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A randomized controlled trial of buprenorphine for probationers and parolees: Bridging the gap into treatment

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ABSTRACT

Background: Buprenorphine can be effective in a variety of community substance use treatment settings outside of methadone programs, including outpatient programs and medical practices. In these settings, it has been found to be effective in reducing opioid use and retaining patients in treatment. Despite its effectiveness and safety, it is rarely provided to individuals with opioid use disorders in probation and parole settings.
Methods: Male and female individuals under probation or parole supervision ($N = 320$) with histories of opioid use disorder will be enrolled in this randomized controlled trial. Participants will be randomized to one of two study arms: *Buprenorphine Bridge Treatment (BBT):* Participants will begin buprenorphine using the MedicaSafe dispensing device immediately after an on-site intake at a community supervision office and continue such treatment until they are transitioned to a community program; or *Treatment as Usual (TAU):* Participants will receive a referral to buprenorphine pharmacotherapy treatment in the community. Treatment outcomes will be: (a) illicit opioid oral saliva drug test results; and (b) treatment adherence (i. entered community based treatment; ii. number of days receiving opioid treatment).
Results: We describe the background and rationale for the study, its aims, hypotheses, and study design.
Conclusions: If shown to increase compliance rates with conditions of probation and parole, buprenorphine treatment co-located at community supervision field offices could have a major impact on delivery of buprenorphine treatment to the criminal justice population. The public health impact of the proposed study would be widespread because this intervention could be implemented throughout areas of the US.

1. Introduction

1.1. Community correction populations need treatment for opioid use disorders

Heroin use and prescription opioid misuse has risen significantly over the past 16 years [1–3] with heroin overdoses increasing by 23% [4]. Opioid use disorders (OUD) are a severe problem among criminal justice populations throughout the world [5–7]. In the US, nearly 4.5 million adults were under community supervision (i.e., probation and parole) at yearend 2015 [8]. This population has disproportionately higher rates of OUD than the general US population [9–11]. However, opioid-agonist treatment (OAT), despite its proven effectiveness in suppressing opioid use, reducing criminal behavior, re-incarceration, and HIV risk behavior [12], is frequently unavailable to individuals under community supervision [13], and when available, often does not lead to treatment initiation [13–15]. One solution to the challenge of linking community correction populations with OUD to OAT would be to make it available at the community correction office. Although used successfully with methadone in NYC in the 1970s [16,17] this approach has rarely been employed since. Given the recent increased use of community corrections in lieu of incarceration [8], it is vital to study the effectiveness of linking individuals under criminal justice supervision to opioid treatment.

1.2. Buprenorphine treatment for OUD

Buprenorphine can be effective in a variety of community settings

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outside of methadone programs, including outpatient programs and medical practices [18–20]. In these settings, sometimes referred to as Office Based Opioid Treatment (OBOT), it has been found effective in reducing heroin use and retaining patients in treatment [19,21–23]. Despite its effectiveness and safety, it is rarely provided to individuals with OUDs in community corrections settings [13,24,25].

1.3. Buprenorphine pharmacotherapy with community corrections populations

We are aware of only three published studies in the US of buprenorphine pharmacotherapy treatment of OUD in community corrections populations [24–26]. Moreover, none of these studies systematically examined the impact of co-location of buprenorphine treatment services at the community criminal justice supervision office. However, these studies did demonstrate the feasibility, acceptability, and effectiveness of treating individuals in community supervision with buprenorphine. Unfortunately, many barriers exist to providing buprenorphine to this patient population. Our recent research in the NIDA-funded CJ-DATS 2 study found that < 10% [27] of parolees and probationers reporting illicit opioid use during the past year were referred for pharmacotherapy, and 8% of a nationwide survey indicated probation/parole agencies provide funds for buprenorphine treatment [13]. Given these obstacles, an approach which co-locates buprenorphine pharmacotherapy at probation/parole offices offers the potential to substantially increase pharmacotherapy treatment in this high-risk population.

1.4. Interim opioid treatment successful as a bridge to treatment entry

Interim methadone treatment (directly observed methadone without formal counseling for people on waiting lists) has been shown in the US to be superior to waiting list control in reducing illicit opioid use and increasing standard methadone treatment entry [28,29]. It has also been found to be as effective over the first 4 months of treatment as methadone with counseling [30]. Interim methadone has also been shown to be effective compared to placebo in Norway [31] and in a US pilot study [32]. To our knowledge, only two promising pilot studies in the US have examined interim buprenorphine pharmacotherapy with adult patients with OUD [33,34]. Abrahamsson and colleagues [33] examined 40 patients on interim buprenorphine and reported 25 (62%) patients were successfully transferred to full-scale treatment. In a randomized study of interim buprenorphine (n = 25) versus waitlist (n = 25) for adult patients with OUD, those patients receiving interim buprenorphine had significantly greater reductions in the frequency of use of any intravenous drug and on the ASI drug and psychiatric domain scores [34].

2. Methods

2.1. Study design

The planned study is a parallel, two-group, randomized, controlled trial in which 320 men and women (under community supervision) will be randomly assigned within gender and community supervision status (probation or parole) to one of two conditions: (1) Buprenorphine Bridge Treatment (BBT): Participants will begin buprenorphine pharmacotherapy using the MedicaSafe buprenorphine dispensing device immediately after an on-site intake at a community supervision office and continue such treatment until they are transitioned to community buprenorphine treatment; or (2) Treatment as Usual (TAU): Participants will receive a referral to buprenorphine treatment in the community. Both conditions will receive information on overdose prevention. Participants will be assessed at baseline, and 1, 2, 3, 6, and 12 months post-intake using a comprehensive assessment battery (See Fig. 1 below).

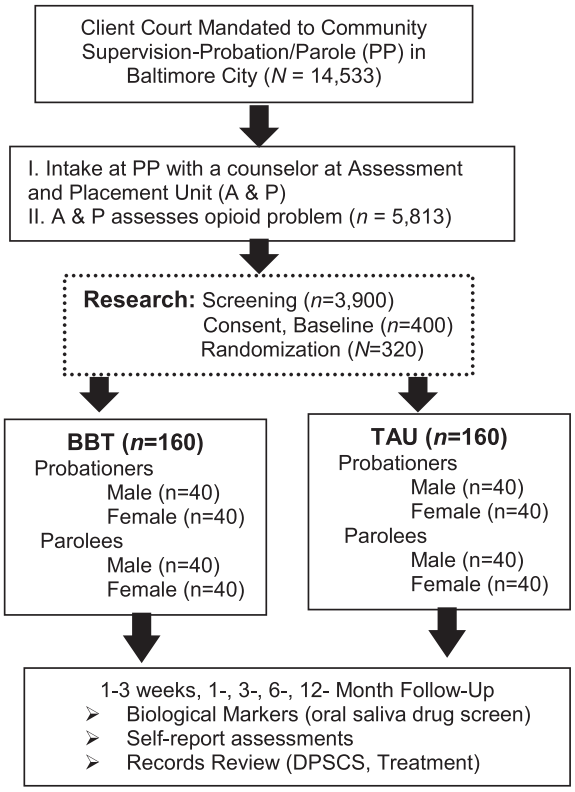

Fig. 1. Study design. BBT = Buprenorphine bridge treatment; TAU = Treatment as usual; PP = Probation/Parole.

2.2. Research questions, outcomes and hypotheses

The primary research question is to examine the relative effectiveness of BBT in comparison to TAU in terms of: (a) illicit opioid oral saliva drug test results. Secondary outcomes include: (b) treatment adherence (i. entered community based treatment; ii. number of days receiving opioid treatment); (c) number of days using illicit opioids; (d) quality of life (i. physical health; ii. mental health); (e) HIV risk behaviors (i. sexual behavior; ii. needle use or sharing); (f) criminal activity; (g) re-arrest; and (h) re-incarceration. Based on previous interim maintenance studies [30,32,35] in general populations at community treatment clinics we hypothesize, the BBT condition will have fewer opioid-positive drug screens, have higher rates of entry into buprenorphine treatment in the community and fewer self-reported days of opioid use. Furthermore, we predict that the BBT condition will have concomitant lower rates of needle use and sharing, risky sexual behaviors, criminal activity, re-arrest, and re-incarceration than will the TAU condition. Lastly, we expect improved quality of life in the BBT condition compared to the TAU condition.

2.3. Study sites

The Maryland Department of Public Safety and Correctional Services (DPSCS), Division of Parole and Probation is responsible for the community supervision portion of DPSCS Operations and ensures individuals are meeting the goal of upholding individual requirements set forth by courts and the Parole Commission. In addition to supervising parolees, probationers and those on mandatory release from the correctional facilities, community supervision staff also conduct presentence investigations and supervise Marylanders who've been court-ordered into the Drinking Driver Monitor Program. A Community Supervision Enforcement Program monitors individuals on home detention.

2.4. Inclusion/exclusion criteria

Eligible participants must meet the following criteria: (1) written informed consent prior to the conduct of any study-related procedures; (2) Male or female, 18–65 years of age, inclusive; (3) Be on parole or probation for at least the next 4 months; (4) Have a Baltimore City address; and (5) Primary diagnosis of (DSM-5) moderate-severe opioid use disorder (at least 4 symptoms) including current use and current physical dependence. [Parolees and probationers not currently physically dependent will be allowed in the study.]

Individuals with one or more of the following conditions will be excluded from the study: (1) Current medical condition that may prevent the participant from safely participating in the study as determined by medical evaluation; (2) Current psychosis or suicidal ideation; (3) Cognitive disorders that prevent the participant from passing a study enrollment quiz; (4) Any pending legal action that would interrupt study participation (e.g., pending incarceration, probation/parole revocation, unadjudicated charges); (5) Exposure to any investigational drug within 8 weeks of screening; and (6) Currently enrolled in a methadone maintenance treatment program or taking long-acting naltrexone. The Food and Drug Administration (FDA) agreed to a labeling revision in December 2016 to allow buprenorphine prescribing to pregnant women. The standard of care for women who become pregnant on buprenorphine has shifted to encourage them to stay on buprenorphine. Therefore, we will include pregnant woman with collaborative clinical decision-making using the buprenorphine-only "mono" product without naloxone.

2.5. Recruitment, informed consent, screening, randomization

A research assistant (RA) will be stationed in the community supervision office during business hours Monday-Friday. Two strategies will be used for recruitment. First, after individuals meet with addictions counselors in the Community Supervision-Assessment and Placement Unit, they will be informed that there is a buprenorphine study that they might be interested in and offered an opportunity to meet with an RA. Second, research staff will place flyers explaining the study in prominent locations at probation/parole offices and parole and probation officers (POs) have agreed to distribute flyers to probationers and parolees when they meet. Research staff will advertise in the probation/parole office during the hours RAs are not present. The RA will meet with potentially-interested individuals in a private space to briefly explain the study to initially assess potential participants' eligibility and interest in the study. A private office will be available for the potential participant to meet with the RA. The RA will review in depth with the parolee or probationer that participation is not mandatory as part of their supervision and they will not be penalized for not participating. Status as a probation/parolee will be confirmed by asking the potential participant to show the RA the MDPSCS community supervision card provided to each Maryland parolee/probationer. The RA will provide an in-depth explanation of the purposes, procedures, risks, and benefits of study participation to probationers and parolees who express interest and who are eligible for the study. Individuals interested in participating will be required to pass an informed consent quiz. After signing the informed consent form and completing a baseline assessment which will take approximately 2 h to complete, each participant will receive a baseline physical from the study physician.

Participants will be assigned to one of the two conditions (BBT or TAU) using a stratified block randomization procedure with random block sizes [36], such that, within gender and community supervision status (probation/parole), for each block of 2, 4, or 6 participants, half will assigned at random to the BBT Condition [n = 160; Probationers (40 men and 40 women); Parolees (40 men and 40 women)], and half to the TAU condition [n = 160; Probationers (40 men and 40 women); Parolees (40 men and 40 women)], ensuring that both male and female participants have an equal chance of being assigned to either condition. [Random block sizes will be used in order to conceal allocation to treatment condition.] [37] Opaque sealed envelopes will be prepared for the study physician and nurse based on this block randomization procedure so that the physician/nurse will know the condition to which a participant will be assigned in order to explain buprenorphine to participants assigned to BBT. The RA will open the designated envelope after baseline assessments are completed and inform the participant to which one of the two conditions he/she has been assigned.

2.6. Data management

Research Assistants complete baseline study assessments and follow-up assessments using direct data entry or on paper (based on internet access at parole and probation). Any forms with paper responses from the participant will be uploaded to the study site Data Management Unit (DMU) within 48 h.

3. Regulatory affairs and data and safety monitoring

3.1. Approvals and certification

The study is approved by Western Institutional Review Board (WIRB). The US Office of Human Research Protections (OHRP) also approved the study protocol. The study was registered at ClinicalTrials.gov (NCT03616236). A federal Certificate of Confidentiality was obtained to protect the confidentiality of the participants' data. In addition, we received approval from the DPSCS Research Committee. It should be noted that the MDPSCS does not have an IRB.

3.2. Data and safety monitoring

The study is being monitored by a Data and Safety Monitoring Board (DSMB). The WIRB, DSMB, and NIDA (the study sponsor) monitor recruitment, retention, and study safety. All Serious Adverse Events are reported to the WIRB, DSMB, and NIDA regardless of their possible relationship to study procedures.

4. Interventions

4.1. Study arm: buprenorphine bridge treatment (BBT)

Buprenorphine-naloxone by prescription will be provided to 160 participants at the Central Intake Unit of the Community Supervision office in Baltimore City. Opioid tolerance will be determined using the following: a) self-report history based on assessments at intake conducted by the Research Assistant (RA); b) oral saliva drug test (rapid) for opioids conducted at baseline assessment by the RA; and c) substance use and medical history and physical exam completed by the study physician at Community Supervision. Opioid-tolerant and non-tolerant participants will initiate buprenorphine using dose induction based on individual patient needs as determined by the study physician. We will follow SAMHSA and ASAM guidelines [38] for buprenorphine dosing for both opioid-tolerant and non-opioid-tolerant individuals. Participants will meet with the study physician/nurse at least weekly at Probation/Parole office to report adverse events and discuss with the physician/nurse about any side effects and their dosage levels (if the dose is suitable or needs changing). The first dose (and second dose when needed) will either be administered at the community supervision office under physician/nurse observation, or given as a part of the initial supply, for home induction with explicit guidance and patient-friendly written instructions. The nurse will also demonstrate the MedicaSafe device and answer any patient questions about how to use the device correctly.

Participants will receive their buprenorphine/naloxone in the MedicaSafe Buprenorphine Dispensing Device. Medicasafe has been awarded multiple grants by the National Institutes of Health to develop

Fig. 2. MedicaSafe Buprenorphine-Naloxone Dispensing Device.

innovative medication technology (www.medicasafe.com/technology). Their patented medication adherence technology has been used by clinicians since 2015, and combines a tamper-resistant medication dispenser with an online platform that allows care providers to monitor a patient's adherence to their medication regimen. MedicaSafe provides four important features: (i) logs every dose dispensed; (ii) alerts and reminds patients; (iii) passcodes are required for continued access; and (iv) locks if there is an attempt to remove too many pills. Smart medication dispensers collect granular adherence data by logging each dispensation. Through the code exchange process at a remote patient check-in via website or phone, this adherence data is communicated to a treatment portal that clinicians can access. The dispenser contains two forms of medication control: (1) Flow-control that limits patients to a daily dose and (2) time-limited passcode access that requires periodic check-ins for continued medication access (see Fig. 2 below). The device automatically locks after the daily dose is dispensed and unlocks 24 h later. Furthermore, the MedicaSafe system is HIPAA compliant. The study physician/nurse will dispense the initial medication supply to subjects at the community supervision office in the device and during the interim BBT treatment, will refill the device each week with new medication according to the prescription. Orientation and assistance in the use of the device (which is quite simple) will be provided by the pharmacist and the study nurse as needed.

4.2. Study arm: treatment as usual (TAU)

All probationers/parolees in the TAU arm will be referred by Community Supervision addictions counselors (Assessment and Placement Unit) to community buprenorphine treatment providers. A referral is initiated by the supervision agent and the substance use assessment is generally scheduled within 24–48 h. The assessor will refer the probationer/parolee to an MAT program that is closest to the individual's home residence.

5. Assessments

Participants will be administered a comprehensive set of assessments designed to measure baseline status (study entry) and subsequent outcome at months 1, 2, 3, 6, and 12 months post-baseline. In addition, the BBT and TAU participants will be asked to provide saliva for oral drug screening during weeks 1–3 and complete the Safe Talk Visual Analogue Scale (VAS). Participants in both conditions will be paid $50 for each assessment (1, 2, 3, 6, and 12 months) at which time they will also provide an oral saliva sample for drug screening (See Table 1. Data Collection Schedule, below). Participants in both condition (BBT and TAU) will be paid $20 for the weekly oral saliva drug screening and completion of the VAS measure during weeks 1, 2, and 3.

5.1. Oral saliva drug test

Oral saliva will be tested on-site (2–5 min). We will test for the following: amphetamine/methamphetamine, cannabis, cocaine/ benzoylecgonine, and opiates/morphine. In addition, we will test for methadone and buprenorphine, and for commonly abused prescription drugs (oxycodone, hydrocodone, and codeine), and for fentanyl. Results will be used as outcome measures of heroin and other opioid use as well as to check on the validity of self-reported drug use information. Those participants in methadone or buprenorphine treatment who screen positive only on their respective treatment medication will be counted as negative for their oral saliva drug test results.

5.2. Treatment status

Treatment entry and retention will be determined by admission/ discharge dates in records of treatment providers and/or the city drug treatment authority. For individuals who drop out of treatment, termination will be defined as no clinic attendance for 30 consecutive days (the same definition used by the Maryland Department of Health, Behavioral Health Administration). Treatment duration for individuals who end treatment will be calculated based on the last date of clinic attendance. Follow-up assessments will collect self-report data on reasons why participants entered, did not enter, or dropped out of treatment. Days in treatment will be continuous measure out of 365 days post intake.

5.3. Addiction severity index (ASI) with timeline follow-Back (TLFB)

The ASI is a standardized 40–60 min clinical research instrument widely used in addiction research to quantify problem areas of alcohol/ drug user populations [39,40]. This instrument has excellent inter-rater and test-retest reliability, as well as discriminant and concurrent validity [39,40]. We will also collect data on substance use frequency and criminal activity to cover the entirety of the follow-up period for 1, 2, 3, 6, and 12 months post-baseline. The TLFB is a method for collecting recent days of substance use [41]. We will use the TLFB to supplement the ASI that only captures the past 30 days. The TLFB will be administered at the 6-, and 12-month assessments to capture the days preceding the past 30 days assessed by the ASI. Outcome measures from the ASI/TLFB will consist of the following self-report measures, adjusted for days at risk in the community: (1) days reported using heroin and other opioids; and (2) days reported committing criminal activity.

5.4. SF-12 health survey

The SF-12 Health Survey is a shorter version of the SF-36 Health Survey that uses just 12 questions to measure functional health and well-being from the patient's point of view. The SF-12 covers the same eight health domains (physical functioning, role functioning physical, bodily pain, general health, vitality, social functioning, role functioning emotional, and mental) as the SF-36 utilizing one or two questions per domain [42,43]. The two composite scores obtained from the SF-12 are physical health (PCS; Cronbach's $\alpha = 0.80$) and mental health (MCS; Cronbach's $\alpha = 0.82$) summaries.

5.5. Risk assessment battery (RAB)

This self-administered questionnaire, designed to identify individuals engaging in acts that could transmit HIV and other infectious diseases, contains 45 items yielding three scores: a drug risk and needle use or sharing, sexual behavior risk, and a combined overall risk [44]. We will be using the drug risk and risky sexual behaviors scales scores.

Table 1
Data collection schedule.

Measures	Baseline	Weeks 1–3	1 mo	2 mo	3 mo	6 mo	12 mo
Primary outcome							
Opioid Use (Oral Saliva Drug Test)	✓		✓	✓	✓	✓	✓
Secondary outcomes							
Adherence to Opioid Treatment (Clinic records)			✓	✓	✓	✓	✓
Opioid Use (ASI, TLFB)	✓		✓	✓	✓	✓	✓
Health Survey (SF-12)	✓		✓	✓	✓	✓	✓
HIV Risk Behaviors (RAB)	✓		✓	✓	✓	✓	✓
Criminal Activity (ASI, TLFB)	✓		✓	✓	✓	✓	✓
Re-arrest (DPSCS records)							✓
Re-incarceration (DPSCS records)							✓
Buprenorphine adherence measures							
Buprenorphine Adherence (Safe Talk VAS)		✓	✓	✓	✓	✓	✓
Pill Count (MedicaSafe)		✓	✓	✓			
Buprenorphine Use (Oral Saliva Drug Test)		✓	✓	✓	✓	✓	✓
Additional measures							
Opioid Overdose (OOS)	✓		✓	✓	✓	✓	✓
Opioid Craving (VAS)	✓		✓	✓	✓	✓	✓
Health-Related Quality of Life (EQ-5D)	✓		✓	✓	✓	✓	✓
Non-Study and Other Medical Services (NSMOS)	✓		✓	✓	✓	✓	✓
Patient Health Questionnaire (PHQ)	✓		✓	✓	✓	✓	✓
Social Support Survey Instrument (SSSI)	✓		✓	✓	✓	✓	✓

5.6. Official record information on criminal activity and supervision

Official record data will be obtained from the MDPSCS at the end of the study. Data will include type (e.g., charges involved) and number of arrests, convictions, and incarcerations; and number and length of time of each imposed sanction. Criminal record data will also be used to assess the validity of self-report criminal activity.

5.7. Safe talk visual analogue scale (VAS)

The VAS will be used to measure the percentage of a prescribed medicine participants indicate they have taken over a specified time period. 0% means they have taken no medicine, 50% means they have taken half of their medicine, and 100% means they have taken every single dose of medicine [45]. The VAS will be administered one time per week for three weeks.

5.8. Pill count (MedicaSafe)

The device will log entries for daily dosing. We will only be able to collect pill count data on participants randomized to BBT. We will be using pill count data to assess adherence to medication.

5.9. Opioid overdose scale

This self-administered questionnaire will ask participants to report the number of opiate overdoses where they did and did not receive medical attention. The questionnaire administered at baseline will cover the period prior to the index incarceration while the questionnaire follow-up in the community, will cover post-release months 1–12.

5.10. Opioid craving scale

Participants are asked to place a mark across the line at the point that corresponds to their immediate craving for opioids. Anchors included 0 mm – 'no cravings' to 100 mm – 'most extreme cravings possible'. [45] Participants will be assessed at baseline and at each follow-up visit and asked about peak cravings during the preceding 24 h.

5.11. EuroQol 5D (EQ-5D)

Health-related quality of life will be measured by the EQ-5D. The preference weights obtained from the EQ-5D will be used to calculate quality-adjusted life-years (QALYs). The EQ-5D is the most widely used generic, preference-based health-related quality of life instrument [46].

5.12. Non-study and other medical services

This measure collects data on other services received such as medical appointments, counseling services, and mental health services.

5.13. The patient health questionnaire

The Patient Health Questionnaire (PHQ) is a multiple-choice self-report inventory copyrighted by Pfizer Inc. [47] that is used as a screening and diagnostic tool for mental health disorders including depression, anxiety and, alcohol, eating, and somatoform disorders. It is the self-report version of the Primary Care Evaluation of Mental Disorders (PRIME-MD), a diagnostic tool developed in the mid-1990s by Pfizer Inc. The PHQ is available in over 20 languages on the PHQ website. Both the original Patient Health Questionnaire and later variants are public domain resources meaning no fees or permissions are required for using or copying the measures.

5.14. Social support survey instrument

This brief, self-administered Social Support Survey instrument was developed for patients in the Medical Outcomes Study (MOS) [48], a two-year study of patients with chronic conditions. It is easy to administer to chronically ill patients, and the items are short, simple, and easy to understand. It may also be appropriate for use with other populations such as justice-involved adults or persons with OUDs. The survey consists of four separate social support subscales and an overall functional social support index. A higher score for an individual scale or for the overall support index indicates more support.

6. Outcomes

The primary outcomes are as follows: (a) illicit opioid oral saliva drug test results. The secondary outcomes are: (b) treatment adherence (i. entered community based treatment; ii. number of days receiving

opioid treatment); (c) number of days using illicit opioids; (d) quality of life (i. physical health; ii. mental health); (e) HIV risk behaviors (i. sexual behavior; ii. needle use or sharing); (f) criminal activity; (g) re-arrest; and (h) re-incarceration.

7. Statistical analysis

A Generalized Linear Mixed Model (GLiMM) will be used to conduct analyses of all outcomes measured repeatedly. It is not necessary that the within-subjects set of observations either be complete or collected at the same points in time for GLiMM models. GLiMM will make use of all available data, and hence, is an ideal statistical procedure for "intent-to-treat" approaches to data analysis, as occur in the proposed study. In the case of the time to re-arrest and time to re-incarceration outcomes, a Cox proportional hazards model will be used. All analyses will be conducted on available study-related data from all participants, regardless of whether or when they drop out of treatment.

7.1. Sample size, power, and effect size

We plan to recruit 320 participants and randomize them equally into each of the two study arms. Time was included in the estimation of power for all outcomes except the failure time outcomes (time to re-arrest, time to re-incarceration). Power was calculated for the failure time variables following the procedure outlined by Wang, Zhang, and Lu (2012) [53] for the proportional hazards model. Assuming $N = 320$ and $\alpha = 0.05$, the resulting power values ($1 - \beta$) for the Treatment Condition × Time effect for the primary outcome of opioid use, as measured by urine screening test results, was 0.84–0.88 [depending on the assumption regarding the covariance structure for Time (compound symmetric heterogeneous, first-order autoregressive, or unstructured)], while the power for the Treatment Condition × Time interaction effect for the secondary outcomes measured repeatedly varied from 0.81 to 0.89 (depending on the distributional assumption regarding the outcome and the assumption regarding the covariance structure for Time). Power for the two failure time variables was conservatively estimated assuming $N = 288$ (due to 10% attrition) to account for censoring due to missing data. Results indicated power exceeding 0.8 under the assumption that the hazard ratio equals or exceeds 1.25.

From a more rudimentary and slightly less accurate perspective, assuming the outcomes follow a normal distribution, power based on the set correlation method [49,50] can be used to calculate effect sizes for desired power, with such estimates likely to be conservative. In this case, assuming $\alpha = 0.05$ and $N = 288$ due to 10% attrition, power of 0.8 is achieved for an effect size of $f^2 = 0.029$ for the Treatment Condition main effect (for the time to-re-arrest and time to re-incarceration outcomes) and $f^2 = 0.046$ for the Treatment Condition × Time interaction effect (for all outcomes measured repeatedly, including the primary outcome measure of opioid use). These effect sizes fall in the "small" range, with $f^2 = 0.02$ considered a "small" effect and $f^2 = 0.15$ a "medium" effect [50]. Under the assumption that the effect in the population was ≥ 0.029 or ≥ 0.046 (i.e., small effects), for the Treatment Condition and Treatment Condition × Time interaction effects, respectively, there is an 80% chance of correctly concluding that the effect is significant if α is set to 0.05 and 288 participants are assessed at 12-month follow-up.

8. Design considerations

We considered using methadone or extended release naltrexone (XR-NTX) in addition to buprenorphine as other arms. However, methadone can only be provided through a specially licensed Opioid Treatment Program that requires a secure medication storage room, nursing staff to directly administer the medication (including on weekends and holidays), and counseling. Such restrictions would require greater cost and space that would make it impractical for co-location of pharmacotherapy with probation/parole services. We decided not to include XR-NTX, because its cost currently is prohibitive, it is much less widely available, and less desired by patients. Most importantly, because of the need for an opioid-free period prior to initiation, it presents logistical hurdles that could complicate the project for individuals with recent opioid use. Individuals returning from prison on parole who did not have any parole violations (substance use) and not actively using opioids might be more suitable for XR-NTX. While we realize that diversion and illicit use of buprenorphine is of some concern to law enforcement, reports indicate that much of diverted use is for self-management of withdrawal [51] so by providing buprenorphine under medical supervision immediately, we might be able to prevent some diversion that would be otherwise undertaken for self-management of OUD.

9. Conclusion

Initiating clinical trials with justice-involved populations involves several additional steps. The protocol must be approved by the OHRP, a federal Certificate of Confidentiality should be obtained, and the cooperation and approval of the state Division of Parole and Probation personnel is necessary. Thus, implementing such treatment within a correctional setting is a challenging task. It is important that treatment, corrections, and research personnel collaborate continually to develop, implement, and evaluate such new interventions effectively [52]. It's crucial that all agencies agree on the basic design and implementation of the study, particularly details regarding logistics and space, and ensuring that study intervention, recruitment, and assessment do not interfere with ongoing routines at the facility. Such studies are an important step in introducing therapies for OUD with individuals incarcerated and individuals released on parole re-entering society. Moreover, it should be noted that this study has resources that might be outside of the typical budget of a criminal justice agency (a nurse available full-time to provide buprenorphine). However, if buprenorphine bridge treatment is found effective it could be scaled up by partnering with community treatment clinics that provide these services. In addition, providing services on-site even 2–3 days a week would be a potential major advancement with regards to implementation. Finally, it is recommended that researchers, treatment providers, and corrections officials should not be limited to reporting outcomes on the efficacy and effectiveness of their interventions, but on the unique challenges they faced and how they overcame these barriers and obstacles. These efforts are valuable in that they serve as a guide for subsequent corrections-treatment-research partnerships. Although research, treatment, and agencies personnel may have different priorities and agenda, they can agree that opioid addiction and its adverse consequences are serious public health problems that can be reduced with careful planning and collaboration.

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