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Effect of a peer-led emergency department behavioral intervention on non-fatal opioid overdose: 18-month outcome in the Navigator randomized controlled trial

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Abstract

Background and Aims: Emergency departments (EDs) provide an opportunity to identify people at risk of overdose and reduce risk. We evaluated the effect of an ED behavioral intervention delivered by peer recovery support specialists (PRSS) on non-fatal opioid overdose.

Design: Two-arm, randomized trial.

Setting: Two EDs in Rhode Island, USA.

Participants: ED patients presenting with an opioid overdose, complications of opioid use disorder, or a recent history of opioid overdose (November 2018-May 2021). Among 648 participants, the mean age was 36.9 years, 68.2% were male, and 68.5% were White.

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Intervention and comparator: Participants were randomized to receive a behavioral intervention from a PRSS (n=323) or a licensed clinical social worker (LICSW) (n=325). PRSS and LICSW used evidence-based interviewing and intervention techniques, informed by their lived experience (PRSS) or clinical theory and practice (LICSW).

Measurements: We identified non-fatal opioid overdoses in the 18 months following the ED visit through linkage to statewide emergency medical services data using a validated case definition. The primary outcome was any non-fatal opioid overdose during the 18-month follow-up period.

Findings: Among 323 participants randomized to the PRSS arm, 81 (25.1%) had a non-fatal opioid overdose during follow-up compared with 95 (29.2%) of 325 participants randomized to the LICSW arm (p=0.24). There was no statistically significant difference in the effectiveness of randomization to the PRSS arm versus LICSW arm on risk of non-fatal opioid overdose, adjusting for history of previous overdose (relative risk=0.86, 95% confidence interval=0.67–1.11).

Conclusions: In Rhode Island, USA, over one-in-four emergency department patients at high risk of overdose experiences a non-fatal opioid overdose in the 18 months post-discharge. We found no evidence that risk of non-fatal opioid overdose differs for emergency department patients receiving a behavioral intervention from a peer recovery support specialist versus a licensed clinical social worker.

Keywords

opioid overdose; drug overdose; opioid-related disorders; substance use; behavioral intervention; peer recovery specialist; social work

INTRODUCTION

Overdose deaths have risen to crisis levels in the United States, largely driven by synthetic opioids such as fentanyl [1]. Non-fatal opioid overdoses are an important predictor of future overdose death [2, 3], and emergency departments (EDs) provide an opportunity to identify people at high risk of overdose and offer services to reduce risk. ED interventions may include initiation of a medication for opioid use disorder, provision of behavioral counseling, provision of take-home naloxone, and referral to addiction treatment, among others [4].

Some EDs now offer behavioral interventions with peer recovery support specialists (PRSS) to patients with a substance use disorder (SUD) [5–7]. Peer recovery support has a long history within community-based programs [8], though few studies have rigorously evaluated the outcomes of such services, particularly in EDs [9–12]. One pragmatic cluster randomized trial comparing a PRSS-led ED behavioral intervention versus a control condition (provision of take-home naloxone and a list of community-based treatment resources) for patients with opioid-related ED visits in Indiana suggested that there was no benefit of PRSS compared to standard care [11]. In contrast, a retrospective difference-in-differences analysis found that implementation of a PRSS-led ED behavioral intervention for patients treated for opioid overdose at New Jersey hospitals was associated with a higher rate of treatment initiation and a lower risk of repeat overdose, although outcomes varied substantially by hospital and time since program implementation [12].

We conducted a randomized controlled trial to evaluate the effectiveness of ED behavioral interventions delivered by a PRSS versus a licensed clinical social worker (LICSW). We previously reported that 30-day SUD treatment engagement was similar across randomization arms [13]. The present report focuses on the effectiveness of the PRSS intervention for reducing non-fatal opioid overdose risk in the 18 months following ED discharge. We hypothesized that the PRSS intervention would result in a greater reduction in non-fatal opioid overdose risk than the LICSW intervention (pre-published).

METHODS

Design

We conducted a parallel, two-arm, randomized trial of an ED behavioral intervention delivered by a certified PRSS compared to one delivered by an ED LICSW, among ED patients at high risk of opioid overdose in Providence, Rhode Island [13, 14]. Participants were randomized 1:1 between the two intervention arms and followed for 18 months to evaluate health outcomes. An 18-month follow-up period was selected based on sample size and power considerations (i.e., to permit sufficient power to detect effects, if present). Of note, we had planned to include a second control group of participants who declined any behavioral intervention, both as a part of the study and their clinical care; however, recruitment for this arm was stopped after six months because eligible patients were also declining participation in the trial.

The detailed Navigator Trial protocol has been published previously (NCT03684681, posted September 26, 2018) [14]. The protocol was approved by the study sites and Rhode Island Department of Health (RIDOH) institutional review boards.

Participants

Setting.—Trial participants were recruited at two EDs within the largest medical system in Providence, Rhode Island. One ED is a level 1 trauma center at an academic tertiary care hospital, and the other is a level 2 trauma center at a high-volume, community-based affiliate hospital. Rhode Island has just under 1.1 million residents [15] and, in 2021, had the 15th highest rate of drug overdose deaths per 100,000 residents in the United States [16]. In 2022, the two study EDs provided care for more than 60% of patients presenting to EDs with opioid overdose in Rhode Island [17].

Eligibility and exclusion criteria.—Adult ED patients were eligible for participation in the trial if they were residents of Rhode Island and were being treated in the ED for opioid overdose or complications of an opioid use disorder (e.g., opioid withdrawal or an injection-related infection) or had experienced an opioid overdose in the past year. Patients were excluded from participation if they had previously enrolled in the trial, had already received a behavioral intervention, did not speak English, or were critically ill or injured, pregnant, incarcerated, in police custody, or unable to provide informed consent.

Procedures

Recruitment.—From November 15, 2018, to May 31, 2021, one of 11 research assistants employed by the study EDs recruited trial participants 24 hours per day, seven days per week. We paused recruitment in April and May 2020 because of the COVID-19 pandemic. The research assistants identified potential participants through review of electronic medical records and referral from ED providers. Once a potential participant was identified, the research assistant introduced the trial, described the study procedures in detail, reviewed the consent form, and discussed questions and concerns with the patient. Following this discussion, the research assistant obtained written, informed consent from eligible and interested patients, including for use of their electronic health record data and linkage of their study data with statewide administrative data to assess study outcomes.

Randomization.—We randomly assigned participants (1:1) to one of the two intervention arms using permuted block sizes and stratification by study site, age (<50 vs. ≥50 years), and sex at birth. A study data manager who was not involved in data collection or analysis developed and concealed the allocation sequence using the REDCap randomization feature [18, 19].

Blinding.—Due to the nature of the interventions, participants, providers, and onsite research staff were not blinded to intervention assignment. However, the RIDOH biostatistician who conducted the administrative data linkages for ascertainment of the study outcomes was blinded to intervention assignment.

Interventions

During the study period, the standard of care at the study sites was for ED patients treated for opioid overdose to receive a behavioral intervention with either a PRSS or LICSW, though this was not necessarily the case for other patients with an opioid use disorder. In usual practice, the specialist who provides the intervention typically depends on staff availability, the time of day, and the preferences of the treating physician. Both PRSS and LICSW aim to address the short- and long-term health and social needs of patients, such as access to naloxone, addiction treatment, housing, and transportation.

In this trial, we used the existing intervention infrastructure at the study sites but randomly assigned participants to receive a behavioral intervention from either (1) a PRSS or (2) a LICSW (see Table 1). We did not monitor or control intervention fidelity because this was a pragmatic trial.

PRSS.—Since 2014, certified PRSS from the Anchor Recovery Community Center's "Anchor ED" outreach program have provided support to patients with opioid use disorders at all EDs in Rhode Island [20]. Through the Anchor ED program, certified PRSS use a range of evidence-based interviewing and intervention techniques, along with their lived experience, to evaluate patients for readiness to seek treatment, provide referrals to treatment, help patients navigate barriers to treatment, and provide overdose prevention education. Following ED discharge, PRSS reach out to the patient daily for up to 10 days to initiate a community-based follow-up plan for regular contact. In the first 48 hours

following discharge, PRSS aim to help patients navigate emerging barriers to treatment and recovery, as well as provide ongoing peer support and overdose prevention education. For the subsequent 90 days, PRSS work with patients to support retention in treatment and provide ongoing peer support and overdose prevention education. Patients have the option to opt-in for support beyond 90 days.

To become a certified PRSS through the Anchor Recovery Community Center, applicants must have been in recovery for at least two years, participate in a 45-hour training program based on the Connecticut Community for Addiction Recovery curriculum, complete at least 500 hours of supervised work providing peer recovery support services, and obtain certification from the International Certification and Reciprocity Consortium [20]. Across the two study sites, there were 30 PRSS available to deliver the ED behavioral intervention, in accordance with their standard practice, within 30 minutes of a request.

LICSW.—Staff LICSW employed by the study sites are also trained in a variety of evidence-based interviewing and intervention techniques, though their approach with patients is grounded in clinical experience and social work theory and practice models (e.g., task-centered practice, cognitive behavioral therapy, crisis intervention) rather than lived experience. For ED patients with an opioid use disorder, LICSW provide a behavioral intervention based on their range of interviewing and intervention techniques, as well as other clinical skills, and provide referrals to treatment. LICSW typically do not interact with patients following discharge from the ED. Across the two study sites, there were 35 staff LICSW available to deliver the ED behavioral intervention, in accordance with their standard practice, within 30 minutes of a request.

Measures

The pre-specified trial endpoints were SUD treatment engagement within 30 days and non-fatal opioid overdose within 18 months following the index ED visit. We previously reported on treatment engagement [13]; the present report focuses on non-fatal opioid overdose.

Primary outcome.—The pre-specified primary outcome was any non-fatal opioid overdose within 18 months following the index ED visit. We identified post-discharge, non-fatal opioid overdoses through linkage to statewide emergency medical services (EMS) data from RIDOH using a validated case definition [21]. Non-fatal opioid overdoses that occurred on the date of the index ED visit were excluded. We assumed that all participants had a complete 18 months of follow-up time to evaluate non-fatal opioid overdose due to the use of statewide EMS data, though overdoses that occurred out of state or were not medically attended were not captured.

Secondary outcomes.—As secondary outcomes, we considered time to first non-fatal opioid overdose, death due to any cause, and death due to opioid overdose in the up to 18 months following the index ED visit. All-cause mortality was included as a secondary outcome due to the potential effect of some intervention services on health and well-being beyond reducing risk of overdose. We identified deaths and the associated cause of death through linkage to statewide vital records data from RIDOH. Although we used statewide

data to evaluate the fatality outcomes, some participants did not have a full 18 months of follow-up time available due to the longer period for RIDOH to finalize the fatality data (up to one year).

Baseline measures.—In multivariable analyses, we considered key baseline characteristics hypothesized to be associated with risk of opioid overdose as potential covariates, including the block randomization variables (study site, age, and sex at birth) and lifetime history of overdose as of the index ED visit. Participants were classified as having history of overdose if their index ED visit was due to opioid overdose or they responded "Yes" to the question "Have you ever overdosed by accident?" on the baseline study questionnaire. Other baseline measures summarized to characterize the study sample included gender identity, race, ethnicity, health insurance status, employment status, reason for the index ED visit, and lifetime history of unstable housing, injecting drugs, and addiction treatment.

Sample size

Based on prior electronic health record data from one of the study sites and estimates in the literature [22, 23]. we assumed that 15% of participants in the LICSW arm would experience a non-fatal opioid overdose in the 18 months following ED discharge. Thus, our sample was estimated to have at least 80% power to detect a 50% relative reduction in the risk of non-fatal opioid overdose in the 18 months post-randomization among participants in the PRSS arm (risk difference=0.075, 95% confidence interval [CI]=0.02–0.13).

Statistical analyses

We conducted all analyses using intention-to-treat principles. Analyses were completed using SAS version 9.4 (Cary, North Carolina), with two-sided tests and significance level alpha=0.05.

Primary outcome.—We used a chi-square test to compare the percentage of participants with any non-fatal opioid overdose during follow-up by randomization arm. Additionally, we used modified (robust) Poisson regression [24, 25] to estimate the effect of randomization arm on risk of any non-fatal opioid overdose during the 18-month follow-up period, including an unadjusted model, a model adjusted for key baseline characteristics associated with the outcome in bivariate analyses (primary analysis), and a model adjusted for the full set of key baseline characteristics hypothesized to be associated with the outcome (i.e., not only those that were associated in bivariate analyses). We used multiple imputation by chained equations [26] to impute missing covariate data, including the following variables as predictors: the outcome, follow-up time, and the full set of key baseline characteristics hypothesized to be associated with the outcome. Twenty imputed datasets were pooled for the regression models.

Secondary outcomes.—We used the Kaplan-Meier method to visualize the cumulative incidence of first non-fatal opioid overdose by randomization arm. Participants who died were censored at that time, and those without a non-fatal opioid overdose were censored after 18 months. We used Gray's test to compare the cumulative incidence of first non-fatal

opioid overdose by randomization arm, and Wilcoxon's test to compare the median time to first non-fatal opioid overdose by randomization arm among participants with any non-fatal opioid overdose. Additionally, we fit Cox proportional hazards models to estimate the effect of randomization arm on time to first non-fatal opioid overdose, including an unadjusted model, a model adjusted for key baseline characteristics associated with the outcome in bivariate analyses, and a model adjusted for the full set of key baseline characteristics hypothesized to be associated with the outcome. Finally, because ED interventions may be most likely to impact risk of non-fatal opioid overdose immediately following discharge, we conducted a sensitivity analysis comparing the survival curves using the Fleming-Harrington weighted log-rank test with greater weight for earlier outcomes (rho=1, gamma=0).

This set of analyses was also completed for the secondary outcomes of all-cause and opioid overdose mortality. However, due to varying follow-up time for the mortality data, we did not compare risk of death using modified Poisson regression and compared the mortality rate by randomization arm using a mid P exact test rather than a chi-square test.

RESULTS

From November 15, 2018, to May 31, 2021, 2,665 potentially eligible ED patients were identified through electronic health record review or referral from a treating physician for in-person study screening (see Figure 1). Of those, 2,007 patients (75.3%) did not consent to participant. Although the remaining 658 patients (24.7%) provided informed consent to participate in the trial, 10 were not randomized to a trial arm because they were no longer interested, identified as ineligible, or for other or unknown reasons.

Thus, 648 ED patients at high risk of opioid overdose participated in the trial, of whom 323 were randomized to the PRSS arm and 325 were randomized to the LICSW arm. Most participants (96.8%, n=627) completed the randomly assigned ED intervention.

Sample description

Among the 648 trial participants, the mean age was 36.9 years, 442 (68.2%) were male, and 444 (68.5%) were White (see Table 2). More than half of participants (61.9%, n=401) had a lifetime history of overdose at baseline, and just under half (45.4%, n=293) were being treated for an opioid overdose at the index ED visit. Most participants reported prior experience with addiction treatment, including 178 (27.5%) currently and 314 (48.5%) previously in treatment.

Baseline characteristics were balanced across randomization arms, except for age. Participants in the PRSS arm were younger than those in the LICSW arm (mean 36.4 vs. 37.2 years).

Primary outcome: any non-fatal opioid overdose

Overall, 176 participants (27.2%) experienced at least one EMS run for a non-fatal opioid overdose within the 18 months following the index ED visit; 116 (17.9%) had one, 29 (4.5%) had two, 16 (2.5%) had three, and 15 (2.3%) had four or more non-fatal opioid overdoses. Within 18 months, 81 participants randomized to the PRSS arm (25.1%)

experienced any non-fatal opioid overdose compared to 95 randomized to the LICSW arm (29.2%, p=0.24).

In the primary analysis, there was no difference in the effectiveness of randomization to the PRSS arm versus LICSW arm on risk of any non-fatal opioid overdose in the 18 months following the index ED visit, adjusting for lifetime history of overdose at baseline (relative risk [RR]=0.86, 95% CI=0.67–1.11, see Table 3). This estimate was consistent in the unadjusted and fully-adjusted models. Of note, lifetime history of overdose at baseline was associated with a higher risk of any non-fatal opioid overdose within the 18-month follow-up period (RR=1.42, 95% CI=1.06–1.90), and this was consistent in the model adjusted for randomization arm and the full-adjusted model.

Secondary outcomes

Time to first non-fatal opioid overdose.—The cumulative incidence of first non-fatal opioid overdose was similar for the PRSS and LICSW arms (p=0.22, see Figure 2). Among participants with any non-fatal opioid overdose, the median time to first non-fatal opioid overdose was 146 days (interquartile range [IQR]=57–262) among those randomized to the PRSS arm and 119 days (IQR=44–304) among those randomized to the LICSW arm (p=0.61). There was no difference in the effectiveness of randomization to the PRSS arm versus LICSW arm on time to first non-fatal opioid overdose within 18 months, adjusting for lifetime history of overdose at baseline (hazard ratio [HR]=0.82, 95% CI=0.61–1.10, see Table 4). In the sensitivity analysis giving greater weight to earlier outcomes, the survival curves were also similar across randomization arms (p=0.21).

Fatal opioid overdose.—A median of 18.0 months of follow-up time was available for the fatality outcomes across participants (IQR=17.3–18.0), and this was similar across randomization arms (p=0.88). Based on the available follow-up time, 11 participants randomized to the PRSS arm (3.4%) experienced a fatal opioid overdose within 18 months compared to 15 randomized to the LICSW arm (4.6%). During this period, participants in the PRSS arm experienced 9.3 opioid overdose deaths per 100,000 person-days compared to 6.8 per 100,000 person-days in the LICSW arm (p=0.43).

The cumulative incidence of opioid overdose death was similar for the PRSS and LICSW arms (p=0.42, see Figure S1). Among participants who died due to opioid overdose, the median time to death was 124 days (IQR=28–317) among those randomized to the PRSS arm and 202 days (IQR=84–346) among those randomized to the LICSW arm (p=0.17). There was no difference in the effectiveness of randomization to the PRSS arm versus LICSW arm on risk of fatal opioid overdose (HR=0.73, 95% CI=0.33–1.58). In the sensitivity analysis giving greater weight to earlier outcomes, the survival curves were similar across randomization arms for opioid overdose mortality (p=0.41).

Death due to any cause.—The results were similar for all-cause mortality. Based on the available follow-up time, 16 participants randomized to the PRSS arm (5.0%) died due to any cause within 18 months compared to 21 randomized to the LICSW arm (6.5%). Of the 37 total deaths, 26 were due to opioid overdose (70.3%). During the 18-month follow-up

period, participants in the PRSS arm experienced 9.9 deaths due to any cause per 100,000 person-days compared to 12.9 per 100,000 person-days in the LICSW arm (p=0.43).

The cumulative incidence of death due to any cause was similar for the PRSS and LICSW arms (p=0.40, see Figure S2). Among participants who died due to any cause, the median time to death was 224 days (IQR=140–382) among those randomized to the PRSS arm and 142 days (IQR=28–331) among those randomized to the LICSW arm (p=0.08). There was no difference in the effectiveness of randomization to the PRSS arm versus LICSW arm on all-cause mortality (HR=0.76, 95% CI=0.39–1.45). In the sensitivity analysis giving greater weight to earlier outcomes, the survival curves were similar across randomization arms for all-cause mortality (p=0.38).

DISCUSSION

In this randomized controlled trial, more than one-in-four ED patients at high risk of opioid overdose (27.2%) experienced a non-fatal opioid overdose in the 18 months following the ED visit. Risk of non-fatal opioid overdose, fatal opioid overdose, and death due to any cause in the 18 months following the index ED visit was similar for participants randomized to a behavioral intervention with a PRSS versus with an LICSW. Of note, history of previous overdose (i.e., as of the index ED visit) was associated with risk of non-fatal opioid overdose in the 18 months post-discharge but not with opioid overdose or all-cause mortality.

The substantial number of non-fatal opioid overdoses in the 18 months post-discharge, as well as the higher risk among participants who had experienced a previous overdose, support the notion that EDs provide critical opportunities to connect patients with life-saving harm reduction and treatment services [4]. ED behavioral interventions with PRSS and LICSW had similar effects on risk of non-fatal opioid overdose, consistent with our previous findings for 30-day SUD treatment engagement [13]. Importantly, we did not have information on the extent of continued contact between PRSS and participants following ED discharge, and those with ongoing PRSS contact may have had better outcomes. Future research on the potential impact of ongoing PRSS contact following the ED visit, as well as other predictors of intervention effectiveness (e.g., patient preferences), would be useful.

Our findings are consistent with a cluster randomized trial among patients with opioid-related ED visits in Indiana, in which risk of re-presentation to the ED for overdose within 12 months was similar (about 17%) for those who had received a PRSS-led ED behavioral intervention and a control condition that included provision of naloxone and a list of community-based treatment resources [11]. The cumulative incidence of overdose within 12 months in our study was somewhat higher (roughly 22%, see Figure 2), which may be due to differing data sources for the outcomes (i.e., EMS vs. ED data), different study periods (ours included 2021, when overdose risk had increased nationally [1]), and other differences in the local drug supply. In contrast, a difference-in-differences analysis among ED patients treated for opioid overdose in New Jersey suggested that implementation of a PRSS-led ED behavioral intervention program may be associated with lower risk of repeat overdose, although the study design had important limitations [12]. For example, the authors were not able to account for other overdose prevention and behavioral health services implemented

at hospitals during the study period, which may have differed for those with and without a PRSS program.

Among ED patients treated for opioid overdose, ED behavioral interventions have previously been found to be associated with increased engagement in SUD treatment post-discharge [27], which is expected to subsequently decrease risk of overdose and death [28–31]. The present study and our previous study of 30-day treatment engagement [13] suggests that whether a PRSS or LICSW delivers the behavioral intervention is likely less critical than receiving one in the first place. Widespread integration of dedicated and appropriately-trained behavioral interventionists into ED care teams has the potential to reduce overdose risk among patients at high risk of opioid overdose, and health systems may consider PRSS and/or LICSW depending on feasibility. Importantly, we did not control intervention components or fidelity, as this was a pragmatic trial of existing intervention infrastructure at the study sites. Study outcomes may have differed with tighter control of the interventions. Future research on which components of a behavioral intervention are essential for effectiveness would be useful.

This study had other important limitations. First, we may have been underpowered to detect a small difference in the effectiveness of the PRSS and LICSW interventions. Second, some participants had incomplete follow-up time for the fatality data, limiting our ability to censor all participants at the time of death in analyses of non-fatal opioid overdose. However, based on available person-time, the mortality rate was similar by randomization arm, so we expect this to impact both arms similarly. Third, despite training not to be involved in the interventions, study research assistants may have influenced participants, which we expect would bias results toward the null. Finally, it was considered unethical to randomize participants to no behavioral intervention, so we were not able to consider whether either intervention was superior to none. Nonetheless, the study was strengthened by its rigorous design and active comparator group. Additionally, there was likely minimal misclassification of the study outcomes and bias arising from loss to follow-up due to the use of statewide administrative data. However, non-fatal opioid overdoses that occurred out-of-state or did not result in a call for emergency assistance would not be captured. While we expect that under-reporting of the primary outcome due to non-medically attended overdoses is likely to be non-differential between arms, it is possible that participants randomized to the PRSS group may have been more or less likely to have a medically attended overdose than those randomized to the LICSW arm.

In conclusion, a substantial percentage (27.2%) of ED patients at high risk of opioid overdose experienced a non-fatal opioid overdose within the 18 months following ED discharge. ED behavioral interventions may reduce risk of overdose and death; however, we found no evidence that the risk of non-fatal opioid overdose, fatal opioid overdose, or death due to any cause differs for patients receiving the intervention from a PRSS versus a LICSW. An improved understanding of the impact of ongoing contact with PRSS following ED discharge, the essential intervention components, as well as which patients may benefit most from working with each type of specialist, would be useful.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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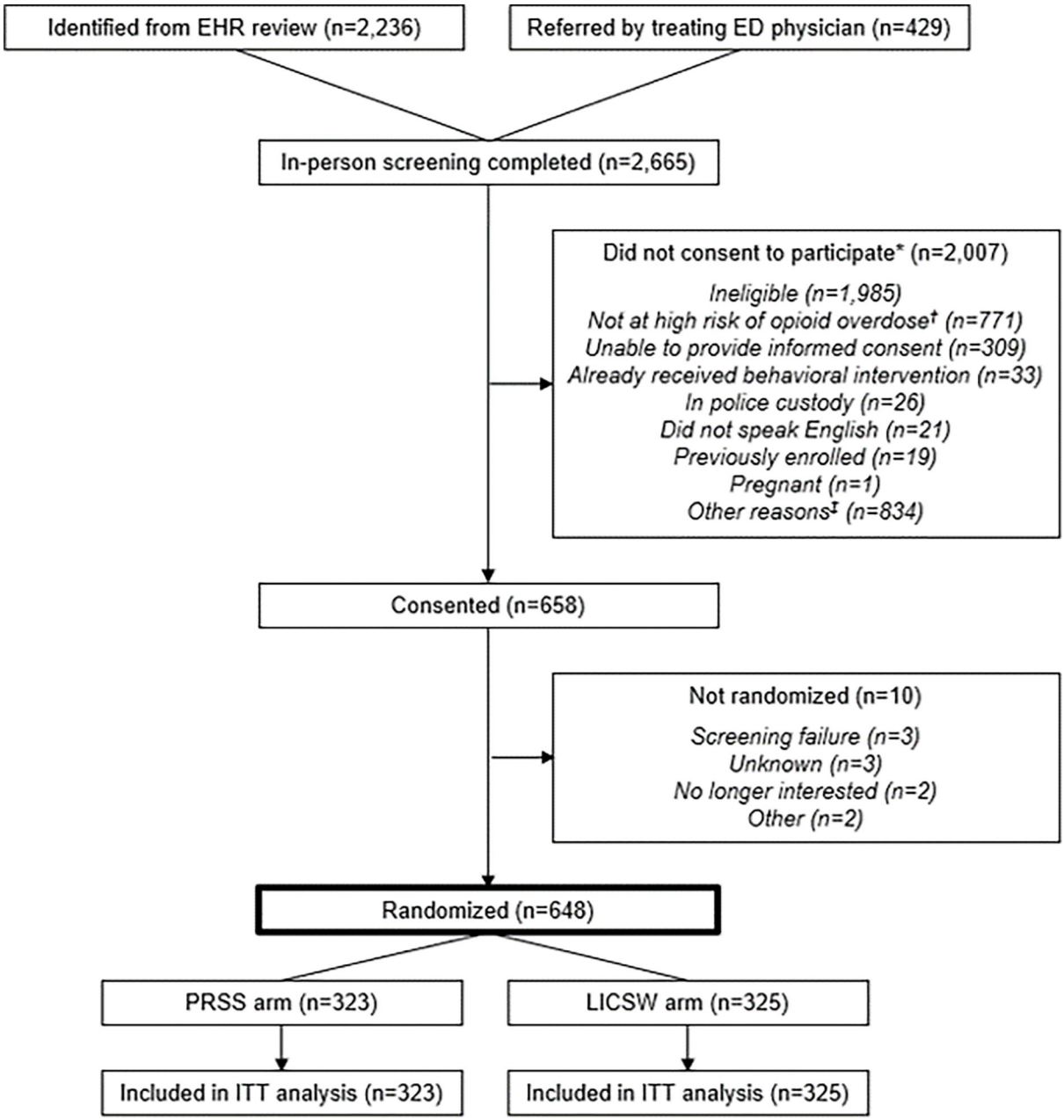

Figure 1. Trial participant flow diagram

Abbreviations: ED, emergency department; EHR, electronic health record; ITT, intention-to-treat; LICSW; licensed clinical social worker; PRSS, peer recovery support specialist.

* More than one response possible.

† Per study criteria, defined as being treated in the ED for opioid overdose or complications of opioid use disorder or having experienced an opioid overdose in the past year.

‡ Included not being interested, other, and unknown reasons.

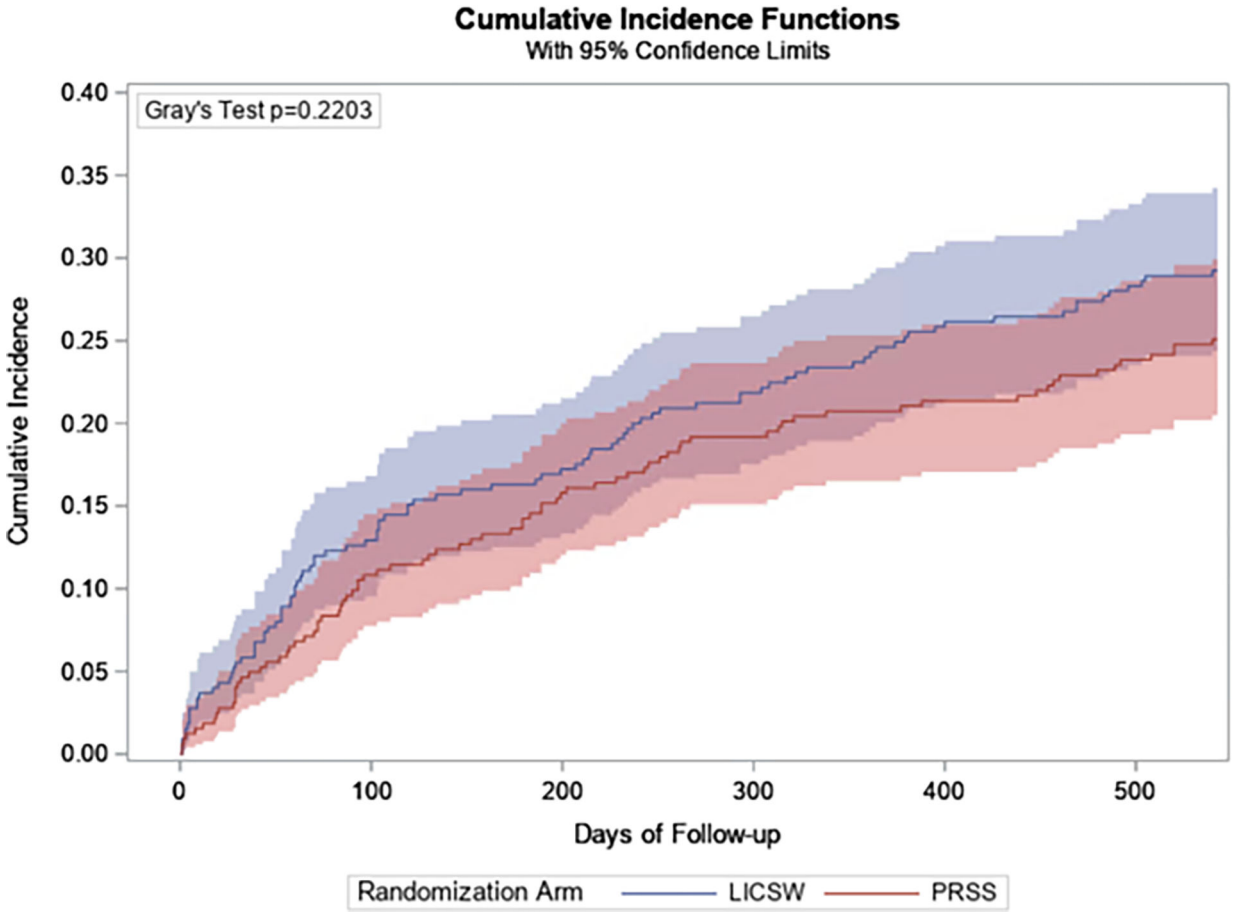

Figure 2. Cumulative incidence of first non-fatal opioid overdose in the 18 months following the index ED visit by randomization arm*

Abbreviations: ED, emergency department; LICSW, licensed clinical social worker; PRSS, peer recovery support specialist.

* Cumulative incidence function estimates the probability that participants in that study arm had experienced a non-fatal opioid overdose. Shaded area indicates 95% confidence limits.

Table 1.

Behavioral intervention arms in the Navigator Trial

	Certified PRSS	LICSW
ED intervention	- Intervention using evidence-based interviewing and intervention techniques plus lived experience	- Intervention using evidence-based interviewing and intervention techniques plus other clinical skills
	- Provide referrals	- Provide referrals
	- Navigate barriers to treatment	
	- Overdose prevention education	
Post-discharge community-based follow-up (<48 hours)	- Navigate barriers to treatment and recovery	Not applicable
	- Ongoing peer support	
	- Ongoing overdose prevention education	
Ongoing community-based follow-up (≥90 days)	- Promote retention in treatment	Not applicable
	- Ongoing peer support	
	- Ongoing overdose prevention education	

Abbreviations: ED, emergency department; LICSW, licensed clinical social worker; PRSS, peer recovery support specialist.

Table 2.

Baseline characteristics of Navigator Trial participants (November 2018 – May 2021)

	Total N=648 n (%)*	PRSS N=323 n (%)*	LICSW N=325 n (%)*
Age (years), mean (SD)	36.9 (10.8)	36.4 (10.5)	37.2 (11.1)
Sex at birth			
Female	206 (31.8)	105 (32.5)	101 (31.1)
Male	442 (68.2)	218 (67.5)	224 (68.9)
Gender identity			
Female	202 (31.2)	103 (31.9)	99 (30.5)
Male	439 (67.7)	216 (66.9)	223 (68.6)
Transgender	1 (0.2)	0 (0.0)	1 (0.3)
Unknown†	6 (0.9)	4 (1.2)	2 (0.6)
Race			
American Indian or Alaska Native	17 (2.6)	8 (2.5)	9 (2.8)
Asian	3 (0.5)	1 (0.3)	2 (0.5)
Black, African, Haitian, or Cape Verdean	39 (6.0)	19 (5.9)	20 (6.2)
Native Hawaiian or Other Pacific Islander	3 (0.5)	1 (0.3)	2 (0.6)
White	444 (68.5)	218 (67.5)	226 (69.5)
Other	62 (9.6)	33 (10.2)	29 (8.9)
Mixed, biracial, or multiracial	61 (9.4)	34 (10.5)	27 (8.3)
Unknown†	19 (2.9)	9 (2.8)	10 (3.1)
Ethnicity			
Hispanic or Latino	107 (16.5)	58 (18.0)	49 (15.1)
Not Hispanic or Latino	541 (83.5)	265 (82.0)	276 (84.9)
Current health insurance			
Yes	576 (90.6)	287 (88.9)	289 (88.9)
No	48 (7.4)	23 (7.1)	25 (7.7)
Unknown†	24 (3.7)	13 (4.0)	11 (3.4)
Currently employed full- or part-time			
Yes	181 (27.9)	86 (26.6)	95 (29.2)
No	450 (69.4)	226 (70.0)	224 (68.9)
Unknown†	17 (2.6)	11 (3.4)	6 (1.8)
Lifetime history of unstable housing			
Yes, within the past six months	283 (43.7)	145 (44.9)	138 (42.5)
Yes, not within the past six months	158 (24.4)	72 (22.3)	86 (26.5)
No	192 (29.6)	98 (30.3)	94 (28.9)
Unknown†	15 (2.3)	8 (2.5)	7 (2.2)
Lifetime history of overdose			
Yes	401 (61.9)	204 (63.2)	197 (60.6)
No	211 (32.6)	98 (30.3)	113 (34.8)

	Total N=648 n (%)*	PRSS N=323 n (%)*	LICSW N=325 n (%)*
Unknown	36 (5.6)	21 (6.5)	15 (4.6)
Lifetime history of injecting drugs			
Yes	333 (51.4)	163 (50.5)	170 (52.3)
No	261 (40.3)	129 (39.9)	132 (40.6)
Unknown†	54 (8.3)	31 (9.6)	23 (7.1)
Lifetime history of addiction treatment			
Yes, currently in treatment	178 (27.5)	78 (24.1)	100 (30.8)
Yes, not currently in treatment	314 (48.5)	162 (50.2)	152 (46.8)
No	133 (20.5)	72 (22.3)	61 (18.8)
Unknown†	23 (3.5)	11 (3.4)	12 (3.7)
Reason for ED visit is opioid overdose			
Yes	293 (45.2)	149 (46.1)	144 (44.3)
No	353 (54.5)	173 (53.6)	180 (55.4)
Unknown†	2 (0.3)	1 (0.3)	1 (0.3)

Abbreviations: ED, emergency department; LICSW, licensed clinical social worker; PRSS, peer recovery support specialist; SD, standard deviation.

*Unless otherwise specified.

†Includes missing, unknown, and declined.

Table 3.

Modified Poisson regression models estimate the effect of randomization arm on risk of any non-fatal opioid overdose in the 18 months following the index ED visit (primary outcome)

	Unadjusted RR (95% CI)	Adjusted* RR (95% CI)	Fully-adjusted† RR (95% CI)
Randomization arm			
PRSS	0.86 (0.67–1.11)	0.86 (0.67–1.11)	0.86 (0.67–1.11)
LICSW	Ref.	Ref.	Ref.
Study site‡			
Hospital A	1.19 (0.84–1.69)	--	1.18 (0.83–1.69)
Hospital B	Ref.		Ref.
Age (years)‡			
<50	1.17 (0.80–1.72)	--	1.16 (0.79–1.69)
≥50	Ref.		Ref.
Sex at birth‡			
Male	1.21 (0.91–1.61)	--	1.16 (0.88–1.54)
Female	Ref.		Ref.
Lifetime history of overdose at baseline			
Yes	1.42 (1.06–1.90)	1.43 (1.07–1.91)	1.40 (1.05–1.86)
No	Ref.	Ref.	Ref.

Abbreviations: CI, confidence interval; ED, emergency department; LICSW, licensed clinical social worker; PRSS, peer recovery support specialist; RR, relative risk.

*Primary analysis. Adjusted only for other characteristics in this table that were associated with the outcome in unadjusted analyses.

†Adjusted for all other characteristics included in this table.

‡Block randomization variable.

Table 4.

Cox proportional hazards models estimating the effect of randomization arm on time to first non-fatal opioid overdose, death due to any cause, and fatal opioid overdose in the 18 months following the index ED visit

	Unadjusted HR (95% CI)	Adjusted* HR (95% CI)	Fully-adjusted† HR (95% CI)
First non-fatal opioid overdose			
Randomization arm			
PRSS	0.83 (0.62–1.12)	0.82 (0.61–1.10)	0.82 (0.61–1.10)
LICSW	Ref.	Ref.	Ref.
Study site≠			
Hospital A	1.21 (0.81–1.82)	--	1.19 (0.79–1.79)
Hospital B	Ref.		Ref.
Age (years)≠			
<50	1.19 (0.77–1.84)	--	1.19 (0.77–1.85)
≥50	Ref.		Ref.
Sex at birth≠			
Male	1.24 (0.89–1.73)	--	1.20 (0.86–1.67)
Female	Ref.		Ref.
Lifetime history of overdose at baseline			
Yes	1.56 (1.11–2.18)	1.57 (1.12–2.20)	1.55 (1.10–2.17)
No	Ref.	Ref.	Ref.
Fatal opioid overdose			
Randomization arm			
PRSS	0.73 (0.33–1.58)	--	0.71 (0.33–1.55)
LICSW	Ref.		Ref.
Study site≠			
Hospital A	1.72 (0.52–5.74)	--	1.61 (0.48–5.38)
Hospital B	Ref.		Ref.
Age (years)≠			
<50	1.33 (0.40–4.43)	--	1.24 (0.37–4.14)
≥50	Ref.		Ref.
Sex at birth≠			
Male	0.63 (0.29–1.36)	--	0.62 (0.28–1.37)
Female	Ref.		Ref.
Lifetime history of overdose at baseline			
Yes	1.21 (0.52–2.78)	--	1.27 (0.55–2.95)
No	Ref.		Ref.
Death due to any cause			
Randomization arm			
PRSS	0.76 (0.39–1.45)	--	0.75 (0.39–1.44)
LICSW	Ref.		Ref.

	Unadjusted HR (95% CI)	Adjusted* HR (95% CI)	Fully-adjusted† HR (95% CI)
Study site‡			
Hospital A	1.43 (0.56–3.67)	--	1.48 (0.57–3.84)
Hospital B	Ref.		Ref.
Age (years)‡			
<50	0.54 (0.25–1.14)	--	0.50 (0.24–1.07)
≥50	Ref.		Ref.
Sex at birth‡			
Male	0.67 (0.35–1.30)	--	0.65 (0.33–1.25)
Female	Ref.		Ref.
Lifetime history of overdose at baseline			
Yes	1.12 (0.56–2.23)	--	1.16 (0.58–2.32)
No	Ref.		Ref.

Abbreviations: CI, confidence interval; ED, emergency department; HR, hazard ratio; LICSW, licensed clinical social worker; PRSS, peer recovery support specialist.

*Adjusted only for other characteristics in this table that were associated with the outcome in unadjusted analyses.

†Adjusted for all other characteristics included in this table.

‡Block randomization variable.