Ecological momentary assessments for self-monitoring and counseling to optimize methamphetamine treatment and sexual risk reduction outcomes among gay and bisexual men

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ABSTRACT

This pilot study evaluated the use of smartphone ecological momentary assessments (EMA) for self-monitoring to optimize treatment outcomes among gay and bisexual men enrolled in an outpatient methamphetamine abuse treatment service program. Participants ($N = 34$) received EMA prompts five times daily to self-monitor their methamphetamine use, cravings, sexual risk behaviors, and associated triggers and affect throughout the 8-week treatment program. Participants were randomized into either a self-directed condition with access to a web-based EMA response visualization dashboard ("EMA + Dashboard"; $n = 16$); or, a counselor-supported condition incorporating weekly, 30-min, one-on-one counseling sessions to review and discuss the participant's self-monitoring data on the dashboard ("EMA + Dashboard + Counselor"; $n = 18$). Pilot participants were compared with historical controls ($n = 102$) as the reference group in multiple regression analyses to assess the impact of the two study conditions on the treatment service program outcomes. Study participants with weekly counseling (EMA + Dashboard + Counselor) exhibited significantly greater reductions in the number of condomless anal intercourse episodes than historical controls ($IRR = 0.02$, 95% CI [0.00, 0.30]), whereas the reduction was of similar magnitude as controls in the EMA + Dashboard self-directed condition ($IRR = 0.23$, 95% CI [0.02, 3.56]). Treatment effects were not significant for comparisons between the two study conditions and historical controls for self-reported methamphetamine use (EMA + Dashboard: $IRR = 1.06$, 95% CI [0.32, 3.49]; EMA + Dashboard + Counselor: $IRR = 0.46$, 95% CI [0.14, 1.49]), number of male partners (EMA + Dashboard: $IRR = 1.02$, 95% CI [0.39, 2.61]; EMA + Dashboard + Counselor: $IRR = 0.54$, 95% CI [0.20, 1.45]), and the likelihood of providing a urine sample that tested positive for methamphetamine metabolites (EMA + Dashboard: $OR = 1.00$, 95% CI [0.79, 1.25]; EMA + Dashboard + Counselor: $OR = 0.93$, 95% CI [0.74, 1.16]). The pilot study provides preliminary evidence that the treatment outcome for condomless anal intercourse can be improved through a combination of smartphone- and counselor-assisted self-monitoring.

1. Introduction

1.1. Methamphetamine use and HIV among gay and bisexual men in the U.S.

In the United States (U.S.), methamphetamine use is more prevalent among gay and bisexual men (GBM) than among heterosexual males. According to the 2015 National Survey on Drug Use and Health, 3.4% of GBM aged 18 or older used methamphetamine in the past year, compared to 0.9% of adult heterosexual men (Medley et al., 2016).

Comprehensive epidemiological data on geographic patterns in methamphetamine use of GBM is lacking, but smaller-scale behavioral studies suggest that methamphetamine use is particularly elevated among GBM in major urban centers such as Los Angeles or New York City (Grov, Bimbi, Nanin, & Parsons, 2006; Halkitis, Levy, Moreira, & Ferrusi, 2014; Reback, Fletcher, Shoptaw, & Grella, 2013; Solomon, Halkitis, Moeller, & Pappas, 2012).

The adverse effects of chronic methamphetamine use are wide-ranging, including neurocognitive impairments (Curtin et al., 2015; Dean, Groman, Morales, & London, 2013), psychiatric illness (Salo

et al., 2011), and increased risk of cardiovascular disease and stroke (Huang et al., 2016). Among GBM and other men who have sex with men (MSM), methamphetamine use has also been shown to increase engagement in unsafe sexual behavior and risk for infection with HIV (Grov et al., 2014; Hirshfield, Remien, Walavalkar, & Chiasson, 2004; Nakamura, Mausbach, Ulibarri, Semple, & Patterson, 2011; Shoptaw & Reback, 2006). This deleterious combination of both direct (e.g., neurological, dental, cardiovascular) and secondary (i.e., increased risk for infection with HIV) consequences of methamphetamine use for GBM in the U.S. has created a pressing need for efficacious and evidence-based interventions specifically tailored to methamphetamine-using GBM engaged in HIV sexual risk-taking.

1.2. Gay-specific cognitive behavioral therapy (GCBT) for methamphetamine-using GBM

Shoptaw and Reback (Reback & Shoptaw, 2014; Shoptaw et al., 2005, 2008) developed and manualized a gay-specific, cognitive behavioral therapy (GCBT) small-group intervention for GBM that supplements standard cognitive-behavioral techniques (Rawson et al., 1995) with gay male cultural references and targets both methamphetamine use and HIV-related sexual risk behaviors. Two randomized controlled trials demonstrated efficacy of the GCBT intervention, showing significant and sustained reductions in methamphetamine use, number of male sex partners, and unprotected anal sex (Shoptaw et al., 2005, 2008). A modified version of the GCBT intervention, named *Getting Off: A Behavioral Treatment Intervention for Gay and Bisexual Male Methamphetamine Users*, was designed to increase cost and time effectiveness (Reback & Shoptaw, 2014) for application in community settings. The *Getting Off* outpatient treatment program comprises 24 group sessions over an 8-week time period. An ancillary low-cost contingency management intervention provides incentives to participants who submit methamphetamine-metabolite-free urine samples. Urine drug screenings are administered thrice weekly for the duration of the program. The *Getting Off* intervention was shown to be similarly efficacious in reducing methamphetamine use and sexual risk behaviors as the original GCBT intervention (Reback & Shoptaw, 2014).

1.3. Augmenting Getting Off through ecological momentary assessment self-monitoring

Evidence-based treatment interventions, such as the *Getting Off* intervention for GBM methamphetamine users, are well-poised to take advantage of recent advancements in mobile, technology-based health interventions. Self-monitoring, a core element of evidence-based interventions (Chorpita, Daleiden, & Weisz, 2005; Michie et al., 2013) and theories of behavior change and self-regulation (Bandura, 1991; Carver, 1979; Kanfer, 1970), has been made more feasible and accessible through the widespread use of mobile phones and may enhance intervention effects. There is modest meta-analytic evidence that self-monitoring supports self-management of diabetes (Warsi, Wang, LaValley, Avorn, & Solomon, 2004) and obesity (Burke, Wang, & Sevick, 2011). Substance abuse intervention research suggests that repeated assessments may increase self-monitoring and thereby improve targeted outcomes (Jenkins, McAlaney, & McCambridge, 2009; McCambridge, 2009). A similar effect may also underlie sexual risk reduction on the order of 15% to up to 30% that was observed in control groups in some HIV prevention trials (Healthy Living Project Team, 2007; Kamb et al., 1998; NIMH Multisite HIV Prevention Trials Group, 1998).

Ecological Momentary Assessment (EMA) is an intensive self-report methodology involving multiple time- and/or event-based prompts for reporting experiences and behaviors throughout a day in natural settings, and has been used extensively in basic behavioral research on substance use (Shiffman, 2009; Shiffman, Stone, & Hufford, 2008). EMA researchers have noted methodological challenges of potential reactivity (i.e., changes in awareness and behaviors or "assessment effects") in response to intensive self-assessments, particularly when a sample population is motivated to change (Heron & Smyth, 2010; Shiffman et al., 2008).

EMA methods have been used extensively in tobacco and alcohol research, including with in-treatment and in-recovery populations, but relatively few studies have examined other substances such as heroin and cocaine (Serre, Fatseas, Swendsen, & Auriacombe, 2015). For example, EMA was instrumental in assessing the impact of cognitive, affective, and motivational factors (Huhn et al., 2016; Marhe, Waters, van de Wetering, & Franken, 2013; Waters, Marhe, & Franken, 2012) as well as stress (Preston et al., 2017) on drug craving and use among heroin- and/or cocaine-dependent patients. One study examined the feasibility and acceptability of EMA in a sample of four male and two female adult methamphetamine-dependent users (Galloway, Didier, Garrison, & Mendelson, 2008). Approximately 30 EMA studies targeted sexual behavior, and a subsample of these included GBM. Wray, Kahler, and Monti (2016) found EMA to be feasible and acceptable in a sample of twelve high-risk MSM who reported on sexual behaviors and substance use. To date, no EMA study has worked with GBM methamphetamine users at high-risk for HIV acquisition and transmission.

EMA and reliable self-monitoring have historically been both costly and labor intensive, relying on paper-based methods, instructions and alarms (i.e., watches or pagers), or, more recently, early technological portals through personal digital assistants, interactive voice response calls or websites. The rapid development and proliferation of smartphone technology over the past decade has enabled EMA and self-monitoring methods to become affordable, portable, and scalable. Acceptability of technology-based interventions is high among GBM who, as early as the 1990s, became vanguard users of emerging digital technologies by adopting the Internet for sexual purposes (e.g., finding sex partners, seeking sexual health information, pornography [Grov, Breslow, Newcomb, Rosenberger, & Bauermeister, 2014]). Recent data indicate more widespread use of mobile technologies by GBM than in other adult populations (Grov, Breslow, et al., 2014).

Prior research has demonstrated promising results in the adoption of technology-based self-monitoring among MSM. In a 6-month prospective study with young adult MSM, participants who completed web-based diaries about their sexual behaviors reported fewer unprotected anal sex acts in retrospective surveys and had fewer new HIV/STI diagnoses than participants without diaries (Glick, Winer, & Golden, 2013; Horvath, Beadnell, & Bowen, 2007). A mixed methods study of self-monitoring and web-dashboards for substance use, sexual risks, medication adherence, and quality of life among people living with HIV suggest that multiple theory-linked mechanisms are at play in supporting behavior change and self-management, including increased awareness of behaviors and triggers, comparison to a personal standard or social norm, reminders, goal progress tracking and accountability, self-rewards, and reinforcement (Swendeman et al., 2015). In summary, theory and emerging empirical research suggest that technology-based self-monitoring using EMA methods may serve to enhance impacts of traditional interventions.

The aim of the present study was to evaluate pilot data on the use of EMA for optimizing treatment outcomes among GBM enrolled in the *Getting Off* outpatient methamphetamine abuse treatment service program in Los Angeles. The pilot study examined the feasibility, acceptability, and potential utility of EMA using smartphones and an open-source mobile health application platform, accompanied by a web-based visualization dashboard, with and without counseling. It was hypothesized that EMA self-monitoring would optimize methamphetamine outpatient treatment outcomes by prompting participants to self-monitor their methamphetamine use, cravings, HIV sexual risk behaviors, and associated triggers and affect throughout the intervention period. The postulated effects of EMA were evaluated by comparing study participants' treatment outcomes with the outcomes of historical controls who participated in the same *Getting Off* outpatient