Development and initial testing of a tailored telephone intervention delivered by peers to prevent recurring opioid-overdoses (TTIP-PRO)

T. Winhusen¹,*, J. Theobald¹, D. Lewis¹, C. M. Wilder¹,² and M. S. Lyons³

¹Addiction Sciences Division, Department of Psychiatry and Behavioral Neuroscience, University of Cincinnati College of Medicine, 3131 Harvey Avenue, Cincinnati, OH 45229, USA, ²Cincinnati Veterans Affairs Medical Center, 3200 Vine Street, Cincinnati, OH 45220, USA and ³Department of Emergency Medicine, University of Cincinnati College of Medicine 231 Albert Sabin Way, Cincinnati, OH 45267, USA

*Correspondence to: T. Winhusen. E-mail: winhusen@carc.uc.edu

Received on September 8, 2015; accepted on February 3, 2016

Abstract

Individuals with opioid use disorder experiencing a non-fatal opioid-overdose (OOD) are at heightened risk for future OODs; there are no interventions to facilitate treatment enrollment for these patients. Our goal was to develop and initially test the ‘tailored telephone intervention delivered by peers to prevent recurring opioid-overdoses’ (TTIP-PRO), a computer-facilitated, peer-delivered, individually tailored secondary prevention intervention designed to: (i) encourage patients to initiate medication-assisted treatment (MAT) and (ii) increase OOD knowledge. A pre–post-study assessed TTIP-PRO-content acceptability and software performance. Two Peer Interventionists, who were abstinent from illicit opioids, enrolled in MAT and had experience with OOD, were recruited from a MAT clinic. Recruitment letters were sent to patients treated for OOD in a hospital emergency department within the prior 8 months. Eight patients received TTIP-PRO and completed pre-/post-assessment. Peer Interventionists completed training within 4 h and reported high satisfaction with TTIP-PRO. There were no performance issues with the software. All participants rated TTIP-PRO as ‘very helpful’. Participants’ OOD knowledge increased significantly, with 69.9% correct responses pre-TTIP-PRO and 93.6% post-TTIP-PRO. Interest in receiving MAT, measured on a 10-point scale, increased from 8.1 to 9.5, but this change was not statistically significant. Further development and testing of TTIP-PRO appears warranted.

Introduction

In recent years, the United States has experienced a growing opioid-use epidemic accompanied by a dramatic rise in opioid-overdose (OOD) deaths [1, 2]. In addition, it is estimated that there were between 99 000 and 253 000 deaths globally in 2010 as a result of illicit drug use, with drug-related deaths accounting for between 0.5 and 1.3% of all-cause mortality among those aged 15–64 [3]. Individuals with opioid use disorder (OUD) experiencing a non-fatal OOD are at heightened risk for future OODs [4, 5]. A recent study revealed that, overall, 7% of patients treated for an OOD in an emergency department (ED) were treated for more than one OOD within 1 year [6]. This proportion was higher in particular subsamples, with 25% of Medicaid OOD patients having more than one OOD ED visit in 1 year [6]. Of note, the patients with repeated OODs accounted for 15% of all OOD ED visits and were more likely to be hospitalized [6]. In addition to the human cost of repeated OODs, there are significant financial costs as well: the median cost of treatment was $4521 for non-hospitalized, and $22 460 for hospitalized, patients [6].
Attempts to mitigate OOD have largely focused on naloxone, an opioid antagonist that is effective in OOD reversal [7]. Research suggests that individuals experiencing a recent non-fatal OOD may be open to entering treatment [8], yet a review of the literature revealed no interventions for facilitating treatment entry for these vulnerable patients. To fill this gap, we created the ‘tailored telephone intervention delivered by peers to prevent recurring opioid overdoses’ (TTIP-PRO), a secondary prevention intervention for individuals with OUD and a recent OOD designed to: (i) encourage patients to initiate medication-assisted treatment (MAT) and (ii) increase knowledge about OOD risk reduction.

Receiving MAT for OUD (e.g. methadone-, buprenorphine-maintenance) significantly reduces the likelihood of OOD [9–12]. However, in addition to the barriers of waiting lists and the costs of MAT, inaccurate negative perceptions of MAT including that it is an ineffective treatment also prevent some individuals with OUD from entering treatment [13, 14]. In addition to using MAT to reduce OOD risk, it has been proposed that educating opioid abusers about OOD risk factors could reduce OOD rates [11, 15–18] and, thus, this was included as a component of TTIP-PRO.

In order to maximize the potential impact of TTIP-PRO on risk-reduction behavior, particularly on entering a MAT program, the creation of TTIP-PRO was guided by the elaboration likelihood model (ELM) of persuasion [19, 20]. The ELM posits that people process persuasive information through two routes: central, in which the material is actively considered, and peripheral, in which the material is given only superficial consideration. Information that is processed centrally and found to be convincing and valuable results in a positive attitude change that is relatively long lasting and predictive of behavior. Communication that is processed by the peripheral route results in attitudes that are susceptible to further change and not predictive of behavior. Conditions that increase the likelihood of information being centrally processed and leading to a positive attitude change (e.g. that MAT would be beneficial) include: (i) the material is seen as personally relevant; (ii) the information can be readily understood; and (iii) the source of the information is considered credible. TTIP-PRO was designed to maximize each of these conditions.

Personal relevance is maximized by tailoring the intervention and targeting a patient population likely to find the material relevant. In applying ELM to health promotion messages, a key recommendation is to use tailored messaging to increase the relevance of the information to intervention recipients [21]. Thus, TTIP-PRO provides tailored feedback to a given individual based on his/her OOD risk factors and knowledge about OOD and MAT. Research suggests that patients with a recent OOD may find TTIP-PRO’s information particularly relevant. Specifically, a study found that 26% of injection drug users experiencing a non-fatal OOD sought treatment for their addiction within 30 days of the event and 75% of those patients enrolled in treatment [8]. Seeking treatment was significantly more likely when someone spoke to the patient about addiction treatment [8]. To enhance patients’ understanding of the information provided in TTIP-PRO, information is provided both verbally and in writing to facilitate multimodal learning. Finally, to provide a credible source of information, all information has a solid empirical basis and is delivered by a Peer Interventionist, who has personal experience with OUD and OOD. Peer Interventionists are typically perceived as highly credible and can provide personal knowledge that facilitates active learning through a shared experiential process [22].

In order to maximize the potential impact of TTIP-PRO on risk-reduction behavior, particularly on entering a MAT program, the creation of TTIP-PRO was guided by the elaboration likelihood model (ELM) of persuasion [19, 20]. The ELM posits that people process persuasive information through two routes: central, in which the material is actively considered, and peripheral, in which the material is given only superficial consideration. Information that is processed centrally and found to be convincing and valuable results in a positive attitude change that is relatively long lasting and predictive of behavior. Communication that is processed by the peripheral route results in attitudes that are susceptible to further change and not predictive of behavior. Conditions that increase the likelihood of information being centrally processed and leading to a positive attitude change (e.g. that MAT would be beneficial) include: (i) the material is seen as personally relevant; (ii) the information can be readily understood; and (iii) the source of the information is considered credible. TTIP-PRO was designed to maximize each of these conditions.

Personal relevance is maximized by tailoring the intervention and targeting a patient population likely to find the material relevant. In applying ELM to health promotion messages, a key recommendation is to use tailored messaging to increase the relevance of the information to intervention recipients [21]. Thus, TTIP-PRO provides tailored feedback to a given individual based on his/her OOD risk factors and knowledge about OOD and MAT. Research suggests that patients with a recent OOD may find TTIP-PRO’s information particularly relevant. Specifically, a study found that 26% of injection drug users experiencing a non-fatal OOD sought treatment for their addiction within 30 days of the event and 75% of those patients enrolled in treatment [8]. Seeking treatment was significantly more likely when someone spoke to the patient about addiction treatment [8]. To enhance patients’ understanding of the information provided in TTIP-PRO, information is provided both verbally and in writing to facilitate multimodal learning. Finally, to provide a credible source of information, all information has a solid empirical basis and is delivered by a Peer Interventionist, who has personal experience with OUD and OOD. Peer Interventionists are typically perceived as highly credible and can provide personal knowledge that facilitates active learning through a shared experiential process [22].

As research on smoking quitlines has shown, telephone interventions can be very cost-effective [27–31]. This article describes the development and initial testing of TTIP-PRO.
The core of the TTIP-PRO intervention included accurate information; literature searches were conducted to find evidence confirming or disconfirming items in the existing assessments. In completing the literature review process, we identified a pool of items that, based on research evidence, should be included in assessments of overdose risk and knowledge; after finding no existing assessments that included our pool of items, we created the PORS and the OOTAS. After finalizing the PORS and OOTAS, we created the TTIP-PRO computer program, which generates the two reports used for the intervention. We then created the Peer Interventionist training manual and proceeded to identify and train Peer Interventionists. Finally, we completed a pre-/post-study to assess the acceptability of the content of TTIP-PRO and the performance of the TTIP-PRO computer program. We describe each step of our process below; approval from the University of Cincinnati (UC)
institutional review board (IRB) was obtained for all stages of development.

Information collected to tailor the intervention

The Personal Opioid-Overdose Risk Survey. The PORS assesses an individual’s OOD risk factors. It only includes risk factors for which there is documented evidence and scoring for each item is based on the strength of the evidence that the factor increases risk. Specifically, effect sizes (e.g. odds ratios) reported in the literature were used as a guide in weighting the PORS items, and modifications were made to existing items when evidence was found for quantitative, rather than simple yes/no, associations (e.g. we found evidence of a positive relationship between number of years using opioids and risk for overdose). Though the PORS largely includes items found in existing assessments, to the best of our knowledge, it is the only OOD risk assessment that includes citations to peer-reviewed literature for each item and item weight. In order to tailor the questions to reference only the type(s) of opioids used by a given individual, there are three versions of the PORS, one for heroin-only users, one for prescription opioid-only users, and one for those who use both heroin and prescription opioids. Table I provides the PORS items for the heroin-only version along with scoring and supporting evidence. During a 4-week period, patients presenting for intake at the UC-affiliated methadone program were asked to anonymously complete the PORS as a self-assessment and to provide suggestions for improving it; 25 PORS were completed with no suggestions for improvement. The PORS takes <5 min to complete.

The Opioid Overdose and Treatment Awareness Survey. The OOTAS assesses knowledge about OOD and MAT; like the PORS, there are three versions of the OOTAS to reflect the type(s) of opioids

| PORS item                                                                 | Answer scoring | Supporting Evidence |
|---------------------------------------------------------------------------|----------------|---------------------|
| Have you recently been increasing the amount of heroin that you use to get high? | Yes: +2         | [35]               |
| Do you often use heroin by injecting?                                      | Yes: +2         | [36–38]            |
| Do you often use benzodiazepines (‘benzos’ or ‘nerve pills’ like Valium or Xanax) while you are using heroin? | Yes: +2         | [11, 36, 39, 40]   |
| Do you often use alcohol while you are using heroin?                      | Yes: +2         | [11, 39]           |
| Do you use some ‘other’ drug (like cocaine, ecstasy, marijuana) while you are using heroin? | Yes: +1         | [36]               |
| Do you ‘test’ your heroin before using it to check its purity?             | Yes: −1         | [9, 12, 35]        |
| In situations where you have been opioid-abstinent (e.g. in jail/prison, inpatient hospitalization, detox treatment) and then go back to using heroin, do you start with the same amount that you were using prior to being opioid abstinent? | Yes: +3         | [41–43]           |
| Are you currently experiencing depressive symptoms (e.g. feeling sad, lonely or hopeless)? | Yes: +1         | [43–45]           |
| Do you have decreased liver function—e.g. from a liver disease, like hepatitis? | Yes: +1         | [46]               |
| Are you currently enrolled in a methadone or suboxone treatment program? | Yes: −2         | [9–12]             |
| Do you frequently drink four or more alcoholic drinks in a day?           | Yes: +2         | [9, 11, 36, 47, 48]|
| How many years have you been using heroin?                                | <5: +4; 5–10: +5; >10: +6 | [9, 11]           |
| How many times have you had an opioid overdose, including your most recent overdose? | +1 for each overdose (up to 6) | [4, 5, 9, 43] |
used. The OOTAS is comprised of four sections: (i) OOD risk factors; (ii) signs of an OOD; (iii) how to respond to an OOD; and (iv) misconceptions about MAT. The first three sections include only evidence-based items supported by a recent literature review, while items for the fourth section are based on both a literature review and on input from the medical staff of the UC-affiliated methadone program. During a 2-week period, patients from the UC-affiliated methadone program were asked to anonymously complete the OOTAS as a self-assessment and to provide suggestions for improving it; 52 OOTASs were completed and several suggestions were provided for improving the comprehensibility of particular items. These suggestions, along with additional suggestions from the staff, were incorporated into the final version of the OOTAS, the heroin-only version of which is provided in Table II. A key difference between the OOTAS and existing OOD knowledge tests is its emphasis on knowledge about MAT (e.g. methadone, buprenorphine) for OUD. Although the OOTAS is similar to the OOKS [32], the OOKS focuses on naloxone for OOD reversal. The OOTAS takes <10 min to complete.

TTIP-PRO computer program

The TTIP-PRO data entry and report-generation system is an application of Microsoft Access 2010 supported by embedded programs written in Visual Basic for Applications. To help eliminate data entry errors, the TTIP-PRO program has several built-in error-checking/data-validation features to ensure that logically inconsistent or out-of-range data are not accepted. All data fields default to ‘blank’ (empty) values, and screens require that key fields (e.g. participant ID, date of data collection, type of opioids used) have non-empty entries before proceeding through the intervention. The TTIP-PRO system stores no identifying personal information, so it can be operated in a relatively low security environment. After an operator enters all relevant information for a particular patient (i.e. the types of opioids used, responses to the PORS and OOTAS), the TTIP-PRO system automatically generates the Personal Feedback Report, which is used by the Peer Interventionist to complete the telephone component of the intervention, and the Personal Risk Factors Report, which is included in the written component of the intervention mailed to the participant. The operator for the initial test of the TTIP-PRO computer program was a research staff member.

Peer-delivered intervention

The Personal Feedback Report begins with tailored feedback based on the patient’s responses to the PORS and OOTAS. The OOTAS portion of a Personal Feedback Report for a fictional heroin-only user is provided in Figure 2. Following this scripted component, the Peer Interventionist initiates an open exchange of information about MAT based on potential prompts provided by the Personal Feedback Report. For example: ‘One of the best protections against an overdose is effective treatment, including methadone or buprenorphine maintenance treatment. As I mentioned, I am in treatment and I am doing really well. Would you like to hear about my experiences?’

The TTIP-PRO mailing

To help reinforce the information that the patient receives during the peer-delivered telephone component of the intervention, each participant is sent a follow-up mailing. The mailing includes: (i) the Personal Risk Factors Report (see section ‘TTIP-PRO computer program’); (ii) SAMHSA’s ‘Opioid Overdose Toolkit: Safety Advice for Patients and Family Members’ and ‘Recovering from Opioid Overdose’; (iii) SAMHSA’s ‘MAT for Opioid Addiction: Facts for Families and Friends’; (iv) a list of local methadone and buprenorphine treatment providers; and (v) a $20 gift card, which is included to help ensure that the participant provides a correct mailing address and opens the mailing. A Personal Risk Factors Report for a fictional heroin-only user is provided in Figure 3.
| Risk for opioid overdose question                                                                 | Correct answer | Supporting evidence |
|--------------------------------------------------------------------------------------------------|----------------|---------------------|
| Using heroin after a period of non-use (e.g. after release from prison/jail or discharge from detox treatment) | Yes            | [12, 40–43, 47, 49] |
| Using heroin with other substances like alcohol or benzodiazepines (‘benzos’ or ‘nerve pills’ such as Xanax or Valium) | Yes            | [9, 11, 12, 39, 50] |
| Having a short history, <1 year, of using heroin                                                | No             | [9, 11, 39]         |
| Having decreased liver function from a liver disease, like hepatitis                           | Yes            | [46, 51, 52]        |
| Having prior opioid overdoses                                                                  | Yes            | [4, 5, 10, 43]      |
| Using heroin by smoking, snorting or taking pills rather than by injecting (needle and syringe)  | No             | [36, 38, 53]        |
| Using heroin that is more pure than usual                                                      | Yes            | [35, 36]            |
| Being enrolled in methadone- or suboxone-maintenance treatment                                | No             | [9–11]              |
| Having depressive symptoms (e.g. feeling sad, lonely or hopeless)                              | Yes            | [43–45, 54]         |
| Drinking alcohol almost every day                                                               | Yes            | [5, 9, 11]          |

| Signs of overdose question                                                                      | Correct answer | Supporting evidence |
|--------------------------------------------------------------------------------------------------|----------------|---------------------|
| Skin (especially the lips and fingertips at first) looks blue                                    | Yes            | [55]                |
| Body very limp                                                                                    | Yes            | [55]                |
| Eyes bloodshot                                                                                    | No             | [17]                |
| Face very pale or clammy                                                                          | Yes            | [55]                |
| Slow pulse, irregular pulse or no pulse                                                           | Yes            | [56]                |
| Throwing up                                                                                      | Yes            | [56]                |
| Acting upset and irritated                                                                        | No             | [55]                |
| Passing out                                                                                      | Yes            | [55]                |
| Choking sounds or a gurgling/snoring noise                                                        | Yes            | [17]                |
| Slow breathing, irregular breathing, or not breathing                                              | Yes            | [55]                |
| Acting really paranoid                                                                           | No             | [55]                |
| Not responding to yelling or pinching or other intense stimulation                                | Yes            | [57]                |

| How to respond to an overdose question                                                           | Correct answer | Supporting evidence |
|--------------------------------------------------------------------------------------------------|----------------|---------------------|
| Call 911                                                                                         | Yes            | [57]                |
| Put the person in a bathtub full of cold water                                                   | No             | [57]                |
| Lay the person on their back                                                                     | No             | [57]                |
| Give the person mouth-to-mouth breathing                                                         | Yes            | [57]                |
| Give the person naloxone (Narcan), if you have it                                                 | Yes            | [57]                |
| Walk the person around                                                                           | No             | [58]                |
| Inject the person with cocaine or methamphetamine                                               | No             | [58]                |

| MAT question                                                                                     | Correct answer | Supporting evidence |
|--------------------------------------------------------------------------------------------------|----------------|---------------------|
| Methadone rots your teeth and bones                                                              | No             | [13]                |
| Methadone and suboxone are worse for your body than heroin                                        | No             | [13, 59]            |
| Methadone and Subutex are safe for a pregnant woman and her unborn child                           | Yes            | [59]                |
| Most people only have to take methadone or suboxone once a day to hold off withdrawal and cravings | Yes            | (NA, from medical MAT staff) |
| People treated with methadone or suboxone get high or sleepy and can’t safely drive or work       | No             | (NA, from medical MAT staff) |
| Methadone and suboxone suppress your immune system—so people get sick more often                 | No             | [14]                |
| Lower doses of Methadone and suboxone are always better than higher doses                         | No             | [59]                |
| Methadone and suboxone are just substitutes for heroin                                            | No             | [59]                |
Peer Interventionist training

Participants and setting

Eligible Peer Interventionists were at least 18 years of age, able to provide informed consent in English, enrolled in a MAT program for at least 1 year, reported being abstinent from illicit opioids for at least 1 year, and had experienced, witnessed and/or lost a family member or friend to an overdose. Potential Peer Interventionists were ineligible if treatment program staff had significant clinical concerns about their participation. For individuals early
Personal Risk Factors
for Bill
5/12/2014

Disclaimer: You were asked about risk factors that are known to be related to increased risk for having an opioid overdose, but you may have other risk factors that we did not assess. This list of risk factors was generated from the answers that you provided.

Anyone who uses heroin is at risk for an overdose. Based on your answers, there are 6 factors that increase your risk above the risk of just using heroin. These factors include:

- **Using heroin by injecting**
  Injection, rather than using by some other method (like smoking or snorting), makes it more likely that you will overdose — the quicker the drug enters your bloodstream, the more likely that the body system that processes the drug will not be able to keep up.

- **Using benzodiazepines ("benzos" or "nerve pills" like Valium or Xanax) while you are using heroin**
  Benzodiazepines can slow down your breathing, just like heroin — if you use them both around the same time, you’re much more likely to overdose.

- **Using alcohol while you are using heroin**
  Alcohol can slow down your breathing, just like heroin — if you’re drinking around the same time that you’re getting high, you’re much more likely to overdose.

- **Following a period of not using heroin, starting with the amount that you were using prior to being abstinent**
  Even one day of not using may lower your tolerance enough so that using your normal amount causes you to overdose.

- **Using heroin. You have been using for 8 years.**
  Anybody who uses is at some risk for opioid overdose. Long-term users suffer the most overdoses. The longer you’ve been using, the more likely it is that you’ll have an overdose.

- **Having had an opioid overdose. You have had 3 overdoses.**
  If you have an overdose and continue using, you’re more likely to have another overdose.

The lowest score you can get on the Personal Risk Survey is a 1, with higher scores indicating increasing risk. Based on your answers, your score on the Personal Risk Survey was a 17.

Please read the enclosed materials for more information about overdose prevention and treatment for opioid use disorder. Thank you!

Fig. 3. Personal Risk Factors Report for a fictional heroin-only user.
in recovery, interacting with active users could increase the risk of relapse; the eligibility criteria of at least 1 year on MAT and 1 year of abstinence from illicit opioids were included to select Peer Interventionists whose recovery is sufficiently stable to mitigate this risk. Peer Interventionists were recruited from the UC-affiliated methadone clinic by word of mouth. The target number of Peer Interventionists was 2–3.

Training
Peer Interventionists were paired with a master’s degree-level trainer. Peer Interventionists completed four training requirements: (i) reading and discussing the Peer Interventionist training manual with their assigned trainer; (ii) role-playing a practice Personal Feedback Report with their assigned trainer; (iii) mastering knowledge of OOD risk factors, as demonstrated by scoring at least 90% on the OOTAS; and (iv) passing a scored mock intervention in which the role of the participant was played by a nurse from the UC-affiliated methadone program.

Assessments
A single master’s degree-level trainer, who had more than 5 years of experience rating the competence of interventionist-trainees, rated each trainee’s performance on the mock intervention. The trainer used a three-point scale (1 = meets expectations, 2 = needs improvement, 3 = expectations not met and additional training required). To be certified, the trainee needed to receive a ‘1’ on at least 5 of the 6 abilities assessed: (i) Ability to provide information while maintaining a conversational tone; (ii) Ability to successfully complete the intervention within 30 min; (iii) Ability to listen; (iv) Sufficient familiarity with the material to answer the participant’s questions; (v) Ability to remain non-judgmental and encouraging; and (vi) Ability to avoid confrontation. The outcome of interest was the Peer Interventionist’s ability to complete training and pass certification within the expected 4-h timeframe.

Initial testing of TTIP-PRO
Study overview
Prior to conducting a pilot efficacy trial, we undertook a pre-/post-study to assess the acceptability of TTIP-PRO-content to both Peer Interventionists and participants and to identify potential issues with the TTIP-PRO computer program. There was limited funding (<$2000) for this project and, thus, we did not utilize the procedures envisioned for the pilot trial in which patients with a non-fatal OOD treated at the UC ED would be recruited prior to leaving the ED. Instead, we used a much less staff-intensive procedure to identify individuals who had experienced a non-fatal OOD and sought their feedback on TTIP-PRO. In addition, we used pre-/post-testing to evaluate TTIP-PRO’s impact on OOD knowledge and interest in receiving MAT.

Participants and setting
The study included two types of participants: (i) the participants who received the TTIP-PRO intervention, referred to as participants, and (ii) the participants who served as Peer Interventionists. Participants were recruited by sending a letter about the study to patients who had been treated for OOD in the UC ED within the prior 8 months. The UC ED, which has over 80,000 visits per year, is part of an urban tertiary-care teaching hospital. The hospital is centrally located in a tri-state region in which all three states have drug-poisoning death rates (driven largely by heroin and opioid analgesics) that are significantly higher than the overall US rate. The county in which the hospital is located has a rate of 28.3 diagnoses of opioid abuse, dependence, or poisoning per 10,000 residents—which is more than double the state’s overall rate [60, 61]. In a recent 12-month period, the UC ED treated 239 unique patients for OOD; the ED does not have a standard approach to providing information about overdose or MAT to patients treated for OOD. Eligible participants were at least 18 years of age, able to provide verbal consent to participate in English, and had used heroin and/or abused prescription opioids in the prior 12 months. Potential participants were ineligible if they...
demonstrated impaired understanding of the study via a formal assessment during the process of obtaining verbal consent for participation. Eligible Peer Interventionists met the requirements described in section ‘Peer Interventionist Training: Participants and setting’ and had successfully completed the training.

Assessments
Participant outcomes of interest were satisfaction with TTIP-PRO and pre-/post-change in: (i) knowledge about OOD as measured by the OOTAS; and (ii) interest in initiating MAT rated on a 10-point scale. To assess satisfaction, participants were asked to rate how helpful they found TTIP-PRO to be on a four-point scale. In addition, participants were asked what they liked most and least about TTIP-PRO and about suggestions for improving it. Peer Interventionist were asked: (i) to rate their satisfaction with providing TTIP-PRO on a four-point scale, (ii) what they liked most and least about providing TTIP-PRO; and (iii) suggestions for improving TTIP-PRO.

Procedures
The participants were scheduled to complete three telephone calls. The first was the Pre-TTIP-PRO call which included an assessment of eligibility and completion of the PORS and OOTAS; the call was completed with research staff and was ~15 min long. The participants were provided with the phone number for a Peer Interventionist and given a time to call to receive the intervention. During this second call, the Peer Interventionist delivered the intervention, which took ~30 min. The third call included completing the OOTAS and assessing the patient’s interest in treatment and feedback on the intervention; this call was completed by research staff within 2 weeks of the second call and took ~10 min to complete. Study participants received $40 in gift cards, $20 as part of the study intervention and $20 for completing the three telephone calls. Peer Interventionists were compensated $40 for completing training/certification, and $10 for each participant for whom they provided the intervention. They were also given $45 to help cover the cost of using their personal phones to deliver the intervention.

Data analysis
Analyses were completed using SAS, Version 9.3 (SAS Institute, Inc.). Statistical tests were conducted at a 5% Type I error rate (two-sided) for all measures. Pre-/post-changes in the percent of correct OOTAS answers and interest in MAT were analyzed using a Wilcoxon signed-rank test. The Wilcoxon signed-rank test is similar to the paired t-test but it does not assume that the paired differences are normally distributed. The percent correct for the OOTAS was determined by adding up the questions that the participant answered correctly, with each question given equal weight. For the overall OOTAS score and for each of the four section scores, the Wilcoxon signed-rank test was used to test for significant by-participant differences in initial versus final scores. The raw qualitative data are presented in the ‘Results’ section.

Results

Peer Interventionists
Sample characteristics
Three potential Peer Interventionists were recruited within 1 week. One training session was offered, which two of the three Peer Interventionists (one man and one woman) completed; the third left before the training started due to an emergent situation that was unrelated to the study. Both Peer Interventionists were White and non-Hispanic.

Peer Interventionist outcomes
Both Peer Interventionists completed training and certification within the designated 4-h time-frame. Both rated their satisfaction with providing TTIP-PRO as 4.0 on a four-point scale. Both Peer Interventionists reported that being able to help others (viz. ‘being able to help people’, and ‘the chance to help somebody else’) was what they liked most about providing the intervention.
Neither reported anything about administering the intervention that they disliked (viz. ‘nothing’ and ‘can’t say I didn’t like anything about it’), nor did they identify anything which they thought was not helpful for participants receiving the intervention. When asked what they thought was particularly helpful for participants receiving the intervention, one reported, ‘I could relate to them—I’ve been through it’, while the other stated that the most helpful aspect for participants was the ‘information provided’. One Peer Interventionist suggested that the intervention would be improved: ‘... if the interventionists could make an appointment for them [the participants] to come to [the] clinic’. The other interventionist had no suggestions for improvement.

### Study participants

#### Sample characteristics

Letters were mailed to 141 individuals who had been treated for OOD, 42 of which were returned as undeliverable. The 13 individuals who responded to the letter and were screened were all eligible for the study. Peer Interventionists received calls from, and provided the intervention to, nine participants, eight of whom were reached by research staff for the follow-up call. All eight participants were White and non-Hispanic and five were female. The participants were 40.3-years old on average (SD = 12.7). Three of the participants were heroin-only users and the other five reported using both heroin and prescription opioids. With a maximum possible score of 28, the average PORS score was 17.1 (SD = 5.2), the proportion endorsing each PORS item is provided in Table III.

#### Participant outcomes

The pre- and post-TTIP-PRO OOTAS results are provided in Table IV. As can be seen, there were significant increases in overall OOD knowledge ($W = 18, P = 0.0078$), responses to overdose ($W = 18, P = 0.0078$) and information about MAT ($W = 18, P = 0.0078$). Participant interest in receiving MAT increased from 8.1 (SD = 3.2) pre-TTIP-PRO to 9.5 (SD = 1.1) post-TTIP-PRO, but this was not statistically significant ($W=3$,

### Table III. Study participants’ PORS results

| Risk factors                                | Pre-TTIP-PRO<sup>a</sup> |
|---------------------------------------------|---------------------------|
| Escalating opioid dosage                    | 6 (75.0%)                 |
| Injecting opioid                            | 8 (100.0%)                |
| Co-use of benzodiazepines                   | 4 (50.0%)                 |
| Co-use of alcohol                           | 3 (37.5%)                 |
| Co-use of other drug                        | 5 (62.5%)                 |
| Testing opioid before use<sup>b</sup>       | 1 (12.5%)                 |
| Following abstinence with same level of use  | 4 (50.0%)                 |
| Depressive symptoms                         | 7 (87.5%)                 |
| Decreased liver function                    | 6 (75.0%)                 |
| Enrolled in methadone or suboxone treatment<sup>b</sup> &nbsp; &nbsp; | 0 (0.0%)                  |
| Four or more alcoholic drinks per day       | 1 (12.5%)                 |
| Years of opioid use                         | 11.6 (11.7)               |
| Number of overdoses                         | 4.8 (6.2)                 |
| PORS total score (1–28)                     | 17.1 (5.2)                |

<sup>a</sup>Cells containing n (%) represent the number (percentage) of participants endorsing.

<sup>b</sup>These items represent protective factors, rather than risk factors.

### Table IV. Study participants’ OOTAS results

| OOTAS section                               | Pre-TTIP-PRO<sup>a</sup> | Post-TTIP-PRO<sup>a</sup> | $W<sup>b</sup>$ | $P$   |
|---------------------------------------------|---------------------------|---------------------------|----------------|-------|
| Risk for opioid overdose                    | 77.5% (10.4%)             | 90.0% (5.3%)              | 11.5          | 0.0781|
| Signs of overdose                           | 89.6% (14.6%)             | 94.8% (4.3%)              | 2             | 0.5000|
| How to respond to an overdose               | 66.1% (7.4%)              | 89.3% (6.6%)              | 18            | 0.0078|
| MAT                                         | 34.4% (32.6%)             | 100.0% (0.0%)             | 18            | 0.0078|
| OOTAS total percent correct                 | 69.9% (12.5%)             | 93.6% (2.5%)              | 18            | 0.0078|

<sup>a</sup>% correct (SD).

<sup>b</sup>Wilcoxon signed-rank test.
All participants rated the helpfulness of TTIP-PRO at the maximum on a four-point scale (4.0, SD = 0.0). No participant had suggestions for improving TTIP-PRO. The responses of each participant about what they liked most and least about TTIP-PRO are provided in Table V; appreciation for being able to speak with someone experienced with OUD and OOD was commonly reported. No problems were encountered with the functioning of the TTIP-PRO computer program.

**Table V. Participants’ statements of what they liked most and least about receiving TTIP-PRO**

| Liked most about the intervention | Liked least about the intervention |
|----------------------------------|-----------------------------------|
| She asked me questions about my own personal history with opiates. She was very helpful. | Too long of a phone call. |
| That she understood because she had experience. I learned things about responses to overdose. I liked finding out about the myths. | was satisfied with the intervention. I wish there were more interventions available to everyone. My husband overdosed but did not go to UC. |
| I liked the fact that he was open and honest. Great to talk to someone with experience. | Nothing negative to say |
| He was very helpful. I liked — him a lot. I felt very comfortable talking to him because he gave me info about his experience as well. | The number of calls. It’s just hard for me to be on the phone for a long period of time. |
| I learned that it’s not okay to put someone in a bath of cold water. | I did not like hearing that I was at such high risk of having another overdose. |
| She was very thorough. We had a good conversation. She was very knowledgeable and concerned about me using. | It was very helpful. |
| I liked that he had a report that he was able to go over and correct myths that I believed in and that he had been in my shoes and had experience with overdose. | I liked everything about the intervention |
| I learned a couple things that I did not know previously. | |

**Discussion**

There is currently no empirically based intervention for managing recurrent OOD. This article describes the development and initial testing of TTIP-PRO, a secondary prevention intervention for individuals with OUD and a recent OOD designed to: (i) encourage patients to initiate MAT and (ii) increase knowledge about OOD. TTIP-PRO was designed to be low cost and, to be maximally effective, was designed according to ELM principles [19, 20]. Rather than using professionals to convey information, TTIP-PRO utilizes peers with similar background experiences to administer the intervention. The TTIP-PRO computer program creates personalized feedback scripts for peers to use, decreasing the need for extensive training and enhancing the intervention with information tailored to each participant. Although TTIP-PRO would be limited to patients with telephone access, it could be easily incorporated into busy ED settings, requiring only that patient permission be obtained for a Peer Interventionist to call; hence, it has the potential to be utilized with a significant number of patients.

Prior to conducting a pilot efficacy trial, we completed a pre-/post-study to assess TTIP-PRO-content acceptability and computer program performance. The results revealed a high degree of satisfaction with TTIP-PRO among both Peer Interventionists and participants. Consistent with past research [24, 25], the participants found the Peer Interventionists to be particularly helpful. Participants’ OOD knowledge increased significantly, specifically in how to respond to OOD and in accurate knowledge about MAT. Participant interest in receiving MAT increased from pre- to post-TTIP-PRO, but this was not statistically significant, which may have reflected a ceiling effect (five of the eight participants had a pre-rating of 10 on the 10-point scale). Although the observed increases in knowledge and motivation were likely due to the peer-delivered intervention, simply completing
the scales may have impacted these outcomes. Implementation of TTIP-PRO, including training and certification of the Peer Interventionists and operation of the TTIP-PRO computer program, revealed no significant issues. Both Peer Interventionists completed training and certification within the designated 4-h time-frame. Overall, the Peer Interventionists and participants were very satisfied with the telephone format, which is consistent with past research finding that telephone counseling interventions can be effective and cost-effective [27–31]; still, one of the eight participants stated that the length of the phone call was what she/he liked least about the intervention while another did not like the number of calls required to complete both the intervention and study assessments. Thus, TTIP-PRO’s telephone-based format may not be ideal for some patients.

The acceptability study was not designed to test the efficacy of TTIP-PRO and had several limitations; thus, the results should be interpreted with caution. First, the sample sizes for both the Peer Interventionists \( (n = 2) \) and participants \( (n = 8) \) were very small. Second, the participants were likely not representative of the patients who will be targeted by TTIP-PRO in that they were recruited through a letter that may have arrived up to 8-months following their OOD as opposed to being recruited from the ED when they were treated for an OOD. Moreover, the eight participants completing the study represented \( \sim 6\% \) of the individuals to whom letters were mailed and, thus, are likely not representative of the patient population. This potential volunteer bias might account for the high PreTTIP-PRO interest in MAT. Another limitation is the lack of validation for the PORS and the OOTAS. For the PORS, which assesses an individual’s OOD risk factors, the predictive validity of the instrument needs to be evaluated. The OOTAS, on the other hand, is a simple knowledge assessment and its four sections are strictly organizational and are not intended to represent latent constructs either real or conceptual; hence, validation testing in not required in order to establish its utility.

Despite the limitations of this initial test, the results suggest that the elements of TTIP-PRO tested do not need to be modified and further development and testing of TTIP-PRO is warranted, including: (i) finalizing the Peer Interventionist training materials by creating training files and evaluating the inter-rater reliability of TTIP-PRO’s competence assessment; (ii) conducting a pilot efficacy trial; and (iii) testing the predictive validity of the PORS. TTIP-PRO, which was designed to be a sustainable intervention, has the potential to significantly improve outcomes for individuals with OUD experiencing an OOD. The training of the Peer Interventionists can be completed within 4 h and each TTIP-PRO intervention can be completed in a 30-min phone call. As a telephone-based intervention, a given set of Peer Interventionists could work with patients from multiple EDs. In addition, TTIP-PRO could be easily modified to work with other populations, including with patients who have experienced an OOD but do not have an OUD. For example, TTIP-PRO could be modified to be a self-administered intervention, in which patients complete the PORS and OOTAS online and automatically receive feedback on their knowledge and personal risk of OOD. Hence, if TTIP-PRO is found to be efficacious its impact on reducing OOD could be substantial.

**Funding**

This work was supported by the University of Cincinnati Department of Psychiatry and Behavioral Neuroscience, which conducted an initial, preIRB scientific review of the study protocol. The Department had no other role in the conduct, analysis, interpretation, or reporting of the study. ClinicalTrials.gov Identifier (NCT02282306).

**Conflict of interest statement**

None declared.

**References**

1. Okie S. A flood of opioids, a rising tide of deaths. *N Engl J Med* 2010; 363: 1981–5.
2. Calcaterra S, Glanz J, Binswanger IA. National trends in pharmaceutical opioid related overdose deaths compared to
Tailored peer-delivered opioid overdose prevention

other substance related overdose deaths: 1999–2009. Drug Alcohol Depend 2013; 131: 263–70.
3. UNODC. World Drug Report 2012. New York, 2012.
4. Coffin PO, Tracy M, Bucciarelli A et al. Identifying injection drug users at risk of nonfatal overdose. Acad Emerg Med 2007; 14: 616–23.
5. Powis B, Strang J, Griffiths P et al. Self-reported overdose among injecting drug users in London: extent and nature of the problem. Addiction 1999; 94: 471–8.
6. Hasegawa K, Brown DF, Tsugawa Y et al. Epidemiology of emergency department visits for opioid overdose: a population-based study. Mayo Clin Proc 2014; 89: 462–71.
7. Bennett T, Holloway K. The impact of take-home naloxone distribution and training on opiate overdose knowledge and response: an evaluation of the THN Project in Wales. Drugs Educ Prevent Policy 2012; 19: 320–8.
8. Pollini RA, McCall L, Mehta SH et al. Non-fatal overdose and subsequent drug treatment among injection drug users. Drug Alcohol Rev 2006; 25: 103–10.
9. Darke S, Ross J, Hall W. Overdose among heroin users in Sydney, Australia: I. Prevalence and correlates of non-fatal overdose. Addiction 1996; 91: 405–11.
10. Darke S, Williamson A, Ross J et al. Non-fatal heroin overdose, treatment exposure and client characteristics: findings from the Australian Treatment Outcome Study (ATOS). Drug Alcohol Rev 2005; 24: 425–32.
11. McGregor C, Darke S, Ali R et al. Experience of non-fatal overdose among heroin users in Adelaide, Australia: circumstances and risk perceptions. Addiction 1998; 93: 701–11.
12. Kerr T, Fairbairn N, Tyndall M et al. Predictors of non-fatal overdose among a cohort of polysubstance-using injection drug users. Drug Alcohol Depend 2007; 87: 39–45.
13. Peterson JA, Schwartz RP, Mitchell SG et al. Why don’t we out-of-treatment individuals enter methadone treatment programmes? Int J Drug Policy 2010; 21: 36–42.
14. Zaller ND, Bazzu AR, Velazquez L et al. Attitudes toward methadone among out-of-treatment minority injection drug users: implications for health disparities. Int J Environ Res Public Health 2009; 6: 787–97.
15. Darke S, Hall W. Heroin overdose: research and evidence-based intervention. Journal of Urban Health: Bulletin of the New York Academy of Medicine 2003; 80: 189–200.
16. Clark AK, Wilder CM, Winstanley EL. A systematic review of community opioid overdose prevention and naloxone distribution programs. J Addict Med 2014; 8: 153–63.
17. Strang J, Manning V, Mayet S et al. Overdose training and take-home naloxone for opiate users: prospective cohort study of impact on knowledge and attitudes and subsequent management of overdoses. Addiction 2008; 103: 1648–57.
18. Wagner KD, Valente TW, Casanova M et al. Evaluation of an overdose prevention and response training programme for injection drug users in the Skid Row area of Los Angeles, CA. Int J Drug Policy 2010; 21: 186–93.
19. Cacioppo JT, Petty RE. The elaboration likelihood model of persuasion. Adv Consum Res 1984; 11: 673–5.
20. Petty RE, Cacioppo JT. The elaboration likelihood model of persuasion. In: L Berkowitz (ed). Advances in Experimental Social Psychology. San Diego, CA: Academic Press, 1986, 123–205.
21. Petty RE, Barden J, Wheeler SC. The elaboration likelihood model of persuasion: Developing health promotions to produce sustained behavior change. In: RJ DiClemente, RA Crosby, M Kegler (eds). Emerging Theories in Health Promotion Practice and Research. San Francisco, CA: Jossey-Bass, 2009, 185–214.
22. Solomon P. Peer support/peer provided services underlying processes, benefits, and critical ingredients. Psychiatr Rehab J 2004; 27: 392–401.
23. White W. Peer-based Addiction Recovery Support: History, Theory, Practice, and Scientific Evaluation. Chicago, IL: Great Lakes Addiction Technology Transfer Center and Philadelphia Department of Behavioral Health and Mental Retardation Services, 2009.
24. Williams RM, Bambara J, Turner AP. A scoping study of one-to-one peer mentorship interventions and recommendations for application with Veterans with postdeployment syndrome. J Head Trauma Rehab 2012; 27: 261–73.
25. Dennis CL. Postpartum depression peer support: maternal perceptions from a randomized controlled trial. Int J Nurs Stud 2010; 47: 560–8.
26. Dennis CL, Hodnett E, Kenton L et al. Effect of peer support on prevention of postnatal depression among high risk women: multisite randomised controlled trial. BMJ 2009; 338: a3064.
27. Abrams DB, Graham AL, Levy DT et al. Boosting population quits through evidence-based cessation treatment and policy. Am J Prev Med 2010; 38: S351–63.
28. Fiore MC, Jaen CR, Baker TB et al. A Clinical Practice Guideline for Treating Tobacco Use and Dependence. 2008 Update - A US Public Health Service report. Am J Prev Med 2008; 35: 158–76.
29. Lichtenstein E, Zhu SH, Teschke GJ. Smoking cessation quitlines: an underrecognized intervention success story. Am Psychol 2010; 65: 252–61.
30. Stead LF, Hartmann-Boyce J, Perera R et al. Telephone counselling for smoking cessation. Cochrane Database Syst Rev 2013; 8: CD002850.
31. Centers for Disease Control and Prevention. Best Practices for Comprehensive Tobacco Control Programs — 2014. Atlanta, GA: Department of Health and Human Services, National Center for Chronic Disease Prevention and Health Promotion, 2014.
32. Williams AV, Strang J, Marsden J. Development of Opioid Overdose Knowledge (OOKS) and Attitudes (OOAS) Scales for take-home naloxone training evaluation. Drug Alcohol Depend 2013; 132: 383–6.
33. Brunsdon N. Overdose Awareness Workshop: injectingadvice.com, 2010. Accessed: 24 March 2014.
34. Flemen K. Housing Opiate Overdose Risk Assessment Tool (HOORAT) Version 4: KFx & Homeless Link, 2010. from http://www.drugsandhousing.co.uk/. Accessed: 19 March 2014.
35. Dunn KM, Saunders KW, Rutter CM et al. Opioid prescriptions for chronic pain and overdose: a Cohort Study. Ann Intern Med 2010; 152: 85–92.
36. Brugal MT, Barrio G, De LFL et al. Factors associated with non-fatal heroin overdose: assessing the effect of frequency and route of heroin administration. Addiction 2002; 97: 319–27.
37. Davis C, Webb D, Burris S. Changing law from barrier to facilitator of opioid overdose prevention. J Law Med Ethics 2013; 41(Suppl 1): 33–6.
38. Gossop M, Griffiths P, Powis B et al. Frequency of non-fatal heroin overdose: survey of heroin users recruited in non-clinical settings. Br Med J 1996; 313: 402.
39. White JM, Irvine RJ. Mechanisms of fatal opioid overdose. Addiction 1999; 94: 961–72.
40. Kimmer SA, Milloy MJ, Wood E et al. Incidence and risk factors for non-fatal overdose among a cohort of recently incarcerated illicit drug users. Addict Behav 2012; 37: 691–6.
41. Merrall ELC, Kariminia A, Binswanger IA et al. Meta-analysis of drug-related deaths soon after release from prison. Addiction 2010; 105: 1545–54.
42. Strang J, McCambridge J, Best D et al. Loss of tolerance and overdose mortality after inpatient opiate detoxification: follow up study. Br Med J 2003; 326: 959–60.
43. Wines JD Jr, Saitz R, Horton NJ et al. Overdose after detoxification: a prospective study. Drug Alcohol Depend 2007; 89: 161–9.
44. Pabayo R, Alcantara C, Kawachi I et al. The role of depression and social support in non-fatal drug overdose among a cohort of injection drug users in a Canadian setting. Drug Alcohol Depend 2013; 132: 603–9.
45. Tobin KE, Latkin CA. The relationship between depressive symptoms and nonfatal overdose among a sample of drug users in Baltimore, Maryland. J Urban Health 2003; 80: 220–9.
46. Bosiljkovska M, Walder B, Besson M et al. Analgesics in patients with hepatic impairment pharmacology and clinical implications. Drugs 2012; 72: 1645–69.
47. Seal KH, Kral AH, Gee L et al. Predictors and prevention of nonfatal overdose among street-recruited injection heroin users in the San Francisco Bay Area, 1998-1999. Am J Public Health 2001; 91: 1842–6.
48. Stewart D, Gossop M, Marsden J. Reductions in non-fatal overdose after drug misuse treatment: results from the National Treatment Outcome Research Study (NTORS). J Subst Abuse Treat 2002; 22: 1–9.
49. Yin L, Qin GM, Ruan YH et al. Nonfatal overdose among heroin users in southwestern China. Am J Drug Alcohol Abuse 2007; 33: 505–16.
50. Darke S, Zador D. Fatal heroin ‘overdose’: a review. Addiction 1996; 91: 1765–72.
51. Tegeder I, Lötsch J, Geisslinger G. Pharmacokinetics of opioids in liver disease. Clin Pharmacokinet 1999; 37: 17–40.
52. Warner-Smith M, Darke S, Lynskey M et al. Heroin overdose: causes and consequences. Addiction 2001; 96: 1113–25.
53. Gossop M, Griffiths P, Powis B et al. Severity of dependence and route of administration of heroin, cocaine and amphetamines. Br J Addict 1992; 87: 1527–36.
54. Yoon Y-H, Chen CM, Yi H-Y. Unintentional alcohol and drug poisoning in association with substance use disorders and mood and anxiety disorders: results from the 2010 Nationwide Inpatient Sample. Inj Prev 2014; 20: 21–8.
55. Goodman LS, Brunton LL, Chabner B et al. Goodman and Gilman’s Pharmacological Basis of Therapeutics. New York: McGraw-Hill, 2011.
56. Williams RH, Erickson T. Emergency diagnosis of opioid intoxication. Lab Med 2000; 31: 334–42.
57. Sporer KA, Kral AH. Prescription naloxone: a novel approach to heroin overdose prevention. Ann Emerg Med 2007; 49: 172–7.
58. Pollini RA, McCall L, Mehta SH et al. Response to overdose among injection drug users. Am J Prev Med 2006; 31: 261–4.
59. Zweben JE, Sorensen JL. Misunderstandings about methadone. J Psychoactive Drugs 1988; 20: 275–81.
60. OhioMHAS. ER Discharge Rates for Opiate-related Diagnoses per 10,000 Persons. Ohio: Ohio Mental Health and Addiction Sevices, 2014. http://mha.ohio.gov/. Accessed: 10 November 2015.
61. Warner M, Hedegaard H, Chen L.H. Trends in Drug-poisoning Deaths Involving Opioid Analgesics and Heroin: United States, 1999–2012. NCHS Health E-Stat: Centers for Disease Control and Prevention, 2014.