tools as it complements current models of behavior change.

The small number of digital psychosocial interventions evaluated in RCTs is surprising, given the recent shifts in healthcare delivery post-pandemic. However, over half of the articles reviewed were published in the last two years. It is likely, given the lag between conducting clinical trials and publication of results, that there are interventions under development that are not present in the literature. It is also highly likely that findings from clinical trials conducted during COVID experienced recruitment delays, further delaying publications. For future research, equivalence trials would be the most suitable option when designing clinical trials to compare digital and in-person counseling for OUD. Instead of superiority trials, this approach would improve the feasibility and expediency of establishing efficacy for new interventions.

While these interventions demonstrate promising findings for improving engagement in care, there remains limited data on how to best adapt and integrate efficacious digital tools in OUD

treatment settings. The impact of digital innovation is most seen in clinical workflows and often can be perceived as an increasing burden on providers and exacerbating the digital divide among underserved patient populations that lack access to more costly devices. Here, the use of participatory action research and implementation research offer systematic approaches to involve key stakeholders in intervention design, integration, and refinement to ensure the sustainability of evidence-driven interventions.

Limitations

Several limitations may have affected the review findings. Across the 16 studies, intervention mode of delivery, control groups, and treatment frequency and duration all varied, making it difficult to synthesize the findings. Additionally, all but two studies were conducted in the United States, one in Canada, and one in Kenya, suggesting that further research is needed in low- and middle-income countries. Similarly, these studies were only peer-reviewed published articles in English, which continues to limit the results. Although not an exclusionary criterion, it is valuable to note that there were no studies with participants who were children under the age of 18. We also did not include any studies that used wearables or social media interventions since they were not integrated into MOUD treatment and did not implement evidence-driven behavior change models. However, future studies are needed to evaluate these modalities and other digital tools that may leverage passive data to better guide digital intervention design.

Conclusion

Overall, participants receiving digital interventions with psychosocial components engaged in the interventions and found them highly relevant to their experience. Some participants in the intervention groups found the digital psychosocial components more engaging than traditional in-person methods, suggesting the viability of flexible, patient-centered treatment delivery. Additional studies are also needed to clarify the most efficacious level of exposure with automated digital content and therapist encounters to

optimize treatment engagement further.

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Supplementary Files

Figures

PRISMA figure.