Published in final edited form as:

J Subst Abuse Treat. 2020 January ; 108: 65–74. doi:10.1016/j.jsat.2019.08.004.

Findings from the Recovery Initiation and Management after Overdose (RIMO) Pilot Study Experiment

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Abstract

This pilot study evaluated the feasibility of the Recovery Initiation and Management after Overdose (RIMO) intervention to link individuals to medication-assisted treatment (MAT) following an opioid overdose. The study team worked with the Chicago Fire Department to train Emergency Medical Service (EMS) teams to request permission from individuals after an opioid overdose reversal to release their contact information; individuals were subsequently contacted by the study team for participation. A mixed-methods study design comprised: (1) an experimental pilot study that examined participation at each stage of the intervention and compared the odds of treatment received for individuals who were randomly assigned to either the RIMO intervention ($n = 16$) or a passive referral control ($n = 17$); and (2) a focus group that was subsequently conducted with participants in the RIMO group to obtain their feedback on the intervention components. Quantitative data was collected on participant characteristics at study intake and treatment received was based on self-report at a 30-day follow-up. The RIMO group had higher odds of receiving any treatment for opioid use ($OR = 7.94$) and any MAT ($OR = 20.2$), and received significantly more days of opioid treatment (15.2 vs. 3.4) and more days of MAT in the 30 days post-randomization (11.2 vs. 0.76), relative to the control group (all $p < .05$). Qualitative data illustrated that participants valued the assertive outreach, engagement, and persistent follow-up components of RIMO, which differed from their prior experiences. The pilot study suggests that the RIMO intervention is able to address the challenges of linking and engaging individuals into MAT after an opioid overdose.

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Keywords

opioid overdose reversal; emergency medical services (EMS); assertive treatment linkage; motivational interviewing; medication-assisted treatment (MAT)

1. Introduction

The emergence of the “opioid epidemic” stemming from increases in misuse of prescription opioids, and, relatedly, in heroin use associated with its relatively lower cost and wide availability, has been extensively documented within the U.S. (Cicero, Ellis, Surratt, & Kurtz, 2014; Compton, Jones, & Baldwin, 2016). Despite decreases in high rates of non-medical use of prescription opioids and stricter prescribing practices over the past decade, the rates of past-year opioid use disorder (OUD) have increased (Jones, 2017). This was likely due to increased availability of illicit opioids such as heroin and fentanyl. Moreover, data from the Centers for Disease Control and Prevention (CDC, 2016) show that between 2013 – 2014 the death rate from the most commonly prescribed opioid pain relievers (natural and semisynthetic opioids) increased by 9%, the death rate from heroin increased 26%, and the death rate from synthetic opioids, including fentanyl and synthetic opioid pain relievers other than methadone, increased 80%.

Chicago has one of the highest rates of opioid overdose and death in the country. In 2011, the Chicago Metropolitan Area ranked first nationally for emergency department (ED) mentions (24,627) for heroin and for ED mentions (13,178) for heroin among African Americans (Kane-Willis et al., 2015). Data from the Chicago Department of Public Health (CDPH; 2016) shows that from 2015 to 2016 the number of opioid-related overdose reversals with naloxone in Chicago increased from 9,297 to ~13,872 (+49%) and the number of opioid-related deaths rose from 426 to 741 (+74%). Over this same period, the number of overdose deaths related to heroin increased 41% (345 to 487), while those related to fentanyl increased 591% (71 to 420). Moreover, the rate of opioid overdoses presenting to hospital EDs increased fastest in the Midwest compared to other parts of the country (70% vs. 30%) from 2016 to 2017 (CDC, 2018).

In response to these alarmingly high rates of opioid-related overdose, there is increasing emphasis on strategies to broadly distribute naloxone to reverse opioid overdose (Compton, Volkow, Throckmorton, & Lurie, 2013; Madah-Amiri, Clausen, & Lobmaier, 2017; Donald, Campbell, & Strang, 2017). In Illinois, the state passed the Heroin Crisis Act in 2015, which expanded training programs for naloxone administration and facilitated access to medication-assisted treatment (MAT) for Medicaid-eligible individuals. Further, in 2016 Illinois initiated training and distribution of naloxone kits through a Substance Abuse and Mental Health Administration (SAMHSA) grant to Prevent Prescription Drug/Opioid Overdose-Related Deaths. In 2017, the Illinois Department of Human Services, Division of Substance Use Prevention and Recovery (IDHS/SUPR) received a SAMHSA Opioid State Targeted Response (STR) grant to expand these overdose prevention efforts to 9 additional high-incident counties and to expand MAT capacity in designated counties (SAMHSA, 2016).

1.1. Effects to engage individuals into services following opioid overdose

Despite the widening distribution of naloxone to reverse an opioid overdose, there remains a significant gap between its administration and mechanisms for linking individuals to MAT (Socías et al., 2018). Rates of treatment engagement following opioid overdose are generally low, with one study indicating that only about one quarter of individuals sought treatment following an overdose (Pollini, McCall, Mehta, Vlahov, & Strathdee, 2006). It is critically important to engage individuals into treatment following an opioid overdose, as prior overdose is a strong predictor of subsequent mortality due to opioid overdose (Caudarella et al., 2016; Stoové, Dietze, & Jolley, 2009). Further, individuals at high risk of repeated overdose are more likely to have complex profiles of other psychiatric and substance use disorders, and hence often require a higher level of care (Blanco & Volkow, 2019).

Numerous barriers to accessing MAT have been identified, including financial, regulatory, geographic, attitudinal, and logistical (Sharma et al., 2017; Alanis-Hirsch et al., 2016; Schwartz et al., 2008; Rosenblatt, Andrilla, Catlin, & Larson, 2015; Knudsen, 2015; Knudsen, Abraham, & Oser, 2011). Intervening with the individual immediately following an opioid overdose reversal presents an underutilized opportunity to initiate a process of engagement (Fairbairn, Coffin, & Walley, 2017), with the aim of linking them into treatment, preferably MAT or other forms depending on their preference. Several intervention models have been developed that provide overdose survivors with information and referrals to treatment; these include partnerships between public safety and public health providers, clinical or peer outreach, or community-based drop-in programs (Formica, Apsler, Wilkins, Ruiz, Reilly, & Walley, 2018). Another approach has focused on screening patients in hospital ED or inpatient settings for OUD and initiating use of medications, such as Suboxone, with referrals provided to community-based MAT providers (Shanahan et al., 2010; Lee, Liebschutz, Anderson, & Stein, 2017; D’Onofrio, O’Connor, et al., 2015; D’Onofrio & Bernstein, 2015; Liebschutz et al., 2014).

Furthermore, spurred by state-level funding, including the STR projects, several innovative models have been developed that use peer recovery specialists to intervene with patients in the ED following an overdose (Powell, Treitler, Peterson Borys, & Hallcom, 2019), and to provide overdose prevention education and naloxone training, continuing outreach and peer support, and referrals to services (McGuire et al., 2019; Wagner et al., 2019; Waye et al., 2019). Yet, even though standard protocols usually require EMS to transport individuals to the ED following naloxone administration, many such individuals refuse to go into an ED or, if they do, leave as soon as they are capable, without having received a treatment referral (Wampler, Molina, McManus, Laws, & Manifold, 2011).

1.2. Partnerships with first responders to opioid overdose

In the City of Chicago, the most common responder to both non-fatal and fatal opioid overdose is the Chicago Fire Department (CFD) Emergency Medical Services (EMS). In 2016, EMS documented 6590 responses for opioid-related overdoses in Chicago. This is approximately 39 overdose events per 100 adults with OUD (i.e., $6590/16901=0.39$). This represents a threefold increase in number of overdose runs between 2013 and 2016. Moreover, the number of overdose runs continues to increase—topping 7200 in 2017.

Because EMS operate on the front lines of contact with individuals who have overdosed (Banta-Green, Beletsky, Schoeppe, Coffin, & Kuszler, 2013), they can provide a critical conduit to engaging individuals into services following the overdose incident (Wagner, Bovet, Haynes, Joshua, & Davidson, 2016; Knowlton et al., 2013). Naloxone can be successfully administered by first responders to individuals following opioid overdose, resulting in high rates of survival (Davis, Ruiz, Glynn, Picariello, & Walley, 2014; Walley et al., 2013) and decreasing the escalating rate of opioid-related deaths (Rando, Broering, Olson, Marco, & Evans, 2015). However, interviews conducted with key informants (e.g., firefighters, EMS personnel, police) in preparation for this study confirmed that in Chicago there is not a consistent protocol for referring individuals to treatment for OUD following naloxone administration, combined with a lack of resources to develop effective linkage protocols. Thus, there is a need for strategies to intervene with individuals following an opioid overdose reversal that do not rely only upon EDs as the initial point of contact.

1.3. Recovery Initiation and Management after Overdose (RIMO)

The study investigators have previously demonstrated the successful use of an assertive outreach and linkage intervention for not-in-treatment individuals at risk of opioid overdose who were contacted by peer outreach in community settings (Scott et al., 2019; Scott, Grella, Nicholson, & Dennis, 2018). In the current study, this assertive outreach component is combined with a linkage and engagement intervention, Recovery Management Checkups (RMC; Dennis, Scott, & Funk, 2003; Scott & Dennis, 2003; Scott, Dennis, Laudet, Funk, & Simeone, 2011). The RMC model has been evaluated and shown to be effective in 2 randomized trials in which individuals were recruited while in SUD treatment and received quarterly follow-ups for 2 to 4 years (Dennis, Scott, & Funk, 2001; Dennis & Scott, 2012; Scott, Dennis & Foss, 2005; Scott & Dennis, 2009), and one randomized trial in which individuals were recruited at discharge from jail-based SUD treatment and received quarterly checkups for 3 years (Scott & Dennis, 2012; Scott, Dennis, & Lurigio, 2017). In all 3 randomized clinical trials, RMC participants were more likely than controls to return to treatment sooner, stay longer, and receive more treatment; they also reported fewer days of substance use and substance use disorders. One third of the participants in these prior studies had OUD; an analysis of this sub-group showed that they did as well or better than others, including an average effect size of $d=0.60$ for treatment initiation relative to those in the control groups (unpublished data).

The goal of this combined intervention, RIMO, is to initiate a sequence of steps to contact, screen, enroll, and link the individual into treatment, following the release of their contact information from EMS. Hence, the RIMO intervention aims to intervene with high-risk individuals following the overdose event, and thereby to shorten the at-risk period when they are not engaged in any form of treatment. The treatment linkage intervention benefitted from the expansion of MAT program capacity in Chicago that was funded by the Illinois Opioid STR project.

2. Materials and Methods

2.1. Study design

The current study uses a mixed-methods approach to examine the implementation and initial outcomes of the RIMO intervention. The mixed-methods design utilized a sequential collection of quantitative and qualitative data, in which the qualitative component was embedded in the quantitative component, i.e., a sub-group of participants in the pilot study participated in the qualitative component. The analytic approach was complementary in that the quantitative component assessed the outcomes of each stage of the RIMO intervention, while the qualitative component enabled an in-depth examination of the implementation of the RIMO intervention from the participants' perspectives (Palinkis et al., 2011). Both quantitative and qualitative data were used to examine the following steps in the intervention process:

1. Following administration of naloxone to reverse an opioid-related overdose and a determination that the individual is alert and oriented, EMS secures an authorization allowing them to release the individual's contact information to the study team.
2. The authorization form is transmitted to the study team (i.e., linkage managers) at Lighthouse Institute.
3. The individual is subsequently located by the linkage managers (via phone) or peer outreach workers via street outreach and invited to participate.
4. The individual is scheduled and transported to the research office for a face-to-face meeting, during which time the linkage manager screens them for study eligibility; if eligible, administers the informed consent, baseline assessment, and randomization to group; and, for those assigned to RIMO, conducts the initial linkage meeting.
5. The individual is scheduled for treatment intake and transported to the appointment.
6. The individual is in MAT and/or other SUD treatment at 30 days post-randomization.

In addition to assessing the feasibility of each step in this process, the quantitative component examined the relative odds of whether the individual is still active in treatment after 30 days compared to a control group that did not receive RIMO.

2.2. Communities for pilot study

The pilot study was conducted on Chicago's West Side along what is known locally as the "heroin highway" as it has multiple drug markets and the highest rates of overdose per capita in the city (Gorner, 2019). The population is 84% black and 10% Hispanic, with 31% of its households below the poverty line. In 2013, 35% of Chicago's hospitalizations for opioids occurred on the West Side, which accounted for 23% of all hospitalizations for opioids statewide. A majority (83%) of those hospitalized for opioids on Chicago's West side were African American (Kane-Willis & Metzger, 2016).

2.3. Study participants and programs

Individuals were eligible for study participation if they: a) had experienced an opioid overdose reversal with naloxone administered by EMS within the past 30 days, b) were not currently in any form of alcohol or drug treatment, c) used heroin or opiates on 13 or more days (weekly) in the past 90 days, d) were aged 18 or older, e) resided in Chicago and were not planning to move in 4 weeks, and f) were cognitively able to provide informed consent.

Individuals assigned to the RIMO condition were linked to one of four licensed detox or MAT programs in Chicago, two of which had received funding for capacity expansion through the Illinois Opioid State Targeted Response (STR) project. Alternatively, if the participant preferred another form of treatment, they were referred and linked to residential, outpatient or intensive outpatient treatment as requested.

2.4. Study procedures

2.4.1. Collaboration with EMS—The study PI (Scott) initially met with representatives from the Chicago Fire Department (CFD) to secure their agreement to participate in the study. CFD management reviewed the study procedures, the protocol for EMS to secure an authorization to release contact information from individuals following an opioid overdose reversal, and the training materials for EMS teams. In addition, the City Legal Department developed the authorization form used in the pilot.

The PI and Co-PI (Dennis) conducted 4 trainings with 42 first responders, including Chiefs from the CFD, EMS crews, and one representative from the Chicago Police Department. The trainings provided an overview of the chronic nature of substance use disorders and the recovery process; the Recovery Management Checkup (RMC) intervention, including prior studies establishing its efficacy for linking individuals to SUD treatment and providing recovery support; RIMO study aims and methods; and step-by-step procedures for EMS to solicit permission from individuals to release their contact information to the study team, following opioid-overdose reversal.

EMS personnel were instructed to follow their usual procedures for determining if the individual had the capacity to provide authorization. If the individual was determined to be alert and oriented, they explained the following:

We are working with the Chestnut Health Systems' Lighthouse Institute on ways to help people get the health care services they need. May we share your name, address and phone number with the Lighthouse Institute so they can get in touch with you in a few days to see how you are doing and to talk about available services?

The EMS documented: (1) the date and time of the overdose event, (2) whether the individual was alert and oriented enough to consent to release of their contact information, (3) whether the individual agreed and provided contact information (i.e., address and phone number), (4) whether they refused transport to the emergency department (ED), and (5) the name of the hospital where they were transported, if applicable. Forms were deposited in a

HIPAA box at the participating fire stations; these were then reviewed by an administrator, scanned, and transmitted electronically to the study office.

In order to assess how well the procedures were implemented, on multiple occasions over the course of the pilot study, the PI accompanied the CFD shift commander to observe the request for authorization across different ambulance crews and was exposed to numerous incidents of overdose-reversal and transport of individuals to the ED. This provided an in vivo perspective on the procedures used in the EMS intervention, the ability of EMS to explain the request for permission to release contact information from individuals, and how individuals responded to these requests.

2.4.2. Participant recruitment—Upon receipt of the authorization forms, the LMs attempted to contact the individual in order to recruit them to participate in the study using similar methods that have been used in prior studies (Scott, 2004). These included calling phone numbers that were recorded on the authorization forms and calling the hospital to which an individual had been taken to determine if they were currently admitted as a patient. On occasion, if telephone contact was unsuccessful, peer outreach workers went to the individual's address to invite them to learn more about the study.

Once the LM or outreach worker located the individuals, they were invited to come to the Lighthouse Institute offices for screening for study eligibility (i.e., current treatment status, weekly use of heroin/other opioids in past 90 days, cognitive capacity to consent). Participants were also asked to bring valid ID to verify their identity. If they elected to participate, they completed the informed consent process and were administered a brief baseline assessment.

2.4.3. Random assignment—Following completion of the baseline assessment, the Research Manager used gRand Urn Randomization (Version 1.10; Charpentier, 2003) to randomly assign participants to one of the two study conditions: RIMO experimental vs. passive referral control. Urn randomization adjusts the probability of assignment to each study condition in ways that simultaneously minimize differences in multiple stratification variables (Stout, Wirtz, Carbonari, & Del Boca, 1994). The base rate was set at 50% to each condition and software attempts to simultaneously balance assignment by gender (female vs. other), age (under 45 vs. other), race (African American vs. other), lifetime opioid use disorder severity (6 to 11 symptoms vs. other), past year number of overdoses (2+ vs. other), past 90 days emergency department visits (2+ vs. other), past 90 days of opioid use (45+ vs. other), and lifetime internalizing disorder symptoms (3+ vs. other).¹ The Research Manager entered the information into the program, generated the assignment, and informed the participants of their group assignment. Assignment was not blind as participants and staff knew if they received the RIMO intervention or not.

2.4.4. RIMO condition—Individuals assigned to RIMO then had a face-to-face meeting with the LM at the Lighthouse office, who engaged them in a discussion about their

¹On one occasion, an individual was too sick to complete the study intake process and was transported to a treatment facility; they were subsequently re-contacted, consented to participate, and randomized to study condition.

willingness to go to treatment, primarily MAT, or other treatment modalities if preferred. Linkage Managers (LM) used motivational interviewing (MI) techniques to: 1) discuss with participants the benefits of their decision to go to treatment, including activities they might enjoy as well as things they do not like about their substance use, 2) provide personalized feedback to participants about the status of their condition based on responses to the assessment instruments, 3) help participants resolve ambivalence about their opioid use and move them toward a commitment to change by accessing treatment, 4) address existing barriers to treatment, e.g., assess Medicaid eligibility and assist with applications, problem-solve issues regarding childcare or transportation, 5) schedule a treatment appointment, 6) develop a reminder schedule for MAT appointments, and 7) problem solve transportation or other challenges that arise. Each participant was also given a project card that provided contact information for Lighthouse Institute and RIMO participants were encouraged to call during regular business hours (i.e., 7:00 am – 7:00 pm) to speak with the LM.

The LM contacted participants 2 – 3 times/week for 4 weeks to ensure that participants completed detox and/or initiated and remained engaged in MAT. This included working with the individual and the treatment provider to minimize missed doses, which can “re-set” the dosing schedule. Specifically, the LM followed-up with the treatment agency and/or participants to determine if they showed for their intake appointments and scheduled dosing for 30 days. When participants missed a dose, the LM contacted them to discuss barriers and strategies that would help them stay in treatment. Additionally, the LM and treatment provider coordinated information on the participant’s barriers to treatment engagement (i.e., scheduling, transportation) and assisted the participant in problem-solving solutions to support their treatment retention. During the first 30 days, the research team provided bus cards for those in need.

LMs that worked on this pilot study had a minimum of a bachelor’s degree and from 1 to 10 years of experience providing RMC in prior and concurrent projects that utilize the RMC with different study samples. These staff had already been trained and certified on MI by the Motivational Interviewing Network of Trainers (MINT; <https://motivationalinterviewing.org/>) based on established criteria (Glenn & Moyers, 2010).

2.4.5. Passive referral control condition—Individuals who were assigned to the control condition following the baseline assessment received a brochure from the research interviewer listing local MAT and other SUD treatment providers in the community. This brochure provided the addresses and phone numbers to various types of MAT treatment providers, sorted by location within the city (i.e. west side, south side). The brochure also provided information about other substance use treatment options, such as residential treatment. In addition, the Opioid Crisis Helpline for Illinois, a toll-free number where individuals are connected to MAT or other treatment in their community, was included.

2.5. Quantitative data collection

The baseline interview was administered at study intake, prior to randomization. A study-specific version of the *Global Appraisal of Individual Needs Quick version 3* (GAIN-Q3, Titus et al., 2013) was used to obtain information on participants’ socio-demographic

characteristics, current substance use, prior experiences of opioid overdose, treatment history, prior hospitalization and contact with ED, and mental and physical health status. LMs completed the baseline interviews face-to-face at enrollment; follow-up interviews were completed in person with study participants² approximately 30 days later using a parallel version of the GAIN-Q3. This included questions on days of treatment, and specifically MAT, received over the past 30 days, which is used in the comparative outcome analyses. In addition, LMs recorded dates of events corresponding to progression through the study stages: date of overdose reversal (collected from authorization form), date authorization form was received by study team, date of in-person screening/study intake meeting, and date of MAT treatment admission (obtained from treatment records for the RIMO group only).

2.6. Quantitative study sample

The study sample comprised 33 individuals (17 in the control group, 16 in the RIMO group) who were successfully contacted, screened, enrolled into the study, and randomized to condition. The study sample included 9 (27.3%) females; 5 individuals of Hispanic ethnicity. Of the 33, 22 (66.7%) described themselves as Black/African American, 3 (9.1%) as White, 3 (9.1%) did not report race, and 5 (15.1%) reported more than one race.

Clinically, all participants had prior overdose history, with 20% having experienced one overdose; 30% having two prior overdoses; 17% having three prior overdoses; and 33% having four or more overdoses. Weekly or more frequent use was reported for any opioid (97%), heroin (97%), other opioids (18%), alcohol (49%), cocaine (39%), cannabis (18%), and/or other drugs (9%). Most were in the severe range for past-year opioid use disorders (94%), other substance use disorders (55%), internalizing mental health problems (79%), and physical health problems (73%). In terms of SUD treatment, 73% had been in treatment in the past year; this includes 39% who had been in MAT in the past 90 days (but 29% for only 1 to 12 days). None of the above characteristics were significantly different by condition ($p < .05$); there were however trends for the RIMO group to be higher than the control group on internalizing mental health disorder symptoms (88% vs. 71%, OR=2.9, n.s.d.) and lower on weekly cocaine use (31% vs. 47%, OR=0.50, n.s.d.).

2.7. Quantitative data analyses

Simple descriptive statistics were used to determine the percentage of individuals that completed each stage in the intervention sequence. Comparisons were made between the RIMO and control group on the primary outcome variables (measured with reference to past 30 days): 1) any opioid treatment received (yes/no), 2) days of opioid treatment received, 3) any MAT received (yes/no), and 4) days of MAT received. Each outcome variable was modeled using univariate logistic regression, with group assignment (1 = RIMO, 0 = control) entered; odds ratios and corresponding 95% confidence intervals were computed for each of the outcome variables to determine effect sizes. Average days in any treatment for opioid use and in MAT specifically were compared across groups using Mann-Whitney U test (aka rank order test) because of the skewed distribution and zero saturation in the control group. The

²One interview was completed by telephone with a participant who was hospitalized.

intervals (in days) between the initial contact with EMS for overdose reversal to: (1) receipt of the authorization form by the study team (n = 75), (2) the in-person meeting for screening (n = 42) and study intake (n = 33), and (3) MAT admission (for the RIMO group only, n = 16) were modeled with survival analyses. Dates of MAT admission for the RIMO group were verified with program records.

2.8. Qualitative method and analyses

A focus group was conducted at the end of the intervention phase with RIMO study participants in order to obtain their perspectives on the intervention process. This information was part of the formative process of refining the RIMO intervention for a subsequent larger, experimental trial (Green et al., 2015). The study PI and Research Project Manager co-facilitated the group, which was conducted at the research office and lasted for 60 minutes. All 16 individuals assigned to the RIMO condition were invited to participate and 9 (56%) attended. Five individuals did not attend the group for the following reasons: hospitalized, in residential treatment or incarcerated, at work, or over slept; and two individuals did not provide a reason.

The group discussion was guided by a set of open-ended questions that asked participants their perceptions and feedback about each component of the RIMO intervention: 1) the initial contact with EMS and request for contact information; 2) interactions with Linkage Managers and outreach workers during study recruitment and intake; 3) initial contact with the Linkage Manager; 4) subsequent interactions with the LM prior to treatment admission; and 5) the treatment intake process. The group discussion was audio-recorded and transcribed by a research assistant for content analyses. The study Co-I (Grella) initially coded the transcripts for common themes that emerged across the discussion, which were then reviewed by the other members of the study team (PI, Co-PI, Linkage Managers) in an iterative process of interpreting the coded data. The summary of qualitative findings was then reviewed by all members of the study team in order to obtain consensus on accuracy and interpretation of the data.

3. Results

3.1. Study recruitment

Figure 1 shows the consort diagram for progression through each step in the study process. EMS transmitted authorization forms for 75 overdose cases to the study team; of these, 51 (67%) individuals were alert and oriented, agreed to share contact information with the study team, and moved to the next stage in the study process. The remaining 24 (33%) were eliminated from the study because: 9 refused to release their contact information; 3 forms were invalid; 2 individuals were not alert and oriented, so permission was not requested; 5 individuals lived outside the service catchment area; 2 individuals were incarcerated subsequent to release of their contact information; and 3 individuals had been previously contacted and enrolled into the study, and had repeat contact with EMS. Among those who the study team attempted to contact, 42 were located and came to the research office for study screening; the remaining 9 were eliminated at this point because: one refused to

schedule a study appointment, 2 did not show to the study appointment, and 6 were not located.

Of the 42 that showed to the study appointment, 33 (79%) were eligible and 9 (21%) were ineligible because: 5 were currently in SUD treatment, 3 reported less than weekly heroin use, and 1 was cognitively impaired and unable to provide informed consent. Of the 33 that were enrolled into the study, 16 were randomized to RIMO and 17 to the control group. This is a conversion rate of 75 overdose contacts to recruit and successfully randomize 33 people or odds of 2.27 to 1.

3.2. Linkage and engagement into treatment

Every RIMO participant had at least one linkage meeting with a LM. LM scheduled a total of 25 treatment intake appointments for RIMO participants; nine (56%) individuals had only one treatment intake appointment, 6 (38%) had two appointments, and one individual (6%) had 4 intake appointments (see Figure 1). Multiple appointments for treatment intake (e.g., detox, MAT) were due to no shows to treatment intake or early treatment drop out and re-linkage.

Of the 16 individuals in RIMO, 13 (81%) were linked to MAT; this included 9 to methadone, 3 to Suboxone in inpatient treatment, and 1 to Suboxone in intensive outpatient. One additional participant was connected to detox and received Suboxone, but did not transition to treatment within the month. Of the 9 participants who entered methadone treatment, 67% received at least two doses. Among the Control group, 6 individuals received any form of opioid treatment (35%) and 3 were admitted into some form of MAT (18%). Figure 2 shows the types of treatment received by group.

Survival curves from the initial contact with EMS to critical benchmarks in the study process are shown in Figure 3. Nearly all (99%) authorization forms ($n = 75$) were transmitted from EMS to the study team within 7 days and 60% were received within one day. Among those scheduled for the in-person screening ($n = 42$), 19% attended the meeting within one day, 74% within 7 days, and 100% were scheduled within 28 days. Among those in the RIMO group ($n = 16$), 44% were admitted to MAT within 7 days and 81% within 28 days.

3.3. RIMO vs. control comparisons on primary outcomes

Table 1 shows the descriptive statistics for treatment received (yes/no) and days of any treatment received for opioid use and for MAT specifically, by group. Individuals in the RIMO group ($n=16$) had higher odds of initiating any kind of treatment (81% vs 35%, OR = 7.94, $p<.05$), initiating MAT specifically (81% vs. 18%; OR=20.22, $p < 0.05$), and received more days of MAT (11.19 vs. 0.76; $d=1.09$, $p < 0.05$) relative to those in the control group. In addition, RIMO participants were more likely to be receiving MAT at 30 days post study randomization (44% vs. 6%; OR=12.44, $p < 0.05$).

3.4. Qualitative analyses

Thematic content analysis of the focus group on the participants' perceptions of the RIMO intervention identified four core components: 1) initial contact with the EMS, 2) assertive outreach and engagement through interactions with the Linkage Managers, 3) persistent follow-up to facilitate access to treatment, and 4) how RIMO differs from other interventions.

3.4.1. Initial contact with EMS—Participants were asked: “*Tell us more about how you felt, after you had received naloxone, when the officer/fire fighter asked you whether it would be ok to share your name, address and phone number with Lighthouse so they can get in touch with you in a few days to see how you are doing and talk about available help? Can you describe any concerns you had at the time?*” Comments from participants illustrated that their first contact with EMS following administration of naloxone was pivotal to initiating the process of change by serving as a conduit to the study team:

‘Cuz this one ambulance guy picked me up twice, he’s like you’re gonna kill yourself man, let me introduce you to these people. Sign this and I’ll help you. And so I signed off on it, and like I said, they made a call, I was deep on the Westside when you came and got me. (Participant #1)

When I woke up I was on the gurnee! I was layin’ in bed, I was woke up! When I woke up she was standin’ right there! She was like, “here go my card”, she explained to me [about the study] and I was like okay. It’s all they gave me, and the next thing I know, the next thing I know [the Lighthouse staff] called. (Participant #3)

3.4.2. Assertive outreach and engagement—In response to the question, “*Tell us more about your interactions with the person at Lighthouse Institute, who first described the study to you. Can you describe what your concerns were at that time?*” participants described their interactions with the study team in ways that validated the implementation of the core assertive outreach components in the RIMO intervention. For example, one man described being contacted by the study team, even though he had provided inaccurate locator information at the EMS contact:

They came out to my house and picked me up because I had given them the wrong phone number. Yeah, they came, but I gave them that address and they didn’t give up on me and came to my house. Probably because I didn’t want to be bothered so I gave them a bogus phone number and they didn’t give up and were at the house and said I’ll take you now. Yeah and without them I wouldn’t be alive today because they kept at it... they called me at least every other day just to see how I was doing and people need that, you know, when you’re lost so badly, you need someone just to call and check on you to see how you are. (Participant #6)

After the initial linkage meeting, it often took several attempts to schedule a treatment intake before the individual decided to accept the admission. Participants expressed that they came to trust the intentions of the LMs to help them and eventually responded to their offer to assist them to enter into treatment.

So when you came and I came here and I seen you, and I got to meet the person who was assigned to me, you know, they grow on you, they're good people, they try to help you help yourself, you know. I need to get into a program, I called, and I plead, and they took care of it. (Participant #1)

3.4.3. Persistent follow-up—To understand the participant's experience of the linkage intervention, they were asked: *"Can you tell us more about your meeting(s) with the Linkage Manager at Lighthouse Institute? Were they helpful? What could have made them more helpful? Was there something in particular that stands out to you?"* Their responses indicated that an essential component of the RIMO intervention was the combination of motivational interviewing techniques with persistent follow-up, as illustrated in these quotes.

I was on destructive path, but after meetin' me, meetin' them, steady follow-up and they follow-up, and they followed up, and they followed up, and the followed-up man, I surrender, you know I'm sayin'? Let's go, let's get it, let's get it in, let's do this! If you gonna help me get in, let's get it. I'm ready to get in here, I'm ready to get my life together (Participant #3)

I was surprised because these people are callin' me. I had just scored, I went and got high, and the lady called me and was like, "I will pick you up right now if you're willing to want to change. If you're willing, really wanna do somethin' for yourself, I'll pick you up right now, where are you at?" (Participant #1)

I was havin' problems with gettin' to my program and I called Lighthouse. And Lighthouse help me continue to get to my program ... [the Linkage Manager] call[s] periodically to see if I'm alright, you know I'm sayin'? And I let her know what's goin' on. (Participant #4)

3.4.4. How RIMO differs from other interventions—Lastly, several participants commented that the nature of the RIMO intervention differed from other interventions they had received in the past by conveying the commitment of the Linkage Managers to helping them in their recovery.

I have been to [many] programs before and I never had a program that cared for me like the Lighthouse did ... I been in the streets for a long, long time and I never seen nobody ever do like you guys (Participant #5)

I'm so grateful for this program. They met me, I was at the hospital, OD'd, and I really didn't care about living anymore because I felt like I was in that dark hole, you know, and I couldn't get out. And I had never heard of a place like this. They cared, and [Linkage Manager] did not give up on me, calls me all the time (Participant #6).

Lighthouse has been a blessin' to me too. When I first came here I was still out there usin' drugs, but Lighthouse really cared. They send people to look for you and try to find you and it seem like every time he would find me in my madness ... This place [Lighthouse] really cares ... the other places they just want you for that bed spot. [Participant #2]

4. Discussion

This study addresses a critical challenge to reducing the high rates of opioid overdose, namely helping individuals with OUD to access treatment following an overdose reversal. The pilot study tested an intervention that combined assertive outreach to individuals following an opioid overdose reversal by EMS and treatment linkage and engagement based on the RMC model. This approach is consistent with recent innovative approaches to intervene with individuals within several days after an overdose (Bowman et al., 2014; Garza & Dyer, 2016) and to build collaborative partnerships with emergency services providers (Samuels, 2014). The study findings contribute to the growing literature on the use of interventions for treatment linkage and recovery support that target individuals who have had an opioid overdose, which have focused on making initial contacts with individuals within hospital EDs (McGuire et al., 2019; Powell, Treitler, Peterson Borys, & Hallcom, 2019; Wagner et al., 2019; Waye et al., 2019). The unique aspect of the RIMO intervention is the combined use of assertive outreach with a well-established treatment linkage intervention for out-of-treatment individuals who are initially contacted outside of the ED, which expands the range of potential access points to the opioid treatment service cascade (Williams, Nunes, Bisaga, Levin, & Olfson, 2019).

This pilot study provides initial data on the feasibility of several core components of the RIMO intervention. First, the study demonstrates the feasibility of partnering with EMS personnel to secure authorization from individuals to release their contact information following administration of naloxone to reverse an opioid overdose. In this way, the process of engagement begins prior to their admission to the ED. Importantly, the pilot study enabled the study team to obtain data on how often individuals refused transport to the ED after an overdose reversal, which is useful information for shaping the methods used to contact the individual. During this pilot, only one person refused transport to the ED. It should be noted that this individual was subsequently contacted directly by the study team, agreed to participate, was randomly assigned to RIMO, and initiated MAT within the month. Hence obtaining authorization for contact is a critical and feasible first step.

Second, the pilot demonstrates the feasibility of locating these individuals after receiving contact information from the EMS through assertive outreach, meeting with them soon after (74% within 7 days), and obtaining their agreement to participate in the study.

Third, the pilot provides evidence that most individuals in the RIMO condition were successfully engaged into MAT and received more days of treatment relative to those in the passive referral control. The intervention team combined the use assertive and persistent contact with motivational interviewing and problem-solving to help individuals surmount the motivational and logistical challenges to entering treatment. Although some people in the passive referral control group did enter treatment on their own, few (18%) received MAT or many days of MAT (Mean = < 1 day in past 30).

Qualitative data from the focus group illustrates the cyclical nature of overdose and relapse and the challenges participants faced in accessing treatment. The participants' comments indicated that they valued the core components of the RIMO intervention, i.e., assertive

outreach and persistent follow-up, as critical to engaging them into treatment. Moreover, the participants appreciated that the study team genuinely cared about them in a way that they had not experienced previously from other service providers. Thus this study addresses a significant challenge to the field, namely linking individuals to treatment after an opioid overdose by using assertive and proactive outreach and engagement strategies.

Study limitations

As a pilot study, the study is necessarily limited in several ways. These include: 1) a small sample size, 2) limited duration of follow-up to determine longer-term treatment retention and outcomes, 3) lack of in-depth assessment to determine potential modifiers and mediators of the primary outcome variables. Further, although all RIMO participants were invited to participate in the focus group, it is possible that those most favorable to the study actually participated, compared to those with other views. A broader range of participant perspectives is needed refine the RIMO procedures in order to encompass divergent perspectives.

In addition, the pilot study faced several challenges to integrating research procedures within real-world operations. For example, the study procedures required that fire station personnel review and scan the authorization forms at the fire station and email them to the research team. Since the fire station utilized electronic medical records for their usual procedures, this requirement to manually scan and email the authorization form was a potential barrier to rapid transmission. Nevertheless, 60% of these forms were received by the study team within one day. With regard to the outreach component, the LMs worked regular business hours, and thus outreach to potential participants could have been expedited with 24-hour coverage, resources permitting. We note that implementation of field procedures was facilitated by conducting multiple meetings between the study team and CFD personnel; by providing trainings to the EMS teams that addressed the background of the study, rationale for the intervention, and potential benefits to EMS by reducing repeated overdoses and emergency interventions; and by having the opportunity for the PI to ride-along with EMS teams to observe and obtain feedback from the field. A future, larger-scale experimental study will build upon what was learned in this pilot study to address these methodological limitations and logistical challenges.

5.0. Conclusion

Expansion of MAT is one of the primary policy initiatives being implemented across states to address the current opioid crisis (Pitt, Humphreys, & Brandeau, 2018; Wickramatilake et al., 2017); yet, given the well-documented challenges that individuals with OUD face in accessing MAT (McCarty, Priest, & Korthuis, 2018), underutilization remains a persistent problem. The findings from this pilot study suggest that the RIMO intervention use of assertive linkage and engagement combined with motivational interviewing helps individuals to surmount these barriers to treatment entry. Individuals who have undergone an overdose reversal with naloxone have a high risk of future overdose and fatality, and, as shown in this study, typically have clinically severe problems that make it harder for them to access services. As a pilot study, these findings are preliminary, but validate the need for a

larger-scale experimental trial of the RIMO intervention that will allow for further evaluation of its effectiveness for treatment initiation and engagement, as well as the indirect effects on subsequent rates of opioid use, overdose, and death.

Acknowledgements

This paper was supported by National Institute on Drug Abuse (NIDA) grant no. DA045774 (PI: Scott). The opinions are those of the authors and do not reflect positions of the government. The authors would like to thank Dr. Alexander Walley for sharing his instrument on opioid reversal, as well as the participants and staff who participated in this study. Questions and suggestions can be addressed to Dr. Scott at cscott@chestnut.org.

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Highlights

- 51/75 people moved to next stage of study screening following overdose reversal
- 33/51 were contacted, eligible for the study, and randomized to RIMO or control
- Individuals in the RIMO group were 20 times more likely to receive MAT vs. controls
- Individuals in the RIMO group had more days of MAT in past 30 days (11.2 vs. 0.8)
- The assertive RIMO linkage intervention addressed typical barriers to MAT entry

Figure 1.
RIMO Experiment Consort Diagram

Figure 2.
Type of treatment received in the first month by group

Figure 3.
Days from initial contact with EMS to receipt of forms from EMS, in-person screening, and MAT admission*

Table 1.

Treatment outcomes in the past 30 days by condition

Treatment in the past 30 days	Total (n=33)		Condition %/Mean		Odds Ratio [OR] ^a		Cohen's effect size d and significance ^b
	% or Mean	Std Dev.	RIMO (n=16)	Control (n=17)	OR & Significance	95% CI	
Any Opioid treatment	58%	50%	81%	35%	7.94*	(1.60, 39.42)	
Days of Opioid Treatment (out of 30)	9.12	11.72	15.19	3.41			1.00*
Any MAT	48%	51%	81%	18%	20.22*	(3.45, 118.65)	
Days of MAT (out of 30)	5.82	9.53	11.19	0.76			1.09*

^aOR are odds ratios for the any treatment variables with * p<.05 and OR >1.2

^bCohen's effect size d calculated on days of treatment as (RIMO-Control)/Total SD with p<.05

d>0.20 in **bold**; Given zero saturation in control group, significance is based on Mann-Whitney U test.