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Practical Technology for Expanding and Improving Substance Use Disorder Treatment

Telehealth, Remote Monitoring, and Digital Health Interventions

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KEYWORDS

• Technology • Telehealth • Digital health • Digital therapeutics • Mobile health • Substance use disorder • Alcohol use disorder • Smoking

KEY POINTS

- The US opioid and stimulant epidemics create expanding need for substance use disorder (SUD) treatment.
- COVID-19 has imposed new demand for telehealth, remote monitoring, and digital health interventions for SUD to enhance clinical practice.
- Technology offers potential to mitigate health-related disparities in SUD care by addressing the needs of diverse patient groups and increasing access to care.
- A strong evidence base supports the feasibility and potential effectiveness of technology-based interventions.
- Patient satisfaction suggests that technology can be accepted and even preferred to conventional approaches to interventions.

INTRODUCTION

This review describes 3 major uses of technology to support treatment of substance use disorder (SUD): telehealth, remote biometric monitoring, and digital health interventions. *Telehealth* uses telecommunication technology such as 2-way interactive video to provide services to patients with SUD from a distance.[1] The coronavirus

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disease 2019 (COVID-19) global pandemic necessitated the expansion of SUD telehealth, and although current evidence supports telehealth as an effective method of SUD treatment delivery,[2,3] greater utilization is needed.[4,5] *Remote monitoring* can now be accomplished via state-of-the-art devices for breath alcohol concentration (BrAC) and biological fluid drug testing. This approach allows frequent biometric assessment of patient substance use without need for in-person contact. *Digital health interventions* including smartphone applications (apps) have adapted behavioral interventions with a strong evidence base such as contingency management and cognitive behavioral therapy (CBT) for digitally streamlined implementation.

With the opioid and stimulant epidemics[6] there is an enormous gap between treatment need and treatment reach. Of 40 million Americans with an SUD in the United States in 2020, only 6.5% received any SUD treatment.[7] Technology-based treatments both complement in-person treatments and may access an untapped population of patients who are unreachable or uninterested in traditional treatment. This practical, rather than systematic,[3,8–14] review provides a condensed discussion of technology-based SUD interventions with strong empirical support.

TELEHEALTH

Provider Visits

Patients use telehealth to connect to clinicians, peer recovery coaches, nurses, pharmacists, and prescribers for opioid use disorder (OUD).[1] Strategies for real-time, synchronous communications can include telephone (audio-only) and 2-way video. Telehealth software can be stand-alone or integrated with an electronic health record. Many telehealth-ready software platforms comply with the Health Insurance Portability and Accountability Act (HIPAA), including free and subscription services (eg, Doxy.Me, Mend, AMC Health). Other telehealth products can be used without incurring HIPAA penalties, such as Apple FaceTime, Google Hangouts video, or Zoom. These platforms use end-to-end encryption that allows only the specified parties to communicate and is thus sufficient for a good faith effort to protect a patient's health information during telehealth visits under current regulations. Public-facing applications do not offer the expectation of privacy (eg, Facebook Live, TikTok) and are not appropriate for telehealth. Telehealth reimbursement varies by insurer and state, and current regulations should be consulted but are trending toward flexibility.[4,15]

A systematic review of SUD telehealth effectiveness evaluated 13 studies including 7 randomized controlled trials (RCTs) across a range of substances and settings.[3] Telehealth was used with individual psychotherapy counseling and opioid pharmacotherapy visits. No study observed a significant difference in substance use outcomes between in-person care and SUD telehealth. Two studies found superior treatment retention with telehealth versus in-person treatments, although one study observed substantial dropout before receiving telehealth treatment. When reported, treatment satisfaction and therapeutic alliance were generally comparable between telehealth and in-person treatments.

A review of buprenorphine OUD telehealth pharmacotherapy examined 69 empirical papers and commentaries published both before and during COVID-19.[16] It concluded that telehealth for OUD can increase buprenorphine access and utilization and patient satisfaction, decrease health care costs, and achieve comparable retention relative to in-person treatment. Analysis of a large sample (n = 28,791) of veterans with OUD receiving buprenorphine treatment before the pandemic found that telehealth was associated with a reduced risk of treatment attrition relative to in-person

services.[17] Despite the unplanned transition to telehealth necessitated by COVID-19, providers have reported improvements in treatment attendance and telehealth patient volumes meeting or exceeding prepandemic (in-person) patient volumes following a brief initial disruption.[18,19]

Group Therapy

Group therapy, the most commonly used therapy format for SUD treatment, has also been implemented virtually.[3,19,20] Several commercially available software options are HIPAA-compliant platforms for delivering group therapy alongside e-prescribing, patient scheduling, online patient portals, and other electronic record-keeping (eg, Mend, Kareo, and inSync Healthcare Solutions).

Across different software and patient populations, current evidence suggests virtual group therapy can be an effective treatment approach for SUD,[3,19,20] although there is a clear need for further randomized trials. A systematic review of telehealth strategies for SUD included 3 studies using group therapy among patients with tobacco, alcohol, and opioid use.[3] One of the included studies was a small (n = 37) randomized trial using virtual group therapy delivered as part of methadone treatment. There was no difference in substance use, treatment adherence, or satisfaction among patients randomized to receive group therapy via videoconferencing versus participants receiving in-person therapy. During COVID-19, a retrospective analysis from an emergency response treatment program for SUD including peer-led group recovery meetings observed an initial disruption with subsequent increased group meeting attendance when transitioning to virtual group meetings.[19] Taken together, existing evidence supports the acceptability and efficacy of virtual group therapy for SUD.

Best Practices for Substance Use Disorder Telehealth

SUD telehealth visits should include (1) sufficient technology/bandwidth speed to support video conferencing, (2) sufficient privacy for the patient at both sides of the patient-provider contact, (3) appropriate visual environment including eye-level contact and an uncluttered workspace, and (4) careful attention to a supportive interaction including a positive attitude and gesticulation that suggests engagement.[12] Standards of in-person treatments should be applied to telehealth visits wherever possible, including detailed assessments, patient histories, and use of standardized measures. Strategies have been developed to determine patient level of risk using traditional and computerized assessments, as well as for safe at-home initiation of OUD buprenorphine treatment.[12] With appropriate structure and safeguards in place, telehealth holds tremendous promise for improving convenience and expanding treatment access.

REMOTE MONITORING

On-site testing is an obstacle in telehealth and for patients with mobility, transportation, work, or childcare challenges–disproportionately affecting underserved populations and further exacerbating health disparities. Testing is critical in one of the most effective SUD interventions, contingency management, which provides monetary incentives contingent on verified substance abstinence.[21] Frequent random substance tests are generally recognized as more effective than predictable testing,[22] but feasibility can be a challenge. Wearable devices or patient-provided self-videos (selfies) may overcome barriers to frequent testing.

Alcohol

Wearable alcohol biosensors

Alcohol biosensor devices can be passively worn by individuals in their daily lives while providing a continuous measure of alcohol use. The Secure Continuous Remote Alcohol Monitor (SCRAM) ankle bracelet is the only commercially available wearable alcohol biosensor. The bracelet is tamper-evident, that is, it cannot be removed by the wearer without cutting the strap or breaking the closure clip, and it detects device removal and tampering through skin temperature and reflectivity changes. It provides a continuous estimate of blood alcohol concentration by sampling alcohol vapor just above the skin. Results are provided on a secure Web site provided by Alcohol Monitoring Systems, Inc. SCRAM has demonstrated feasibility, reliably detecting consumption at a level of 2 or more standard drinks and treatment-related changes in drinking.[23–25]

Broad use of SCRAM in clinical settings has been limited due to its large size and weight (about 6 oz and about the size of a deck of cards), high cost ($1500 per device plus a daily service fee of approximately $5), and social stigma due to its use with criminal justice–involved populations.

Remote breathalyzers

Alcohol use can also be objectively measured using remote breathalyzers.[26] Soberlink uses a wireless handheld breathalyzer and facial recognition to verify the patient's identity. When patients perform a BrAC test, a photo is automatically taken and facial recognition software verifies that the uploaded picture matches their reference picture. BrAC results can be sent in real time to treatment providers and an approved list of patient support contacts. Two controlled trials demonstrated acceptability, feasibility, and efficacy when combined with contingency management.[26,27]

Another remote breathalyzer is the BACtrack Mobile Pro. This police-grade device has good sensitivity at low BrAC levels (ie, 95% of measurements underestimate venous blood alcohol concentrations by no more than 0.02%).[28] Results are transmitted via Bluetooth to a smartphone. Unlike the larger and heavier (5.3–8.4 ounces) Soberlink, the BACtrack is palm- or purse-sized (1.7 ounces). For a witnessed remote test, the user performs a video selfie, which is reviewed for validation.[29]

Tobacco

Smokerlyzer

Smoking status can be objectively measured via breath carbon monoxide (CO).[30,31] Because breath CO is cleared rapidly from the body, handheld, smartphone-compatible monitors offer frequent testing to detect smoking lapses. The iCO Smokerlyzer is small and portable, plugging directly into a smartphone and providing reliable and valid CO measurement comparable to professional-grade CO monitors.[31] The Smokerlyzer has a range of 0 to 100 parts per million (ppm) and a suggested smoking abstinence cutoff of 6 ppm. The software facilitates self-monitoring and sharing of results with designated contacts.[31] Studies have shown its effectiveness for detecting smoking reductions and abstinence.[30–32]

Other Drugs

Oral fluid panels

Oral fluid drug testing can verify patients' substance use with video-selfie testing administered on a random schedule.[30] Premier Biotech, Inc.'s OralTox rapid saliva test kits have a 510(k) clearance from the Food and Drug Administration (FDA) for in vitro diagnostic use for amphetamine, cocaine, methamphetamine, cannabis, methadone,

opiates, oxycodone, and phencyclidine. Oral fluid testing offers a shorter window of detection (12–48 hours for most substances) relative to urine; however, it is unobtrusive, requires no toilet facilities, and thus far seems less susceptible to sample tampering.[33]

Oral fluid testing is necessary with electronic cigarette use (vaping), because breath CO will not detect noncombustible tobacco use.[34] For example, the Alere iScreen OFD Oral Fluid Cotinine Test, measuring the primary metabolite of nicotine in saliva, can be performed at the office or remotely via selfie video and will yield a positive result for 1 to 2 days after nicotine use (whether via e-cigarettes, ie, vaping, or nicotine replacement therapy medication).

Medication Adherence

Remote monitoring of methadone and buprenorphine adherence has used electronic pill dispensers. Electronic pill dispensers contain individual dosing compartments that open only during preprogrammed times. The dispensers can provide notices when medication is available and alerts for missed doses. Effective remote monitoring has been achieved with methadone take-home doses using the MedMinder ("Jon")[35] and with buprenorphine, using the Med-O-Wheel.[36]

Video directly observed therapy (Video DOT) has been used as an alternative to electronic pill dispensers.[37–39] For example, a commercially available Video DOT platform offered by emocha Mobile Health allows patients to use a smartphone app to securely submit videos of themselves taking medication, which providers then review to confirm adherence. Pilot studies have shown that Video DOT for buprenorphine is feasible and acceptable and results in similar rates of illicit opioid use and treatment engagement compared with treatment-as-usual.[37–39]

DIGITAL HEALTH INTERVENTIONS

Many health and wellness Web sites and smartphone apps are marketed to treat SUD.[8] Unfortunately, most are of poor quality and lack research validation,[13] whereas researchers have developed many digital tools with outcome data but not availability or support.[14] There are, however, several technology-based SUD interventions that are evidence based and freely or commercially available.[21]

Computer- and Web-Based Interventions

Programs that aim to develop cognitive and behavioral skills to reduce substance use or promote abstinence can be accessed via web-browser from laptop or desktop computers through a health care provider or direct patient access.[8] Computer-based training for CBT (CBT4CBT; https://cbt4cbt.com/) is a self-guided, web-based training that uses games, cartoons, interactive video exercises, and quizzes to promote understanding of substance use patterns, skills for coping with craving, and improvements in decision-making about substance use.[40] RCTs favor CBT4CBT as an improvement over treatment-as-usual for persons who use alcohol, cannabis, cocaine, and opioids.[40] CBT4CBT is currently available in conjunction with office-based treatments for SUD at a low cost (approximately $100) and has also demonstrated potential efficacy as a standalone treatment.[41]

Other computer- and web-based trainings include CheckUp & Choices (https://checkupandchoices.com/) and Vorvida (https://us.vorvida.com/) for alcohol use disorder and Breaking Free Online (https://www.breakingfreeonline.com/) for opioid, cannabis, alcohol and other SUDs.[42] The DEAL project (https://dealproject.org.au/) and the SHADE program (https://shadetreatment.com/) address co-occurring depressive symptoms and alcohol use.[43]

Several effective computerized/web-based trainings serve as the backbone of smartphone app interventions for SUDs. Therapeutic Education System (TES) is a web-based computerized intervention that can use incentives to support drug abstinence and the community reinforcement approach to enhance nondrug sources of reinforcement for long-term recovery.[44] TES is supported by several RCTs and served as the basis for the reSET and reSET-O apps. For tobacco use, the web-based contingency management program Motiv8, which incentivizes smoking abstinence, was supported by several randomized trials and served as the basis for the novel mMotiv8 mobile app.[32]

Smartphone Applications for Tobacco Cessation

Several research-supported smoking cessation apps are available for consumers at the Apple App Store and Google Play. The most robust treatment effect sizes for smoking cessation smartphone apps incorporate abstinence incentives contingent on providing negative breath CO.[21]

QuitGuide and quitSTART

The QuitGuide (for adults) and quitSTART (for adolescents and young adults) apps are free digital smoking cessation tools through the US Centers for Disease Control (CDC) created by the National Cancer Institute (NCI). Both applications provide tools for addressing craving, tracking progress and milestones, providing helpful notifications and location alert triggers when a person is at a prespecified high-risk location, as well as tools to incorporate sharing goals with a support network (eg, text messaging your quit date to friends, sharing progress on social media). In addition, quitSTART has brief games to "distract" from cravings.

iCanQuit

iCanQuit is a mobile app for smoking cessation that incorporates strategies from Acceptance and Commitment Therapy[45] that includes (1) allowing urges to smoke pass rather than actively avoiding smoking urges and (2) motivating smokers to quit based on alignment with personal values. Efficacy of iCanQuit for long-term smoking cessation was supported in a randomized trial such that past-30-days abstinence at the 12-month follow-up was greater with iCanQuit (28%) relative to the CDC/NCI QuitGuide app (21%).[45]

Pivot

Pivot is a smoking cessation tool using CO monitoring and smoking cessation coaches that tailors its strategy according to each person's readiness to quit.[46] The intervention guides users to use pharmacotherapies, log cigarettes, and monitor CO values using the app in collaboration with their coach. Cohort studies have provided encouraging data for Pivot with respect to increasing likelihood of making a quit attempt, increasing confidence to quit, and reducing cigarettes per day.[46]

Quit Genius

Quit Genius was developed in the United Kingdom based on CBT for smoking cessation. It includes self-monitoring (with or without breath CO), goal-setting, feedback on progress, pharmacotherapy encouragement, video/audio lessons and quizzes, and access to a smoking cessation coach via phone contact and in-app chat. A randomized trial found that participants assigned to Quit Genius reported a significantly higher rate of smoking abstinence (past-14-days) at 4 weeks after quit day (34%) relative to those who received only brief advice (23%).[47]

DynamiCare Health

The DynamiCare Health app incentivizes treatment attendance, completion of in-app CBT, and nicotine cessation. The app monitors remote videos of breath CO for smoking[30] and salivary cotinine for e-cigarettes.[34] The company's staff provide feedback and reinforcement for abstinence. In a cohort study, pregnant smokers who were assigned to DynamiCare plus a best-practice quit line referral (vs quit line alone) had quit rates of 37% versus 13% during late pregnancy with 40% versus 10% abstinence at 4 weeks postdelivery.[30] The app has received FDA Breakthrough Device designation for pregnant smokers.

Smartphone Applications for Alcohol and Substance Use Disorder

Smartphone apps have been developed for alcohol and other SUDs by standardizing and automating effective aspects of in-person substance use treatment, including CBT, substance testing, pharmacotherapy, and abstinence incentives. Some interventions are specifically targeted for alcohol, but others such as reSET and DynamiCare Health can target multiple substances simultaneously. Many apps are designed to be combined with in-person SUD treatment, but some may have independent treatment utility. Apps that are currently available and with some level of research support are reviewed in the following section.

VetChange

VetChange is a free mobile app created by the VA's National Center for Posttraumatic Stress Disorder (PTSD) for veterans and other service members to address problem drinking, smoking, and PTSD symptoms. VetChange is a fully automated self-guided program incorporating CBT including personalized feedback on alcohol use and PTSD symptoms, alcohol tracking, goal-setting, coping tips, and building a support system.[48] VetChange is supported by research evidence from an RCT and convenience samples from nationwide implementation of the web-based version of the VetChange intervention.[48,49] VetChange resulted in significantly greater reductions in drinking and PTSD symptoms over an 8-week intervention period relative to a wait-list control.[49] VetChange has demonstrated larger treatment effect size relative to other brief interventions to address alcohol use among veterans, including telephone-, web-, and in-person treatments.[50]

Connections: from Comprehensive Health Enhancement Support System Health

Connections is a recovery support and relapse prevention tool that has been developed from Addiction-Comprehensive Health Enhancement Support System (A-CHESS).[51] Designed for persons leaving residential treatment, it offers educational information about recovery, communications with designated providers and support groups/discussions, breathing and refusal exercises, and alert messages triggered by prespecified high-risk locations. In an RCT, patients who were assigned to use the A-CHESS app during treatment-as-usual had significantly fewer risky drinking days and greater odds of reporting abstinence at 8- and 12-month follow-up relative to patients assigned to treatment-as-usual only.[51] A-CHESS has also been adapted for OUD treatment[52] and patients who speak Spanish.[53]

reSET and reSET-O

reSET and reSET-O deliver 2 evidence-based interventions: CBT lessons based on TES (see earlier discussion on Computer and Web-Based Interventions) and contingency management.[54] CBT topics relevant to abstinence and recovery incorporate fluency training, with comprehension tests. Patients earn small amounts of money on a probability schedule (eg, 50% of rewards result in money; the remainder

acknowledge "good job") for completing lessons and providing evidence of recent abstinence via drug-negative urinalysis (when results are entered by the clinician). reSET is designed for treatment of alcohol, stimulants, or cannabis use disorder, whereas reSET-O is designed for patients receiving buprenorphine for OUD. Both apps allow patients to track recent drug use, cravings, and triggers. reSET-O also includes self-reports of medication adherence and can provide medication dosing notifications. reSET products are designated Breakthrough Devices and are FDA authorized for prescription by a licensed clinician. The clinician submits an enrollment form to the manufacturer, whose staff then guides patients in using the app. A 12-week course may be reimbursable by insurance.

DynamiCare Health

The DynamiCare Health app delivers remote contingency management incentives to treat alcohol,[29] opioid,[55] and stimulant use.[56] Abstinence is monitored remotely via selfie video of randomly scheduled breathalyzer and/or saliva tests. It incentivizes attendance (validated via GPS), medication adherence, self-assessment, and self-directed CBT lessons. Recovery coaches transition participants from monetary incentives to community reinforcers (eg, employment, savings, independent housing, and healthy relationships) over 4 to 8 months.[57] Monetary rewards of $100 to $200 per month are delivered via a smart debit card that blocks use at bars, liquor stores, casinos, and other high-risk situations. The app has been determined not to violate Federal anti-kickback and inducement regulations.[58] Costs may be covered by insurance, Medicaid, employers, or the patient or family. Prospective cohort studies and RCTs demonstrate significant findings for alcohol, opioid, stimulant, tobacco, and nicotine cessation.[29,30,34,55,56]

DISCUSSION

Strengths of Technology-Based Approaches

Technology offers many advantages for providers and patients. Patients have greater access to tools and services, avoiding objective obstacles, including transportation limitations, work schedule conflicts, and childcare disruptions. Technology-based treatments can be delivered even to patients who lack smartphones, because Medicaid covers phones and data plans under the Affordable Care Act.[59] Convenience for providers is enhanced as well, with work-from-home and flex-time scheduling. Telehealth may also yield useful insights into patients' home life.[60,61] Technology-based treatments can be preprogrammed, which means increased fidelity and improved scalability. Automation reduces the burdens of specialized SUD training and complex infrastructure. More frequent patient contact becomes feasible, with opportunities for real-time alerts and interventions. Technology supports personalization based on use status and readiness to change. Finally, as most of the individuals with SUD do not seek treatment in brick-and-mortar programs, digital interventions may prove to be a more feasible and attractive option.

Limitations of Technology-Based Approaches

Few randomized trials have compared in-person versus technology-based treatments for SUD. Prospectively designed noninferiority trials are needed.[3,14] Practically, establishing new patients via telehealth may be challenging for patients with housing instability or limited access to technology. Treatment hotlines where mobile or landline phones can be used to initiate longer-term telehealth treatments may help with onboarding new patients.[62] Clinicians speculate that in-person visits provide structure, accountability, rapport, and evidence of substance use or withdrawal that is

not achieved with telehealth.[61] However, technology-based treatments do not preclude some in-person interaction (eg, a hybrid model of care),[5] supplementation of telehealth with additional remote monitoring,[4] or providing access to structured digital health interventions.[4] Care must be taken that technology-based treatments do not exacerbate treatment access gaps among persons with limited technology access or literacy. Even so, data collected among low-income populations or those without smartphones suggest that technology-based SUD treatments are feasible, acceptable, and effective among these patients.[51,56,63] Although privacy and software security must be continually monitored and strengthened,[64] many digital interventions have extensive privacy-protection features including end-to-end encryption, host and cloud firewalls, virtual private networks, physically hardened servers, and antivirus and antimalware software.

Evolving Policies

During the pandemic, Federal regulations were loosened to permit remote initiation of buprenorphine and methadone OUD treatment.[65] The Centers for Medicare & Medicaid Services intends to extend expanded regulations for SUD treatment via telehealth (eg, audio-only reimbursement, removal of geographic licensure restrictions) through 2023, and appeals are being made to permanently increase telehealth reimbursement for SUDs.[4,15,65] The Biden administration has noted barriers to use of certain evidence-based treatments and has formally called on the Office of National Drug Control Policy to "identify and address policy barriers related to contingency management interventions," and to "explore reimbursement for motivational incentives and digital treatment for addiction."[66] These initiatives will help to rectify the underutilization of effective evidence-based treatments and are well aligned with the emergence of digital health interventions.

SUMMARY

Most people with SUDs do not seek treatment. The pandemic has created other obstacles due to social distancing and other stressors that amplify the incidence of SUD. Patients with SUDs need improved access and acceptability of effective SUD treatment. Telehealth, remote biometric monitoring, and digital health interventions are transforming the delivery of SUD treatment. Technology has the potential to greatly expand access to both usual care and complementary evidence-based interventions. Future research will evaluate generalizability and the implementation models needed to realize the potential of these new treatment delivery tools.

CLINICS CARE POINTS

- Technology-assisted SUD care is available, feasible, and effective in the era of the opioid and stimulant epidemics, COVID-19, and beyond.
- Providers have multiple technology options to support telehealth and adjunctive digital health interventions for SUD including evidence-based smartphone apps.
- Patients may accept, like, and even prefer services and tools that are technology based.
- The effectiveness, quality, and security of technology-based services and tools should continue to accumulate supporting evidence via valid scientific research.

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