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Addictive Behaviors

Bridging waitlist delays with interim buprenorphine treatment: Initial feasibility

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HIGHLIGHTS

- Despite the effectiveness of opioid maintenance, treatment waitlists persist.
- We developed an interim buprenorphine treatment (IBT) for waitlisted opioid abusers.
- IBT significantly reduced illicit opioid use, withdrawal and craving.
- IBT may reduce risks for patients and society during delays to treatment.

ARTICLE INFO

ABSTRACT

Despite the effectiveness of agonist maintenance for opioid dependence, individuals can remain on waitlists for months, during which they are at significant risk for morbidity and mortality. Interim dosing, consisting of daily medication without counseling, can reduce these risks. In this pilot study, we examined the initial feasibility of a novel technology-assisted interim buprenorphine treatment for waitlisted opioid-dependent adults. Following buprenorphine induction during Week 1, participants (n = 10) visited the clinic at Weeks 2, 4, 6, 8, 10 and 12 to ingest their medication under staff observation, provide a urine specimen and receive their remaining doses via a computerized Med-O-Wheel Secure device. They also received daily monitoring via an Interactive Voice Response (IVR) platform, as well as random call-backs for urinalysis and medication adherence checks. The primary outcome was percent of participants negative for illicit opioids at each 2-week visit, with secondary outcomes of past-month drug use, adherence and acceptability. Participants achieved high levels of illicit opioid abstinence, with 90% abstinent at the Week 2 and 4 visits and 60% at Week 12. Significant reductions were observed in self-reported past-month illicit opioid use (p < .001), opioid withdrawal (p < .001), opioid craving (p < .001) and ASI Drug composite score (p = .008). Finally, adherence with buprenorphine administration (99%), daily IVR calls (97%) and random call-backs (82%) was high. Interim buprenorphine treatment shows promise for reducing patient and societal risks during delays to conventional treatment. A larger-scale, randomized clinical trial is underway to more rigorously examine the efficacy of this treatment approach.

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1. Introduction

Opioid misuse and dependence are reaching epidemic proportions in the United States (US), resulting in overdoses, premature death, infectious disease and economic costs of $56 billion annually (Becker, Sullivan, Tetrault, Desai, & Fiellin, 2008; Birnbaum et al., 2011; Clausen, Waal, Thoresen, & Gossop, 2009; Hser, Hoffman, Grella, & Anglin, 2001; Jones, Mack, & Paulozzi, 2013; Paulozzi, 2012; SAMHSA, 2010; Shah, Lathrop, Reichard, & Landen, 2008; Wisniewski, Purdy, & Blondell, 2008). The problem is increasingly urgent in rural areas which often struggle with high rates of opioid misuse and a lack of available treatment options (Fortney & Booth, 2001; Lenardson & Gale, 2007; Rosenblum et al., 2011; Rounsaville & Kosten, 2000; Sigmon, 2014).

While opioid maintenance is the most efficacious treatment (Johnson et al., 2000; Mattick, Breen, Kimber, & Davoli, 2014; Stotts,

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Dodrill, & Kosten, 2009), demand for treatment can exceed available capacity (Friedmann, Lemon, Stein, & D'Aunno, 2003; Wenger & Rosenbaum, 1994). An alarming number of methadone clinics have waitlists, due in part to inadequate public funding, unfavorable zoning regulations and requirements for comprehensive care that increase their cost (Des Jarlais, Paone, Friedman, Peyser, & Newman, 1995; Fountain, Strang, Griffiths, Powis, & Gossop, 2000; Gryczynski, Schwartz, O'Grady, & Jaffe, 2009; Peles, Schreiber, Sason, & Adelson, 2012; Peles, Schreiber, & Adelson, 2013; Peterson et al., 2010). Many areas also lack office-based buprenorphine treatment capacity due to barriers to obtaining the special federal certification needed for pre-scribing buprenorphine, physicians' concerns about induction logistics, reimbursement challenges, potential for medication nonadherence or diversion, and challenges in delivering psychosocial services to patients (Barry et al., 2008; Becker & Fiellin, 2006; Kissin, McLeod, Sonnefeld, & Stanton, 2006; Netherland et al., 2009; Sigmon, 2015). Taken together, opioid-dependent individuals can remain on waitlists for months and are at significant risk for illicit drug use, criminal activity, infectious disease and mortality during this delay to treatment (Adamson & Sellman, 1998; Clausen et al., 2009; Cooper, 1989; Darke & Hall, 2003; Schwartz et al., 2009; Schwartz et al., 2009; Schwartz, Kelly, O'Grady, Gandhi, & Jaffe, 2011; Warner-Smith, Darke, Lynskey, & Hall, 2001; Wenger & Rosenbaum, 1994).

One effort to reduce these risks has been to offer interim methadone treatment (IMT), in which methadone clinics can provide medication without accompanying psychosocial services on a temporary basis when only a waiting list would be otherwise available (Federal Register, 1993; IOM, 1995). IMT has been consistently demonstrated to reduce drug use, drug-related risk behaviors and criminal activity among patients awaiting entry into comprehensive treatment (Gruber, Delucchi, Kielstein, & Batki, 2008; Schwartz et al., 2006; Schwartz, Jaffe, Highfield, Callaman, & O'Grady, 2007; Schwartz et al., 2008; Schwartz et al., 2009; Schwartz et al., 2011; Schwartz et al., 2011; Yancovitz et al., 1991). However, methadone treatment in the US is limited to licensed specialty clinics, it requires daily visits dur-ing the first few months of treatment and the medication poses considerable risk of overdose death if ingested by non-tolerant individuals (Luty, O'Gara, & Sessay, 2005). Further, federal IMT reg-ulations mandate that patients ingest all doses under direct obser-vation, requiring daily clinic visits (IOM, 1995). They also limit its duration to 120 days, with clinics required to discharge patients at that time if a slot has not become available. Despite successful efforts in Baltimore to bring IMT to scale (Schwartz et al., 2009a), few other localities have used this approach. Taken together, these features have constrained the ability of IMT to treat opioid users while they await entry into standard opioid treatment.

We have been developing a novel interim opioid treatment to bridge delays in treatment access while surmounting the above barriers. Our intervention consists of four components, each selected to support delivery of an efficacious pharmacotherapy to waitlisted opioid-dependent adults while reducing the risk of medication nonadherence and diversion. First, we chose buprenorphine as the interim dosing medication because its pharmacological profile is associ-ated with reduced abuse liability and overdose risk (Bickel & Amass, 1995; Johnson, Strain, & Amass, 2003; Walsh, Preston, Stitzer, Cone, & Bigelow, 1994; Walsh, Preston, Bigelow, & Stitzer, 1995). Buprenorphine is also available without the rigid regulatory regulations, daily observa-tion of dosing and 120-day limit required for interim methadone. Second, we are using a computerized device to facilitate mobile buprenorphine dispensing while reducing risk of nonadherence or diversion. While pill bottles with Medication Event Monitoring System caps (MEMS; Aprex Corporation, Fremont, CA) have been used for years, they have substantive limitations. Patients can access all of their doses each time they open the bottle, and the cap only records a time-date stamp for each opening rather than the amount of medication re-moved. For the present study, we used the Med-O-Wheel Secure device

(Addoz, Forssa, Finland), a portable, disc-shaped device which can hold several weeks' worth of doses with each dose stored in a separate cell and only available during a predetermined 3-hour window. The Med-O-Wheel also includes locks and alarms to prevent tampering and ac-cess to tablets outside the preset time window. Third, we developed a mobile health (*m*Health) platform for monitoring patients on a daily basis. *m*Health applications hold significant potential for permitting de-livery of monitoring, education and treatment beyond the confines of the medical office (Boyer, Smelson, Fletcher, Ziedonis, & Picard, 2010). Particularly promising are those that provide customized content or monitoring via phone, as phone-based systems offer advantages of low cost, consistent delivery, expanded access, 24-hour availability, pri-vacy and convenience (Crawford et al., 2005; Helzer et al., 2008; Kim, Bracha, & Tipnis, 2007; Moore et al., 2013; Rose et al., 2010; Rose et al., 2010; Stacy, Schwartz, Ershoff, & Shreve, 2009). Our *m*Health sys-tem uses an Interactive Voice Response (IVR) platform to deliver auto-mated calls to participants nightly to assess their drug use, withdrawal and craving. Finally, while biochemical verification via urine drug test-ing is the most objective method for evaluating recent drug use (Chermack et al., 2000; Fendrich, Johnson, Wislar, Hubbell, & Spiehler, 2004; Kilpatrick, Howlett, Sedgwick, & Ghodse, 2000; Preston, Silverman, Schuster, & Cone, 1997; Wish, Hoffman, & Nemes, 1997), fre-quent visits are incompatible with resource-constrained settings and with rural areas where daily travel to treatment is challenging. We de-veloped a random sampling approach whereby patients are contacted at random times via IVR and instructed to return to the clinic for urinal-ysis. Random sampling increases the effectiveness of urine monitoring, as patients remain unaware of when the next screen will be requested, reducing the possibility that they can tailor drug use to subvert mon-itoring (Harford & Kleber, 1978; Manno, 1986). At each random call-back, participants also must present their device for inspection by staff to ensure there is no indication of tampering, nonadherence or diversion.

In this 12-week pilot study, we sought to evaluate the initial feasibil-ity of this novel interim buprenorphine treatment (IBT) in reducing illic-it opioid use and drug-related risk behavior among opioid-dependent individuals awaiting entry into agonist maintenance. Our aim was to pilot the intervention in a small sample of waitlisted opioid abusers and identify any procedural adjustments indicated to be necessary prior to proceeding with a larger-scale randomized trial.

2. Methods

2.1. Participants

Opioid-dependent adults were recruited via flyers posted through-out the community and distributed to local opioid treatment providers. Eligible participants had to be ≥18 years old, in good health, meet DSM-V criteria for opioid use disorder, provide an opioid-positive urine spec-imen and be currently waitlisted with an opioid treatment program (OTP) or office-based buprenorphine provider. Those with a significant psychiatric or medical illness that could interfere with participation were excluded, as well as those who were pregnant or nursing. Individ-uals dependent on sedative-hypnotics were also excluded, due to the medical risks and notably low success rates with sedative-dependent opioid abusers (Stitzer & Chutuape, 1999). The study was approved by the University of Vermont Institutional Review Board and participants provided written informed consent prior to participating. All 10 individ-uals who were screened, deemed eligible and offered the study agreed to participate.

2.2. Study design

Participants completed buprenorphine induction during Week 1 (or longer if required), during which they attended the clinic daily. Thereaf-ter, they visited the clinic at Weeks 2, 4, 6, 8, 10 and 12 to ingest their

buprenorphine dose under staff observation, provide a urine specimen and receive their remaining doses in the Med-O-Wheel. Participants received calls daily from the IVR system, as well as IVR-generated random call-backs (approximately twice monthly) for an additional urinalysis and medication adherence check visit.

2.3. Assessments

Intake screening included a Demographic and Drug History Questionnaire, the psychoactive substance dependence section of the DSM-V (American Psychiatric Association, 2013) and Addiction Severity Index (ASI; McLellan, Luborsky, & Cacciola, 1985). Participants also completed a medical history, received a brief physical examination, provided a urine specimen and received $30. At each subsequent visit, their use of alcohol, prescribed and illicit drugs was assessed via Time-Line Followback (Sobell, Sobell, Leo, & Cancilla, 1988). At Weeks 4, 8 and 12, participants completed follow-up assessments consisting of modified versions of the intake battery, with an additional treatment satisfaction survey administered at Week 12.

2.4. Buprenorphine administration

Study medication consisted of buprenorphine/naloxone sublingual tablets (Amneal Pharmaceuticals, Bridgewater, New Jersey). During Week 1, participants attended the clinic daily and individualized dose adjustments were determined using the Clinical Institute Narcotic Assessment (Peachey & Lei, 1988) with the aim of stabilizing participants on a dose sufficient to achieve withdrawal suppression without intoxication or sedation (Sigmon, Dunn, Badger, Heil, & Higgins, 2009; Sigmon et al., 2013). At subsequent visits during Weeks 2–12, participants ingested that day's buprenorphine dose under nurse observation and received the remaining doses for the upcoming interval in the Med-O-Wheel. Each dose was secured in individually-locked compartments and available only during a predetermined 3-hour window each day. Participants were instructed to bring the device with them to both scheduled and random call-back visits (below). They could also return to the clinic between scheduled visits if concerns arose or a dose evaluation was needed.

2.5. Biochemical monitoring

Participants provided urine specimens under observation of a same-sex staff member at each visit. Specimens were immediately temperature tested and analyzed via enzyme multiplied immunoassay (Microgenics, Fremont, CA) for opioids (e.g., methadone, buprenorphine, oxycodone, hydrocodone, hydromorphone, heroin). If a participant failed to provide a scheduled urine sample, it was considered positive for illicit opioids. Samples were also tested for non-opioid drugs (e.g., cocaine, amphetamines, benzodiazepines, marijuana). Finally, participants provided a breath sample which was analyzed for recent alcohol use (ALCO-SENSOR III, Intoximeters, Inc., St. Louis, MO).

2.6. mHealth monitoring

The IVR system contacted participants each evening to assess any opioids or other drug or alcohol use, as well as opioid-related craving or withdrawal symptoms. Instances of use, craving or withdrawal prompted additional detailed questions (e.g., type and amount used, severity of craving and withdrawal), as well as provision of information about ongoing support meetings taking place in the community. Participants could also make inbound calls to the system at any time to complete their daily check-in if they anticipated missing the call.

2.7. Random call-backs

Participants were contacted via IVR approximately twice per month on a random basis and instructed to return to the clinic within 12 h. For each call-back, they were instructed to refrain from taking that day's dose and instead bring in their Med-O-Wheel device to ingest their medication under observation of the research nurse. The device was inspected for any evidence of tampering, nonadherence or diversion, and participants provided a staff-observed urine specimen.

2.8. Data analyses

Analyses were performed on all subjects independent of early dropout or noncompliance, consistent with an intent-to-treat approach (Armitage, 1983). Missing urine samples were considered as opioid-positive for the primary analysis. Descriptive statistics were used to characterize baseline demographic and drug use variables and the percent of urine specimens testing negative for illicit opioids at each 2-week study visit. Overall percent abstinence and its corresponding 95% confidence interval were derived based on GEE modeling that accounts for correlated observations within each participant. Similar to prior studies (Fiellin et al., 2006), buprenorphine adherence was evaluated using a review of nurses' notes, random call-back data and Med-O-Wheel monitoring. Participants were classified as adherent for a given day if adherence was documented by a nurse's note or by the Med-O-Wheel having successfully dispensed a dose on that day. Repeated measures analyses of variance were used to examine changes in ASI composite scores and frequency of self-reported illicit opioid use across intake, 4-, 8- and 12-week follow-ups. Growth curve analyses using random intercept and slope models were used to describe temporal trends in withdrawal and craving. Analyses were performed using SAS 9.3 (SAS Institute, Inc., Cary, NC). Statistical significance was determined using $\alpha = .05$.

3. Results

3.1. Participants

Demographic and drug use characteristics are presented in Table 1. Participants reported using opioids regularly for 8.4 ± 4.6 years, and 40% reported a lifetime history of intravenous drug use. While most endorsed a prescription opioid as their current primary drug of abuse, 60% reported a lifetime history of heroin use. Participants had been on a treatment waitlist for 5.5 ± 6.3 months, with all currently waitlisted for a local OTP and 30% also waitlisted for office-based buprenorphine treatment. When asked to rate how troubled or bothered they were by their inability to access treatment from 0 (not at all) to 100 (extremely), participants' mean rating was 89.6 ± 16.

3.2. Technology-assisted buprenorphine administration

Participants' mean buprenorphine dose was 15.4 ± 4.0 mg. A total of 819 buprenorphine doses were administered during the study, with 161 ingested at the clinic under staff observation and 658 dispensed via Med-O-Wheel. All aspects of the technology-assisted buprenorphine administration went smoothly, and all devices were returned at the end of the study. Buprenorphine adherence was high, with participants taking their medication on 99% of study days.

3.3. Opioid abstinence

Participants achieved favorable rates of illicit opioid abstinence, submitting a total of 73.3% (95% CI: 47–89%) illicit opioid-negative specimens across the six scheduled study visits. Of the specimens categorized as opioid positive, 31% tested positive for illicit opioids and 69% were missing and thus presumed positive. Inspection of abstinence

Table 1
Demographic and drug use characteristics (n = 10).

Age	35.7 (9.4)
Male, %	50
Caucasian, %	100
Employed full-time, %	40
Education, yrs	12.1 (0.2)
Duration of regular opioid use, yrs	8.4 (4.6)
Past-month opioid use, days	29.3 (0.8)
Ever used IV, %	40
Ever used heroin, %	60
Primary route of administration, %	
Oral/sublingual	40
Intranasal	40
Intravenous	20
Past year primary opioid of abuse	
Prescription opioid, %	80
Buprenorphine, %[a]	63
Mean daily dose, mg	11.2
Oxycodone, %[a]	37
Mean daily dose, mg	126.7
Heroin, %	20
Mean daily amount, bags	13.8
Addiction Severity Index (ASI)[b]	
Drug	.36 (.08)
Alcohol	.06 (.07)
Employment	.36 (.30)
Legal	.12 (.21)
Family/social	.12 (.13)
Psychiatric	.19 (.22)
Medical	.41 (.37)

Note: Values represent mean (SD) unless otherwise indicated.

[a] The percentages of participants endorsing each prescription opioid subtype are based on the total of 8 primary prescription opioid users.

[b] ASI composite scale scores range from 0–1.

data over time showed an increase following intake in the percent of participants negative for illicit opioids, which peaked at 90% at the Week 2 and Week 4 assessments (Fig. 1, upper panel). Abstinence rates declined somewhat in the final weeks, though 60% of participants were abstinent from illicit opioids at the final Week 12 visit.

Participants reported a significant reduction in the number of days of illicit opioid use in the past month, from 29.3 ± 0.8 days at intake to 3.98 ± 1.0, 0.14 ± 0.1 and 0.35 ± 0.2 days at the 4-, 8- and 12-week follow-ups, respectively (p < .001). Amount of money spent on illicit opioids during the past month showed a similar pattern, decreasing from a mean of $1294 (range: $520–$4000) at intake to only one subject reporting spending a total of $150 at Week 4 and no reported money spent at the 8- and 12-week assessments.

3.4. Clinical stability

Seventy percent (7/10) of participants were retained through the 12 weeks of treatment, with the three noncompleters dropping out at Weeks 3, 5 and 9. Participants reported significant reductions in IVR-assessed opioid withdrawal (p < .001) and craving (p < .001) during stabilization, after which levels remained low for the remainder of the study (Fig. 1, middle and lower panels). With regard to adherence, 97% of the daily IVR calls were satisfactorily completed. Participants successfully completed 82% of random call-backs and, when the urine specimens collected at these random visits were examined, 96.3% tested negative for illicit opioids. With regard to other drugs of abuse, 92%, 100%, 100%, and 42% of scheduled urine specimens tested negative for cocaine, amphetamines, benzodiazepines and marijuana, respectively. Finally, there were significant changes in the drug (p = .008) subscale score of the ASI from baseline to the 4-, 8- and 12-week follow-up assessments, with all follow-up scores significantly lower than intake (p's < .05).
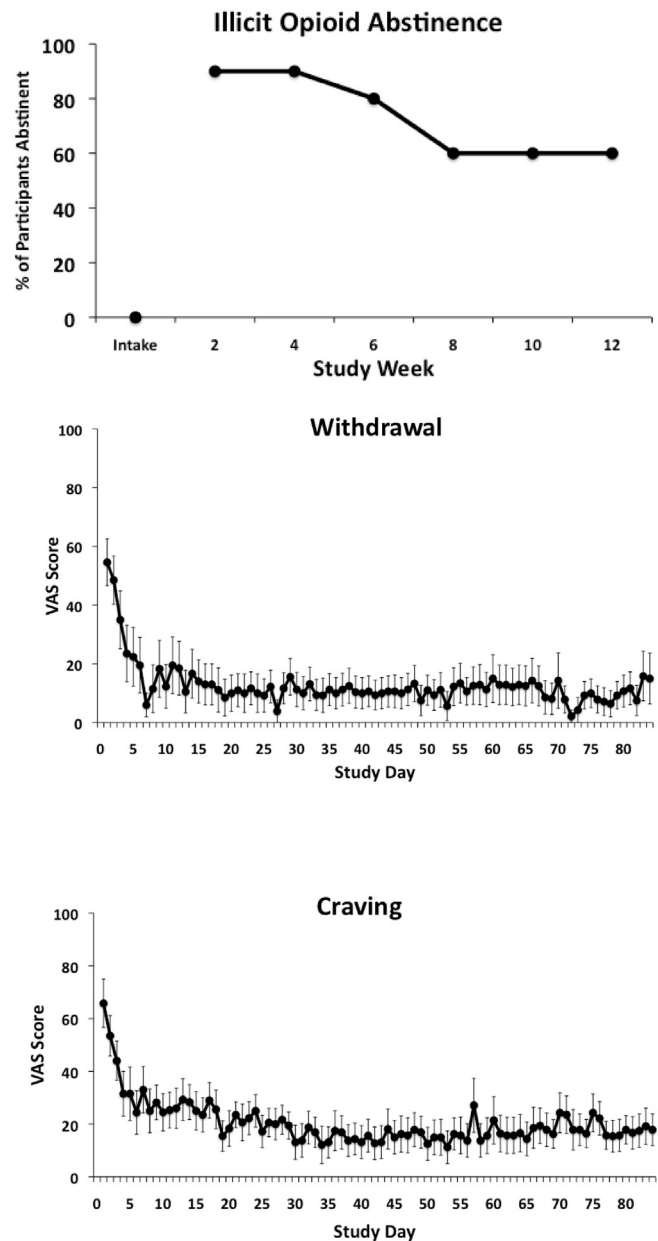

Fig. 1. Data points represent the percentage of illicit opioid-negative urine samples submitted at intake and each consecutive scheduled visit (top panel). Data points represent participants' mean ratings of opioid withdrawal severity (middle panel) and opioid craving (lower panel) across consecutive daily IVR calls.

3.5. Treatment acceptability

At Week 12, participants' satisfaction with the IBT intervention as a whole as well as its individual components was assessed, from 1 (not at all) to 5 (extremely). Mean ratings were 4.7 ± 0.9 for IBT and 4.9 ± 0.1, 4.9 ± 0.1, 3.4 ± 0.7 and 3.5 ± 0.9 for the buprenorphine, Med-O-Wheel, IVR and random call-back components, respectively. When asked to identify the most valuable IBT component, all participants endorsed buprenorphine. The questionnaire also included an open-ended question inviting participants to offer suggestions for any changes that should be made to the IBT intervention. The most common suggestion, submitted by 40% of participants at the 12-week assessment, was to extend the length of IBT so that it remains in place until they gained entry into standard treatment. On a related note, while research staff made great efforts during the study to help participants find

a treatment provider who could take them upon the conclusion of their participation, only one was able to transition immediately into an available treatment slot following the study.

4. Discussion

Despite the demonstrated effectiveness of agonist maintenance for opioid dependence, treatment capacity is inadequate to meet demand in many areas of the country. There is a critical need to develop innovative and effective approaches for bridging gaps in treatment access. In this pilot study, we sought to evaluate the feasibility of IBT for extending evidence-based pharmacotherapy to waitlisted opioid-dependent adults. While buprenorphine's pharmacological and regulatory profile lends towards its use with reduced-intensity approaches, only a single study to date has evaluated its utility in an interim dosing paradigm for waitlisted individuals. That trial was conducted in Norway over a decade ago with heroin-dependent individuals awaiting methadone treatment (Krook et al., 2002). Participants were randomized to receive buprenorphine or placebo for 12 weeks, without psychosocial support. Buprenorphine treatment was associated with significantly greater retention and lower self-reported heroin use, though attrition was still high with two-thirds of patients having dropped out by Week 12. The investigators also used no objective measure of opioid abstinence, relying instead on patients to rate their recent drug use via visual analogue scales. Thus, the present study represents the first effort to our knowledge to evaluate buprenorphine's potential utility in an interim dosing approach with abstinence confirmed biochemically.

Participants achieved favorable rates of opioid abstinence, with 73% of specimens testing negative for illicit opioids and 60% of participants abstinent at the end of 3-month study. These initial pilot outcomes are promising and similar to or better than previous studies evaluating IMT (Schwartz et al., 2006; Schwartz et al., 2011; Yancovitz et al., 1991). They also compare favorably to the above interim buprenorphine study (Krook et al., 2002). Important to note is that these outcomes were achieved with substantially less monitoring than those earlier trials, all of which involved daily or near-daily clinic visits for observed dosing. Indeed, our IBT participants averaged four visits per month, which stands in striking contrast to the 24–28 visits per month in prior studies. The rates of illicit opioid abstinence achieved in this study with computerized buprenorphine dispensing and reduced in-person monitoring are also similar to or better than those seen in previous studies of more conventional buprenorphine and methadone maintenance (Fiellin et al., 2014; Ling & Wesson, 2003; Mattick et al., 2014).

The technology-assisted buprenorphine dispensing component appeared feasible in promoting medication adherence. Of the 819 doses administered during the study, 80% were dispensed via the Med-O-Wheel. With sufficient staff and participant training in how to use the devices, all aspects of the computerized dispensing went smoothly. Eighty-two percent of random call-backs were satisfied, which compares favorably to prior studies utilizing random call-backs without the technology-based component (e.g., 62% successful call-backs, Silverman, Robles, Mudric, Bigelow, & Stitzer, 2004). Our medication adherence outcomes also fare well against the only study to our knowledge using MEMS caps in buprenorphine-maintained patients (Fiellin et al., 2006). In that trial, buprenorphine adherence was moderate (71% of study days), varied widely across patients, and was significantly correlated with illicit opioid abstinence. The results of that study led the authors to conclude that the observed variability in adherence highlighted the need to measure buprenorphine adherence in future research and to monitor and encourage adherence in clinical practice to improve treatment outcomes.

Additional measures of clinical stability and acceptability were also promising. Participants reported significant reductions in the frequency of illicit opioid use, consistent with prior studies evaluating IMT (Gruber et al., 2008; Schwartz et al., 2009a; Yancovitz et al., 1991). They

maintained high levels of abstinence from illicit drugs other than marijuana and adherence to our daily monitoring system was high, with 97% of IVR calls satisfactorily completed. Participants also reported high levels of satisfaction with IBT and its individual elements, particularly the buprenorphine and Med-O-Wheel components. Taken together, IBT may be effective in reducing illicit opioid use and other risk behaviors among opioid-dependent individuals awaiting entry into more comprehensive opioid treatment.

Several strengths of this pilot study should be noted. First, it employed biochemical monitoring and random call-backs that included observed dose ingestion, medication adherence checks and staff-observed urinalysis. These methods permitted a rigorous evaluation of participants' drug use despite a relatively lean schedule of clinic visits. Second, we leveraged technology to support buprenorphine dispensing and daily monitoring. While the Med-O-Wheel has begun to be used clinically in Finland where it is manufactured (Tacke, Uosukainen, Kananen, Kontra, & Pentikäinen, 2009; Uosukainen, Pentikainen, & Tacke, 2013), this is the first study to our knowledge to rigorously evaluate its utility as a component of buprenorphine treatment for opioid dependence. With regard to the mHealth monitoring, IVR systems seem uniquely compatible with IBT and with opioid-dependent patients more generally (Moore et al., 2013). They are an excellent fit with resource-constrained settings, requiring no specialized equipment or extensive training. IVR hardware and software can support multiple clinic sites and have no on-site installation costs beyond telephone access. IVR systems also provide broad access for lower income and marginalized populations, as touch-tone phones are familiar, easy to use, and more widely available than computers. Finally, this pilot study extends our scientific knowledge about interim opioid treatment to new populations and settings. Whereas all prior studies on interim treatment were conducted with heroin-dependent patients (Gruber et al., 2008; Krook et al., 2002; Schwartz et al., 2006; Schwartz et al., 2007; Schwartz et al., 2009a; Schwartz et al., 2011; Yancovitz et al., 1991), the majority of our participants were primary prescription opioid abusers. The prior studies were also conducted in urban areas (i.e., San Francisco, CA; Oslo, Norway; Baltimore, MD; New York, NY). This is the first to examine the utility of interim treatment in the rural and suburban areas which stand to significantly benefit from it.

Several limitations should also be noted. The primary limitation is that this was an unrandomized pilot trial with a limited sample size. A larger-scale randomized clinical trial is currently underway to more rigorously evaluate the efficacy of IBT in waitlisted opioid-dependent individuals randomly assigned to interim buprenorphine vs. continued waitlist control. Most participants endorsed a prescription opioid as their primary drug of abuse, which may limit the generality of our results to heroin-dependent individuals. Our randomized trial will include a greater proportion of primary heroin and intravenous users, which will allow us to examine the efficacy of IBT in a more representative sample. However, it is also worth noting that 60% and 40% of pilot study participants reported a lifetime history of heroin and intravenous drug use, respectively. Finally, while we used the term "interim buprenorphine treatment" to represent the technology-assisted dosing protocol being evaluated in this study, its duration was limited to 12 weeks and thus did not cover the full waiting period until a conventional treatment slot became available for many participants. However, if demonstrated to be efficacious, our IBT intervention could indeed be used to bridge any duration of delay until full treatment is available.

This initial pilot study represents a promising first step towards the development of an IBT that could reduce illicit drug use and drug-related risk behaviors among waitlisted opioid abusers. Controlled studies with larger sample sizes are needed to evaluate the efficacy of this intervention, as well as to identify the individual characteristics that may predict the patients who can succeed with such a low-intensity treatment vs. those who will require more intensive monitoring and support for good outcomes. Overall, however, providing interim opioid

treatment as opposed to a waitlist when a formal treatment slot is unavailable stands to reduce drug-related risks and consequences to the patient and for society more generally.

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