Study Protocol

Protocol Title: m-Health to Increase Service Utilization in Recently Incarcerated Homeless Adults

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Population: A total of 462 homeless men and women (≥18 years old) who enroll in the Bridge Homeless Assistance Center's Homeless Recovery Program after release from either the Dallas county jail or the Dallas City Jail will be recruited.

Number of Sites: Single site

Study Duration: This is a 5-year study

Subject Duration: Participants will complete assessments during 5 in-person visits (i.e., baseline visit, randomization visit [within 72 hours of the baseline visit], and 1-, 3- and 6-month follow-up visits). We will also examine arrest records to determine if participants are arrested within 12 months of the baseline visit. If in-person visits are not possible, follow-up visits may be completed in the community, by phone, or by sending a link through text or e-mail.

General Information:

There is a significant revolving door of incarceration among homeless adults, a population with substantial health disparities. Homeless adults who receive the professional coordination of individualized care (i.e., case management) during the period following their release from jail experience fewer mental health and substance use problems, are more likely to obtain stable housing, and are less likely to be re-incarcerated. The proposed study will use mobile technology to address these barriers and fill gaps in the understanding of the causes of the revolving door of homeless incarceration. Specifically, 462 homeless adults who enroll in a shelter based Homeless Recovery Program after release from county jail will be randomly assigned to one of three treatment groups: 1) usual shelter-based case management (UCM), 2) UCM plus a study provided smartphone (UCM+SP), and 3) UCM with a study provided smartphone that is preloaded with an innovative care management app (SPCM). The SPCM app is an extension of the research team's previous successful work using mobile devices to assess and modify health behaviors in low income and homeless adults. Those assigned to SPCM will receive smartphones that will prompt (twice weekly) connections to shelter based case managers. The app will also offer direct links to care managers (available during normal business hours) and crisis interventionists (available 24 hours a day, 7 days a week), with the touch of a button. It is hypothesized that SPCM will increase utilization of case and crisis management services thereby addressing unmet needs (e.g., obtaining shelter, clothing, counseling, identification) and reducing homelessness and re-arrest. Another key focus of this study is to address gaps in the understanding of mechanisms that drive re-arrest and homelessness by using traditional in-person (i.e., baseline, 1, 3, and 6 months post-baseline) and smartphone based (i.e., daily for 6 months) assessment methods to identify distal and proximal predictors (e.g., affect, thoughts, behaviors, events) of continued homelessness and arrest. This research represents a step toward integrated service connection and healthcare service provision for one of the most undeserved, high need, and understudied populations in the United States. Smartphone apps that increase the use of available healthcare services and identify predictors of key outcomes (e.g., homelessness, re-arrest, medication compliance) could be used to reach hard to reach populations with histories of significant and persistent health disparities (e.g., homeless adults).

Background Information:

At least 1.5 million people experience homelessness each year in the United States (US) and 6.2% of US adults have been homeless at some point in their lifetime.[2] Homeless adults are more likely to be male, single, and African American,[1] and have average life expectancies that are 8 (women) to 13 (men) years shorter than domiciled adults.[3] Homeless adults are more likely to spend time in jail than domiciled adults,[4] and as many as 32% of jailed adults report being homeless in the year prior to their arrest.[4,5] Further, homeless adults are more likely to return to jail after incarceration than domiciled adults.[6] In Texas, more than half of adults released from county jails are re-arrested within one year,[7] and many of those re-arrested are homeless.[8] In the Dallas County Jail alone, 5530 homeless adults were incarcerated in 2013 at an estimated cost of $12,557,406.[9]

Incarcerated homeless adults have a variety of risk factors that increase the likelihood of re-arrest. For instance, homeless inmates are more likely than domiciled inmates to have histories of mental illness and/or substance use disorders.[4,8] Our own research has indicated that homeless adults released from jail in the past year were more likely than those not recently incarcerated to have a history of substance use and/or mental health problems.[10] Thus, there is a strong need for mental health and substance abuse treatment among homeless adults following their release from incarceration. Studies have indicated that the link between homelessness and incarceration[11] can be attenuated through the use of case management services.[12-14] The overall significance and scope of this issue was eloquently stated by Kushel and colleagues in their evaluation of the "revolving door" of homeless incarceration,[11] "High rates of imprisonment among homeless populations may be the end result of a system that does not provide access to timely services, including access to housing, health care, mental health care, and substance abuse treatment, and systems that have obstacles preventing receipt of these services by people exiting prison" (p. 1751). Thus, individuals who leave jail and return to the community without stable housing are at increased risk for premature mortality[15,16] and re-arrest[6,8] and are critically in need of interventions that increase access to services.

Case management is simply the professional coordination of individualized care.[17] Specifically, case managers link individuals with relevant services and help them to overcome barriers to service utilization. In addition to linking clients with services, case managers engage in client assessment, practical support, service planning, advocacy, and monitoring of service utilization and progress.[14,18,19] More intensive case management services (often employed with homeless adults) include a multi-dimensional approach with integrated counseling, independent living skills building, assertive outreach, and crisis intervention.[20] Case management has been shown to be effective in improving housing stability, mental health, quality of life, and social functioning; while reducing substance use, hospitalization stays, and incarceration in at-risk populations[21-23] including homeless and recently incarcerated adult populations (see meta-analysis[19]).

Homeless individuals have many needs following release from incarceration including housing, employment, substance abuse and mental health treatment, medical care, medication, social support, proof of identification, and legal aid.[4,5,24,25] Although public services often exist to address these needs, there are many barriers to service utilization and obtaining stable housing.[26] For example, it is difficult for an individual to identify which services and housing placement programs are and are not available to those with histories of arrest, substance abuse, and serious mental illness.[13,27-29] Furthermore, failure to provide valid identification (e.g., driver's license or birth certificate) limits the ability to obtain employment assistance and disability services, and is often rationale for arrest by police.[26] In addition, lack of access to transportation reduces the ability of this population to access free and available community services (e.g., food, clothing, temporary housing, obtaining identification).[30] There are also many specific barriers to the utilization of case management among homeless adults, including lack of a permanent address, inconsistent access to phone service, lack of transportation to case management visits, and not having easy access the phone numbers of service providers.[3,31-35] These factors reduce the ability of homeless adults to schedule appointments and limits the ability of providers to contact patients regarding appointments.[36,37]

Our own research in the summer of 2013 indicated that cell phone ownership is common among homeless adults, with 58.4% reporting that they had active cell phone service (there are government programs that pay for cell phone service for very low-income adults). Other studies have indicated that 70% of homeless adults who have cell phones use them to connect with peers and family members, 32% carry a phone for safety reasons (e.g., access to emergency services), and 23% use a phone to communicate with current or potential

employers.[35-37] Another study demonstrated that although 62% of homeless youths possessed activated cell phones, only 17% were using their cell phone to connect to case managers.[36] Thus, initial evidence indicates that cell phones are already being used in homeless populations, but few homeless adults are using their phones to contact case managers who have the primary role of linking individuals to care and coordinating care for those in need. **Thus, a significant opportunity for novel interventions is being missed.** Smartphone apps may be a novel way to offer direct access to case management, and may be a practical and useful means by which to reduce barriers to service utilization in vulnerable and hard to reach populations. It is notable that smartphone service plans are no longer cost prohibitive to conducting intervention research. For instance, in our previous studies that have used smartphones, the cost for an activated smartphone with monthly talk, text, and internet has been under $30 per month (the cost for the phone is included in the monthly fee), **which is equivalent to less than the cost of ½ of 1 day in the Dallas County Jail**.

Aside from demographic variables and history of mental illness and/or substance use/abuse, very few predictors of re-arrest and sustained homelessness have been identified.[4] To date, all studies that have examined predictors of incarceration, re-arrest, health, and continued homelessness among homeless adults have used traditional in-person assessment methods that are usually conducted retrospectively or months/years before the predicted outcome.[4,11,33,38-41] **Studies have indicated that traditional assessment methodologies provide biased and/or inaccurate estimates due to recall bias and errors in memory** (e.g., assessing the number of drinks consumed or level of depression or anxiety over the past week or month).[42,43] Ecological momentary assessment (EMA), in which handheld devices are used to capture "real time" experiences that vary daily (or from moment to moment), is currently the most accurate way to measure phenomena in real time in natural settings.[42,44] Although EMA has been used in a variety of populations and with multiple health outcomes, only one study[45] outside of our own work[46] has collected EMA data in homeless adults. The proposed study will identify key variables, measured proximally (EMA data) and distally (traditional in-person assessments and EMAs), that predict re-arrest and homelessness. These rich data will address knowledge gaps that have limited our understanding of and ability to intervene in this marginalized population.

Overall, the significance of this trial will be to evaluate a technology-driven application to increase access to service providers in a highly vulnerable group of homeless adults and to thereby decrease the likelihood of re- arrest and homelessness. In addition, we hope to improve our understanding of the proximal and distal factors that contribute to homelessness and incarceration recidivism. *This contribution is significant because it is a step towards the development of practical, inexpensive, and effective interventions for homeless adults.*

Objectives:

Our *long-term goal* is to reduce health disparities among recently incarcerated homeless adults. The primary study objectives will be attained by pursuing the following *specific aims*:

a. **To compare case management and crisis management service utilization among recently incarcerated homeless adults who are randomized to the UCM,UCM+SP, and SPCM conditions.** It is hypothesized that homeless adults assigned to SPCM will utilize more case management and crisis management services than those assigned to UCM or UCM+SP.

b. **To compare the effect of treatment condition on alcohol use, drug use, and psychological distress.** It is hypothesized that the SPCM group will demonstrate greater improvements in each outcome compared to UCM+SP or UCM

c. To identify key factors (alcohol and drug use, social support, psychological distress, quality of life) that predict re-arrest and nights spent homeless using traditional and smart phone-based assessment approaches. It is hypothesized that key variables that are measured in- person (e.g., alcohol/drug use, perceived social support, psychological distress, quality of life) and via daily phone-based assessments (e.g., affect, stress, discrimination, alcohol/drug use) will have direct effects on re-arrest and number of homeless nights. These key variables are also hypothesized to mediate the relation between treatment condition and number of homeless nights and re-arrest.

Study Design:

This study is a 3-arm randomized controlled trial. Specifically, male and female homeless adults who enroll in a shelter based homeless recovery program following release from either the Dallas County Jail or the Dallas City Jail (N=462 will be randomized to one of three conditions: Usual Case Management (UCM); Usual Care plus Smartphone (UCM+SP); or Usual Care plus Smartphone based Case Management (SPCM). SPCM will be delivered through a modified version of the PI's previously developed smartphone application (i.e., "app") on a study provided smartphone. The app will not provide case management and crisis intervention services directly; rather, **it will prompt twice weekly contact with their case manager** and provide links to service providers through the touch of a button. Primary study outcomes are service utilization, number of homeless nights, and re-arrest. Another key focus of this study is to address gaps in our understanding of the factors that drive re- arrest and homelessness by using traditional in-person (i.e., baseline, 1, 3, and 6 months post- baseline) and smartphone based (i.e., daily for 6 months) assessment methods to identify distal and proximal predictors of continued homelessness and arrest. Arrest records will be examined to determine if participants are re-arrested within 12 months of study enrollment.

Participants who are randomly assigned to the UCM+SP or SPCM conditions will receive a smartphone at the randomization visit and they will be asked to carry it with them at all times for 6 months (26 weeks). Date, time, location, and duration of SPCM app feature use (e.g., case manager calls) will be recorded by the app for future analysis. See Table 1 for a summary of study conditions.

Study Conditions

1. **Usual Case Management (UCM) group.** The UCM group will receive the standard Homeless Recovery Program currently offered at The Bridge. In order to qualify for the standard homeless recovery program, individuals must complete The Bridge intake and substantiate homelessness (e.g., provide evidence that they spent the previous night in a shelter or jail). The Bridge intake includes a comprehensive needs assessment, and demographic information is obtained. Following intake, Bridge guests receive a day pass that grants them access to many of the services available at The Bridge (e.g., meals, showers, laundry, phone, mail, library, barber shop, and storage space for their belongings). Those who enroll in The Bridge Homeless Recovery Program receive an identification card and can gain access to *additional* services including case management, Metro Care (onsite mental health and substance abuse counseling), housing assistance, disability/veteran's benefits assistance, job readiness training, legal aid, and bus passes. Although these services are freely available to all guests enrolled in The Bridge Homeless Recovery Program, many services are offered only during normal business hours and in-person visits are the norm.

   Bridge case managers are licensed professional counselors and/or Master's level clinicians who adhere to the ***Standard Case Management Model***.[19,47] Case managers assist homeless adults with: 1) developing care and housing plans; 2) making and maintaining linkages to on- and off-site service providers (e.g., mental health and substance abuse providers); 3) obtaining vital documents needed for housing and income (e.g., birth certificates, state identification, social security cards); 4) job readiness training and placement (if appropriate); 5) overcoming barriers related to criminal history; 6) development of and re-connection with support systems; and 7) transitioning from homelessness to appropriate housing. Case managers also advocate on behalf of homeless adults by serving as a connection between all agencies that will be assisting the guest, their families, and any other involved parties. Guests are encouraged to meet with their case managers weekly; however, Bridge data have indicated that those who enroll in the **Bridge Homeless Recovery Program complete a total of 1.95 and 3.12 case management sessions in the first 1 and 6 months of enrollment**, respectively.

   Bridge triage/intake specialists (i.e., Qualified Mental Health Professionals [QMHP]) are primarily responsible for completing the Bridge intake process with shelter guests, determining eligibility for the Bridge Homeless Recovery Program, and ensuring that guests are linked with onsite case management staff and the on/off-site service providers they need (e.g., mental health, substance

abuse programs). The intake process includes behavioral/mental health and treatment history, substance abuse and treatment history, risk and safety assessment, medical history, criminal history, history of homelessness, and assessment of social support and other protective factors. Participants experiencing mental health crises will be directed to contact ADAPT Mobile Crisis at (866) 260-8000. The ADAPT phone number will be pre-programmed into the study app.

2. **UCM + Smartphone group.** The UCM+SP group will receive UCM and an activated study smartphone. This smartphone only group (without the SPCM app) is necessary because homeless adults who have phones may have higher levels of social support, which may be related to mental health, quality of life, and their ability to obtain housing and avoid re-arrest.[3,37,48] All smartphones will include standard cellular service that includes unlimited text messaging, unlimited minutes of domestic talk, and unlimited Internet access (speeds are throttled after monthly download limit is reached). Participants will be informed that they may use the phone to make calls, text, and use the internet as they wish during the 6-month course of the study. Participants randomized to the UCM+SP condition will receive phones with a very basic app that will only include the "Call Study Staff" and "Payment" functions (see Table 1) on the app home screen and will push daily. *Links to treatment/case management resources will not be loaded onto phones for participants in UCM+SP condition.*

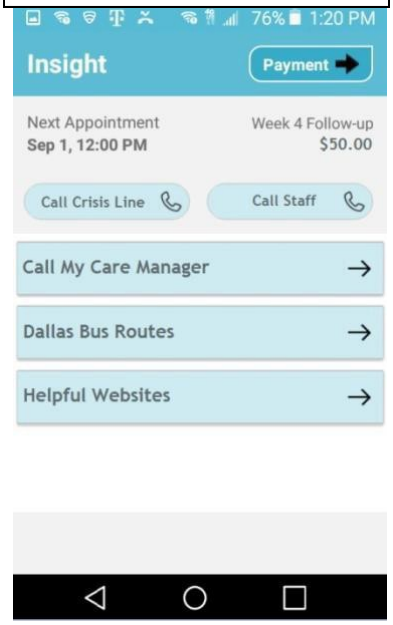
3. **Smartphone Based Case Management (SPCM) group.** Participants who are assigned to the

   SPCM group will have access to UCM and will receive a smartphone that is preloaded with an innovative app that will provide direct links to services (see Table 1 for app features and Figure 1 for a depiction of the app home screen). Smartphones and service plans will be identical to what is provided to the UCM+SP group. Participants in the SPCM and UCM+SP groups will be allowed to keep the phones as compensation at the end of the study.

   Recent research has indicated that phone prompts can increase service utilization.[49,50] For example, Lucht showed that twice weekly phone prompts increased phone-based counseling sessions in alcohol dependent patients.[49] To increase the likelihood that SPCM group participants will use the resources available through the app, the phone will be programmed to automatically prompt/suggest a connection with their Bridge case manager twice per week.

Table 1. SPCM group smartphone application features

Figure 1: SPCM home screen



Feature/Button	Description of feature
Call My Care Manager	Clicking this button will automatically call the participant's assigned Bridge case manager. Individual Bridge case managers are assigned to all Bridge Homeless Recovery Program enrollees and they are available from 8:00am to 5:00pm Monday through Friday (see letter of support from Bridge CEO).
Call ADAPT Crisis Line	Clicking this button will call the free ADAPT mobile crisis line. The crisis line is available 24 hours a day, 7 days a week to help homeless individuals address and overcome crises.
Helpful Websites	Clicking this option will lead to a menu of websites that may be useful to participants (e.g., Dallas public transit routes, online support groups (e.g., Narcotics and Alcoholics Anonymous)
Call Study Staff	Clicking this option will connect participants to study staff if they encounter problems with the study phone and/or rescheduling missed follow-up appointments.
Payment	This button indicates the amount in gift cards that participants have earned for completing EMAs to date. These gift cards will be awarded when each participant presents at The Bridge to complete 1-, 6-month follow-up assessments (see EMA Compensation in section **3.8.b.**).

Specifically, the phone will ring/vibrate on two occasions each week at random times between 9:00 am and 5:00 pm, Monday through Friday to ask participants if they would like to contact their Bridge case manager. Participants will be able to select “No” (this will decline the connection), “Yes” (this will prompt the phone to automatically call their case manager), or “Maybe later today” (this will initiate the opportunity for another connection with their case manager 2 hours later). Participants will be instructed to leave a voice message or speak with an alternate case manager when their case manager cannot be reached. We decided against more frequent prompts to connect with case managers (e.g., daily) because of higher participant burden and concern for overwhelming the case management system.

Sources of Materials

There will be 3 sources of data for the current study: 1) in-person data collected in private rooms at The Bridge, at a private location in the community, by telephone or online using the REDCap software system when in-person visits are not possible; 2) Ecological Momentary Assessment (EMA) data collected on study provided smartphones; and 3) arrest data for all arrests in the City of Dallas and Dallas County provided to Dr. Gonzalez by the Dallas County Jail. Dallas City Jail records are publicly accessible.

1. **In-person data.** Demographic, psychosocial, environmental, and behavioral data will be collected from all participants via traditional self-report questionnaires during 5 in-person visits (i.e., baseline visit, the randomization visit [within 72 hours of the baseline visit], the 1, 3- and 6-month follow-up visits) on a laptop or tablet computer using Questionnaire Development System (QDS) software (see detailed description below). If in-person visits are not possible, interviews will be conducted over the telephone and manually entered into the QDS system by Link2Care staff. In addition, participants will complete timeline follow-back measures with study researchers to determine homeless nights, alcohol use, and other substance use. These in person visits will occur at The Bridge Homeless Shelter or at another location in the community if the participant is unable to attend their appointment at The Bridge. Additionally, these in-person visits may be conducted over the phone when in-person visits are not possible, or by texting or e-mailing a link to the REDCap survey. Information regarding residency status, social security number and if participants are employees of The University of Oklahoma Health Sciences Center (OUHSC), will be collected at baseline visit using a questionnaire. This information will not be utilized in data analysis and is being collected for Federal Tax purposes as required by The University of Oklahoma Health Sciences Center. If participants earn $600 or more, OUHSC will report the income to the IRS and mail a form 1099 to the participant’s address by January 31 of the following year.

2. **EMA data.** Individuals randomized into the 2 smartphone conditions (i.e., UCM+SP and SPCM) will receive a smartphone at the randomization visit and will be asked to carry the phone with them at all times for 6 months (26 weeks). All participants randomized to a smartphone condition will be trained to use the smartphone app for data collection and resource utilization purposes, and participants will be instructed to call study staff in the event that they are having difficulty with the phone. These participants will be asked to complete one EMA each day, administered through a secure smartphone application (i.e., app). Smartphones will be programmed to automatically cue an assessment each day 30 minutes after the participant’s self-reported usual waking time. The “usual waking time” is reported by the participant to the research staff at the randomization visit, and may vary by day of the week. If the participant does not acknowledge the EMA, it will be rescheduled for later that day to increase the likelihood that EMAs are completed. Participants will respond to EMA questions on the smartphone using the touch screen. Daily EMAs will inquire about the substance use, sleeping arrangements, stress, discrimination episodes, etc., from the previous day. In addition, EMAs will ask participants to rate their emotional state (e.g., affect, stress level,). The smartphone app will also collect geolocation data up to every five minutes of the study, regardless of app use.

3. **Arrest data.** The Dallas County Jail collects and maintains a dataset that contains demographic characteristics (including homelessness status), and arrest data on all individuals who are arrested in the County. Dr. Gonzalez will have access to this dataset for the purposes of this study (see **Director of Criminal Justice Letter of Support**). Specifically, Dr. Gonzalez will receive a complete updated and encrypted dataset of all arrested study participants from a Dallas County employee every 6 months. Upon receipt, she will search the dataset for study participants and record whether a participant was arrested or not, the date(s) of arrest, and the class and type of the alleged crime (e.g., violent vs. non-violent, property crime, misdemeanor, felony) in a new study dataset. This arrest data will be used as one of the primary outcome variables for this study. Dallas City Jail records are publicly available online at https://www.municipalrecordsearch.com/dallastx/Cases. This database will augment County Jail records and be searched to determine eligibility and arrest.

Study Population:

Consistent with our previous research with this population, we have limited exclusion criteria so that the sample is as broad and representative of the population as possible. Interested individuals (N=462 will be included in the study if they: 1) were released from Dallas County Jail in the past 60 days; 2) plan to reside in the Dallas area for the next year, 3) enroll in The Bridge Homeless Recovery Program, 4) are willing and able to attend the visit, randomization visit, and the 1, 3, and 6-month follow-up visits; 5) score ≥ 4 on the REALM- SF indicating > 6th grade English literacy level (i.e., a 7th grade reading level is necessary to complete assessments; 12% to 14% of those screened for Projects Advance and Aspire had REALM scores <7th gradereading level; <1% of Bridge guests are non-English speakers), 6) read aloud from the Informed Consent document to ensure understanding, and 7) score >24 on the Mini-Mental State Exam indicating no substantialcognitive impairment.

Participant Recruitment. Individuals who identify as homeless upon release from the Dallas County Jail will be given a 2-sided flier by jail re-entry staff (see flyer in Study Documents). One side of the flyer will provide information about services that may be useful to homeless adults in Dallas (e.g., directions to the Bridge and other nearby shelters where they may obtain meals, shelter, housing assistance and other services; this is current standard practice at the jail). We have received permission from the jail (see Director of Criminal Justice letter of support) to use the blank side of this flier to briefly describe this study. Each flyer will have a unique identification number and the individual's name to allow us to track the response rate based upon the number of flyers distributed. This flyer will be considered a "ticket" for screening and potential participation into this study. If individuals misplace the flyer, they will be able to be screened for study inclusion if they can provide other evidence of recent (past 60 day) incarceration. See Recruitment Flyer attachment in Study Documents.

We considered recruiting participants and beginning case management while individuals were still incarcerated, but due to legal issues, jail policies, and the potential that incarcerated individuals may feel coerced into participating in this study, we decided to have jail pre-release staff only hand out flyers and provide a brief outline of the study during the jail discharge process.

Individuals who were released from the Dallas County Jail or the Dallas City Jail in the past 60 days and present at The Bridge will complete a shelter intake form, be given a Bridge identification badge, and enroll in the Bridge Homeless Recovery program if interested (this is the current standard of care at The Bridge). These individuals will receive information about this completely voluntary study and will be informed that Bridge services are not contingent upon study enrollment. Eligible adults who remain interested the study will be directed by The Bridge Triage/Intake Coordinator (see Bridge Subcontract) to the study research staff for screening. Only U.S Citizens will be allowed to participate in the study.

Participant Retention

All participants will be asked for in-depth locator information during the initial visit, which will be updated every 15 days by phone call or text. This information will be stored in a locked file cabinet, and we will not share this information with anyone outside of the study team. We will use all the information you provide, including phone calls, text messages, e-mails, and social media handles, to locate you and

remind you of follow- up visits. In addition, these data will be updated during every subsequent visit. Our team will make every effort to locate participants to remind them of follow-up visits using all available information provided by the participant, including phone calls, text messages, e-mails, and social media handles. For social media contacts, the research team will create a closed study profile. Research participants will be contacted using private or direct messages on social media if they consent to be contacted using this mode on the locator form. No contact or 'friend' requests will be accepted in order to protect participant confidentiality. If participants do not complete 5 or more sequential EMAs and have not been responsive to the research teamafter repeated contact attempts, a text message will be sent to the participant. This text message will alert the participant that their cell phone service will be terminated if they do not contact the research team within one week. If the participant's phone service is terminated because he/she did not complete 5 or more sequential EMAs and was not responsive to the research team, then the participant will not be eligible to receive areplacement phone.

Study Procedures

Participants will complete assessments during 5 in-person visits (i.e., baseline visit, randomization visit [within 72 hours of the baseline visit], and 1, 3- and 6-month follow-up visits). Figure 2 demonstrates participant flow and a brief summary for each study visit is provided below:

Visit 1: During this visit, informed consent will be obtained, individuals will be screened, and interested individuals who meet the study inclusion criteria will complete the baseline study. This visit will take up to 2 hours to complete (see Table 2 and the Appendix for assessment measures and actual assessment items).

Visit 2: This visit will take approximately 1 hour to complete. During this visit, participants will be randomized to one of three study conditions. All participants will complete additional study measures. Two-thirds of all participants will receive a smartphone. Those who are randomized to the smartphone groups will be shown how to use the phone to complete assessments, and how to use the app features. Researchers will utilize the participant's Google Play Store account to download the Insight app. Those participants who are randomized to receive smart phones during visit 2 will have an app blocker installed on their phone to prevent phone loss. This app blocker will prevent the participant from access to the phone settings, the Google Play Store or allow deletion the Insight App. Only the research staff will have the password required to access those functions or delete the Insight App. At visits 3 or visit 4, the app blocker will be removed for participants who completed 50% or more of the daily EMA Surveys over the past 30 days as an additional incentive. At the conclusion of the study, the Insight app, and all app data will be removed from the phone, and the phone will be given to the participant to keep. The study data will be removed from the phone and all data collection through the Insight application will end. Researchers will delete the app from the phone and advise the participant the study has concluded. At visit 2, study participants will receive three referral coupons to pass on to others who are interested in the study. If a coupon recipient successfully completes visit 1, the participant who made the referral will be compensated $20 on the study credit card, for a maximum of 6 successful referrals. Each coupon will include a random unique identification number that identifies the person who provided the coupon and will be valid for the 6 months the participant is active in the study. Participants will be given up to 6 coupons in total if the initial coupons have been distributed. The study team may replace lost or destroyed coupons at their discretion. Participants have a 14-day period to complete visit 2 and be randomized into one of the study conditions. Participants who are not randomized within the 14-day period will be terminated from the study.

Visits 3, 4, and 5: These visits will occur 1-, 3-, and 6-months after Visit 1. During these visits, participants will complete questionnaires. These visits will take about 1-2 hours to complete and may be completed in person or online using REDCap. Participants will be contacted prior to these visits via phone (call and/or text) and/or mail (see appointment letter in study documents). Participants have a 14-day window to complete visits 3 and 4 and a 30 day window to complete their visit 5, after their scheduled appointment date. After this visit window participants will not be allowed to attend the scheduled visit. For visits 3-5, participants may complete their visits up to 5 days prior to their scheduled appointment.

Figure 2. Participant flow

Screening/Baseline Visit 1	Randomization Visit 2	1 Monthfollow-up Visit 3	3 Monthfollow-up Visit 4	6 Month follow-up Visit 5

Participants who are randomly assigned to the UCM+SP or SPCM conditions will receive a smartphone at the randomization visit and they will be asked to carry it with them at all times for 6 months (26 weeks). Date, time, geolocation, and duration of SPCM app feature use (e.g., case manager calls) will be recorded by theapp for future analysis.

Traditional Measures (in-person). Traditional assessment data will be primarily collected on laptop/tablet computers using Questionnaire Development System (QDS) software at baseline and follow-up visits. QDS utilizesa computer-administered self-interview format (i.e., ACASI), which reduces data entry errors and the need to retain paper copies of raw data. Each item appears on the computer screen while the program simultaneously reads the item (participants may select their responses only after QDS reads each item). Participants wear headphones so that others do not hear the survey items. .

Participants have reported few problems using the QDS program, including those with no computer experience. Staff will be available to help participants who may have difficulty. The amount of time needed to complete the QDS administered questionnaires varies by study visit. Based on our previous experience with collecting data in homeless adults we estimate that the baseline visit will require approximately 1-2 hours to complete and follow-up assessment visits will require approximately 1-2 hours. Note that although breaks have been encouraged in our previous studies that have used QDS assessments in this homeless population, none actually took breaks. Examples of traditional measures are listed in Table 2 and include multiple constructs that are hypothesized to directly and indirectly (i.e., mediation of the treatment effect) affect the study outcomes. In addition, barriers to phone-based case management sessions and staff and participant perceptions of the SPCM app will be assessed.

Table 2. In-person assessment measures

Demographics/Background
Demographic Information Questionnaire
Homelessness Questionnaire
Arrest History[51]
Health, Mental Health, & Health Behavior
Patient Health Questionnaire 52 (depression/anxiety/alcohol)
Mental Health Component from the SF-12[53]
Health Related Quality of Life[54]
Alcohol and Drug Timeline Follow Back[55]
88 COVID-19 Vaccine
Common Measures for Adult Well-Being[89]
Stress/Stressor Measures
Discrimination[56]
Urban Life Stressors Scale[57]
Personal Victimization[58]
Perceived Stress Scale – Short Version[59]
Negative Affect
Aggression[60]
Positive and Negative Affect Schedule61
Loneliness Scale[62]
Interpersonal/Intrapersonal Resources
Interpersonal Support Evaluation List-12[63]
Religious Participation

See Appendix A for measure descriptions, assessment items, and a schedule that indicates which measures will be administered at each visit. In addition to the QDS System, assessment data may be collected through the REDCap system. REDCap is a secure web application for building and managing online surveys and databases and is specifically tailored for the management and administration of online data collection for research studies.

Alcohol/drug use, re-arrest, and number of homeless nights will be collected using a Timeline Follow-backprocedure (See Appendix) at all 1, 3, and 6-month follow-up visits. In addition, arrest data from the Dallas County Jail and the Dallas City Jail will be examined to identify participants who are re-arrested within 12- months of the randomization visit (see **Director of Criminal Justice Letter of Support**). This will provide anobjective measure of the date and time of arrest as well as a description of the offenses that occurred. The research team will share participant's name and date of birth to obtain this information, but no additional information that the participant provides to us over the course of the study will be shared with this Dallas County employee or the Jail. For participants who complete online surveys via REDCap, the participant will be instructed to call the research team to complete the Time Line Follow Back for location, drug and alcohol use.

Ecological Momentary Assessment Measures (EMA; phone based). EMA is currently the most accurate way to measure phenomena in near real-time in natural settings.[42,44] Thus, EMA methodology will enable the identification of key variables that predict study outcomes with less bias than traditional in-person

assessments. At the randomization visit, those assigned to the UCM+SP and SPCM conditions will be trained on how to use the smartphone to complete EMAs and how to use the "Call Study Staff" and "Payment" button/options. Those assigned to the SPCM condition will be trained to use the features of the full smartphone app. All participants who receive smartphones will be prompted by the phone to complete one EMA 30 minutes after waking each day for 6 months beginning the day after the randomization visitAfter completion of the EMA, a joke or link to a joke will presented to the participant via the smartphone. EMA data, collected over a 6-month period, will be used to identify key risk and protective factors that significantly impact substance use, re-arrest (i.e., re-arrest rates tend to peak within 6-12 months of jail discharge[67]), and continued homelessness (homeless episode duration peaks at 180-190 days;[68,69] see Aim 3).

EMA Assessments. The EMA methodology that will be used in this study is similar to that developed by Shiffman and colleagues[43,70,71] and was used in our previous studies. EMA items will assess multiple constructs that are hypothesized to be related to the study outcomes (see examples in Table 3). The phone will audibly and visually cue EMAs for 5 minutes, 30 minutes after each participant's self-reported usual waking time. If the participant does not respond to the EMA prompt, the EMA will be recorded as missed and another prompt will be pushed later that day (this will reduce the likelihood of missed EMAs). EMAs will take approximately 2-4 minutes to complete. All EMAs will be date and time stamped for future analyses. Daily EMA items will ask about current affect and stress. In addition, participants will be asked a number of questions about the prior day that are hypothesized to be related to study outcomes (see Table 3). On Mondays, the daily EMA items and additional items will be assessed. Additional Monday items will cover topics/variables that have less day to-day variability (e.g., arrest; witnessing crimes or violence; emergency room visits; hospitalization; quality of life). Examples of EMA constructs that will be assessed are listed in Table 3 and actual EMA items are included in table

Table 3. EMA measures.

Daily Assessments
Positive and Negative Affect[66]
Sleeping Arrangements
Social Support and Interactions
Perceived Stress & Current Stressors
Discrimination
Prescription Medication Use
Alcohol Consumption
Other Illicit Substance Use
Meal Consumption
Weekly – Monday Assessments
Arrest
Employment
Crime/Violence
Emergency Room Visits
Hospitalization
Quality of Life Items
Pandemic Stress Index (PSI)

Compensation. Participants will receive compensation for completing each in person visit (i.e., Visits 1 and 2 = $30; Visits 3-5 = $50) in the form of gift cards (via Greenphire). Participants who receive study phones will also be compensated based upon the percentage of EMAs completed. Participants who are randomized to receive a smartphone, will have the opportunity to earn additional payment every 15 days for completing daily surveys on the phone. Participants will not receive payment for EMA surveys until they confirm or update the locator information (research staff will attempt to contact participants every 15 days). The level of payment for these daily surveys will depend upon the number of EMA surveys that are completed within each 15-day period. If participants complete at least 13 EMA surveys within a 15-day period, they will receive $50, if they complete at least 11 EMA surveys within a 15-day period, they will receive $30, and if they complete at least 7 EMA surveys within a 15-day period, they will receive $20. Participants will be able to track the number of EMA surveys they have completed by clicking a button on the phone. Payments or completing QDS questionnaires will be issued at scheduled in-person visits only.

Data and Safety Monitoring:

The study poses minimal risk to participants; therefore, the co-Principal investigators (Drs. Businelle and Gonzalez) will continuously monitor and report any adverse events. Review of the data and safety monitoringplan (e.g., procedures for screening and consenting participants, computer and phone-based data storage) will occur during the monthly research team meetings. Adverse events are not expected. Although unlikely given our experience, any unanticipated problems (adverse events, protocol deviations, other problems) will be promptly reported to the IRB. The NIH will be informed of any actions taken by the IRB as a result of its continuing review.

Statistics
All randomized participants will be included in the analyses and the trial will end once 462 participants are randomized and complete all study components. Preliminary data analyses, manuscript preparation, and conference presentations will begin in Year 2.

Aim 1. The number of participants (*n* = 144 in each group) was estimated based on the following assumptions: 1) random allocation of participants between 3 conditions; 2) type I error rate set to 0.05; 3) a 30% dropout rate for each condition;[23] 4) targeted minimum power of 0.9, and 5) a conservative increase of 4.5 case management sessions between the UCM and SPCM conditions across the 6-month study period. The estimated increase in in case management sessions is based on Lucht et al.,[49] which showed that 20% of all phone-based prompts to connect with an alcohol treatment counselor resulted in actual treatment sessions. Mondays, the daily EMA items and additional items will be assessed. Additional Monday items will cover topics/variables that have less day-to-day variability (e.g., arrest; witnessing crimes or violence; emergency room visits; hospitalization; quality of life). Examples of EMA constructs that will be assessed are listed in Table 3 and actual EMA items are included in the Appendix.

	Compensation (Usual Care)	Compensation (Smartphone Groups)
Visit 1 (Today)		
Questionnaire	$30	$30
Visit 2 (Within 3 Days)	$30	$30
Visit 3 (1-Month Follow-Up)		
Questionnaire	$50	$50
Phone Assessments	N/A	Up to $50 every 15 days for survey completion ($100)
Visit 4 (3-Month Follow-Up)		
Questionnaire	$50	$50
Phone Assessments	N/A	Up to $50 every 15 days for survey completion ($200).
Visit 5 (6-Month Follow-Up)		
Questionnaire	$50	$50
Phone Assessments	N/A	Up to $50 every 15 days for survey completion ($300).
TOTAL:	**Up to $210**	**Up to $810**

Analyses. Primary analyses for this aim will compare counts of the total number of case and crisis managementsessions that occurred between the randomization visit and the 6-month follow-up across the 3 conditions using analysis of covariance (ANCOVA). Covariates may include race/ethnicity, age, sex, lifetime months homeless, type of arrest (e.g., violent vs. non-violent), substance abuse or mental health diagnoses,

and education. The Tukey-Kramer adjustment will be used to examine all pairwise comparisons across conditions. We will also determine if the intervention has similar effects across races, gender, and age**Aim 2.** Based on the available data in criminal justice and homeless populations, we expect a 30% reduction in alcohol and drug use days in SPCM and a 15% reduction in alcohol and drug use days in UCM+SP compared with UCM.[3,126] Given these expected differences, the proposed sample size of 462 participants (144 per condition) will yield 90% minimum power for comparing the frequency of alcohol and drug use days across conditions. Furthermore, the proposed sample size of 462 participants has 80% minimum power to detect a 24% greater decrease in psychiatric symptoms[127] in the SPCM group and 10% greater decrease in the UCM+SP group relative to UCM).

Analyses. Multi-level models, also known as mixed models will assess the impact of condition on alcohol and drug use and psychological distress. This method considers the auto correlated nature of this data, and 'unstructured' covariance may be specified to account for the unequal spacing of observations (in-person and EMA data). Covariates for analyses will include baseline characteristics that are known predictors of each outcome, including age, race/ethnicity, employment status, criminal history, and periods of lifetime homelessness. We will also test for interactions between treatment and key demographic variables (e.g., race,ethnicity, gender, and age).

Aim 3. The detectable effects for analyses based on a complete EMA sample size of 201 participants (allowing for 30% study drop-out; see Gonzalez and Rosenheck3 for follow-up rates in a sample of homeless adults with both serious mental illness and substance abuse), 2-sided tests, alpha=.05, and power=.80 are presented in Table 8. Where appropriate, these estimates account for the fact that repeated observations from the same person will be correlated. The most conservative detectable effects for the GLMM EMA analyses will be presented. Thus, calculations are based on an N of 201 individuals completing 80% of 183 assessments during the 6-month EMA study period for a total of 29,426 EMAs across all participants. Since few EMA studies have been conducted in this population, we computed detectable effects using a reasonable range of intraclass correlation coefficient (ICC) values. Detectable effects estimates depend on the variance inflation factor (VIF)134 which is based on both the size of the ICC and the average number of observations per person. The VIFs used to calculate the effective sample size are displayed in Table 8. Thus, using the EMA data, we will be able to detect factors that predict reductions in homeless nights by as little as 3.1 percentage points.

Analyses. Logistic Regression of traditional in-person assessments (e.g., substance use, social support, psychological functioning, quality of life; see Table 7 for other key constructs) and summarized EMA data (e.g., affect, stress, discrimination, alcohol and drug use) will be conducted to identify significant demographic, psychosocial, environmental, and behavioral predictors of re-arrest in the 12 months following the randomization visit (binary outcome). Covariates may include treatment group, age, gender, race/ethnicity, education, type of crime, and other variables as appropriate. Change scores (e.g., change in social support from baseline to the 1-month follow-up visit) will also be examined as potential predictors of re-arrest.

Generalized Linear Mixed Model Regression Analyses (GLMM) will be used to examine the longitudinal effect of key risk and protective factors on number of homeless nights (measured repeatedly using a timeline follow-back procedure at in-person follow-up visits). GLMM can handle fixed and random effect model parameters, nested designs, and repeated measures with various correlation structures.[128,129] GLMM can also handle different variance functions, unbalanced designs where the number of repeated observations varies across individuals, and the situation where assessments within a week are more highly correlated than assessments separated by multiple weeks or months. We will assess the best way to model the correlation of the repeated measures using the methods of Wolfinger[130] and statistics such as Akaike's and Schwarz's information criteria. Adjustments for multiple comparisons will be made according to Westfall and Young.[131]

GLMM will also be used to identify proximal predictors of homeless nights (assessed each day) using EMA data. EMAs generate an enormous amount of data; therefore, we will be able to address multiple within

and between subject questions. For example, we will examine key EMA variables (e.g., negative affect, stress) and parameters (e.g., intercept, slope, quadratic term, volatility) as potential predictors of homeless nights. This invaluable information may be used to detect high-risk situations that may be targeted in future "smart interventions." EMA data will also allow us to address other important exploratory questions like: 1) what psychosocial changes occur as an individual moves from homelessness into housing, and 2) what effect do events like exposure to discrimination, violence, or hospitalization have on homeless nights.

Mediation. The PROCESS macro for SPSS/SAS (described in Hayes, 2013;[132] and available online[133]) will be used to conduct exploratory mediation analyses to identify variables that mediate the relation between condition and homeless nights and re-arrest outcomes. This method uses an ordinary least squares path analytic framework to estimate direct and indirect effects in single and multiple mediation models with bootstrapped confidence intervals. The macro can also be used to evaluate moderated mediation models including those with dichotomous outcomes (e.g., arrest vs. no arrest).

Ethics:

Approval for this study is being sought from the Committee for the Protection of Human Subjects (CPHS) of the University of Texas Health Science Center at Houston. Individuals who were released from the Dallas County Jail or the Dallas City Jail in the past month and present at The Bridge will complete a shelter intake form, be given a Bridge identification badge, and enroll in the Bridge Homeless Recovery program if interested (this is the current standard of care at The Bridge). These individuals will receive information about this completely voluntary study and will be informed that Bridge services are not contingent upon study enrollment. Eligible adults who remain interested the study will be directed by The Bridge Triage/Intake Coordinator (see Bridge Subcontract) to the study research staff for screening. Informed consent will be obtained prior to screening for this study.

Data handling and record keeping:

General Procedures. Each participant will be assigned an identification number that will be utilized in place of names in all electronic and print data files. The sheet containing the links between participant names and identifiers will be kept in locked filing cabinet when not in use and will be destroyed 12 months after data collection has been completed. All print information, including informed consent and screening questionnaires, will be stored in a separate locked filing cabinet in Dr. Gonzalez's office. All electronic data (with names omitted) will be maintained on the investigator's computers, and all computers and electronic files will be password protected. Because sensitive data will be collected, a Certificate of Confidentiality has been obtained to ensure that data cannot be subpoenaed and used against participants in court, and this information will be explained to all participants during the informed consent process.

In-person data. Participants will complete questionnaire data on a laptop or tablet computers using the Questionnaire Development System (QDS) program. Participants will wear headphones and the computer will read each question aloud. Participants will be instructed that they may elect to not answer questions that they choose not to answer. When in-person visits are not possible, follow-up visits may occur by phone. QDS does not allow participants to exit without a password. Thus, participants will not have access to other programs or files on the computer. In addition, all questionnaire data is automatically saved and password protected. At the end of each day, participant data will be removed from the laptop/tablet computers and saved into a password protected database. To ensure that research staff are adequately trained in data collection, confidential, and the protection of human subjects, all project staff will complete extensive training focused on each of the following topics: 1) project rationale and objectives; 2) the informed consent process; and 3) general data collection procedures (e.g., computer data collection, privacy). They will also complete all confidentiality, conflict of interest, and HIPAA training programs bi-annually as required by the University of Texas School of Public Health. To maintain the integrity of the data, participants will be required to show identification at each

follow-up visit prior to completing the study assessments.

EMA data. Participant responses to study questions will be encrypted and stored on the study smartphone. Encrypted data will be automatically uploaded to our secure server multiple times each day. Thefollowing features are designed to ensure the security of EMA data: 1) the data stored on the smartphone device is in a SQLite database in a sandbox environment, where read/write operations are only available through the programming application (i.e., no file or output is readable to end users); 2) a 10 character password (only known to researchers) is required to authenticate the current user before data can be manually accessed or manually downloaded from the smartphone to the server; 3) the web browser application linking the investigator's computer to the database is on HTTPS protocol (SSL certificate with encryption) which will guarantee the data transfer from web browser to the backend database is well protected; and 4) the backend database is hosted by Microsoft Azure servers and the University of OklahomaHealth Sciences Center in a secure setup. These steps will ensure the security of EMA data.

Arrest data. A list of participant names will be shared with a single Dallas County employee. As stated in the letter of support, the Dallas County Jail (Ron Stretcher, Director of Criminal Justice) will send Dr. Gonzalez an encrypted database every 6 months that contains a list of arrested participants, dates of arrest, and charges filed in Dallas County. Dr. Gonzalez will use this database to identify study participants who were re-arrested within the 12 months following the date of randomization. Dr. Gonzalez will create a new database that includes the participant identification number, date of re-arrest, and class/type of alleged crime. Participant names will not be included in this newly created dataset. This re-arrest data will eventually be merged into the master dataset. Each iteration of the Dallas County Jail dataset will be deleted/destroyed after Dr. Gonzalez extracts relevant information. The Dallas City Jail database will be searched to augment arrest data from the Dallas County Jail.

Certificate of Confidentiality. Participants will be asked to answer questions about private information that may have legal consequences if it were disclosed. Therefore, before data collection is initiated, researchers will obtain a Certificate of Confidentiality to protect participants from the mandated release of study data. All participants will be informed that this Certificate has been obtained, and what protections it affords them during the informed consent process. Participant data will not be released to any party outside the research team.

Quality control and assurance:

Drs.Gonzalez and Businelle will develop data management and quality assurance procedures for the study data, which will continue through all years of this project. Quality assurance procedures will include a data collection protocol documented in a protocol manual and regular meetings between Drs. Gonzalez, Businelle, Kendzor, and other project staff. The QDS data entry system provides field checks, range checks for continuous variables, valid value checks for categorical variables, checks for legitimate dates and times, and logical consistency. All EMA data and jail provided arrest data will be encrypted and secured on the researcher's password protected computers at the moment of receipt and through all years of the project. Preliminary analyses will be initiated shortly after data collection begins to assess data quality. Dr. Cannell will be primarily responsible for overseeing data cleaning and data preparation (e.g., combining of EMA, QDS, REDCap and Arrest datasets) for analyses.

Publication Plan

Data analyses, manuscript preparation using preliminary data, and conference presentations will begin in Year

All participants will be mailed a brief summary of the main study findings within 12 months of study completion.References

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