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Implementations of a Text-Message Intervention to Increase Linkage from the Emergency Department to Outpatient Treatment for Substance Use Disorders

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Abstract

Aim—To determine acceptability and explore potential usefulness of a text messaging (SMS) program aimed at increasing attendance at outpatient treatment for substance use disorders (SUD) after emergency department (ED) referral.

Method—A retrospective analysis of 377 adult patients from 2 urban EDs seeking treatment for SUD (opioids (n=168), alcohol (n=188), benzodiazepines (n=21)) referred to outpatient treatment and offered an SMS program which included daily (1) motivational messages focused on positive thinking, (2) ecological momentary assessments (EMA) related to craving with tailored behavioral strategy messages, (3) EMA of drug use with tailored feedback to reduce abstinence violation effects, and (4) reminders about treatment location and phone number. We assessed acceptability by examining opt-in rates, EMA completion rates over the first week and end-of-program qualitative feedback. We assessed how individuals who opt in differ in outcomes from those who opt out by examining rates of outpatient SUD treatment attendance recorded from the medical record.

Results—167 patients (44%) opted in to the SMS program. Over 7 days, around 33% of EMA were completed. Median helpfulness score was 8 (IQR 6 to 10) out of 10 and 84% would recommend the SMS program to someone else. Individuals who opted in to the SMS program had higher rates of SUD treatment initiation than individuals who did not opt-in (70.7% vs. 40.9%)

Conclusions—We found evidence supporting acceptability and potential usefulness of an automated text message program to assist treatment attendance for some individuals with SUDs discharged from the ED. A controlled trial is needed to examine whether SMS program exposure is associated with improved treatment attendance compared to standard care.

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1. Introduction

1.1. Background

The number of individuals with a substance use disorder (SUD) who seek care in emergency departments (ED) in the US is large and growing. For example, in 2013 it was estimated that 2.5% of all ED visits are related to SUD, a relative 37% increase from 2006 (Weiss et al., 2015). The rate of ED patients with SUD being successfully linked with specialty treatment is low. For example, one multi-site study showed that among those who screen positive for SUD in the ED and are referred to treatment, only 25.7% had at least one formal SUD treatment contact at 3-months post-referral (Bogenschutz et al., 2014). In another study of ED patients who screened positive for SUD, 80% of participants reported no SUD treatment over 3-months follow-up (Merchant et al., 2015). This is consistent with national statistics. Of the 21.7 million individuals in the US identified with SUD, only 2.35 million were treated at a specialty facility (Center for Behavioral Health Statistics and Quality, 2017).

The period between initial treatment seeking to treatment engagement is an extremely vulnerable time for individuals with SUD. Motivation can be rapidly overwhelmed by physiological symptoms of withdrawal and craving for drug use (Larimer et al., 1992). These vulnerabilities are exacerbated when an individual leaves the medical setting and returns to their environment, which can include drug-related cues and psychosocial stressors (Redko et al., 2006). Currently, there is no evidence-based intervention that provides support to individuals with SUD during this period of vulnerability.

Delivering behavioral support through mobile digital platforms (i.e. mHealth) could help sustain an individual's motivation for SUD treatment after ED referral (Marsch et al., 2014). A recent systematic review found that 55% of mobile digital interventions studied against a control group generated positive findings on one or more substance use outcomes (Nesvag & McKay, 2018) including several studies showing increased treatment seeking/attendance (e.g. Gonzalez et al., 2014). Still, it remains unknown whether mHealth interventions are feasible and acceptable to ED patients with SUD.

1.2. Initial SMS Intervention

In prior work, we developed an interactive text message intervention focused on providing individuals with SUD support over the vulnerable period between ED discharge and treatment entry called PIER1 (Preventing and Interrupting Early Relapse). PIER1 was designed to help build therapeutic alliance (Meier et al., 2005), was based largely on the relapse prevention model (Larimer et al., 1992), and incorporated techniques found to be effective in prior digital interventions (Nahum-Shani et al., 2016). Design features included: (1) a morning reflection message; (2) ecological momentary assessment (EMA) batteries delivered randomly during two day-time blocks that assessed severity of craving, and the relation of withdrawal symptoms, mood and anxiety, and environmental triggers to craving; (3) tailored feedback to help individuals cope with these triggers; (4) feedback specific to end-of-day report of illicit drug use; (5) a goal commitment prompt and support for daily abstinence; and (6) user-triggered "just-in-time" craving support. We pilot tested PIER1 in 17 ED patients with opioid use disorder, finding response rates to EMA averaged 30% and

themes from follow-up interviews included ease of use, social connection, and self-empowerment (Suffoletto et al., 2017)

1.3. SMS Intervention Changes

We then refined PIER1 in an effort to improve usability and effectiveness in supporting ongoing motivation for treatment. To reduce participant burden, we decreased the number of text message that required responses. For example, we reduced craving assessments from twice to once daily, limited EMA of triggers for craving, and removed the daily goal commitment query completely. Given that prior studies have shown utility of text reminders to improve appointment attendance after ED care (Arora et al.,2015), we incorporated daily text reminders to prompt patients about their addiction treatment referral. Finally, to make it relevant to other (non-opioid) drugs of use disorder, we customized feedback messages to the primary substance of use.

1.4. Quality Improvement Project

We implemented PIER2 as a pilot quality improvement project to better understand how the program would be accepted within the context of routine care. We educated a select group of ED nurses from two urban EDs to offer the PIER2 program to any adult who presented with opioid, alcohol, or benzodiazepine use disorder and was referred to outpatient treatment at an affiliate hospital. In this study, we sought to determine patient acceptability and treatment attendance outcomes from this pilot implementation. We hypothesized that individuals who opt in to use the PIER2 program would have higher rates of SUD treatment attendance than patients who chose not to use PIER2. Findings from this study could help guide further development and testing of mobile interventions to improve linkage of vulnerable patients with SUD treatment.

2. Methods

2.1. Overview

This study is a retrospective analysis of existing data collected as part of a pilot QI project. We received IRB approval to abstract retrospective data from (1) the medical record of patients approached for PIER2 participation to collect basic demographics and SUD treatment attendance outcomes and (2) the SMS database to collect EMA response rates for patients who agreed to use the PIER2 program.

2.2. PIER2 Enrollment

From January to October 2018, 377 adult patients from 2 urban EDs seeking treatment for SUD and referred to outpatient treatment were approached for participation in the PIER2 program. Whether or not the patient agreed to enroll in the PIER2 program, the ED nurse accessed a password-protected web portal and entered the patient's first name, cell phone number, primary substance of use (i.e. alcohol, benzodiazepines, and/or opioids), and date of treatment follow-up. The nurse chose the primary substance of use based on patient report of which substance they most wanted to focus on stopping. Patients who agreed to enroll in the PIER2 program were required to sign a document explaining the program and risks associated with texting sensitive information. As part of this process, participants were

encouraged to set up a password on their phones, turn off lock screen text notifications, and delete any texts that they did not want someone else to see. If they agreed to enroll, their phone number was entered into the PIER2 program and they began receiving messages. We did not offer any compensation or incentives for program participation. All procedures were approved by the university's quality assurance board.

2.3. Standard care in the ED

Prior to ED discharge, patients were medically cleared by a physician and spoke with a nurse about discharge plans. This included a handout providing the location and telephone number of outpatient treatment service. Patients were supplied with one to two days' worth of medications for withdrawal. Patients with alcohol or benzodiazepine withdrawal symptoms were provided with chlordiazepoxide and patients with opioid withdrawal were given either buprenorphine or (if uninterested in buprenorphine) clonidine.

2.4. PIER2 Program

Upon program enrollment, the participant received a series of welcome text messages, including instructions to text the keyword "crave" for immediate support, and to text "stop" to stop the program at any time. Beginning on the day following enrollment, participants received morning reflection messages aimed at increasing positive cognitions about success in recovery (Krentzman, 2013), e.g., "*Begin by visualizing yourself as a non-user. Think about what that person would look like, act and do. You may only have to change a little to accomplish this*!" They also received a message reminding them of the location and phone number for SUD treatment.

Once a day, during a randomly selected time between12pm and 4pm, participants received the EMA: "*How strong is your urge to use [primary substance of use] right now, on a scale from 0 (not at all) to 10 (completely)*?" (Wasan et al. 2012). If they reported a score =0, they received: "You report no craving right now." If they reported a score 1 to 5, they received: "You report some craving right now." If they reported a score 6 to 10, they received: "*You report a high amount of craving right now"* . Participants with any score >0 then received: "*Are physical withdrawal symptoms contributing to this sensation*?" If they affirmed withdrawal symptoms, they received a message focused on assisting symptom management (Ziedonis et al., 2009). If they reported withdrawal symptoms were not contributing to cravings, they received the EMA: "*Is your mood or anxiety level affecting any urge to use opioids*?" If they reported contribution of mood or anxiety to craving, they received a message focused on stress management (Hendershot et al., 2011). If they denied mood or anxiety as a trigger, they received the following EMA: "*Is your immediate environment (including people) contributing to this craving*?" If they affirmed a contextual cue, they received a message focused on context management (Garland & Howard, 2014), e.g., "*It is a good sign that you noticed a risky situation. Try to separate yourself*." If a person denied that withdrawal, mood or anxiety, or contextual cues were contributing to cravings, they received the following message, "*Cravings and urges to use are temporary. Distract yourself with activities and reach out to people who care about you and they will pass*."

Each evening at 8 PM, participants received a customized EMA: "*Have you used any [substance] in the past 24 hours?*" where [substance] was chosen by the nurse based on the patient's primary substance of use. If participants responded that they had not used, they received a positive feedback message. If participants reported substance use, they received a message attempting to mitigate "abstinence violation" effects (Birke et al., 1990).

After enrolling the first 83 participants, we decided that we should systematically collect some measurement of perceived usefulness. Therefore, the remaining 84 participants, upon completion of 7 days of EMA, received EMA to assess perceptions of PIER2 program usefulness. The first question was: "*On a scale from 0 (not at all) to 10 (completely), how helpful did you find this program*?". The second question was: "*Would you recommend this program to someone else*."

For all PIER2 queries, participants who did not respond within 1 hour, received a re-prompt. If a participant did not respond within 1 hour of the re-prompt, the response window closed. Any text sent by participants outside the 2-hour window prompted the reply message, "*We are unable to respond to you right now. If you have an emergency, please call crisis number or dial 911*." Participants also received this reply message when they sent an unsolicited text message, with the exception of messages which were determined to be benign and did not require a response. Examples of benign messages included "*Thanks", "Yes*", or emojis. Unsolicited text messages were sent to the treatment team and were reviewed and replies or phone calls were made as needed.

2.5. Medical Record Review

We accessed the medical records of all patients who were offered the PIER2 program. We abstracted the following data: medical record number, sex, age, race, marital status, if they attended at least one SUD treatment appointment, how many SUD treatment appointments they missed, if they completed the initial (detoxification) SUD treatment process.

2.6. Data Analyses

We assessed acceptability by first examining PIER2 opt-in rates, comparing patient characteristics between those who opted in to those who did not using student-tests for continuous and chi-squared tests for categorical variables. We then examined PIER2 engagement over the first week by examining EMA completion rates, exploring patient factors associated with EMA completion using multi-level models to account for clustering of EMA within individuals. We then assessed end-of-program user perceptions by examining the mean score of "helpfulness" ratings and the percent of participants who would recommend it to someone else.

We assessed usefulness by examining rates of outpatient SUD treatment attendance recorded from the medical record, comparing PIER2 participants to those who did not use PIER2 using a chi-squared test. To adjust for other factors that could have influenced treatment attendance, we included covariates with univariate association with treatment attendance (e.g. race, ED site of referral) in a multivariable model, reporting adjusted odds of SUD treatment attendance with 95% confidence intervals (95% CI). All statistical analyses were performed using Stata 15.0 (Stata Inc)

3. Results

3.1. PIER2 Enrollment

Between January and October 2018, among the 377 ED patients offered the PIER2 program, 167 opted in for a 44% acceptance rate. Characteristics of those who opted-in and those who did not are shown in Table 1. Overall, the mean age was 39 years, with a range of 19 to 71 years. Most patients were white and single marital status. The distribution of primary substance of use was as follows: 168 individuals (44.6%) using opioids, 188 individuals (49.9%) using alcohol, 21 individuals (5.5%) using benzodiazepines. There were lower rates of patients with opioid use who enrolled in PIER2 compared with other primary substances. A higher percentage of patients from ED #2 agreed to use PIER2 than from ED #1.

3.2. PIER2 Engagement

Craving EMA: Over 7 days, 113 enrolled patients (67.7%) responded to at least one craving EMA. A total of 385 out of 1169 craving EMA were completed (32.9%). Completion of craving EMA went from 50.9% on day 1 to 13.8% by day 7. Completion of craving EMA were higher in individuals seeking help for alcohol use (37.9%) and benzodiazepine use (34.1%) compared to individuals seeking help for opioid use (24.3%). No other patient-level factors (i.e. age, sex, race, marital status) were associated with missing craving EMA. Twenty-five individuals proactively requested craving support a total of 46 times (1 individual texted CRAVE 7 times; 2 individuals 5 times; 1 individual 3 times).

Drug use EMA: Over 7 days, 119 enrolled patients (71.3%) responded at least once to drug use EMA. A total of 400 out of 1,169 end-of-day drug use EMA were completed (34.2%). Completion of drug use EMA went from 47.3% on day 1 to 13.8% by day 7. Completion of drug use EMA were higher in individuals seeking help for alcohol use (40.3%) compared to individuals seeking help for benzodiazepine use (26.4%) and opioid use (25.6%). No other patient-level factors (i.e. age, sex, race, marital status) were associated with missing drug use EMA.

3.3. PIER2 User Perceptions

Among the 53/84 participants who completed end-of program ratings of helpfulness (63.1% response rate), median score was 8 (IQR 6 to 10) out of 10. Among the 43/84 participants who completed the query about whether they would recommend the PIER2 program to a friend, 36 (83.7%) replied affirmative. There were no differences in ratings between primary substance of use.

3.4. Outpatient Treatment Initiation

Overall, 202/377 individuals (53.6%) initiated outpatient SUD treatment within a week of ED discharge. There was a higher treatment initiation among those who opted-in to PIER2 compared to those who refused (70.7% vs. 40.0%; $p<0.0001$). The adjusted odds of SUD treatment initiation are shown in Table 2.

3.5. Craving Severity and Contextual Correlates

Among the 385 times when craving EMA was completed, respondents indicated no craving (i.e. craving rating=0) 146 times (37.9%) it was reported as a zero (i.e. no craving). Among the times when any craving was reported, mean severity rating was 5.6 (SD 2.9), with higher mean craving severity among individuals seeking help for opioids (mean 5.9; SD 2.6) and benzodiazepines (mean 6.3; SD 2.9) compared to individuals seeking help for alcohol use (mean 4.8; SD 2.8). Reported contributors to cravings were: withdrawal symptoms 160/251 times assessed, mood 70/83 times assessed, and context 4/13 times assessed.

3.6. Drug Use

At least one day with drug use was reported by 35 individuals (21%) over the first 7 days (benzodiazepines, n=4; alcohol, n=19; opioids, n=12). Craving severity rating was significantly higher on days when drug use was reported versus days when no drug use was reported (mean 4.9 versus 2.9). In a multilevel model accounting for clustering within individuals, each unit increase in craving severity was associated with an increased odds of drug use (OR=1.2; 95% CI 1.07 to 1.37).

4. Discussion

4.1. Main Findings

We found evidence that an automated text message program is acceptable to ED patients seeking treatment for SUDs. When ED patients were offered PIER2 as an extension of clinical service, around four out of ten elected to use it. This suggests that many patients with SUD perceive the need for additional support and are willing to use text messaging to communicate with health systems about their SUD. We also found that patients with SUD who opted in to use PIER2 had higher rates of SUD treatment attendance after discharged from the ED compared to those who do not opt in to use PIER2 (70.7% vs. 40.9%), which equated to four times the odds of attendance when adjusting for other relevant covariates. This finding could be a reflection that individuals who opted in are generally more motivated to receive assistance. Techniques for increasing interest and uptake of programs like PIER2 among patients with SUD should be a research priority.

4.2. Secondary Findings

Although only around a third of EMA were completed over 7 days, most individuals had some engagement with PIER2. This is consistent with findings from our earlier research using a program similar to PIER2 (Suffoletto et al., 2017) as well as with the sub-optimal engagement with other digital interventions for substance use disorder (Nesvag & McKay, 2018). It may reflect the difficulty with timely EMA responsiveness among those with SUD or a general distrust /disinterest in sharing sensitive information with a health system. Despite this sub-optimal engagement, we did find that patients who provided feedback had overall positive perceptions about PIER2 including 84% who would recommend the program to someone else. Techniques for keeping patients with SUD engaged with digital behavioral support once they have opted in should be a research priority.

Individuals seeking help for opioid use had lower rates of opting in to use PIER2, lower EMA response rates, and lower odds of treatment attendance compared to individuals seeking help for alcohol and benzodiazepine use. This suggests that motivation for treatment may be especially difficult in the opioid-use population. Related, we found that craving severity and drug use were higher in the first week after ED discharge for individuals seeking help for opioid use, providing further evidence of vulnerabilities in this patient population.

4.3. Study Strengths

First, we examined a racially diverse and often neglected population of individuals with SUD. Second, we developed an mHealth intervention incorporating behavioral strategies to support motivation for SUD treatment in the period following initial help-seeking, which has not generally been the focus of prior mHealth intervention designs. Third, we examined and compared findings across three major substances of abuse. Fourth, we used different sources of outcome data (i.e. self-report, daily EMA and medical record data) to inform assessments of usability and effectiveness. Fifth, we implemented the PIER2 program as part of routine care, thus being able to make less biased conclusions about what is feasible in this setting.

4.4. Prior Behavioral Interventions for SUD Treatment Linkage

To date, in-person behavioral interventions for SUDs have not shown favorable effects on treatment-related outcomes after initial treatment seeking in primary care or emergency departments. Donovan et al. (2001) found that a motivational attrition prevention intervention did not enhance treatment entry, completion or outcome among people seeking treatment for SUD. Roy-Byrne et al. (2014), Saitz et al. (2014), Bogenschutz et al. (2015) and Merchant et al. (2015) also did not show differences in treatment attendance between motivational interviewing arms compared with controls. D'Onofrio et al. (2015) found that brief intervention in the ED for patients with opioid use disorder did not improve rates of treatment attendance at 30 days compared to referral alone. Even if in-person motivational interventions were found to be effective, time, personnel and training barriers preclude implementation in most EDs (McCormack, 2017).

Several mHealth interventions for SUD support have been tested (Tofighi et al., 2017), but none targeting treatment initiation after referral. Christensen et al (2014) found that opioid-dependent patients on buprenorphine randomized to an internet-based community reinforcement approach intervention plus contingency management had higher rates of abstinence and treatment adherence compared to patients who got contingency management alone. Gustafson et al. (2014) reported that individuals exiting residential treatment for alcohol use disorder and randomized to an mHealth intervention had fewer high-risk drinking days out to 12-months compared with a control arm. Liang et al (2018) found that adults in methadone maintenance randomized to an SMS intervention incorporating cognitive behavioral principles to support in-the-moment coping had less drug use at 1-month follow-up compared to a control arm that received non-SUD texts. This is the first study to show that an SMS intervention provided after treatment referral could increase treatment attendance among ED patients with various SUDs.

4.5. Limitations

Given that PEIR2 was offered as a service in the ED, we did not randomize patients. Therefore, the differences between patients who chose to use PIER2 and those who did not were not randomly distributed between groups. Although we found that there were a lower percentage of patients seeking help for opioid use who opted-in to use PIER2, we do not know reasons for not this, which could include concerns about burden or privacy or reflect lack of motivation for digital support. We also cannot ensure that all patients with SUD were offered PIER2. This could have led to the ED nurses only offering it to those who they thought would benefit, potentially biasing reported acceptance rate. This is likely given we found differences between ED #1 and #2 in patient opt-in rates. We were not able to systematically record all SUD patients who were seen in the EDs during the period of implementation, perhaps over-estimating opt-in rates. Participants were sampled from an urban ED and therefore may not represent adults with other SUDs. We did not collect outcome data from outside medical records or patient interviews, therefore could have under-estimated true SUD treatment attendance. We did not systematically record other treatments that participants were receiving during their exposure to PIER2 (i.e., methadone), and therefore cannot comment on whether these treatments were associated with treatment attendance. We found low and variable completion of EMA, limiting interpretation of event-level associations. Also, we did not collect all reasons for elevated craving (i.e. withdrawal symptoms, poor mood, context) on every occurrence of craving, thus cannot comment about the simultaneous overlap among predictors. Finally, percentage of enrolled individuals who provided program ratings was low, potentially biasing qualitative findings.

4.6 Conclusions

We found that an automated text message program informed by behavioral theories and incorporating daily interactions is acceptable to and perceived as useful by many ED patients with SUD. Additional research is needed to determine optimal program design to enhance engagement and a controlled trial is needed to examine whether exposure to PIER2 is associated with improved treatment attendance compared to standard care.

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Highlights

- 44% of Emergency Department patients with Substance Use Disorder (SUD) being referred to outpatient treatment agreed to use the text message (SMS) program
- Attendance at SUD treatment was higher among patients enrolled in the SMS program compared to those who refused (70.7% vs. 40.9%)
- 84% of patients who used the SMS program would recommend it to someone else.

Table 1:

Baseline Characteristics

Characteristics	SMS (n=167)	No SMS (n=210)	P-value
Age, mean (SD)	39.8 (12.2)	39.4 (11.0)	0.94
Female, n (%)	97 (58.1)	136 (65.8)	0.19
Race, n (%)			
White/Caucasian	137 (82.0)	158 (75.2)	0.08
African American	25 (15.0)	47 (22.4)	
Other/Missing	5 (3.0)	5 (2.4)	
Marital status			
Single	118 (70.7)	158 (75.2)	0.6
Married	27 (16.2)	28 (13.3)	
Divorced or Separated	22 (13.2)	24 (11.4)	
Primary Substance			
Benzodiazepine	13 (7.8)	8 (3.8)	0.001
Alcohol	97 (58.1)	91 (43.3)	
Opioid	57 (34.1)	111 (52.9)	
Referral Site			
ED #1	66 (39.5)	110 (52.4)	0.013
ED #2	101 (60.5)	100 (47.6)	

Abbreviations: SD=standard deviation; ED=Emergency Department

Table 2:
Logistic Regression Model for SUD Treatment Attendance

	AOR	95% CI	p-value
PIER2	3.95	2.44 to 6.39	<0.0001
No PIER2	REF		
White race	2.19	1.25 to 3.84	0.001
Black race	REF		
Opioid Use	0.46	0.29 to 0.73	0.001
Alcohol and Benzo Use	REF		
ED2	0.34	0.21 to 0.54	<0.0001
ED1	REF		

Abbreviations: AOR=adjusted odds ratio; REF=reference group; SUD=substance use disorder; ED=Emergency Department