The Substance Use Treatment and Recovery Team (START) study: protocol for a multi-site randomized controlled trial evaluating an intervention to improve initiation of medication and linkage to post-discharge care for hospitalized patients with opioid use disorder

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Abstract

Background: People with opioid use disorder experience high burden of disease from medical comorbidities and are increasingly hospitalized with medical complications. Medications for opioid use disorder are an effective, life-saving treatment, but patients with an opioid use disorder admitted to the hospital seldom initiate medication for their disorder while in the hospital, nor are they linked with outpatient treatment after discharge. The inpatient stay, when patients may be more receptive to improving their health and reducing substance use, offers an opportunity to discuss opioid use disorder and facilitate medication initiation and linkage to treatment after discharge. An addiction-focus consultative team that uses evidence-based tools and resources could address barriers, such as the need for the primary medical team to focus on the primary health problem and lack of time and expertise, that prevent primary medical teams from addressing substance use.

Methods: This study is a pragmatic randomized controlled trial that will evaluate whether a consultative team, called the Substance Use Treatment and Recovery Team (START), increases initiation of any US Food and Drug Administration approved medication for opioid use disorder (buprenorphine, methadone, naltrexone) during the hospital stay and increases linkage to treatment after discharge compared to patients receiving usual care. The study is being conducted at three geographically distinct academic hospitals. Patients are randomly assigned within each hospital to receive the START intervention or usual care. Primary study outcomes are initiation of medication for opioid use disorder in the hospital and linkage to medication or other opioid use disorder treatment after discharge. Outcomes

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are assessed through participant interviews at baseline and 1 month after discharge and data from hospital and outpatient medical records.

Discussion: The START intervention offers a compelling model to improve care for hospitalized patients with opioid use disorder. The study could also advance translational science by identifying an effective and generalizable approach to treating not only opioid use disorder, but also other substance use disorders and behavioral health conditions.

Trial registration: Clinicaltrials.gov: NCT05086796, Registered on 10/21/2021.

https://www.clinicaltrials.gov/ct2/results?recrs=ab&cond=&term=NCT05086796&cntry=&state=&city=&dist=

Keywords: Opioid use disorder (OUD), Medications for opioid use disorder (MOUD), Addiction consult team, Collaborative care, Linkage to follow-up, Inpatient

Background

The US opioid epidemic continues to be of urgent national concern. Between 1999 and 2019, nearly 500,000 people died from an overdose involving opioids [1]. In 2020 and 2021, coincident with the COVID-19 pandemic, fatal and non-fatal opioid-related overdoses increased even more rapidly than in previous years [2–4]. People with opioid use disorder (OUD) experience high burden of disease from medical comorbidities [5] and are increasingly hospitalized with medical complications related to OUD [6–8]. Between 2002 and 2012, annual hospitalizations for OUD in the US nearly doubled, from 301,707 to 520,275, with inpatient charges for these hospitalizations nearly quadrupling [8]; by 2018, the number of inpatient stays related to OUD reached an estimated 748,900 [9]. Medications for opioid use disorder (MOUD) are highly effective and help reduce overdose rates, criminal behavior, infectious disease, and mortality [10–12] and are the standard of care for people with OUD, but patients with an underlying OUD admitted to the hospital seldom initiate MOUD while in the hospital or are linked with outpatient treatment for their OUD after discharge [13–15]. High rates of patient directed discharges among people with OUD (about 15%) suggest failure to address issues related to OUD such as opioid withdrawal and pain while in the hospital [16] and also lead to failed transitions to follow-up care after hospital discharge [17]. Between 2011 and 2015, about half a million hospitalization discharges per year included a diagnosis of OUD without provision of treatment or prevention services [18]. Failing to address OUD while patients are in the hospital either for a complication related to their OUD or for another illness or injury is a missed opportunity to initiate critical and life-saving treatment and leaves patients at high risk of continued use, delays in care, overdose, and costly readmission [6, 14, 17, 19–21].

Hospitalization is a critical time to identify patients with OUD and to initiate evidence-based treatments [16, 22]. Starting MOUD in the hospital and linking patients with post-discharge care addresses a common treatment gap and could improve patient outcomes and lower readmissions and costs. Some studies suggest that the inpatient hospitalization is a reachable moment when patients with OUD may be willing to engage with treatment, including initiating MOUD, if barriers can be reduced [23–33]. Although inpatient physicians frequently manage clinical conditions related to OUD, such as acute overdose, withdrawal, and infectious diseases, many report lacking knowledge and skills for addressing OUD [34, 35]. Given pressures to minimize length of stay in the hospital on the acute cause of admission, hospital teams may defer addressing chronic conditions like OUD. Moreover, few hospitals have established organizational infrastructure to support effective treatment of OUD, such as addiction focused consultative teams, evidence-based protocols, or the ability to coordinate care transitions needed to link patients to community resources [36]. Stringent federal privacy regulations, prescribing, dispensing and tracking regulations, insufficient training and reimbursement issues, create additional barriers [37–39]. Not least of all, patients with OUD often may not perceive the need to start treatment [40–42], and they may also experience stigma in health care settings [43, 44], leading to even greater ambivalence.

A hospital-based addiction consultation service has the potential to increase delivery of MOUD to patients with OUD (as well as other substance use disorders) during their hospitalization and link them to treatment after hospital discharge [45]. Prior studies suggest that an inpatient addiction consult team may have a positive effect on MOUD initiation and linkage to post-discharge care [34, 46] and result in lower readmission rates [47], and that this type of team is feasible, acceptable to patients and providers, and cost-effective to implement [34, 48–53]. Additionally, studies also show that patients who initiate MOUD in the hospital are more likely to continue MOUD for their OUD after discharge.

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[54] However, while these descriptive, observational, and quasi-experimental studies [29, 31, 47, 49, 53, 55–63] provide high-quality evidence, there have been no randomized controlled trials (RCTs) to test effectiveness of this model specifically for patients with OUD. RCTs can add definitive evidence to inform decisions on adoption of models of care, which is particularly valuable in a resource constrained health care system [64].

This article describes the protocol for a multi-site, RCT being conducted in three diverse hospitals in the United States to test whether an inpatient addiction consult team informed by the collaborative care model [65, 66] and evidence-based tools and resources, including motivational interviewing [67] and focused discharge planning [68, 69], improves MOUD initiation and linkage to post-discharge care for people with OUD compared to usual care.

Study objectives and specific aims

This study will evaluate whether an addiction consult team called the Substance Use Treatment and Recovery Team (START) increases initiation of any US Food and Drug Administration (FDA)-approved MOUD (buprenorphine, methadone, naltrexone) during the inpatient stay, and increases linkage to treatment after discharge among hospitalized patients with OUD, compared to patients receiving usual care. Secondary outcomes include having an OUD-specific discharge plan, post-discharge MOUD and medical care utilization, and past 30-day opioid use. We hypothesize that compared to usual care, a higher proportion of patients in the START arm will initiate MOUD in the hospital; have linkage to post-discharge OUD treatment, including MOUD and psychotherapy; have an OUD-specific discharge plan; will receive any medical care; and will have fewer days of opioid use.

Methods
Study design and setting

This study is a three-site, pragmatic randomized controlled trial (RCT) testing the effects of START versus usual care (UC) on primary and secondary outcomes see Fig. 1 for study flow diagram. The trial is being conducted at Cedars-Sinai Medical Center (CSMC) in Los Angeles, the University of New Mexico (UNM) Hospital in Albuquerque, and Baystate Medical Center (BMC) in Springfield, Massachusetts. Patients are randomly assigned within each hospital to receive either START or UC, stratifying by any prior MOUD exposure and study site. Study outcomes are assessed through participant interviews at baseline and 1 month after discharge and data from hospital and outpatient medical records.
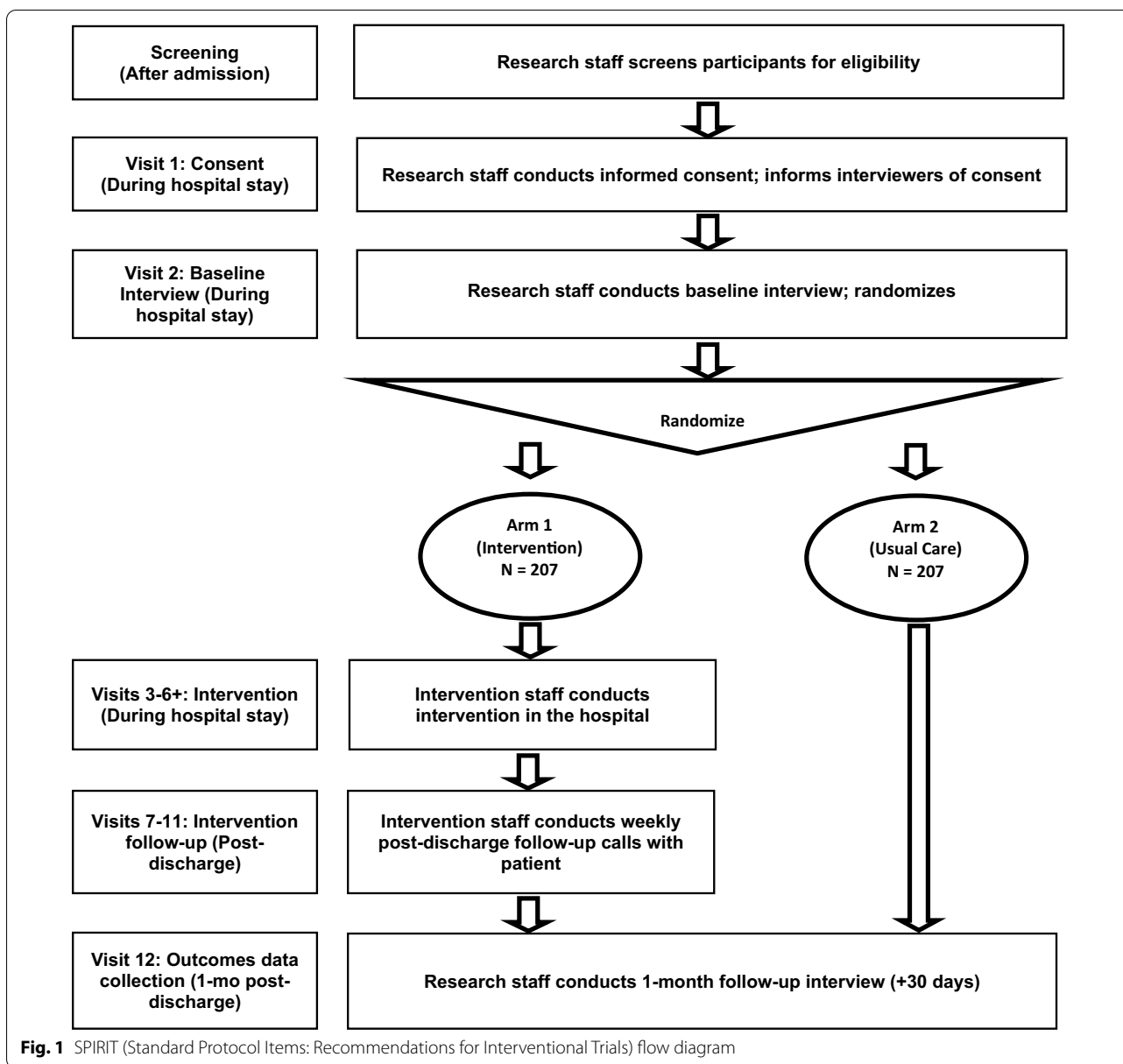
Participants

The study will enroll 414 patients across all three hospitals over the course of approximately 10 months. (Our timeline may extend beyond 10 months due to delays associated with the COVID-19 pandemic). In order to be eligible for the study, individuals must be current inpatients at one of the three participating hospitals; be 18 or older; have a probable OUD diagnosis, defined by scores of > 3 on the heroin or prescription opioid section of the World Health Organization Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST) [70]; speak English or Spanish as a primary language; have a life expectancy of greater than 6 months (i.e., they are not in hospice); and be able to provide informed consent. Participants already receiving MOUD during their hospitalization will not be eligible for the study.

Study conditions
Intervention condition: START

The START is an addiction consultation team comprised of an addiction medicine specialist (AMS) and care manager (CM) utilizing evidence-based interventions for OUD. The START provides diagnostic assessments, makes appropriate treatment recommendations, assists with implementation of treatment plans, establishes OUD-focused discharge plans, and facilitates linkage to treatment after discharge. The START is informed by the principles of the collaborative care model, a team-based treatment approach typically delivered by a physician-care manager team that has been found effective in health care settings for increasing use of evidence-based care and improving patient behavioral and substance use disorder outcomes but has not been previously adapted for a hospital-based addiction consult team [65, 66, 71, 72]. Collaborative care principles that inform this model include a patient-centered care team, population-based care that tracks patients using a registry, and use of evidence- and measurement-based care [73]. The START consists of an addiction medicine specialist (AMS) and a care manager (CM) who use a tailored intervention consisting of evidence-based tools and resources to overcome barriers to MOUD initiation and linkage to follow-up care. Table 1 details evidence-based tools and resources the START uses to address barriers to MOUD and linkage.

The START CM and AMS have interrelated roles providing patient care, at times providing recommendations to the primary medical team, at other times directly delivering services; responding to specific challenges related to addiction and its bio-psycho-social implications; and overseeing clinical team-based care regarding the patient's OUD. Each AMS is a physician who holds a DEA X-waiver and/or board certification in addiction

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Screening (After admission)	Research staff screens participants for eligibility
Visit 1: Consent (During hospital stay)	Research staff conducts informed consent; informs interviewers of consent
Visit 2: Baseline Interview (During hospital stay)	Research staff conducts baseline interview; randomizes

Randomize

Arm 1 (Intervention) N = 207

Arm 2 (Usual Care) N = 207

Visits 3-6+: Intervention (During hospital stay)	Intervention staff conducts intervention in the hospital
Visits 7-11: Intervention follow-up (Post-discharge)	Intervention staff conducts weekly post-discharge follow-up calls with patient
Visit 12: Outcomes data collection (1-mo post-discharge)	Research staff conducts 1-month follow-up interview (+30 days)

Fig. 1 SPIRIT (Standard Protocol Items: Recommendations for Interventional Trials) flow diagram

medicine or psychiatry. The AMS conducts a medical assessment, including withdrawal potential, relapse risk, and relevant comorbidities that influence medical management of OUD, and evaluates whether the patient is a candidate for MOUD. FDA-approved MOUDs include methadone, buprenorphine/naloxone, and naltrexone. If appropriate for MOUD, the AMS discusses the treatment with the patient and the patient's medical team and either will provide consultative guidance (if requested by the medical team) or prescribe the medication. The AMS provides ongoing clinical supervision to the CM and is available to communicate with aftercare providers to support continuous MOUD. The CM and AMS

discuss patient care in terms of diagnosis, motivation for change, treatment and aftercare planning, barriers, and potential solutions. For patients in the one-month follow-up period, the CM provides updates to the AMS on measurement-based care elements including withdrawal symptoms, substance use, MOUD adherence, and side effects.

The CM (START CMs have an MSW, LCSW, and/or more than 5 years of experience working with people with substance use disorders) delivers an adapted Brief Negotiated Interview [(BNI); a structured, evidence-based approach designed to improve readiness for substance use disorder treatment based on motivational

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Table 1 How the START addresses treatment barriers for inpatients with OUD with evidence-based tools and resources

OUD care needed	Barrier	START component	Evidence-based tools and resources
Diagnosis and assessment for OUD, pain, withdrawal and psychosocial issues	Primary medical team focused on acute issues and may not identify or provide treatment for the underlying OUD	CM and AMS trained to assess OUD and relevant comorbidities, and to address key problems during the hospitalization in a non-judgmental and respectful way; whole person focus	DSM-5 diagnostic criteria [102] ASAM level of care criteria tool [103]
Motivational interviewing/harm reduction/trauma-informed care	Patient ambivalence, disempowerment and perceived stigma; mistrust	CM uses motivational interviewing, psychoeducation and trauma-informed care	Brief Negotiated Interview (BNI) [104, 105], adapted for hospital setting Education about safe injecting practices and overdose, provision of intranasal naloxone at discharge Culturally appropriate trauma-informed care [77]
Assessment of indications for MOUD	Inpatient provider lack of knowledge about MOUD, training and protocols	AMS with DEA X-waiver; MOUD protocols	ASAM national practice guideline for the use of medications in the treatment of addiction involving opioid use [103] Protocol for use of MOUD in the inpatient setting (adapted from California Bridge Project) [81]
OUD-focused discharge planning	Poorly coordinated care transitions; discharge planning not OUD-specific	CM uses adapted evidence-based discharge planning protocol and facilitates appropriate communication between key medical providers	Project Reengineered Discharge (RED), adapted for patients with OUD [69] Electronic registry to monitor protocol delivery and track patients after discharge [73]
Access to post-discharge OUD care	Limited outpatient capacity	Rapid-access discharge pathways set up	Relationships with community OUD providers to establish rapid-access discharge pathways, resource lists

interviewing (MI)] [74–76] to engage, assess, and help motivate the patient to initiate treatment and/or post-discharge care for their OUD; provides educational information to the patient about MOUD, psychosocial interventions, and overdose prevention; conducts psychosocial assessments and assesses for risk factors; and guides the patient through safety planning and crisis management as needed. Working with the AMS and the primary medical team the CM also works with the patient to develop an OUD-focused discharge plan using techniques and materials adapted from Project Reengineered Discharge (RED), an evidence-based discharge planning protocol [68], that include active planning and teach-back techniques, facilitated linkage to follow-up care, and post-discharge follow-up. For patients who do not initiate MOUD and do not wish to obtain follow-up care, the CM addresses harm reduction needs and helps facilitate linkage if the patient's readiness changes. The CM uses a registry to track treatment and follow-up and to prioritize care based on the patient's level of need.

The START "starts" where the patient is; that is, the START respects patients' thoughts and feelings about their opioid use, does not confront them about their use,

and does not try to persuade them to initiate MOUD or other treatment. Consistent with the BNI, the AMS and CM use a MI style in their approach to talking with patients [76]. MI is a client-centered, directive but non-confrontational counseling style for eliciting behavior change. The examination of ambivalence around behavior change is a central tenet of MI. The AMS and CM use MI in their encounters with the patient to help them resolve ambivalence about starting treatment for an opioid use disorder. The START also recognizes that personal and cultural backgrounds inform patients' experiences with opioid use and treatment. The START practices trauma-informed care and cultural humility. Trauma-informed care involves engaging in shared decision-making, building trust, empowering patients, and creating a safe environment to respond to trauma in ways that are culturally and linguistically appropriate [77]. Nearly half of people with OUD have a lifetime history of post-traumatic stress disorder [78, 79], which makes addressing trauma an especially important part of care for this population. Cultural humility is a part of trauma-informed care, and it is crucial for providing equitable, effective care to diverse populations [80].

The components of the START workflow are as follows (see Fig. 2):

1. **Triage** The CM or AMS assesses the patient's acute biopsychosocial stability and prioritizes interventions in accordance with clinical status and hospital course. Some patients may need an urgent intervention to address active withdrawal, or counsel to prevent a patient directed discharge. For other patients, intervention is deferred while acute medical conditions are stabilized.

2. **Engage, assess, plan** If there is not an urgent need for medical intervention or after the urgent medical need is addressed, the CM and/or AMS:

   – Engages with the patient (CM and AMS)
   – Conducts a diagnostic and biopsychosocial assessment (CM)
   – Conducts a biomedical assessment and addresses comorbidities (AMS)
   – Delivers the adapted BNI to assess and increase readiness for treatment and develops a plan for initiating evidence-based treatment (MOUD, psychotherapy) during and after the hospital stay (CM)
   – Ensures the patient understands the follow-up plan and addresses barriers (CM)

3. **Treat** Treatment includes:

   – Facilitating appropriate management of intoxication, withdrawal symptoms, comorbidities, and MOUD (AMS)
   – Facilitating psychosocial treatment for OUD, if indicated and available (CM)
   – Educating patients about harm reduction strategies (CM), including use of overdose reversal kits (CM/AMS)

4. **Communicate and Coordinate**

   – The CM and AMS communicate with each other to continue care throughout 1 month after the patient is discharged
   – The CM and AMS communicate with the patient and medical team, and, when appropriate, the patient's family and outpatient providers

5. **Follow up** The CM calls the patient once a week for 1 month after the patient is discharged from the hospital to assess whether the patient is following through with the discharge plan. The CM may also call outpatient providers to facilitate linkage to care.

UC study condition

UC consists of each hospital's current practices for managing patients identified with OUD along with each patient enrolled in the study receiving MOUD education
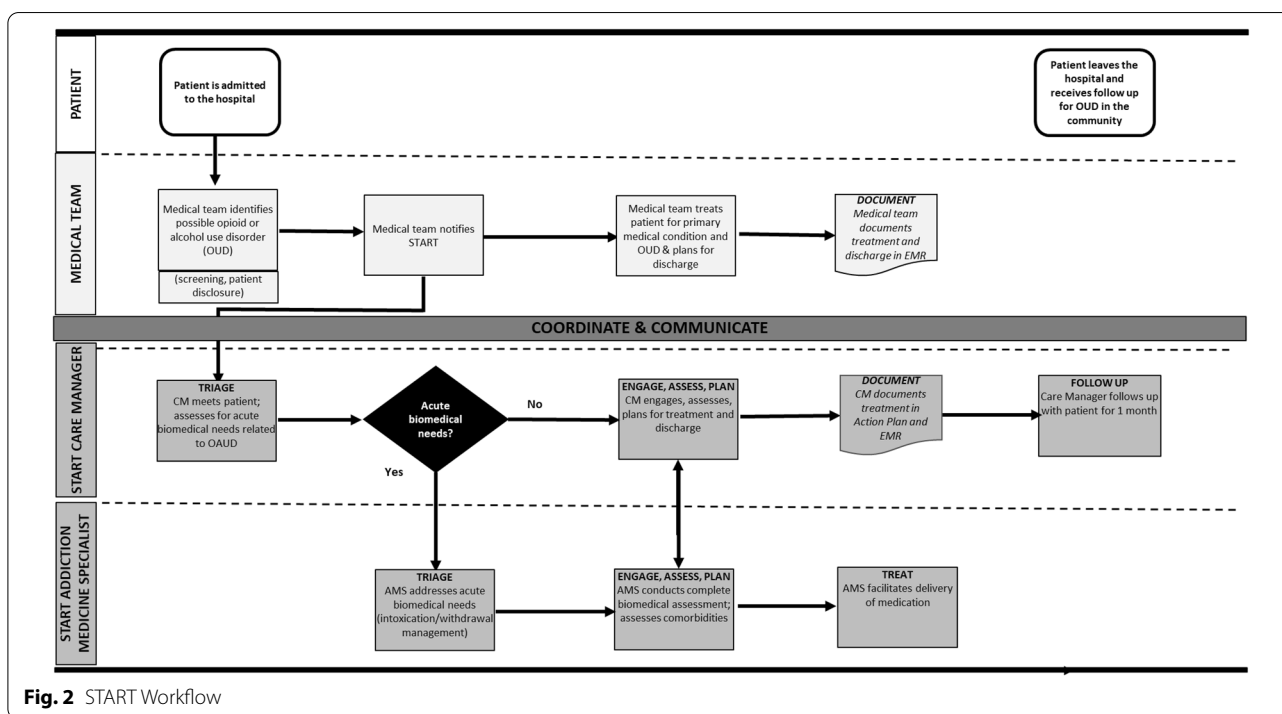

Fig. 2 START Workflow

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and referral information. We use UC as the comparator because there are no other evidence-based interventions for achieving our proposed outcomes. None of the hospitals currently employs an addiction consult team that consists of an AMS and CM that systematically uses a set of principles based on collaborative care along with evidence-based tools and resources (e.g., motivational interviewing, adapted BNI and Project RED resources) to support patients with OUD. A CM and AMS at each hospital serve as CM and AMS for the START study and will not see UC patients during the study period. At CSMC, patients randomized to the UC study condition may receive a referral to the existing consultation liaison (CL) psychiatry service if the patient's medical team determines the need for a consult, or they will be treated and provided discharge planning directly by the medical team. The CSMC CL service has clinicians who can discuss opioid use with the patient and help the patient initiate medication, if indicated. These usual CL service providers also can provide consultation to the medical team on whether medication initiation in the hospital and treatment after discharge are indicated. At UNM and BMC hospitals, patients randomized to the UC study condition can be treated directly with MOUD and provided discharge planning by the medical team. At BMC Hospital, the referring physician will have the option of contacting the standard psychiatric CL or addiction consult service for patients in the UC study condition, which will not include an AMS or CM. If the START AMS or CM at any hospital is approached by a member of the medical team for consultation on an OUD patient, they will refer them to the California Bridge Program Tools and Resources website [81].

Study procedures
Inclusion and exclusion criteria
Inclusion criteria are as follows: (1) admitted to an inpatient bed at CSMC, UNM Hospital, or BMC; (2) age 18 and older; (3) have a probable OUD diagnosis, defined by scores of > 3 on the opioid section of the Alcohol, Smoking, and Substance Involvement Screening test (ASSIST) [70]; (4) speaks English or Spanish as primary language; (5) able to provide informed consent. An individual who meets any of the following criteria is excluded from participation in this study: (1) already receiving FDA-approved medication treatment for an opioid use disorder in the hospital, defined as not being on MOUD at the time the patient is approached by the study team; (2) < 6 months life expectancy.

Patient identification and recruitment
Approved study staff prescreen patients for screening and potential enrollment through a daily electronic medical record (EMR) report of risk factors for opioid use disorder that lists potentially eligible subjects (variables include demographics, opioid history, diagnoses, and screenings) and through clinician referral to the study. Upon consent from the requesting medical team (required at two of the three hospitals), study staff conduct eligibility screening. Screening is conducted in person or remotely using an approved and secure web-based data capture system (REDCap) [82] housed at the study statistics and data coordinating center (SDCC) at UNM.

Consent, baseline and follow-up interviews, randomization
Study staff conduct the informed consent process including reviewing the full consent form and/or the consent summary with the patient. Consent is obtained via electronic signature. All patients are given patient education materials on OUD and harm reduction. Approved study staff conduct an in-person or remote 30–40 min baseline interview. Interview data are recorded on a tablet or computer into REDCap. Each site is responsible for remunerating their participants $50 per their institutional practice. Following the baseline interview, approved study staff randomize the patient to the START or UC arm by accessing a site-specific randomization module in REDCap. Study staff randomize participants into START or UC using stratified, block randomization, stratified by site and prior MOUD exposure, and using randomly permuted block sizes of 2, 4, and 8 (all programmed into REDCap). All patients enrolled in the study receive information on OUD and MOUD, and on how and where to receive services. Enrollment is continuous with the goal of reaching the desired sample size (N = 414); some sites may enroll more or less than others. Interviewers from the RAND Corporation Survey Research Group (SRG) conduct a follow-up interview by telephone 1 month after the patient is discharged from the hospital, within a 2 month follow-up window. The UNM SDCC provides contact information to RAND SRG through secure REDCap access. The follow-up interview is 30–40 min, and RAND SRG remunerates participants $50 per each hospital's practices. See Table 2 for SPIRIT (Standard Protocol Items: Recommendations for Interventional Trials) schedule of enrollment, interventions, and assessments.

Measures
Outcome variables
We provide our primary and secondary outcome variables and endpoints in Table 3.

Measures
We included measures of demographics, mental health symptoms, social support, medical symptoms and treatment, substance use treatment history, opinions about

MOUD, experience of chronic illness care, and opinions about the START intervention. Table 4 shows all measures and data sources for outcomes and potential covariates, mediators, and moderators.

Intervention fidelity measures

Fidelity to the START intervention key components (collaborative care, the brief negotiated interview, and addiction-focused discharged planning) as well as competency in using MI will be measured. Table 5 shows our fidelity and MI competency measures.

Data safety and monitoring board (DSMB)

The University of California Los Angeles (UCLA) Data and Safety Monitoring Board for Addiction Medicine (DSMBAM) serves as the DSMB for this stuy. DSMBAM members are multidisciplinary and include expertise in addiction medicine, biostatistics, basic science, epidemiology, clinical trail methodology, and biomedical ethics.

Data management and quality control

Data will be collected from multiple sources throughout the course of the study. All prospectively collected data will be directly entered into the UNM REDCap electronic data capture system which is administered by the UNM Clinical and Translational Science Center (CTSC). The UNM Statistics and Data Coordinating Center (SDCC) will develop electronic data collection forms of the patient interviews in REDCap. All data will be stored on UNM's secured servers and behind their firewall. Other data sent to UNM will be transferred via SFTP following all institutional policies and executed data use agreements. The SDCC team at UNM will be responsible for data quality control, including evaluating data for adherence with the protocol and for accuracy. Site queries will occur every 2–4 weeks. Study status reports generated from the database will provide a basis for ongoing monitoring of subject accrual and retention, as well as completeness of data.

Statistical analysis

Baseline characteristics will be summarized with descriptive statistics including means and standard deviations or medians and interquartile ranges for continuous variables, and frequencies and percentages for categorical variables. Summaries will be presented overall, by intervention arm, and stratified by previous MOUD exposure. Continuous baseline demographics and characteristics will be compared with *t* tests or Wilcoxon rank sum tests, as appropriate. Categorical variables will be compared with chi-square or Fisher exact tests, as appropriate. Corresponding confidence intervals will be reported in addition to p-values. The primary and secondary analyses will be performed for the intention-to-treat population, which consists of all randomized subjects. Every effort will be made to obtain all necessary outcome and covariate data. We will use inverse probability weighting and multiple imputation to adjust for missing covariate data [83]. Specifically, we will examine whether observable baseline characteristics differ by attrition status, and if so, we will adjust our comparisons using weights. Multiple imputation will be used to impute intermittently missing data for study completers. We will not impute data for outcomes, only for covariates.

Primary and secondary endpoint analysis

Unadjusted point estimates and confidence intervals for proportions and means will be reported by arm and by prior MOUD use for endpoints. Primary endpoints will be compared between arms by fitting a multivariable logistic regression model to each that includes as independent variables: intervention arm, prior MOUD exposure and site, as well as relevant baseline characteristics as covariates, including age, insurance status (as a marker for income), race, and ethnicity. Additional covariates that may be included are substance use severity, homelessness, length of index hospitalization, comorbid medical and psychiatric conditions, as well as any other variables also thought to be associated with outcomes that demonstrated imbalance between treatment arms [84]. Site will be included as a fixed effect to reflect the study design and to control for potential variability in START implementation. Odds ratios and their Bonferroni-adjusted 97.5% Wald confidence intervals will be reported for the two primary endpoints. Should the prevalence of outcomes be relatively high in both arms, log-binomial or Poisson regression models will be considered with risk ratios and their 97.5% confidence intervals reported, instead [85]. Similar analyses as described for the primary endpoints will be performed for these secondary proportions outcomes, but instead reporting 95% confidence intervals. A general linearized model to number of days of opioid use will be fitted along with the covariates described for the logistic regression models. An appropriate link function will be identified and used based on the distribution of the outcome data.

Exploratory analysis

Mixed findings in past research of consult services suggest that sex possibly could moderate START effectiveness [86–88]. We will conduct exploratory analyses to see if patient sex or gender, as well as race/ethnicity, has an effect on primary outcomes or retention. Adjusted odds ratios and their 95% confidence intervals will be calculated from interaction effects between treatment group and sex or gender from the specified linear models for the

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Table 2 SPIRIT (Standard Protocol Items: Recommendations for Interventional Trials) schedule of enrollment, interventions, and assessments

Timepoint	Study period				
	Enrollment	Post-enrollment			
	−T1	T1	0		T2
	Screening, consent	Baseline	Intervention (during hospital stay)	Intervention follow-up (post-discharge)	Follow-up interview (30–60 days post-discharge)
Eligibility screen	X				
Informed consent	X				
Randomization		X			
Interventions					
Intervention 1	X	X	X	X	X
Control	X	X			X
Assessments					
ASSIST	X				
Demographics	X				
MOUD utilization	X				X
Employment		X			X
Depression (PHQ-9)		X			X
Anxiety (GAD-7)		X			X
Social support (MSPSS)		X			
Overdoses		X			X
Pain intensity and frequency (PEG)		X			X
30-day opioid (and other substance) use (adapted from NSDUH)		X			X
SUD treatment utilization (adapted from NSDUH)		X			X
SUD healthcare and mental health utilization (adapted from GAIN)		X			X
Opinions about MOUD		X			
Severity of substance use (PROMIS)		X			X
Patient experience of stigma		X			
Significant other with OUD		X			
Criminal justice involvement		X			
Patient experience of chronic illness care (PACIC)					X
Therapeutic alliance (CAHPS)[a]					X
Satisfaction with START[a]					X

[a] Intervention group only

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Table 3 Outcome variables and endpoints

Outcome	Endpoint
Primary	
In-hospital initiation of MOUD	Proportion of patients in each arm who initiate MOUD prior to discharge, defined as use of any FDA-approved pharmacotherapy for OUD, including buprenorphine, naltrexone and methadone
Linkage to follow-up OUD care	Proportion of patients in each arm who attend at least one OUD-related care visit within 30 days of hospital discharge
Secondary	
OUD-specific discharge plan	Proportion of patients in each arm with an after-hospital care plan that specifies a date and time for a post-discharge addiction care appointment
Any post-discharge MOUD utilization	Proportion of patients in each arm who initiate MOUD or continue MOUD treatment within 30 days following hospital discharge
Post-discharge outpatient medical care	Proportion of patients in each arm who complete at least one visit to an outpatient medical provider within 30 days of hospital discharge
Past 30-day number of days with any opioid use	Mean (or median, depending on distribution) days of use in the past 30 days after hospital discharge

primary and secondary outcome measures. To explore possible mechanisms of how START works, we will conduct the following exploratory analyses: (1) assess the mediating effect of inpatient MOUD initiation on use of MOUD and linkage with OUD treatment post-discharge; (2) assess the mediating effect of completion of an OUD-specific discharge plan on linkage with OUD treatment 30 days post-discharge; (3) assess the moderating effects of patient characteristics (e.g., gender, race, ethnicity, insurance status, comorbid conditions, prior MOUD use) on medication initiation and post-discharge linkage. We will summarize bivariate relationships between site and patient characteristics. To evaluate how these relationships may affect endpoints, we will assess the interaction effects between site and these covariates from the regression models described for the primary and secondary analyses. Additionally, of interest is time to linkage to care following discharge. A Cox proportional hazards model will be fitted to the time to linkage with intervention arm and other relevant baseline characteristics as covariates, including age, insurance status (as a marker for income), race, and ethnicity. Additional covariates identified for the primary and secondary analyses may also be included. The proportional hazards assumption will be assessed. The relative risk and 95% CI for the two arms will reported and median times to linkage will be reported.

Sample size and power
A sample size of n = 414 (allowing for 20% attrition) and adjusted type I error rate of 2.5% provides 84% power to detect an odds ratio of 2.3 comparing the inpatient MOUD initiation rates in the START and UC arms, stratified on prior MOUD use. Based on literature, 14% of UC patients who are MOUD-naïve initiate MOUD in hospital [19]. Assuming the average of MOUD-naïve and MOUD-experienced inpatient MOUD initiation rates is 20%, we have an adequate sample size and power to detect this increase of inpatient MOUD initiation in the START arm (37%) compared to UC [19, 54, 89]. We base the sample size estimate on the linkage to care measure (Primary Endpoint 2) since the probabilities of successful linkage are lower than for inpatient MOUD initiation. Linkage to care rates reported in the literature range between 10 and 17% in usual care settings. To err on the side of caution, we estimate linkage to care in UC for MOUD-naïve and MOUD-experienced to be 5% and 10% [19, 54, 89, 90], respectively, yielding an average of 7.5%. We hypothesize that at least 20% of patients randomized to the START arm will link to OUD care (attend at least one OUD-related visit) within 30 days following discharge. Assuming a Bonferroni-corrected, two-sided type I error rate of 2.5% to adjust for two primary endpoints, we will enroll a minimum of 414 patients (207 in each intervention arm) to have 80% power to detect this difference. This estimate includes an adjustment for up to 20% attrition. This effect size corresponds to a clinically meaningful odds ratio of 3.0. Prior studies in different settings have found larger effects [54, 84, 90], supporting our ability to conduct this test. Sample size calculations for the primary endpoints were performed in PASS 14 using stratified Mantel–Haenszel tests for two proportions between two groups [91], with strata defined as 50% MOUD-naïve and 50% MOUD-experienced [54, 84, 90, 92, 93]. Due to the short 1 month duration of participation, subject withdrawal from the study is not anticipated to be significant.

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Table 4 Measures

Variable	Measure	Data source
Sociodemographics		
Age, sex (assigned at birth), gender identity, hispanic ethnicity, race, housing status	N/A	Eligibility screener
Marital status, income, education and insurance type	N/A	Baseline interview
Mental health status and symptoms		
Prior psychiatric diagnosis (bipolar disorder or schizophrenia)	N/A	Eligibility screener
Prior psychiatric hospitalization		
Depression (9 items)	PHQ-9 [106, 107]; GAD-7 [108–110]	Baseline interview
Anxiety (7 items)		1-month follow-up
Social support		
Social support: family, friends, significant other (6 items; 2 each scale)	Modified multidimensional scale of perceived social support [111]	Baseline interview 1-month follow-up
Medical symptoms/treatment		
Overdoses (lifetime, past 3 mos)	N/A	Baseline interview 1-month follow-up; EMR
Primary and secondary diagnosis (inpatient stay)	Medical or mental health conditions as determined by the inpatient physician	EMR
Pain intensity and duration	PEG [112]	Baseline interview 1-month follow-up
Length of hospital stay	Days in hospital	EMR
Substance use treatment history		
Ever used MOUD; times started an MOUD; type of MOUD; other treatment	N/A	Eligibility screener
Recent substance use treatment utilization; opinions; consequences; stigma		
SUD treatment utilization	Adapted from National Survey on Drug Use and Health (NSDUH) [113]	Baseline interview 1-month follow-up (validation through follow-up with service provider)
Healthcare utilization (ER, inpatient, outpatient) related to SUD (5 items)	Adapted from Global Appraisal of Individual Needs (GAIN) [114]	Baseline interview 1-month follow-up
Opinions about MOUD	Adapted opinions about MAT (OAMAT) [115]	Baseline interview
Severity of substance use	PROMIS	Baseline interview 1-month follow-up
Patient experience of stigma	Adapted from Grosso et al. [116]	Baseline interview
Patient experience of chronic illness care (11 items)	Patient Assessment of Chronic Illness Care (PACIC) [117]	1-month Follow-up
Criminal justice involvement	Locally developed	Baseline interview
Intervention—related		
Intervention "dose"; exposure	Amount time spent with patient number of encounters with patient	START registry (Deidentified)
Therapeutic alliance	Consumer Assessment of Healthcare Providers and Systems (CAHPS®) [118]	1-month follow-up (START only)
Satisfaction with START intervention	Locally developed	1-month follow-up (START only)

Discussion

The START, a collaborative care-informed consultative team, is proposed to increase adoption of evidence-based care and improve outcomes for hospitalized patients with OUD. Hospitals have extensive experience using care managers to improve in-hospital and follow-up care for several patient populations at high risk of readmission [94, 95], including acute medical patients [96], and some have a consultation service to support the medical team with patients in need of behavioral health care. More recently, addiction-focused consult teams have begun to emerge in hospitals across the United States and elsewhere [29, 31, 47, 49, 55–63]. However, patient-level randomized controlled trials are necessary to evaluate how addiction consult teams affect outcomes for hospitalized patients with OUD. The addiction consult team, along

Table 5 Fidelity and competency measures

Domain	Measure
Collaborative care processes [119]	
CM visit	Proportion of patients who saw CM at least one time
AMS visit	Proportion of patients who saw AMS at least one time
CM/AMS consultation	Proportion of patients who were discussed at least one time by CM and AMS
Follow-up	Proportion of patients who got at least 1 follow-up within 4 weeks after discharge
Evidence-based care: BNI [67]	
	Proportion of patients who got pros and cons
	Proportion of patients who got the readiness ruler
	Proportion of patients who got an OUD-focused action plan
Evidence-based care: RED [68, 69]	
	Proportion of patients for whom CM reviewed action plan prior to discharge
	Proportion of patients who reported that CM reviewed action plan in a way that they understood
	Proportion of patients for whom a follow-up appt was made prior to discharge
Competency using MI	
Baseline	CM and AMS reached "good" MI competency at baseline Motivational Interviewing Treatment Integrity scale (MITI) [120] (recorded interviews)
Midpoint	CM and AMS reached "good" MI competency at midpoint (recorded interviews)

with the evidenced-based tools and resources adapted for the START intervention, offers a novel, comprehensive approach for facilitating MOUD initiation in the hospital and linking patients to follow-up care for OUD. While other consult services described in the literature have additional professionals such as peer navigators and nurses on the team, [97, 98] we chose to test a foundational low-resource model, as many hospitals do not have the volume of patients with OUD to justify larger, more complex multidisciplinary consultation services. In future research additional models can be tested to identify core team members and components.

Our study is a multi-site, randomized pragmatic trial that will enroll patients at three diverse academic hospitals, allowing for a real-world implementation context, which will inform and potentially accelerate translation of the START into practice. Moreover, the START has potential for high impact because it can both improve public health and advance translational science. The undertreatment of OUD is an important public health and translational science problem. In 2015, 11.5 million individuals reported misusing opioids, and 1.9 million reported being addicted to opioids [99], yet fewer than 20% received any treatment [101]. By experimentally testing the effects of the START, this study could both improve public health by identifying an efficient and generalizable model to increase OUD treatment delivery and decrease the downstream effects of untreated OUD. This study can also advance translational science by identifying an effective and generalizable approach to address translational roadblocks that result in the undertreatment of substance use disorders and behavioral health conditions in hospital settings.

design and execution and manuscript review and revision. GM contributed to intervention development and execution, and manuscript preparation, review and revision. KEW contributed to study design and manuscript review and revision. TN contributed to study design and manuscript review and revision. ID contributed to the study design and execution, intervention development, will contribute to the analysis, and drafted the manuscript with AJO. All authors read and approved the final manuscript.

Availability of data and materials
The datasets generated and analyzed during this study are not publicly available due to the sensitive nature of the data. They can be made available from the corresponding author on reasonable request and with execution of appropriate Data Use Agreements.

Declarations

Ethics approval and consent to participate
The CSMC institutional review board (IRB) serves as the single-site IRB for the study. All patients must provide informed consent to participate.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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References

1. Centers for Disease Control National Center for Health Statistics. (2020). Wide-ranging online data for epidemiologic research (WONDER). Retrieved June 1 from http://wonder.cdc.gov. Accessed 15 Jan 2022.
2. Holland KM, Jones C, Vivolo-Kantor AM, Idaikkadar N, Zwald M, Hoots B, et al. Trends in US emergency department visits for mental health, overdose, and violence outcomes before and during the COVID-19 pandemic. JAMA Psychiat. 2021;78(4):372–9.
3. Soares WE 3rd, Melnick ER, Nath B, D'Onofrio G, Paek H, Skains RM, et al. Emergency department visits for nonfatal opioid overdose during the COVID-19 pandemic across six US health care systems. Ann Emerg Med. 2022;79(2):158–67.
4. Centers for Disease Control and Prevention. Vital statistics rapid release: providional overdose counts: centers for disease and prevention. 2021. https://www.cdc.gov/nchs/nvss/vsrr/drug-overdose-data.htm.
5. Bahorik AL, Satre DD, Kline-Simon AH, Weisner CM, Campbell CI. Alcohol, cannabis, and opioid use disorders, and disease burden in an integrated health care system. J Addict Med. 2017;11(1):3–9.
6. Hsu DJ, McCarthy EP, Stevens JP, Mukamal KJ. Hospitalizations, costs and outcomes associated with heroin and prescription opioid overdoses in the United States 2001–12. Addiction. 2017;112(9):1558–64.
7. Singh JA, Cleveland JD. National U.S. time-trends in opioid use disorder hospitalizations and associated healthcare utilization and mortality. PLoS ONE. 2020;15(2):e0229174.
8. Ronan MV, Herzig SJ. Hospitalizations related to opioid abuse/dependence and associated serious infections increased sharply, 2002–12. Health Aff. 2016;35(5):832–7.
9. Fingar KR, Owens PL. Opioid-related and stimulant-related adult inpatient stays, 2012–2018. In: Agency for healthcare research and quality, editor. Statistical Brief #271 ed. Rockville; 2021.
10. Larochelle MR, Bernson D, Land T, Stopka TJ, Wang N, Xuan Z, et al. Medication for opioid use disorder after nonfatal opioid overdose and association with mortality: a cohort study. Ann Intern Med. 2018. https://doi.org/10.7326/M17-3107.
11. Volkow ND, Frieden TR, Hyde PS, Cha SS. Medication-assisted therapies—tackling the opioid-overdose epidemic. N Engl J Med. 2014;370(22):2063–6.
12. Tsui JI, Evans JL, Lum PJ, Hahn JA, Page K. Association of opioid agonist therapy with lower incidence of hepatitis C virus infection in young adult injection drug users. JAMA Intern Med. 2014;174(12):1974–81.
13. Naeger S, Mutter R, Ali MM, Mark T, Hughey L. Post-discharge treatment engagement among patients with an opioid-use disorder. J Subst Abuse Treat. 2016;69:64–71.
14. Reif S, Acevedo A, Garnick DW, Fullerton CA. Reducing behavioral health inpatient readmissions for people with substance use disorders: do follow-up services matter? Psychiatr Serv. 2017;68(8):810–8.
15. Rosenthal ES, Karchmer AW, Theisen-Toupal J, Castillo RA, Rowley CF. Suboptimal addiction interventions for patients hospitalized with injection drug use-associated infective endocarditis. Am J Med. 2016;129(5):481–5.
16. Fanucchi L, Lofwall MR. Putting parity into practice—integrating opioid-use disorder treatment into the hospital setting. N Engl J Med. 2016;375(9):811–3.
17. Binswanger IA. Commentary on Hsu, et al. (2017): a systems approach to improving health services for overdose in the hospital and across the continuum of care-an unmet need. Addiction. 2017;112(9):1565–6.
18. Peterson C, Xu L, Mikosz CA, Florence C, Mack KA. US hospital discharges documenting patient opioid use disorder without opioid overdose or treatment services, 2011–2015. J Subst Abuse Treat. 2018;92:35–9.
19. Nordeck CD, Welsh C, Schwartz RP, Mitchell SG, Cohen A, O'Grady KE, et al. Rehospitalization and substance use disorder (SUD) treatment entry among patients seen by a hospital SUD consultation–liaison service. Drug Alcohol Depend. 2018;186:23–8.
20. Walley AY, Paasche-Orlow M, Lee EC, Forsythe S, Chetty VK, Mitchell S, et al. Acute care hospital utilization among medical inpatients discharged with a substance use disorder diagnosis. J Addict Med. 2012;6(1):50–6.
21. Gupta A, Nizamuddin J, Elmofty D, Nizamuddin SL, Tung A, Minhaj M, et al. Opioid abuse or dependence increases 30-day readmission rates after major operating room procedures: a national readmissions database study. Anesthesiology. 2018;128(5):880–90.
22. Stewart S, Swain S. Assessment and management of alcohol dependence and withdrawal in the acute hospital: concise guidance. Clin Med. 2012;12(3):266–71.
23. Pecoraro A, Horton T, Ewen E, Becher J, Wright PA, Silverman B, et al. Early data from project engage: a program to identify and transition medically hospitalized patients into addictions treatment. Addict Sci Clin Pract. 2012;7:20.
24. Pollini RA, O'Toole TP, Ford D, Bigelow G. Does this patient really want treatment? Factors associated with baseline and evolving readiness for change among hospitalized substance using adults interested in treatment. Addict Behav. 2006;31(10):1904–18.
25. Velez CM, Nicolaidis C, Korthuis PT, Englander H. "It's been an experience, a life learning experience": a qualitative study of hospitalized patients with substance use disorders. J Gen Intern Med. 2017;32(3):296–303.
26. Englander H, Weimer M, Solotaroff R, Nicolaidis C, Chan B, Velez C, et al. Planning and designing the Improving Addiction Care Team (IMPACT) for hospitalized adults with substance use disorder. J Hosp Med. 2017;12(5):339–42.
27. Huhn AS, Tompkins DA, Dunn KE. The relationship between treatment accessibility and preference amongst out-of-treatment individuals who engage in non-medical prescription opioid use. Drug Alcohol Depend. 2017;180:279–85.
28. Bhatraju EP, Ludwig-Barron N, Takagi-Stewart J, Sandhu HK, Klein JW, Tsui JI. Successful engagement in buprenorphine treatment among

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hospitalized patients with opioid use disorder and trauma. Drug Alcohol Depend. 2020;215:108253.

29. Brothers TD, Fraser J, MacAdam E, Morgan B, Francheville J, Nidumolu A, et al. Implementation and evaluation of a novel, unofficial, trainee-organized hospital addiction medicine consultation service. Substance abuse. 2021;42(4):433–7.

30. Button D, Hartley J, Robbins J, Levander XA, Smith NJ, Englander H. Low-dose buprenorphine initiation in hospitalized adults with opioid use disorder: a retrospective cohort analysis. J Addict Med. 2022;16(2):e105–e11.

31. Trowbridge P, Weinstein ZM, Kerensky T, Roy P, Regan D, Samet JH, et al. Addiction consultation services—linking hospitalized patients to outpatient addiction treatment. J Subst Abus Treat. 2017;79:1–5.

32. Wakeman SE, Kane M, Powell E, Howard S, Shaw C, Kehoe L, et al. A hospital-wide initiative to redesign substance use disorder care: impact on pharmacotherapy initiation. Subst Abus. 2021;42(4):767–74.

33. Kennedy AJ, Wessel CB, Levine R, Downer K, Raymond M, Osakue D, et al. Factors associated with long-term retention in buprenorphine-based addiction treatment programs: a systematic review. J Gen Intern Med. 2022;37(2):332–40.

34. Calcaterra SL, Binswanger IA, Edelman EJ, McNair BK, Wakeman SE, O'Connor PG. The impact of access to addiction specialist on attitudes, beliefs and hospital-based opioid use disorder related care: a survey of hospitalist physicians. Subst Abus. 1–9.

35. Wakeman SE, Pham-Kanter G, Donelan K. Attitudes, practices, and preparedness to care for patients with substance use disorder: Results from a survey of general internists. Subst Abus. 2016;37(4):635–41.

36. Hussain M, Seitz D. Integrated models of care for medical inpatients with psychiatric disorders: a systematic review. Psychosomatics. 2014;55(4):315–25.

37. Institute of Medicine. Improving the quality of health care for mental and substance-use conditions: quality chasm series. Appendix B, constraints on sharing mental health and substance-use treatment information imposed by federal and state medical records privacy laws. Washington: National Academies Press; 2006.

38. Raven MC, Carrier ER, Lee J, Billings JC, Marr M, Gourevitch MN. Substance use treatment barriers for patients with frequent hospital admissions. J Subst Abus Treat. 2010;38(1):22–30.

39. Madras BK, N. J. Ahmad, J. Wen, J. Sharfstein, and the Prevention, Treatment, and Recovery Working Group of the Action Collaborative on Countering the U.S. Opioid Epidemic. Improving access to evidence-based medical treatment for opioid use disorder: strategies to address key barriers within the treatment system. NAM Perspect Discus P. 2020; https://doi.org/10.31478/202004b.

40. DiClemente CC, Norcross JC. In search of how people change: applications to addictive behaviors. Am Psychol. 1992;47(9):1102–14.

41. Gregoire TK, Burke AC. The relationship of legal coercion to readiness to change among adults with alcohol and other drug problems. J Subst Abus Treat. 2004;26(1):35–41.

42. Opsal A, Kristensen Ø, Clausen T. Readiness to change among involuntarily and voluntarily admitted patients with substance use disorders. Subst Abus Treat Prev Policy. 2019;14(1):47.

43. Kopera M, Suszek H, Bonar E, Myszka M, Gmaj B, Ilgen M, et al. Evaluating explicit and implicit stigma of mental illness in mental health professionals and medical students. Community Ment Health J. 2015;51(5):628–34.

44. Stull LG, McGrew JH, Salyers MP, Ashburn-Nardo L. Implicit and explicit stigma of mental illness: attitudes in an evidence-based practice. J Nerv Ment Dis. 2013;201(12):1072–9.

45. Wakeman SE, Kanter GP, Donelan K. Institutional substance use disorder intervention improves general internist preparedness, attitudes, and clinical practice. J Addict Med. 2017;11(4):308–14.

46. Englander H, Dobbertin K, Lind BK, Nicolaidis C, Graven P, Dorfman C, et al. Inpatient addiction medicine consultation and post-hospital substance use disorder treatment engagement: a propensity-matched analysis. J Gen Intern Med. 2019;34(12):2796–803.

47. Marks LR, Munigala S, Warren DK, Liang SY, Schwarz ES, Durkin MJ. Addiction medicine consultations reduce readmission rates for patients with serious infections from opioid use disorder. Clin Infect Dis. 2019;68(11):1935–7.

48. Barocas JA, Savinkina A, Adams J, Jawa R, Weinstein ZM, Samet JH, et al. Clinical impact, costs, and cost-effectiveness of hospital-based strategies for addressing the US opioid epidemic: a modelling study. Lancet Public Health. 2022;7(1):e56–64.

49. Braithwaite V, Ti L, Fairbairn N, Ahamad K, McLean M, Harrison S, et al. Building a hospital-based addiction medicine consultation service in Vancouver, Canada: the path taken and lessons learned. Addiction. 2021;116(7):1892–900.

50. Calcaterra SL, Lockhart S, Callister C, Hoover K, Binswanger IA. Opioid use disorder treatment initiation and continuation: a qualitative study of patients who received addiction consultation and hospital-based providers. J Gen Intern Med. 2022;1–9. https://doi.org/10.1007/s11606-021-07305-3.

51. Priest KC, McCarty D. Making the business case for an addiction medicine consult service: a qualitative analysis. BMC Health Serv Res. 2019. https://doi.org/10.1186/s12913-019-4670-4.

52. Priest KC, Englander H, McCarty D. "Now hospital leaders are paying attention": a qualitative study of internal and external factors influencing addiction consult services. J Subst Abus Treat. 2020;110:59–65.

53. Gryczynski J, Nordeck CD, Welsh C, Mitchell SG, O'Grady KE, Schwartz RP. Preventing hospital readmission for patients with comorbid substance use disorder : a randomized trial. Ann Intern Med. 2021;174(7):899–909.

54. Liebschutz JM, Crooks D, Herman D, Anderson B, Tsui J, Meshesha LZ, et al. Buprenorphine treatment for hospitalized, opioid-dependent patients: a randomized clinical trial. JAMA Intern Med. 2014;174(8):1369–76.

55. Tran TH, Swoboda H, Perticone K, Ramsey E, Thompson H, Hill K, et al. The substance use intervention team: a hospital-based intervention and outpatient clinic to improve care for patients with substance use disorders. Am J Health Syst Pharm. 2021;78(4):345–53.

56. Thompson HM, Faig W, VanKim NA, Sharma B, Afshar M, Karnik NS. Differences in length of stay and discharge destination among patients with substance use disorders: the effect of Substance Use Intervention Team (SUIT) consultation service. PLoS ONE. 2020;15(10):e0239761.

57. Calcaterra SL, McBeth L, Keniston AM, Burden M. The development and implementation of a hospitalist-directed addiction medicine consultation service to address a treatment gap. J Gen Intern Med. 2021. https://doi.org/10.1007/s11606-021-06849-8.

58. Martin M, Snyder HR, Coffa D, Steiger S, Clement JP, Ranji SR, et al. Time to ACT: launching an Addiction Care Team (ACT) in an urban safety-net health system. BMJ Open Qual. 2021;10(1):e001111.

59. McNeely J, Troxel AB, Kunins HV, Shelley D, Lee JD, Walley A, et al. Study protocol for a pragmatic trial of the Consult for Addiction Treatment and Care in Hospitals (CATCH) model for engaging patients in opioid use disorder treatment. Addict Sci Clin Pract. 2019. https://doi.org/10.1186/s13722-019-0135-7.

60. McWilliams C, Bonnie K, Robinson S, Johnson C, Puyat JH, Klimas J. Preliminary results of psychiatric inpatients referred to an addiction medicine consult service. J Addict Med. 2020;14(4):352–3.

61. Nordeck CD, Welsh C, Schwartz RP, Mitchell SG, Cohen A, O'Grady KE, et al. Rehospitalization and substance use disorder (SUD) treatment entry among patients seen by a hospital SUD consultation-liaison service. Drug Alcohol Depend. 2018;186:23–9.

62. Wakeman SE, Metlay JP, Chang Y, Herman GE, Rigotti NA. Inpatient addiction consultation for hospitalized patients increases post-discharge abstinence and reduces addiction severity. J Gen Intern Med. 2017;32(8):909–16.

63. D'Amico MJ, Walley AY, Cheng DM, Forman LS, Regan D, Yurkovic A, et al. Which patients receive an addiction consult? A preliminary analysis of the INREACH (INpatient REadmission post-Addiction Consult Help) study. J Subst Abuse Treat. 2019;106:35–42.

64. Rosen L, Manor O, Engelhard D, Zucker D. In defense of the randomized controlled trial for health promotion research. Am J Public Health. 2006;96(7):1181–6.

65. Katon WJ, Lin EH, Von Korff M, Ciechanowski P, Ludman EJ, Young B, et al. Collaborative care for patients with depression and chronic illnesses. N Engl J Med. 2010;363(27):2611–20.

66. Katon W, Unutzer J, Wells K, Jones L. Collaborative depression care: history, evolution and ways to enhance dissemination and sustainability. Gen Hosp Psychiatry. 2010;32(5):456–64.

Ober *et al. Addiction Science & Clinical Practice*   (2022) 17:39

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67. Leiter RE, Yusufov M, Hasdianda MA, Fellion LA, Reust AC, Block SD, Tulsky JA, Ouchi K. Fidelity and Feasibility of a Brief Emergency Department Intervention to Empower Adults With Serious Illness to Initiate Advance Care Planning Conversations. J Pain Symptom Manage. 2018;56(6):878–885. https://doi.org/10.1016/j.jpainsymman.2018.09.003.

68. Jack BW, Chetty VK, Anthony D, Greenwald JL, Sanchez GM, Johnson AE, et al. A reengineered hospital discharge program to decrease rehospitalization: a randomized trial. Ann Intern Med. 2009;150(3):178–87.

69. Re-Engineered Discharge (RED) Toolkit. Content last reviewed February 2020. Agency for Healthcare Research and Quality, Rockville, MD. https://www.ahrq.gov/patient-safety/settings/hospital/red/toolkit/index.html. Accessed 15 Jan 2022.

70. Humeniuk R, Ali R, Babor TF, Farrell M, Formigoni ML, Jittiwutikarn J, et al. Validation of the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST). Addiction. 2008;103(6):1039–47.

71. Alford DP, LaBelle CT, Kretsch N, Bergeron A, Winter M, Botticelli M, et al. Collaborative care of opioid-addicted patients in primary care using buprenorphine: five-year experience. Arch Intern Med. 2011;171(5):425–31.

72. Katon W, Von Korff M, Lin E, Simon G, Walker E, Unutzer J, et al. Stepped collaborative care for primary care patients with persistent symptoms of depression: a randomized trial. Arch Gen Psychiatry. 1999;56(12):1109–15.

73. AIMS Center. Principles of Collaborative Care: Unviersity of Washington. 2021. https://aims.uw.edu/collaborative-care/principles-collaborative-care. Accessed 28 Jan 2022.

74. D'Onofrio G, Pantalon MV, Degutis LC, Larkin GL, O'Connor PG, Fiellin DA. Project Ed Health III: BNT training manual for opioid dependent patients in the emergency department. New Haven: Yale University School of Medicine; 2009.

75. D'Onofrio G, O'Connor PG, Pantalon MV, Chawarski MC, Busch SH, Owens PH, et al. Emergency department-initiated buprenorphine/naloxone treatment for opioid dependence: a randomized clinical trial. JAMA. 2015;313(16):1636–44.

76. Miller WR, Rollnick S. Motivational interviewing: helping people change. 3rd ed. New York: Guildford Press; 2013.

77. Substance Abuse and Mental Health Services Administration. SAMHSA's concept of trauma and guidance for a trauma-informed approach. Rockville: Substance Abuse and Mental Health Services Administration; 2014.

78. Dahlby L, Kerr T. PTSD and opioid use: implications for intervention and policy. Subst Abuse Treat Prev Policy. 2020;15(1):22.

79. Ecker AH, Hundt N. Posttraumatic stress disorder in opioid agonist therapy: a review. Psychol Trauma. 2018;10(6):636–42.

80. Substance Abuse and Mental Health Services Administration. TIP 59: a treatment improvement protocol: improving cultural competence. Rockville: U.S. Department of Health and Human Services Substance Abuse and Mental Health Services Administration; 2014.

81. California Department of Health Care Services. California bridge program tools and resources Oakland, CA: The Public Health Institute. 2021. https://cabridge.org/tools/resources/. Accessed 21 Jan 2022.

82. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)–a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. 2009;42(2):377–81.

83. Seaman SR, White IR, Copas AJ, Li L. Combining multiple imputation and inverse-probability weighting. Biometrics. 2012;68(1):129–37.

84. Lee CS, Liebschutz JM, Anderson BJ, Stein MD. Hospitalized opioid-dependent patients: exploring predictors of buprenorphine treatment entry and retention after discharge. Am J Addict. 2017;26(7):667–72.

85. Spiegelman D, Hertzmark E. Easy SAS calculations for risk or prevalence ratios and differences. Am J Epidemiol. 2005;162(3):199–200.

86. Grubbs KM, Cheney AM, Fortney JC, Edlund C, Han X, Dubbert P, et al. The role of gender in moderating treatment outcome in collaborative care for anxiety. Psychiatr Serv. 2015;66(3):265–71.

87. Brooks HL, O'Brien DC, Salvalaggio G, Dong K, Hyshka E. Uptake into a bedside needle and syringe program for acute care inpatients who inject drugs. Drug Alcohol Rev. 2019;38(4):423–7.

88. Nordeck CD, Welsh C, Schwartz RP, Mitchell SG, O'Grady KE, Gryczynski J. Opioid agonist treatment initiation and linkage for hospitalized patients seen by a substance use disorder consultation service. Drug Alcohol Depend Rep. 2022;2:100031.

89. Trowbridge P, Weinstein ZM, Kerensky T, Roy P, Regan D, Samet JH, et al. Addiction consultation services—linking hospitalized patients to outpatient addiction treatment. J Subst Abuse Treat. 2017;79:1–5.

90. Cushman PA, Liebschutz JM, Anderson BJ, Moreau MR, Stein MD. Buprenorphine initiation and linkage to outpatient buprenorphine do not reduce frequency of injection opiate use following hospitalization. J Subst Abuse Treat. 2016;68:68–73.

91. The Comprehensive R Archive Network. Power analysis functions along the lines of Cohen. 1988. https://CRAN.R-project.org/package=pwr.

92. NCSS 2020 Statistical Software (2020). NCSS, LLC. Kaysville, Utah, USA. http://ncss.com/software/ncss. Accessed 18 July 2022.

93. R Core Team. R: A language and environment for statistical computing. Vienna: R Foundation for Statistical Computing; 2017.

94. Adib-Hajbaghery M, Maghaminejad F, Abbasi A. The role of continuous care in reducing readmission for patients with heart failure. J caring sci. 2013;2(4):255–67.

95. Naylor MD, Brooten D, Campbell R, Jacobsen BS, Mezey MD, Pauly MV, et al. Comprehensive discharge planning and home follow-up of hospitalized elders—a randomized clinical trial. JAMA. 1999;281(7):613–20.

96. Bielaszka-DuVernay C. Redesigning acute care processes in Wisconsin. Health Aff. 2011;30(3):422–5.

97. French R, Aronowitz SV, Brooks Carthon JM, Schmidt HD, Compton P. Interventions for hospitalized medical and surgical patients with opioid use disorder: A systematic review. Substance abuse. 2021:1-13.

98. Priest KC, McCarty D. The role of the hospital in the 21st century opioid overdose epidemic: the addiction medicine consult service. J Addict Med. 2019;13(2):104–12.

99. Davenport S, Matthews K. Milliman White Paper: opioid use disorder in the United States: diagnosed prevalence by payer, age, sex, and state. Seattle: Milliman; 2018.

100. Center for Behavioral Health Statistics and Quality (CBHSQ). 2016 Results from the 2015 National Survey on Drug Use and Health: detailed tables. http://www.samhsa.gov/data/sites/default/files/NSDUH-DetTabs-2015/NSDUH-DetTabs-2015/NSDUH-DetTabs-2015.pdf.

101. Wu L-T, Zhu H, Swartz MS. Treatment utilization among persons with opioid use disorder in the United States. Drug Alcohol Depend. 2016;169:117–27.

102. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th ed. DC: American Society of Addictive Medicine; 2013.

103. American Society of Addiction Medicine (ASAM). What is the ASAM criteria?. 2018. https://www.asam.org/resources/the-asam-criteria/about.

104. Boston University School of Public Health. The Brief Negotiated Interview (BNI). https://www.bu.edu/bniart/sbirt-in-health-care/sbirt-brief-negotiated-interview-bni/. Accessed 21 Jan 2022.

105. Yale University School of Medicine. BNI for opioid use disorders. 2018. https://medicine.yale.edu/sbirt/opioidusedisorders.aspx. Accessed 21 Jan 2022.

106. Gelaye B, Tadesse MG, Williams MA, Fann JR, Vander Stoep A, Andrew Zhou XH. Assessing validity of a depression screening instrument in the absence of a gold standard. Ann Epidemiol. 2014;24(7):527–31.

107. Kroenke K, Spitzer RL, Williams J. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med. 2001;16(9):606–13.

108. Löwe B, Decker O, Müller S, Brähler E, Schellberg D, Herzog W, et al. Validation and standardization of the Generalized Anxiety Disorder screener (GAD-7) in the general population. Med Care. 2008;46(3):266–74.

109. Ruiz M, Zamorano E, García-Campayo J, Pardo A, Freire O, Rejas J. Validity of the GAD-7 scale as an outcome measure of disability in patients with generalized anxiety disorders in primary care. J Affect Disord. 2011;128(3):277–86.

110. Spitzer R, Kroenke K, Williams JBL. A brief measure for assessing generalized anxiety disorder: the GAD-7. Arch Intern Med. 2006;166(10):1092–7.

111. Zimet GD, Powell SS, Farley GK, Werkman S, Berkoff KA. Psychometric characteristics of the multidimensional scale of perceived social support. J Pers Assess. 1990;55(3–4):610–7.

112. Krebs EE, Lorenz KA, Bair MJ, Damush TM, Wu J, Sutherland JM, et al. Development and initial validation of the PEG, a three-item

scale assessing pain intensity and interference. J Gen Intern Med. 2009;24(6):733–8.

113. Center for Behavioral Health Statistics and Quality. National Survey on Drug Use and Health (NSDUH): CAI specifications for programming (English Version). Rockville: Substance Abuse and Mental Health Services Administration; 2019.

114. Dennis ML. Global Appraisal of Individual Needs (GAIN): administration guide for the gain and related measures. Bloomington: Chestnut Health Systems; 2003.

115. Friedmann PD, Wilson D, Knudsen HK, Ducharme LJ, Welsh WN, Frisman L, et al. Effect of an organizational linkage intervention on staff perceptions of medication-assisted treatment and referral intentions in community corrections. J Subst Abuse Treat. 2015;50:50–8.

116. Grosso AL, Ketende SC, Stahlman S, Ky-Zerbo O, Ouedraogo HG, Kouanda S, et al. Development and reliability of metrics to characterize types and sources of stigma among men who have sex with men and female sex workers in Togo and Burkina Faso. BMC Infect Dis. 2019;19(1):208.

117. Glasgow RE, Wagner EH, Schaefer J, Mahoney LD, Reid RJ, Greene SM. Development and validation of the Patient Assessment of Chronic Illness Care (PACIC). Med Care. 2005;43(5):436–44.

118. Agency for Healthcare Research and Quality. CAHPS ECHO Survey Measures Rockville: Agency for Healthcare Research and Quality. 2018. https://www.ahrq.gov/cahps/surveys-guidance/echo/about/survey-measures.html.

119. Bao YDB, Jung HY, Chan YF, Unützer J. Unpacking collaborative care for depression: examining two essential tasks for implementation. Psychiatr Serv. 2016;67:418–24.

120. Moyers TB, Manuel JK, Ernst D. Motivational Interviewing Treatment Integrity Coding Manual 4.1. 2014. Unpublished manual.

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