


# A Mixed-Methods Evaluation of the Feasibility of a Medical Management-Based Text Messaging Intervention Combined With Buprenorphine in Primary Care

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## ABSTRACT

**BACKGROUND:** Mobile health (mHealth) tools offer an effective and personalized approach to enhance chronic disease management and may partially offset provider-level barriers to increasing buprenorphine prescribing in primary care. This study assessed the feasibility of integrating a text messaging-based medical management tool (TeMeS) in primary care among patients initiating buprenorphine.

**METHODS:** TeMeS messages are categorized per the medical management model, programed in a HIPAA-compliant texting software (Apptoto©), and delivered in a tiered fashion over 8-weeks to patients. This mixed-methods evaluation of TeMeS utilized key stakeholder feedback (patients, physicians, administrators, nursing), text messaging software process measures, thematic analysis of patient participant text message content, and electronic administrative data (eg, appointment adherence, treatment retention) at 2-months.

**RESULTS:** The study team approached 65 patients and  $n = 14$  (21%) were ineligible or declined to participate in the study. Most eligible participants owned a smartphone (90%), responded to at least one text query (88%) over an average of 24 days, and few requested to stop receiving texts (6%). Participant text replies included responses to cognitive behavioral therapy-based queries (13.8%), confirming or rescheduling appointments (6.1%), and insurance, pharmacy, or clinical issues pertaining to buprenorphine dispensation or dosing (2%). Suggestions for design modifications included personalizing message content and adjusting message frequency per patient risk of illicit opioid reuse, use of video-based informational content, and real-time provider and staff support for emergent issues.

**CONCLUSION:** Our findings highlight the acceptability, feasibility, and high rates of engagement of utilizing text messaging to enhance self-management among patients initiating buprenorphine treatment.

**KEYWORDS:** opioid use disorder, buprenorphine, mobile health, text messages

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## Introduction

Opioid overdose fatalities in the United States remain among the highest globally.<sup>1</sup> Buprenorphine is a schedule III controlled substance approved for office-based use and typically prescribed by generalists.<sup>2</sup> Office-based opioid treatment (OBOT) is approximated on the medical management model and has been tested in numerous clinical trials.<sup>3,4</sup> This basic psychosocial platform combines effective medications for opioid use disorder (MOUD) with patient education, adherence counseling, individualized care plans, access to specialty care, and encouragement of 12-step and counseling involvement.<sup>3,5</sup> Despite these efforts, OBOT is characterized with high rates of loss to follow-up in the 3 months following induction to buprenorphine (~40%) and highlights the need for

personalized approaches to improve retention.<sup>6–8</sup> Further, few clinicians prescribe buprenorphine relative to rising opioid overdose fatalities and is attributed to challenges with managing complicated inductions, patient scheduling, medication dose management during induction, and between-visit patient-provider communication.<sup>9,10</sup>

Mobile health (mHealth) interventions confer a personalized approach to enhance chronic disease management, may partially offset provider-level barriers to increasing buprenorphine prescribing, and potentially improve patient retention in OBOT.<sup>11</sup> Text messaging is the most ubiquitous mobile phone feature nationally, among patients in addiction treatment, and in OBOT.<sup>12–14</sup> Self-management texting support tools have demonstrated reductions in tobacco, alcohol, and



methamphetamine use.<sup>15,16</sup> As well, smokers receiving text messaging demonstrated equal rates of smoking cessation compared to individuals randomized to a smart phone application.<sup>17</sup>

Our current unobserved induction protocols rely on passive telephone support via calls to the clinic to address any unanticipated issues. However, patient contact with clinic staff is rarely used at our program and in other studies.<sup>18</sup> However, the clinical impact of a text messaging intervention in OBOT remains largely unclear. Our team designed a prototype of an automated text messaging intervention built upon key components of the medical management model (TeMeS) to improve retention in OBOT post-induction to buprenorphine and reduce provider burden.<sup>19</sup> The intervention was intended to offer automated reminders (eg, appointments, medication dosing), general information (eg, linkage with self-help groups, clinic phone numbers, overdose education), and support based on key elements of cognitive behavior therapy and motivational interviewing. The intervention did not incorporate clinic or research staff communication with patients or on-demand features triggering clinical support for patients.

The current study evaluated the acceptability and feasibility of integrating a text messaging-based medical management intervention (TeMeS) in OBOT among patients initiating buprenorphine. This mixed-methods descriptive study incorporated key stakeholder feedback (patients, physicians, administrators, nursing) combined with the text messaging software process measures and electronic administrative data (eg, appointment adherence, treatment retention) to assess feasibility. Study findings of this preliminary version of TeMeS set the stage for incorporating additional intervention components to enhance integration and clinical outcomes in OBOT.

## Methods

### *Study design*

We conducted a single-site, 2-month, nonrandomized prospective cohort study to assess the acceptability and feasibility (eg, participant feedback, engagement with the intervention over time) of TeMeS between August 2018 and December 2019. We used convenience sampling to approach 65 adult patients ( $\geq 18$  years old) with opioid use disorder (OUD) initiating buprenorphine in the Bellevue Hospital OBOT program. Patients that met eligibility criteria (ie, mobile phone ownership, fluency in English, expected to reside in NYC for at least 2 months post-enrollment, newly initiating buprenorphine treatment) were consented, provided with an optional training in mHealth use (eg, phone privacy safeguards, text message use), and had their phone numbers entered in the Apptoto© software, and authenticated for use. Patient participants were not provided with mobile phones or subsidized mobile phone plans. Subjects were reimbursed with \$20 transportation vouchers following enrollment and completion of the 2-month

individual interview. The study obtained ethical approval from the New York University School of Medicine Institutional Review Board.

### *Setting*

Since 2006, the Bellevue Hospital OBOT program has provided low-threshold MOUD (ie, buprenorphine, extended-release naltrexone, buprenorphine extended-release) to a primarily low-income patient population.<sup>7</sup> The clinic consists of 9 DEA-waivered primary care physicians and offers unobserved “home” buprenorphine induction and maintenance to a census of approximately 170 patients.<sup>18</sup> Patients receive medical management for OUD and other health needs on a weekly basis until they are successfully stabilized on buprenorphine, and evaluated on a monthly or bimonthly basis thereafter. Clinic visits reinforce efforts to reduce illicit substance use or maintain abstinence, engage with self-help groups and outpatient counseling, facilitate referrals to specialty services (eg, psychiatry, hepatology), and discuss the results of urine drug screen testing.

Patients are provided with the clinic mobile phone number to reach clinicians during regular clinic hours in the event of any unanticipated administrative or clinical issues. Clinic administrative staff regularly call patients once prior to each scheduled clinic visit. Clinic telephone call reminders were not discontinued among patient participants participating in the study.

### *Intervention*

The intervention design rests upon the medical management model and messages were categorized as follows: (a) patient-provider communication (ie, clinic phone number, address, business hours); (b) buprenorphine adherence (queries on cravings and withdrawal symptoms and instructions supporting induction and stabilization); (c) self-management (informational content on buprenorphine, cravings, withdrawal symptoms, city- and hospital-wide HIV and Hepatitis C services, specialty care, primary care, counseling, and social services); (d) reinforcement of opioid abstinence based on motivational interviewing and cognitive behavior therapy; and (e) encouraging of 12-step meeting and counseling participation. Message content and operational sequences (ie, messaging algorithms, 2-way response trees) were based on numerous mixed-methods and qualitative studies conducted by our team that addressed attitudinal and structural barriers to buprenorphine treatment to enhance linkage and retention in OBOT.<sup>8,11-13</sup> Subsequent usability studies identified areas for further optimization, including modifications to message content and operational sequences guiding patients during home-induction, stabilization, and maintenance on buprenorphine treatment.<sup>20,21</sup>

Messages and operational sequences were programed in a HIPAA-compliant texting software (Apptoto©) and allowed

the study team to track participant use (ie, replies to message queries) over time. Message sequences were launched in a tiered fashion to avoid redundant content and burden, and the frequency of daily messaging was reduced following stabilization on buprenorphine. Message content and frequency was not personalized based on buprenorphine dosage. No patient health information was transmitted or requested in text messages and the texting software was not linked to the clinic electronic medical records. Patients could request to terminate enrollment in the messages by texting “STOP” or contacting the study team. Key stakeholders, including Bellevue Hospital buprenorphine providers (n=3), administrators (n=3), and clinic nursing (n=2) could alert the study team during clinic hours regarding any concerns or general observations pertaining to intervention design and its impact on clinical care. Participants were made aware that the intervention was fully automated without any staff contact. However, study staff reviewed the texting software daily and relayed any participant queries or concerns to the clinic administrators and/or providers.

#### Data collection

The 14-item baseline survey consisted of demographic and clinical characteristics gathered from the electronic medical records and at enrollment by the study team (eg, age, race/ethnicity, insurance status, medical and/or psychiatric diagnosis). Items pertaining to mobile phone and text message usage patterns were based on prior surveys conducted by the study team and included: (1) type of mobile phone ownership (smartphone, basic cellphone, landline, or none); (2) mobile phone ever used to obtain help for recovery or general health; (3) intrusion of privacy with their mobile phone; and (4) frequency of text messaging.<sup>12,13</sup>

Follow-up surveys were conducted at 2 months by the study team to identify areas of potential optimization based on the Technology Acceptance Model (TAM), a theoretically-based approach to intervention design. Core TAM domains incorporated in the 9-item interview guide included: (1) ease of use of adopting the intervention to enhance recovery, potential privacy concerns, and mobile phone use difficulties (eg, lack of coverage, mobile phone ownership); (2) perceived usefulness in improving adherence to buprenorphine induction dosing instructions and strategies to improve patient-physician communication during complicated withdrawals, and self-management; (3) intention to use over time during induction, stabilization, and maintenance; and (4) perceived enjoyment and annoyance, particularly with the operational sequences of scheduled text queries to inform design adjustments to the intervention.<sup>22</sup> Follow-up mixed-methods surveys were conducted among patient participants at 2 months. Process measures captured from the texting software included rate of patient responses to software-initiated text queries, number of

**Table 1.** Demographic and clinical characteristics of study patients in office-based opioid treatment in a New York City public hospital setting (n=50).

MEASURES	DISTRIBUTION, N (%)
Gender	
Male	48 (96)
Race-ethnicity	
African-American	16 (32)
Hispanic/Latinx	13 (26)
White	21 (42)
Insurance status	
Medicaid	38 (76)
Medicare	4 (8)
Privately-insured	1 (2)
Uninsured	7 (14)
Average age (SD)	44.1 ( $\pm$ 11.8) years old
Psychiatric comorbidities	25 (50)
Medical comorbidities	24 (48)

participant-initiated requests for clinician telephone assistance, and requests to “STOP” receiving messages. Thematic analysis was also conducted of patient text message responses to the texting software.

Exploratory secondary outcomes pertaining to treatment retention (weeks-in-treatment) and adherence to scheduled visits were tracked using a structured review of the electronic medical records. Attendance to scheduled appointments were categorized as early ( $\geq$ 30 minutes prior to the scheduled visit time), on-time ( $<$ 30 minutes to the schedule visit time), late ( $\geq$ 30 minutes after the scheduled visit time), or no-show.

#### Analytic plan

Descriptive statistics characterized baseline patient survey demographic, clinical, and technology use (see Table 1), and feasibility (eg, eligible patients enrolling in the text messaging intervention, rates of replies to text queries over time, cancellation requests). Although participants were informed that the intervention was fully automated without any staff contact, some patient participants replied to messages and the study team analyzed these texts to explore potential administrative and clinical needs. Subject responses to individual interviews were hand-written by study staff with prior training in qualitative research methods (BT, CM) and ensured the validity of the analysis by independently reviewing responses line-by-line to yield data clusters that were labeled into brief headings of codes, and then coding categories using an a priori coding

**Table 2.** Responses to text message queries and reminders among 50 patient participants in office-based opioid treatment in a New York City public hospital setting.

MESSAGE CATEGORY	N (%)	EXAMPLES
Reflections on cognitive behavioral therapy queries	48 (13.8)	“Working out, basketball, and a NA meeting”;
Appointment concerns or issues	21 (6.1)	“My next appointment to see my doctor is when?”; “Can I do a visit after 12 noon? I worked a double shift today and will be going into work late tomorrow. I’m so sorry”
Prescription and pharmacy issues	7 (2)	“I lost my subs [suboxone] and going crazy”; “The prescription never when through”; “Unfortunately my Medicare won’t pay for the correct dosage and so I will spend the next four days without medication. Don’t know how this is gonna work.”
Mental health	7 (2)	“I need a mental health therapist”
Medication dosing	6 (1.7)	“I have a lot of cravings. How many can I take please? I don’t feel good.”
Patient-physician communication	5 (1.4)	“Dr. XXXX, please call me soon”
Clinic address	4 (1.1)	“Where are you located?”
Pain issues	4 (1.1)	“I am trying to substitute my methadone with this new drug [suboxone] for pain relief. So far it has worked fairly well for my withdrawals. I find it doesn’t work quite as well for pain. I’ve been asked to take three tabs a day. I am more comfortable at four tabs a day.”
Social services	4 (1.1)	“I need a place to stay and sleep. I have until the 6th of this month to get out of my sister’s house.”

scheme based on themes related to the technology acceptance model. Any discrepancies were addressed in consensus sessions.

## Results

The study team approached 65 patients and 50 of the 54 eligible patients (92.6%) agreed to participate and were then, consented and enrolled into the study. Although few patients declined to enroll in the study due to lack of interest in receiving text messages ( $n=4$ ), numerous patients were excluded due to lack of mobile phone ownership ( $n=10$ ) and not being fluent in English ( $n=1$ ). Participants were mostly male ( $n=48$ , 96%), Medicaid-insured ( $n=38$ , 76%), African-American ( $n=16$ , 32%) and Hispanic/Latinx ( $n=13$ , 26%), with a mean age of 44.1 ( $\pm 11.8$ ) years (see Table 1). Most participants owned a smartphone ( $n=45$ , 90%) versus a basic cellphone ( $n=5$ , 10%), utilized text messaging at least once per day ( $n=40$ , 80%), and denied having their phone accessed in a manner that compromised their privacy ( $n=43$ , 86%). Participants reported owning at least 2 mobile phones (range 1, 10) and having an average of 2 phone numbers (range 1, 7) in the past year. Fewer respondents used their mobile phone to access care or obtain information for OUD treatment or their general health (28%). Respondents preferred to receive text messaging ( $n=20$ , 40%) or had no preference for text messaging versus telephone contact ( $n=24$ , 48%).

The text message software launched 2829 messages and received 347 responses from participants. Most participants responded to at least one text message query ( $n=44$ , 88%) and generated an average of 8 ( $\pm 8.7$ ) replies to software-launched

text queries over a period of 24.1 ( $\pm 20.5$ ) days. Few participants requested to stop receiving texts during the 2-month study period ( $n=3$ , 6%). Although participants were informed that the texting software was fully automated without any staff contact, some participants self-initiated queries or comments that were archived in the software. Participant messages to the software consisted of reflections on cognitive behavioral therapy-based queries ( $n=48$ , 13.8%), confirming or rescheduling appointments ( $n=21$ , 6.1%), and insurance, pharmacy, or clinical issues pertaining to buprenorphine dispensation or dosing ( $n=7$ , 2%; see Table 2). No participants required technical support to engage with the intervention.

### Follow-up interviews

Individual interviews were conducted at 2-months until achieving code and thematic saturation ( $n=16$ ). Most participants found the texting tool generally useful ( $n=15/16$ , 93.8%). Key themes that emerged from interviews included: (1) the ease of access to text message-based informational content “instead of looking for [clinic] paperwork,” checking voice-mails from clinic staff, or requiring internet access to access their email or patient portal; (2) the importance of delivering supportive content beyond induction and the 2-month study period due to ongoing risks of opioid reuse; and 3) tailoring content and message frequency per each patients’ clinical needs. Respondents were generally satisfied with the operational sequences (ie, response trees) and found the frequency of messages to be appropriate. Suggestions for improving intervention design included: (1) reducing the frequency of messages

for individuals with prior experience enrolling in OBOT; (2) allowing patients to select the frequency of software-initiated messages and times or days they may be “bored” and at increased risk of opioid reuse (eg, weekends, holidays); (3) encouraging patients to mute or utilize a unique ringtone for non-urgent software-initiated text alerts; (4) ensuring a heterogeneity of messages to avoid “repetitive” content that may give the impression that clinic staff are “not being sincere”; (5) increasing the use of video-based informational content; and (6) utilizing emoticons.

Messages reinforcing adherence to buprenorphine were described as “helpful” and emphasized the importance of patient education on medication side-effects and unobserved induction dosing recommendations to facilitate self-management of cravings and withdrawal symptoms. Another respondent lauded the importance of these messages to ensure adherence in the event “addicts suffer from depression and do drugs.” Suggestions for improving patient-physician communication included the availability of a “crisis hotline” or patient-initiated alert system that could expedite access to a provider in the event of worsening cravings, opioid reuse, or psychiatric symptoms. Suggestions for improving patient engagement with self-help groups and counseling included displaying contact information of nearby counseling programs, self-help group sponsors, hotlines, and meeting times and locations. In addition to message content categorized by the medical management model, participants also emphasized the importance of texts addressing social determinants of health, including facilitating access to food pantries, emergency housing, and health insurance. There were no reports of privacy concerns with the text messages.

Feedback from buprenorphine providers (n=3), administrators (n=4), and nursing staff (n=2) affiliated with Bellevue Hospital’s OBOT program were mostly positive and cited patient satisfaction with the messages. One physician recalled participant feedback about the texts being “equivalent to AA [alcoholics anonymous] for him.” Another patient recalled to their physician having been in the metro to procure illicit opioids, but had decided to return home after receiving a supportive text. Such experiences highlight the importance of delivering messages that may disrupt behaviors leading to opioid reuse in a variety of community settings. Problems with the intervention cited by administrators included patients’ appointment schedules being entered incorrectly during 2 occasions requiring further safeguards by the study team in the first month of the study and averted any further errors.

### *Clinical outcomes*

The majority participants receiving the texting intervention following their initial visit in the OBOT program were enrolled in the clinic at 2-months (n=33, 66%). The texting software launched 173 appointment reminders and participants were

generally early (n=34, 19.7%) or on-time (n=72, 41.6%) to their visits rather than being late (n=23, 13.3%) or missing visits entirely (n=44, 25.4%).

### **Discussion**

Findings from this feasibility study in a safety net OBOT program describe high acceptability and utilization if a text message-based medical management tool among patients initiating buprenorphine treatment. Participants utilized the texting tool repeatedly during the 2-month study period without posing any privacy risks or exposing technical issues. Follow-up surveys highlighted the benefit of automated content (eg, appointment reminders, medication dosing instructions, clinic contact information) combined with texts facilitating access to in-person support (eg, self-help groups, sponsors, hotlines, and evidence-based psychosocial counseling). Analysis of archived text messages also revealed the importance of offering real-time staff contact with patients to promptly address unanticipated administrative (eg, prescription errors, prior authorization requests) and clinical issues (persistent cravings, withdrawal symptoms) that place patients at elevated risk of illicit opioid reuse and loss-to-follow-up.

The lack of mobile phone ownership (n=10) and high rates of turnover of mobile phones and phone numbers among some patients pose major obstacles to expanding the role of mHealth in OBOT and emphasize the need for regularly querying patients for updated contact information and distributing subsidized mobile phones and payment plans via the Federal Communications Commission Lifeline program upon initiation of treatment.

Individual interviews at 2-months revealed ease of use utilizing the texting tool without the need for technical support throughout the study period or confusion interpreting message content. Despite the perceived usefulness of the texting tool to support patients during induction on buprenorphine, participant feedback highlighted the importance of providing ongoing reminders and supportive content beyond induction and the initial 2-month study period due to the perceived risk of opioid reuse. Additional design modifications suggested by participants that may enhance the perceived usefulness of the texting tool included ensuring human contact (eg, clinicians, peers, counselors, self-help group sponsors) in text responses to patient queries, utilizing emoticons and multimedia content (eg, links to videos), and offering on-demand access to buprenorphine providers to address unanticipated clinical issues that may heighten the risk of illicit opioid reuse.

Suggestions for sustaining patient use over time included personalizing the frequency of messages delivered to patients per clinical and psychosocial needs that may change over time. Delivering a set frequency of messages among all clinic patients across the 2-month period was perceived to be an annoyance by some respondents since they self-reported being more experienced in buprenorphine treatment and requiring less text

support regarding induction but would benefit from more content pertaining to securing specialty care or social services.

The administrative utility of such a mobile tool is notable and may partially offset patient calls to the clinic for issues that may be rapidly addressed via text contact (eg, reschedule or cancel appointments, obtain clinic directions). Further studies are needed to assess the cost-effectiveness of such mobile health tools in mitigating administrator burden with answering phone calls or checking voicemails versus responding to patient text queries via a computer dashboard.

### Limitations

Although the texting software was able to timestamp sent or received messages, it is unclear what percentage of messages were read or understood. Rates of retention at 2- and 6-months in this feasibility study are comparable to rates published previously from this site. The study was sized for feasibility testing and final “de-bugging” of the intervention and was not intended to provide a definitive test of intervention efficacy on 8-week treatment retention.

### Conclusion

Our findings demonstrate the acceptability, feasibility, and high rates of engagement with the intervention among patients in substance use disorder treatment settings.<sup>11,16</sup> However, further design modifications and studies are required to identify components that may enhance the clinical impact of texting in primary care for PWUOs, such as incorporating clinic staff communication, contingency management, or behavior change principles that may reinforce treatment success.

### Author Contributions

CFL, BT, MD, CM, and JDL made substantial contributions to the conception and design; all co-authors were involved with the interpretation of data and drafting the manuscript.

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