JOURNAL OF CHILD & ADOLESCENT SUBSTANCE ABUSE
2016, VOL. 25, NO. 3, 181–187
http://dx.doi.org/10.1080/1067828X.2014.981771

Routledge
Taylor & Francis Group

# Testing a Dynamic Automated Substance Use Intervention Model for Youths Exiting Foster Care

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**ABSTRACT**

With an ever-increasing gap between need and availability for substance use services, more scalable and efficient interventions are needed. For youths in the foster care system, this gap is dramatic and expands as they leave care. Effective prevention services are strongly needed for this group of vulnerable young people. We propose a novel technology-driven intervention for preventing problematic substance use among youths receiving foster care services. This study extends the work in brief computerized interventions by adding a text message-based booster, dynamically tailored to each individual's readiness to change. It also combats many barriers to service receipt. Dynamically tailored interventions delivered through technologies commonly used by adolescents and young adults have the strong potential to reduce the burden of problematic substance use.

**KEYWORDS**

computerized intervention; dynamic; foster care; tailored; text message

## Introduction

Psychosocial interventions, delivered face-to-face in individual, family, or group settings, remain the dominant form of treating mental illness (Kazdin & Blase, 2011). Although this practice continues to be refined, scholars have called for new approaches for decades, citing the impossibility of reaching everyone who needs help (Albee, 1959). With more than one-quarter of the United States population meeting criteria for a *Diagnostic and Statistical Manual of Mental Disorders* (*DSM*-IV) condition (Kessler & Wang, 2008) and only 700,000 mental health professionals (Hoge et al., 2007), innovative approaches are needed to scale up services and meet the needs of individuals.

## Barriers to adolescent substance use treatment

The effects of this gap between need and availability are evident among younger populations, as fewer than 10% of adolescents and young adults who are in need of substance use treatment receive care in this traditional way (Substance Abuse and Mental Health Services Administration, 2009). However, lack of providers is not the sole reason for this accessibility issue. Many youths do not perceive the need for substance use services, despite meeting criteria for alcohol and substance use diagnoses (Wu & Ringwalt, 2006). As with adults, youths often do not feel that their use of substances is problematic or may believe that such behavior is normative, given their developmental stage (Johnson, Stiffman, Hadley-Ives, & Elze, 2001; Marlatt, Larimer, Baer, & Quigley, 1993).

Adolescents may also not know where they can turn, should they recognize the need for professional help (Klein, McNulty, & Flatau, 1998). Volunteering such information to parents or other adults is unlikely, given concerns about stigma (Corrigan, 2004; Rickwood, Deane, & Wison, 2007) and confidentiality (Rickwood et al., 2007). Difficulty articulating the extent of their troubles (Feldstein Ewing, Hendrickson, & Payne, 2008) and navigating health service systems makes it unlikely that they would seek help independently. Often, long delays in addressing these issues result in parents and/or systems (e.g., criminal justice, social services) becoming the conduit for substance use treatment, only after the development of a more challenging, more problematic behavioral presentation, resulting in substantial personal and societal costs. Indeed, compared to adults, young people have a faster progression from first use to diagnostic thresholds, a shorter duration from first to second dependence

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diagnosis, and more comorbid mental health problems (Clark, Kirisci, & Tarter, 1998; Winters, 1999).

Given additional barriers such as lack of transportation and finances (e.g., means to pay for services, health insurance), growing trends of client-therapist mismatch on cultural and ethnic demographics (Commission on Ethnic Minority Recruitment Retention and Training, 2008), distrust of/disconnect with providers (D'Amico, 2005; Rickwood et al., 2007), and use of approaches lacking a solid research base (Becker & Curry, 2008), it is not surprising that nearly one-third of adolescents leave outpatient therapy before treatment completion (Williams & Chang, 2000). Taken together, traditional clinical services are severely limited in their ability to reach this particular population.

## The case for youths in foster care

Of the more than 400,000 youths receiving services in the United States foster care system, approximately 26,000 annually will exit, or "age out," of that system (most at age 18) and are removed from state-supported services (United States Department of Health and Human Services, 2012). Considered adults, aged-out youths are responsible for their own independent care, including housing, health care, and financial resources. Although the transition to adulthood presents many challenges for emerging adults in the general population, the path for those in foster care presents considerable barriers (Masten, Obradović, & Burt, 2006; Osgood, Foster, Flanagan, & Ruth, 2005; United States Department of Health and Human Services, 2007). While in the foster care system, youths often experience significant home and school instability, both of which negatively impact the scaffolding upon which adolescents build a successful path to adulthood (Geenen & Powers, 2007; McCoy, McMillen, & Spitznagel, 2008). Not surprisingly, lifetime drug use and diagnostic rates among youths in foster care are dramatically higher than in non-foster populations (see Braciszewski & Stout, 2012, for a review).

Upon exit, many former foster youths continue to report alarmingly high rates of unemployment, unstable housing, and both psychiatric and physical health issues (Courtney & Dworsky, 2006; Courtney et al., 2005; Courtney, Piliavin, Grogan-Kaylor, & Nesmith, 2001; Pecora et al., 2006). Indeed, almost half of foster care alumni report housing instability, and 1 in 5 indicate chronic homelessness within two years of leaving foster care (Fowler, Toro, & Miles, 2009). In terms of substance use, the picture remains bleak. Estimates of past-year substance dependence diagnoses range from 3.6% to 8.0%, compared to rates of 0.5 to 0.7% in non-foster populations (Pecora, White, Jackson, & Wiggins, 2009; White, O'Brien, White, Pecora, & Phillips, 2008). Lifetime diagnostic rates are equally concerning, with more than 11% meeting criteria for alcohol dependence and 21% for substance dependence, far higher than rates in the general population estimates (7.1% and 4.5%, respectively; White et al., 2008).

Incidence rates directly following exit from foster care may be most concerning, with an increase of alcohol and substance abuse diagnoses in 11% and 13% of alumni, respectively, within one year of aging out (Courtney et al., 2005). In contrast, rates in a comparable normative population are approximately 1% to 2% (Substance Abuse and Mental Health Services Administration, 2009). These rates clearly indicate that the transition out of foster care is a critical time for these new adults and intervention to prevent alcohol and substance abuse are greatly needed.

## Services for foster youths and alumni

To compound these difficulties, foster youths generally have less access to support services and family resources than their non-foster care counterparts (Courtney et al., 2005; Geenen & Powers, 2007; McCoy et al., 2008), as they are detached from their former systems of care upon reaching age 18. For those who have left the system, this gap between need and availability is even wider (Casanueva, Stambaugh, Urato, Fraser, & Williams, 2011; Ringeisen, Casanueva, Urato, & Stambaugh, 2009; Schneiderman, Brooks, Facher, & Amis, 2007) and continues to extend over time, as the incidence of substance use increases and access to care remains low (Casanueva et al., 2011; McCarthy, Van Buren, & Irvine, 2007).

Given low access to services among former foster youths, interventions are likely most effective when delivered before individuals age out of care. However, even with a connection to Medicaid and other state-supported services, these youths tend not to be assessed for substance use problems or referred to treatment (Casanueva et al., 2011; Cheng & Lo, 2010). When services *are* offered or made available, other significant barriers exist, including fears of negative consequences upon acknowledgment of substance use (Braciszewski, Moore, & Stout, 2014); reluctance to bond with a provider/counselor given difficult experiences with previous close relationships (Braciszewski et al., 2014); general mistrust of institutions (Braciszewski et al., 2014; Davis, 2003); and lack of delivery, coordination, or continuity of care, given housing instability (Horwitz, Owens, & Simms, 2000; Kelleher & Scholle, 1995; Simms, Dubowitz, & Szilagyi, 2000) or overburdened case managers (Schneiderman, 2004). Consequently, foster youths use acute health services and emergency clinics at rates far greater than other

low-income adolescents (Rubin, Alessandrini, Feudtner, Localio, & Hadley, 2004). Thus, substance use services should be a priority for youths preparing to age out of foster care, and will need to address the population-specific needs and barriers to adequate care.

## Computer- and mobile phone-based interventions

Utilization of new technology platforms to address problem behaviors is on the rise (Ritterband & Tate, 2009). Computer-based interventions, for example, have been shown to be effective for several psychiatric disorders (Kaltenthaler, Parry, Beverley, & Ferriter, 2008; Spek et al., 2007), physical health issues (Portnoy, Scott-Sheldon, Johnson, & Carey, 2008; Ybarra & Bull, 2007), smoking cessation (Rooke, Thorsteinsson, Karpin, Copeland, & Allsop, 2010), and substance use (Bickel, Christensen, & Marsch, 2011; Moore, Fazzino, Garnet, Cutter, & Barry, 2011; Rooke et al., 2010). Text message-based interventions are also increasingly being developed and have shown feasibility and efficacy for diabetes (Krishna, Boren, & Balas, 2009), nicotine dependence (Bock et al., 2013; Whittaker et al., 2009), alcohol (Kuntsche & Robert, 2009; Suffoletto, Callaway, Kristan, Kraemer, & Clark, 2012), and other substance use (Laursen, 2010).

In addition to their advantages in delivering evidence-based intervention content effectively, reliably, and flexibly, computer- and mobile phone-based methods can address many barriers to youths receiving substance use services. First, use of computers and mobile phones increases the likelihood of willful and honest reporting in large part to the perception of privacy and confidentiality (Turner et al., 1998; Weisband & Kiesler, 1996). Moreover, youths have reported these interactions to be more favorable than face-to-face meetings with providers (Pilowsky & Wu, 2013). Second, 93% of young people have access to or own a computer and nearly as many (73%) have a mobile phone (Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013), making it possible to reach individuals unlikely to access traditional care systems (Moore et al., 2011). Such accessibility can dramatically reduce labor costs (Newman, Szkodny, Llera, & Przeworski, 2011), as the majority of funds are allocated toward intervention development rather than delivery. Third, within any given mental health problem, individuals will have divergent experiences, risk and protective factors, and pathways to recovery. New technologies allow for a high degree of tailoring and personalization, increasing acceptability and effectiveness (Ondersma, Chase, Svikis, & Schuster, 2005). Finally, this technology allows screening and brief intervention to be more readily used in settings where adolescents are typically treated, such as in primary care (see Pilowsky & Wu, 2013, for a review). In this way, lag times between initial development of problems and onset of treatment can be reduced. Barriers specific to foster youths are also addressed, as provider-client bonds are not required, housing instability becomes less of a major obstacle, and case manager burden and labor costs are reduced.

Despite their wide reach, cost-effectiveness, and ease of accessibility, these new technologies are not without their limitations. The *long-term* impact of brief computer-based interventions for alcohol and substance use has not been favorable. Reports of significant between-group differences at a six-month follow-up are mixed (Moore et al., 2011; Rooke et al., 2010) and one-year post-intervention effects have only been found in one study (Kypri, Langley, Saunders, Cashell-Smith, & Herbison, 2008). The addition of booster sessions, often consisting of one or two brief meetings with treatment staff, has also not received strong support (Moore et al., 2011; Rooke et al., 2010). With regard to text message-driven interventions, some have shown promise (e.g., Suffoletto et al., 2012). This approach, however, is still in its infancy with few trials having been conducted.

## A new method of dynamic intervention

An additional limitation to both traditional and technology-based interventions is that they often assume a linear model of behavior change. That is, an individual accumulates information, weighs the valence of that information, makes a decision, and begins a new behavioral repertoire that keeps him or her at a distance from mental illness and its sequelae. While such simplistic models can be useful, complementary models of dynamic change are needed that view change as (a) often chaotic, dependent on initial conditions, and difficult to predict and (b) taking place within a complex system, often non-linearly (Resnicow & Page, 2008).

Interventions based on dynamic models should be of sufficient duration with multiple assessment points, examining motivations, behaviors, and emotions known to be involved in the behavior change process. Such was the case in a recent trial utilizing a computer-based substance use intervention with postpartum women (Ondersma, Grekin, & Svikis, 2011). In that study, within-session changes in motivation were associated with substance use outcomes at a 4-month follow up. Also relevant was the timing of assessment during the intervention (i.e., stimulation), as post-feedback (one of three major sections of the intervention) inquiry was the strongest predictor of future behavior.

To this end, approaches like Ecological Momentary Assessment (EMA) significantly augment our ability to

collect and make use of this type of data. With more data, complex, non-linear models could be used to examine patterns of behavior and predict, with much greater accuracy, distal outcomes. Such benefits would be realized in the trimming of measurement "error" seen in linear models (Resnicow & Page, 2008).

Finally, interventions would be best served by incorporating dynamic tailoring of content, and technology-based approaches are an optimal medium to carry this out. Given adequate assessment before and during the intervention, individual participant responses can be used to adapt content, specific to that person. With an indefinite "memory," the computer can provide feedback about progress and behavior change, as well as possibly "learn" the best algorithms for intervention delivery based on individual responses (Miller, 2001).

## Future directions

It seems clear that with the large gap between substance use service need and utilization, new and accessible intervention approaches are needed. Rather than filling that gap with *more* services, we believe there is a strong argument for *efficient and scalable* services. We have recently launched a project to design and test a preventive substance use intervention that can address many of the limitations of traditional care, as well as the weaknesses in the current models of computer- and mobile phone-based interventions. While this program is specifically aimed at the even larger need/utilization gap among youths exiting the foster care system, it is easily modified and scalable for the general population.

iHeLP (Interactive Healthy Lifestyle Preparation) involves an initial 20-minute computerized screening and brief intervention (SBI), designed and implemented using computerized intervention authoring software (CIAS; Ondersma et al., 2005; Ondersma, Svikis, & Schuster, 2007), a sophisticated intervention development tool that allows for the modification and delivery of screening, assessment, and intervention, personalized for individual participants. The specific SBI designed for iHeLP addresses alcohol and illicit drug use by using an approach consistent with Motivational Interviewing (MI; Miller & Rollnick, 2013) and following the FRAMES (Miller & Sanchez, 1994) approach to brief interventions.

As mentioned earlier, long-term (i.e., more than six months) outcomes of computerized SBIs have not been strong, even with the addition of booster sessions (Moore et al., 2011; Rooke et al., 2010). Such meetings happen infrequently and have been separated from the initial intervention by as much as 10 months (Wood et al., 2010). Given our argument for the dynamic nature of change, we believe less intense, more frequent boosters are needed. Thus, to improve upon previous limitations, we are using short message service (SMS) text messaging (TM) as an extension of the single-session computerized intervention. Text messaging offers many additional benefits to computer-based approaches and previous booster models, providing reliability, consistency, and regular frequency, and allowing for the continued delivery of evidence-based intervention content, adjusted for changes in participant behavior and readiness.

Within iHeLP, participants receive daily messages for a period of six months. Content is theoretically grounded in MI (Miller & Rollnick, 2013), the Transtheoretical Model (TTM; Prochaska & DiClemente, 1992), and Social Cognitive Theory (SCT; Bandura, 2001). To take advantage of synchrony between MI and TTM, text messages are tailored to each participant's level of motivation to reduce their substance use by using content appropriate for that person's current TTM stage of change. However, behavior change is often dynamic, where non-linear changes take place as a result of complex, adaptive processes and need to be considered within the context of interventions (Resnicow & Page, 2008). Accordingly, individuals' motivational levels will likely fluctuate over the course of the study. To account for these changes, we use weekly "poll questions" to assess changes in motivation. When participants respond in such a way that alters their stage of change (e.g., moving from pre-contemplation to contemplation), the content of their messages reflects that change. This design allows more up-to-the-minute tailoring of message content, rather than relying solely on baseline or follow-up data collected months after the initial interview. Although some text messaging approaches have used ongoing feedback based on post-baseline assessments (e.g., Suffoletto et al., 2012), and one tobacco intervention study has implemented a similar model of dynamic change (Bock et al., 2013), we believe ours to be the first study involving active adaptation to fluid levels of motivation to change alcohol and drug use.

In an age where technology use is almost ubiquitous in the United States, it makes sense to leverage the potential advantages. Certainly, iHeLP is not a substitute for acute substance abuse services and is not intended to replace clinicians, case managers, or other health service professionals. However, it has the potential to serve as a cost-effective, useful screening tool, indicated prevention model, and catalyst for further treatment, if needed. Substance use is among the most serious issues facing foster youths; however, little attention has been paid to screening, assessment, prevention, or treatment of these problems (Casanueva et al., 2011; Cheng & Lo, 2010; McCarthy et al., 2007; Ringeisen et al., 2009; Schneiderman et al., 2007). Despite calls for an increase in attention

to substance use among foster youths and routine screening for mental health and substance use problems (Havlicek, Garcia, & Smith, 2013), we are not aware of any intervention that specifically targets substance use among youths who are preparing to exit the foster care system.

We are also excited by the possibility of iHeLP's generalization to young populations outside of foster care, since a major advantage of a dynamic, automated approach is that it can be adapted and tailored across populations and afflictions. Although iHeLP was designed for foster youths, with their group-specific barriers to service, this approach would likely be suitable for other young adults experiencing similar issues.

Our excitement is tamed, of course, by the knowledge that more work is to be done. Surely, even if iHeLP is shown to be effective in larger studies, several refinements could be made. First, it will be important to demonstrate its impact within an effectiveness trial. Case managers may be reluctant to hand over a set of responsibilities to a machine outside their control. Second, these dynamic programs would likely benefit from enhanced interactivity. At present, our text messaging component is predominantly "push" only. While poll questions are asked and responses are used to alter the intervention, there is very little dialogue. Such dialogue, which is better represented in the computer portion of the intervention, could augment the user's experience and mitigate any feelings of the phone being an annoyance. Third, more complex dynamics and programming, beyond what we have proposed, can hopefully increase the efficacy and speed at which change occurs. Such leveraging of artificial intelligence techniques would certainly improve the impact of these approaches (Ondersma et al., 2011). Finally, there is a growing focus on the important predictive role of social support and relationships on recovery from substance use (Kelly, Stout, Magill, & Tonigan, 2011). Preliminary reports indicate strong approval for the addition of a social networking component to a TM intervention (Bock et al., 2013). Thus, infusing a client's family members, friends, or other supports of their choosing into this dynamic system should only serve to improve its function.

## Funding

This work was made possible by a Corporate Development Grant from the Pacific Institute for Research and Evaluation, grant number R34DA034822 from the National Institute on Drug Abuse.

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