Integration of Technology-based Behavioral Health Interventions in Substance Abuse and Addiction Services

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Abstract

The past decade has witnessed revolutionary changes to the delivery of health services, ushered in to a great extent by the introduction of electronic health record systems. More recently, a new class of technological advancements—technology-based behavioral health interventions, which involve the delivery of evidence-informed practices via computers, web-based applications, mobile phones, wearable sensors, or other technological platforms—has emerged and is primed to once again radically shift current models for behavioral healthcare. Despite the promise and potential of these new therapeutic approaches, a greater understanding of the impact of technology-based interventions on cornerstone issues of mental health and addiction services— namely *access, quality, and cost*—is needed. The current review highlights 1) relevant conceptual frameworks that guide this area of research, 2) key studies that inform the relevance of technology-based interventions for behavioral healthcare access, quality, and cost, 3) pressing methodological issues that require attention, 4) unresolved questions that warrant further investigation, and 5) practical implications that underscore important new directions for this emerging area of research.

Introduction

Substance and alcohol addiction is a chronic and often relapsing disorder costing the United States more than $600 billion annually in healthcare, productivity, and crime-related costs (NIDA, 2011). While more than 23 million, or nearly 10%, of all Americans aged 12 years or older struggle with serious substance and alcohol use problems, approximately 90% of those suffering are not receiving treatment at a specialty facility, signaling a significant treatment gap (SAMHSA, 2013). The factors contributing to this gap are multi-faceted, including psychological barriers such as perceived stigma and embarrassment, as well as logistical barriers such as lack of transportation and availability of providers in rural areas (Cunningham, Kypri, & McCambridge, 2011). Consequently, researchers and health

services stakeholders are motivated to identify new approaches to addiction services that can address or circumvent these well-established barriers to treatment.

The past decade has witnessed revolutionary changes to the delivery of health services more broadly, ushered in to a great extent by the introduction of electronic health record (EHR) systems (Pating, Miller, Goplerud, Martin, & Ziedonis, 2012). Despite the various challenges and growing pains that have accompanied this movement, fairly widespread implementation of EHR within behavioral healthcare systems has forged on, carrying with it unprecedented opportunities for enhanced efficiency and quality of care. Related to—yet quite distinct from—EHR systems, a new class of technological advancements has emerged and is primed to once again radically shift current models for behavioral healthcare (Gustafson et al., 2011; Marsch, 2012; Mohr, Burns, Schueller, Clarke, & Klinkman, 2013).

Technology-based behavioral health interventions, which involve the delivery of evidence-informed practices via computers, web-based applications, mobile phones, wearable sensors, or other technological platforms, are rapidly being developed and tested for efficacy in individuals with substance abuse and dependence issues (Marsch, 2012). Technology-based behavioral health interventions are gaining credence as therapeutic resources, both as "stand-alone" patient-facing tools and as integrated augments to care, due to rapidly growing evidence of their effectiveness and efficiency (Marsch, Carroll, & Kiluk, 2014; Newman, Szkodny, Llera, & Przeworski, 2011).

The rapid technological advancements and developing evidence base supporting these approaches have effectively positioned technology-based interventions at the forefront of behavioral health care innovation (Jones et al., 2013). Reflecting this trend, the recently concluded 22nd National Institute of Mental Health Conference on Mental Health Services Research focused on "learning mental health care systems." Along this theme, special attention was given to ways in which technology can, and has begun to, transform behavioral healthcare. Still, the developing literature base on technology-based behavioral health interventions has focused primarily on efficacy research and, in many ways, has not yet explicated the important implications for behavioral health services. While the opportunity clearly exists for technology-based behavioral health interventions to address cornerstone issues of health services research—namely *access, quality, and cost*—direct empirical evidence for these relationships is less clear. Enthusiasm within the field regarding the promise and potential of technology-based interventions, along with the relative lack of attention specifically within a health services context, has prompted the following primary question to be explored in this review:

In what ways do technology-based behavioral health interventions address issues of access, quality, and cost of substance abuse and addiction services?

Critical to this discussion is also an understanding of how technology-based behavioral health interventions function pragmatically within a health services context. For instance, efforts to integrate technology-based interventions into practice must consider potential modifying system, organization, and adopter level factors in order to promote the synergistic interaction of technology within health service systems. In light of this, the current review will also address the potential ways in which technology-based behavioral health

interventions might interact with contextual factors at the levels of the system, organization, and adopter (i.e., providers and patients). The focus of this review is on evidence-based practices (EBPs) delivered through or enhanced by technological platforms and framed in comparison to traditional health service approaches (e.g., in-person therapy with counselor) for substance abuse and addiction. The current review highlights 1) relevant conceptual frameworks that guide this field, 2) key studies that inform the above research question, 3) pressing methodological issues that require attention, 4) unresolved questions that warrant further investigation, and 5) practical implications that underscore important new directions for this emerging area of research.

Conceptual Frameworks

One important issue for researchers, particularly within new and emerging fields, is to consider relevant conceptual frameworks and models that yield insight into the pertinent constructs, processes, and relationships that describe the given phenomenon of interest. With regard to the role of technology-based behavioral health interventions in addressing health services issues of access, quality, and cost, it is possible that existing conceptual models will need to be supplemented with newer frameworks to account for the unique processes and mechanisms involved. Indeed, Riley et al. (2011) argue that while efforts to develop technology-based behavioral health interventions should attend to current health behavior theory, existing models may be inadequate to fully delineate the unique components and interactive nature of new technology-based approaches. Accordingly, the current literature in this area applies broad health behavior models to frame the existing deficiencies in health services use and potential role of technology therein, but also has developed new frameworks to organize and characterize specific mechanisms and pathways that directly implicate health service outcomes.

For instance, some studies have found utility in the health belief model for conceptualizing web- and computer-based health interventions and how they may address access to substance abuse services (Becker, 1974; Riley et al., 2011). The health belief model posits that health behavior change is determined by the belief that one is susceptible to an adequately severe condition, a sufficient perception of associated health threat, and the relative comparison of perceived benefits and barriers associated with engaging in a particular health behavior, such as obtaining substance abuse services (Becker, 1974; Britt, Hudson, & Blampied, 2004). Cassell, Jackson, & Cheuvront (1998) illustrated how the health belief model could be applied to Internet-based interventions that tailor messages specific to the benefits and barriers associated with engaging in health behaviors. Additionally, Strecher et al. (2008) used the health belief model to inform intervention components of a larger smoking-cessation intervention within a randomized trial. Generally speaking, research in this area has primarily focused on the concept of perceived barriers to health service utilization, emphasizing the factors precluding individuals from receiving the necessary services and highlighting the key leverage points by which technology-based behavioral health interventions address the existing deficiencies in health service use (Cassell et al., 1998). Many of the most salient barriers to utilization of substance abuse services have been mentioned above, including stigma, transportation, and provider availability.

Worth noting, very few studies of technology-based interventions specifically targeting substance abuse and addiction problems have used existing health behavior or health service use models to inform the interventions. Strecher (2007) exposed the tendency for researchers of Internet-based interventions to use limited health information-transfer models or, worse, no health behavior models at all, to guide development and dissemination. Marsch (2012) also highlighted that expanded conceptual models are needed to better guide the scientific development, implementation, and evaluation of technology-based behavioral health interventions.

Meeting this need, at least in part, Litvin and colleagues (2013) recently developed an organizing framework for technology-based interventions for substance use disorders. This framework directly addresses the relevance of technology-based substance abuse interventions in addressing the issues of access to and quality of health services. Four key domains are explicated in this framework, including Accessibility, Intervention Content, Usage, and Human Contact. Targeting access to substance abuse services, the Accessibility domain specifies the flexibility of settings and locations (home, work, clinic, school) where technology-based interventions can be deployed, as well as the varying degrees of portability (mobile vs. stationary) of these interventions. The Usage domain references the varying levels of duration (limited vs. indefinite), exposure (e.g., prompts, system-generated "paradata"), and strategies to influence attrition (non-usage, dropout). Targeting quality of substance abuse services, the Intervention Content domain indicates the degree to which a technology-based intervention is static versus dynamic, tailored to individual needs and preferences, and grounded in a theoretical orientation. Also targeting quality, the Human Contact domain designates the degree to which a technology-based intervention accommodates the integration of personal interaction, either with a clinician or peers, and whether that interaction is synchronous (e.g., "real-time" chat rooms) or asynchronous (e.g., electronic discussion board forums). This organizing framework, along with eventual models to supplement this framework, will provide an important guide for scientific inquiry in this area.

Conceptual models have not been explicitly utilized to inform ways in which technology-based behavioral health interventions may interact with contextual factors at the levels of the system, organization, and adopter. However, the Conceptual Model for the Diffusion of Innovations in Health Service Organizations is particularly fitting to investigation of integrating new innovations within a complex health services context that involves multiple levels of influence (i.e., outer context, system, adopter) (Greenhalgh, Robert, Macfarlane, Bate, & Kyriakidou, 2004). This framework illustrates that dissemination and implementation of new innovations (e.g., technology-based behavioral health interventions) is determined by the interactions between the outer context (e.g., political climate, incentive and mandates), system antecedents (e.g., organizational culture and climate), system readiness (e.g., tension for change, dedicated time and resources), and the innovation itself (e.g., relative advantage). A review by Emmons, Weiner, Fernandez, and Tu (2012) that identified measures of constructs within the Greenhalgh model found one study that explored the relationships between system antecedents, specifically absorptive capacity and organizational culture, on the dependent variable of information technology adoption (Caccia-Bava, Guimaraes, & Harrington, 2006). Greenhalgh et al. (2004) specifically note

that the interaction between technology-based innovations and adopters within the service sector is a "particularly fruitful area" of research (p. 617), indicating the need for adequate technical capability, adopter commitment, communication skills, and resources to support ongoing implementation issues. This framework, and other models that attend to the multi-level determinants of disseminating and implementing new technologies within health service contexts, will likely prove valuable in carrying this line of inquiry forward.

Key Studies

While literature on technology-based interventions for substance abuse and addiction is rapidly developing, a number of studies have begun to demonstrate the potential for, and current applications of, technology to meet health service needs for enhanced access, quality, and cost-effectiveness.

Access

The enhanced flexibility for delivery of technology-based interventions through various settings and the increasing portability of these tools directly target identified barriers to substance abuse service access (Litvin et al., 2013). Technology-based substance abuse interventions have been accessed not only in mental health and substance abuse clinics (e.g., Carroll et al., 2008), but also in schools (e.g., Marsch, Bickel, & Badger, 2007), the workplace (e.g., Doumas & Hannah, 2008), at home (e.g., Finfgeld-Connett & Madsen, 2008; Hester, Delaney, Campbell, & Handmaker, 2009), and in other medical settings (e.g., Ondersma, Chase, Svikis, & Schuster, 2005). Technology-based behavioral health interventions are also becoming increasingly portable, as devices trend towards smaller form factors (Litvin et al., 2013). Delivery of substance abuse services are therefore becoming less defined by setting, as individuals can access interventions and resources via ubiquitous mobile technologies in virtually any context or location.

Technology-based interventions also have the ability to lower consumer threshold for initiation of treatment (Clarke & Yarborough, 2013). For individuals with low problem severity who perceive barriers (e.g., stigma, desired privacy, transportation) precluding them from seeking substance abuse treatment, technology-based interventions may provide the optimal "lower dose" treatment to foster service access. Similarly, those who would prefer to manage a mild to moderate substance abuse problem "on their own" are particularly unlikely to seek traditional health services, yet technology-based interventions may instill an enhanced sense of empowerment while still providing evidence-based care. Further, technology-based interventions have the ability to refer at-risk individuals to in-person treatment (Clarke & Yarborough, 2013). While recent efforts have largely focused on the direct provision of services through technology-based interventions, the potential for technology to identify those at-risk, assess condition severity, and provide resources to connect individuals with treatment providers should not be overlooked.

Worth mentioning, the degree to which access to substance abuse services is impacted by technology is likely to depend in part on the aim of technology-based intervention. By nature, "stand-alone" tools that require no provider guidance or support, and thus can be disseminated widely at a population level, will have greater reach than tools that are tied in

with a larger treatment plan (King et al., 2009). Of course, the appropriateness and quality of services are also highly important considerations when selecting which technology-based approach to use and should always be weighed alongside the projected impact on service access.

Quality

While enhanced access may be the most obvious contribution of technology-based behavioral health interventions, there are numerous mechanisms by which these tools are aiming to improve the quality of substance abuse services. For instance, research has highlighted the innovative use of mobile technologies to provide "just-in-time" therapeutics that deploy targeted messages (e.g., text messages, motivational videos), resources (e.g., psychoeducation, nearby AA meetings), real-time communication and support (e.g., clinician, peer, avatar), and evidence-based interventions (e.g., cognitive behavioral therapy, mindfulness-based stress reduction) in times of greatest need for at-risk individuals (Gustafson et al., 2011; Marsch, 2012). Technology-based behavioral health interventions are also often programmed for optimal tailoring to a wide range of individual needs, preferences, and profiles to be more engaging and useful to consumers (Marsch, 2012).

With regard to effectiveness research, a comprehensive review and meta-analysis suggested a medium effect size for Internet-based mental health interventions, including those for substance and alcohol abuse (Barak, Hen, Boniel-Nissim, & Shapira, 2008). Importantly, this study also found no effect size difference between Internet-based interventions and in-person therapy. More recent research indicates that self-help computer-based cognitive behavioral therapy (CBT) is effective, but that results are stronger and more sustained when interventions include at least some level of therapist contact (Newman et al., 2011). Nevertheless, studies generally indicate that the therapeutic benefits of technology-based approaches are additive to those of in-person treatment only, resulting in a higher quality "bundle" of substance abuse services (Carroll et al., 2008).

Aside from effectiveness data, technology influences quality of substance abuse services in other ways, including providing unprecedented levels of standardization and fidelity of service delivery (Litvin et al., 2013). Evidence-based interventions are programmed to technological platforms, and stakeholders can be assured that the core components of these interventions are being delivered consistently across consumers. Finally, technology-based interventions are also delivering efficient and effective training to substance use counselors (Cucciare, Weingardt, & Humphreys, 2009; Weingardt, Cucciare, Bellotti, & Lai, 2009). Indirectly, these provider training approaches have great potential to improve the quality with which in-person substance abuse services are delivered.

Cost

Arguably, the most important component in making the case for technology-based behavioral health interventions is demonstrating lower costs and higher cost-effectiveness, relative to traditional in-person approaches to substance abuse care. Interestingly, there are comparatively fewer studies that directly address the impact of technology-based approaches on service costs, perhaps reflecting the difficulty in conducting comprehensive cost

analyses. The data that does exist, however, is quite promising. One study indicated that computer-based contingency management was more cost-efficient than a comparable therapist-led intervention, and that the savings potentially offset the costs of subsidizing voucher-based incentives for patients (Bickel, Marsch, Buchhalter, & Badger, 2008). Other research has found that adding computer-based CBT to treatment as usual costs approximately $39 per patient. Results indicated that this would be cost-effective to agencies if the value of an additional drug-free patient was at least $21, which was projected to apply for most substance abuse treatment clinics (Olmstead, Ostrow, & Carroll, 2010). While initial evidence indicates high cost-effectiveness of technology-based behavioral health interventions, much more cost-related research will be needed from both the patient and provider perspectives in order to maximize buy-in from substance abuse care decision-makers.

Technology-based Interventions in Contexts of Substance Abuse Care

As evidence mounts that technology-based behavioral health interventions can improve health services outcomes in systems of substance abuse care, adoption of these tools will continue to rise, necessitating a better understanding of how new technology-based approaches might interact with contextual factors at the levels of the policy, system, organization, and adopter (i.e., providers and patients). Only recently have studies begun to focus on contextual considerations and implementation issues associated with the integration of technology-based interventions into substance abuse service systems. One study assessing the feasibility of an electronic screening, brief intervention, and referral to treatment program purposefully attended to issues of the outer context (i.e., reimbursement policies), organization (i.e., school operations), and multiple stakeholder perspectives (i.e., administrators, teachers, parents, students) in order to facilitate the adoption, implementation, and sustainability of the new technology (Curtis, McLellan, & Gabellini, 2014). Further, King, Brooner, Peirce, Kolodner, & Kidorf (2014) cite multiple adopter- and organization-level barriers to implementation of web-based videoconferencing for substance abuse counseling. Despite the recent attention in this area, Marsch et al. (2014) highlight the need for much more research to better understand the multi-leveled process of integrating technology-based behavioral health interventions into complex systems of care.

Methodological Issues

Along with the unprecedented opportunities to simultaneously address substance abuse service access, quality, and cost through technology-based behavioral health interventions come uniquely challenging methodological issues. It has become increasingly apparent that the traditional approaches, methods, and designs for implementing and evaluating substance abuse interventions are not suitable when applied to technology-based interventions (Danaher & Seeley, 2009). For instance, the mismatch between rapidly advancing versions of technology and the life cycle of multi-year research studies can be problematic in technology-based intervention research. Thus, the continuously evolving nature of technology-based interventions signals the need for innovative research designs (Mohr et al., 2013a). These designs will require the ability to continuously evaluate effectiveness as new

updates to technology-based interventions, and the technologies that deliver those interventions, are introduced.

A recent approach by Mohr, Cheung, Schueller, Brown, & Duan (2013b), known as the Continuous Evaluation of Evolving Behavioral Intervention Technologies (CEEBIT), is one such solution to this methodological challenge. CEEBIT demonstrates a strategy resembling an "open-panel horserace" in which advancements to the initial version of technology are added to the study protocol as they become available, the interventions are compared, and then versions that perform relatively poorly are discarded in a step-wise fashion (p. 518). This design may prove useful in not only maximizing the best possible care over time, but also helping to ensure that the interventions disseminated at the conclusion of a given study are not delivered through a platform that is obsolete or outdated such that they not useful to individuals who could benefit from these interventions.

Secondly, this review of the literature revealed very few studies that included follow-up assessments of outcomes. Most of the research to date has focused on testing the efficacy of various technology-based behavioral health interventions, not attending to the maintenance of impact post-intervention. Furthermore, the majority of studies in this line of inquiry have utilized randomized trials or other experimental approaches with the primary intent on demonstrating an effect within tightly controlled settings. Therefore, it is difficult to confidently claim whether any of technology-based behavioral health interventions will be able to maintain long-term positive effects and the degree to which any positive effects can be replicated in natural, "real world" settings.

One particularly promising opportunity for research and practice involving technology-based behavioral health interventions is the ability to collect vast amounts of outcomes and context-related data via both self-reported (e.g., ecological momentary assessment) and unobtrusive methods (e.g., ongoing sensor-based monitoring) (Marsch, 2012). The potential exists, for instance, for mobile technologies (e.g., wearable sensors, smartphones) to map indicators of a substance abusing individual's context, behavior, and physiology (e.g., sympathetic nervous system) in order to accurately detect periods of high risk for substance use and intervene accordingly with "just-in-time" therapeutic approaches. However, a key methodological challenge in this realm is conducting meaningful analyses on these types of big data (Mohr et al., 2013a). Statistical methods currently used within social, behavioral, and medical science fields are inadequate in properly modeling highly intricate patterns and trends characteristic of very large and complex data sets.

Finally, worth mentioning is the current lack of a toolkit or road map to guide the process of rolling out technology-based substance abuse interventions within systems of behavioral healthcare. Components of this guide might include 1) a decision analysis tool (e.g., decision flow chart) for study design, 2) a menu of appropriate methodologies for various research contexts, 3) a chart depicting progressive stages of technology-based implementation with special attention to potential barriers, facilitators, and strategies unique to each stage, 4) common implementation pitfalls, and 5) recommendations for appropriate statistical analyses. Such a tool would be highly useful for researchers and implementers seeking a

compilation of best practices for the integration of technology-based behavioral health interventions in substance abuse and addiction service systems.

Unresolved Questions

Gaps in the literature reviewed above raise a number of questions and issues that require further inquiry. Current research on the impact of technology-based interventions on access to substance abuse services focuses on avenues by which evidence-based care has reached a wider audience, but has not translated these findings to an assessment of the direct impact on unmet need. Therefore, it will be important in future research to quantify to what degree technology-based interventions actually address the unmet need for substance abuse services. As an array of technology-based interventions demonstrate efficacy, health services research will be charged with the task of substantiating that the promise of enhanced access is resulting in a greater proportion of those in need actually receiving services, technology-based or otherwise.

Existing literature on the influence of technology-based interventions on substance abuse service quality has documented effectiveness research, innovative capabilities of technology, enhanced fidelity, and provider training; however, less attention has been paid to understanding the range of approaches to integrating technology-based interventions into a larger substance abuse service system. Therefore, future efforts should strive to clarify how technology-based interventions should be integrated into contexts of substance abuse care to maximize service quality and outcomes for patients. Accounts of both successful and unsuccessful implementation efforts will yield important insights to inform best practices for combining technology-based approaches with traditional care practices. Relatedly, further guidance is needed to help identify circumstances in which it is most appropriate to treat technology-based interventions as completely "stand-alone" approaches (i.e., no provider support), as fully integrated "adjuncts" to treatment (e.g., supplementary "booster" interventions), or elsewhere along this continuum.

With regard to cost, the available research reports promising cost-effectiveness data; however, rigorous cost analysis data is largely unavailable. Future research should aim to provide appraisals of upfront and continuing costs, as well as estimates of when agencies can expect to recoup those costs (i.e., "break-even") or, ideally, realize financial savings. Substance abuse treatment agencies may be particularly attuned to the upfront costs of implementing technology-based behavioral health interventions; therefore, clear evidence of value added, along with return-on-investment and breakeven analyses, will be critical to obtaining buy-in from decision-makers.

Finally, very little implementation research has been conducted in this area, leading to questions involving which types of strategies should be used to roll out new technology-based behavioral health interventions. It will first be important to establish best approaches for engaging key stakeholders and to gain an understanding of critical organizational and system antecedents that facilitate adoption of technology-based interventions. Future research should also identify, develop, and compare implementation strategies that will serve to streamline the highly involved process of integrating new technology-based

interventions into complex systems of care. This research must attend to the range of contextual factors and stakeholder perspectives, including the outer (i.e., external) context, service system, organization, provider, and patient levels. In line with this recommendation, Mohr et al. (2013a) astutely highlighted that "as a new and evolving field, [technology-based intervention] research is encountering challenges that no single field or specialty can address alone" (p. 337).

Practical Implications

This review of existing conceptual models, relevant studies, methodological challenges, and future directions has identified several important implications for research, health service delivery, and policy. As recognized in prior literature, technology-based behavioral health interventions hold much promise and potential for improving the prevention, management, treatment, and long-term recovery of those with substance abuse problems (Marsch, 2012). The current review suggests that these benefits may have considerable application for the access, quality, and cost of substance abuse services. More research is needed, however, to further translate initial evidence of enhanced reach, effectiveness, and efficiency into compelling evidence of actual health service improvements.

It is also apparent that delivery of technology-based interventions that are integrated into a larger health services system involves multi-level contextual considerations that will require buy-in and engagement from the range of stakeholders (e.g., administrators, clinicians, patients). Relatedly, health service delivery efforts will also require diverse sets of skills and expertise, including those of information technologists, organizational change experts, health services researchers, and direct service providers. Finally, policies involving privacy regulations, billing, and incentives for the delivery of technology-based behavioral health interventions greatly influence the implementation of these tools. Policy changes are sorely needed to improve the confidentiality and security of patient information, the development and activation of new billing codes, and consistent provision of reimbursement mechanisms for providing technology-based substance abuse services. Successes on each of these fronts —research, practice, and policy—will be instrumental in shaping the future integration of technology-based interventions into substance abuse services.

Acknowledgments

References

Barak A, Hen L, Boniel-Nissim M, Shapira NA. A comprehensive review and a meta-analysis of the effectiveness of internet-based psychotherapeutic interventions. Journal of Technology in Human Services. 2008; 26(2–4):109–160.

Becker MH. The health belief model and personal health behavior. Health Education Monographs. 1974; 2:324–473.

Bickel WK, Marsch LA, Buchhalter AR, Badger GJ. Computerized behavior therapy for opioid-dependent outpatients: a randomized controlled trial. Experimental and Clinical Psychopharmacology. 2008; 16(2):132. [PubMed: 18489017]

Britt E, Hudson SM, Blampied NM. Motivational interviewing in health settings: a review. Patient education and counseling. 2004; 53(2):147–155. [PubMed: 15140454]

Caccia-Bava M, Guimaraes T, Harrington SJ. Hospital organization culture, capacity to innovate and success in technology adoption. Journal of Health Organization and Management. 2006; 20(3):194–217. [PubMed: 16869354]

Carroll K, Ball S, Martino S, Nich C, Babuscio T, Nuro K, Rounsaville B. Computer-assisted delivery of cognitive-behavioral therapy for addiction: a randomized trial of CBT4CBT. American Journal of Psychiatry. 2008; 165(7):881–888. [PubMed: 18450927]

Cassell MM, Jackson C, Cheuvront B. Health communication on the Internet: an effective channel for health behavior change? Journal of health communication. 1998; 3(1):71–79. [PubMed: 10947375]

Clarke G, Yarborough BJ. Evaluating the promise of health IT to enhance/expand the reach of mental health services. General hospital psychiatry. 2013; 35(4):339–344. [PubMed: 23701698]

Cucciare MA, Weingardt KR, Humphreys K. How Internet technology can improve the quality of care for substance use disorders. Current Drug Abuse Reviews. 2009; 2(3):256–262. [PubMed: 20443772]

Cunningham JA, Kypri K, McCambridge J. The use of emerging technologies in alcohol treatment. Alcohol Research & Health. 2011; 33(4):320. [PubMed: 23580017]

Curtis BL, McLellan AT, Gabellini BN. Translating SBIRT to public school settings: An initial test of feasibility. Journal of substance abuse treatment. 2014; 46(1):15–21. [PubMed: 24029623]

Danaher BG, Seeley JR. Methodological issues in research on web-based behavioral interventions. Annals of Behavioral Medicine. 2009; 38(1):28–39. [PubMed: 19806416]

Doumas DM, Hannah E. Preventing high-risk drinking in youth in the workplace: a web-based normative feedback program. Journal of Substance Abuse Treatment. 2008; 34(3):263–271. [PubMed: 17600650]

Emmons KM, Weiner B, Fernandez ME, Tu SP. Systems Antecedents for Dissemination and Implementation A Review and Analysis of Measures. Health Education & Behavior. 2012; 39(1):87–105. [PubMed: 21724933]

Finfgeld-Connett D, Madsen R. Web based treatment of alcohol problems among rural women: results of a randomized pilot investigation. Journal of psychosocial nursing and mental health services. 2008; 46(9):46. [PubMed: 18823000]

Greenhalgh T, Robert G, Macfarlane F, Bate P, Kyriakidou O. Diffusion of innovations in service organizations: systematic review and recommendations. Milbank Quarterly. 2004; 82(4):581–629. [PubMed: 15595944]

Gustafson DH, Shaw BR, Isham A, Baker T, Boyle MG, Levy M. Explicating an evidence-based, theoretically informed, mobile technology-based system to improve outcomes for people in recovery for alcohol dependence. Substance use & misuse. 2011; 46(1):96–111. [PubMed: 21190410]

Hester RK, Delaney HD, Campbell W, Handmaker N. A web application for moderation training: Initial results of a randomized clinical trial. Journal of Substance Abuse Treatment. 2009; 37(3):266–276. [PubMed: 19339137]

Jones DJ, Forehand R, Cuellar J, Kincaid C, Parent J, Fenton N, Goodrum N. Harnessing innovative technologies to advance children's mental health: Behavioral parent training as an example. Clinical psychology review. 2013; 33(2):241–252. [PubMed: 23313761]

King VL, Brooner RK, Peirce JM, Kolodner K, Kidorf MS. A randomized trial of Web-based videoconferencing for substance abuse counseling. Journal of substance abuse treatment. 2014; 46(1):36–42. [PubMed: 24035556]

King VL, Stoller KB, Kidorf M, Kindbom K, Hursh S, Brady T, Brooner RK. Assessing the effectiveness of an Internet-based videoconferencing platform for delivering intensified substance abuse counseling. Journal of Substance Abuse Treatment. 2009; 36(3):331–338. [PubMed: 18775625]

Litvin EB, Abrantes AM, Brown RA. Computer and mobile technology-based interventions for substance use disorders: An organizing framework. Addictive behaviors. 2013; 38(3):1747–1756. [PubMed: 23254225]

Marsch LA. Leveraging technology to enhance addiction treatment and recovery. Journal of addictive diseases. 2012; 31(3):313–318. [PubMed: 22873192]

Marsch LA, Bickel WK, Badger GJ. Applying computer technology to substance abuse prevention science: Results of a preliminary examination. Journal of Child & Adolescent Substance Abuse. 2007; 16(2):69–94.

Marsch LA, Carroll KM, Kiluk BD. Technology-based interventions for the treatment and recovery management of substance use disorders: A JSAT special issue. Journal of substance abuse treatment. 2014; 46(1):1–4. [PubMed: 24041749]

Mohr DC, Burns MN, Schueller SM, Clarke G, Klinkman M. Behavioral Intervention Technologies: evidence review and recommendations for future research in mental health. General hospital psychiatry. 2013a; 35(4):332–338. [PubMed: 23664503]

Mohr DC, Cheung K, Schueller SM, Hendricks Brown C, Duan N. Continuous evaluation of evolving behavioral intervention technologies. American journal of preventive medicine. 2013b; 45(4):517–523. [PubMed: 24050429]

National Institute on Drug Abuse, National Institutes of Health. InfoFacts. NIDA; Bethesda, MD: 2011. Understanding drug abuse and addiction; p. 1

Newman MG, Szkodny LE, Llera SJ, Przeworski A. A review of technology-assisted self-help and minimal contact therapies for drug and alcohol abuse and smoking addiction: Is human contact necessary for therapeutic efficacy? Clinical Psychology Review. 2011; 31(1):178–186. [PubMed: 21095051]

Olmstead TA, Ostrow CD, Carroll KM. Cost-effectiveness of computer-assisted training in cognitive-behavioral therapy as an adjunct to standard care for addiction. Drug and alcohol dependence. 2010; 110(3):200–207. [PubMed: 20392575]

Ondersma SJ, Chase SK, Svikis DS, Schuster CR. Computer-based brief motivational intervention for perinatal drug use. Journal of Substance Abuse Treatment. 2005; 28(4):305–312. [PubMed: 15925264]

Pating DR, Miller MM, Goplerud E, Martin J, Ziedonis DM. New systems of care for substance use disorders: treatment, finance, and technology under health care reform. Psychiatric Clinics of North America. 2012; 35(2):327–356. [PubMed: 22640759]

Riley WT, Rivera DE, Atienza AA, Nilsen W, Allison SM, Mermelstein R. Health behavior models in the age of mobile interventions: are our theories up to the task? Translational Behavioral Medicine. 2011; 1(1):53–71. [PubMed: 21796270]

Strecher V. Internet methods for delivering behavioral and health-related interventions (eHealth). Annual Review of Clinical Psychology. 2007; 3:53–76.

Strecher VJ, McClure JB, Alexander GL, Chakraborty B, Nair VN, Konkel JM, Pomerleau OF. Web-based smoking-cessation programs: results of a randomized trial. American journal of preventive medicine. 2008; 34(5):373–381. [PubMed: 18407003]

Substance Abuse and Mental Health Services Administration. NSDUH Series H-46, HHS Publication No. (SMA) 13–4795. Rockville, MD: SAMHSA; 2013. Results from the 2012 National Survey on Drug Use and Health: Summary of National Findings.