


Article

E-VOLUTION: A Text Messaging–Powered Intervention—Connection, Support, and HIV Eradication

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This longitudinal, nonexperimental, quantitative study examined the acceptability, feasibility, and efficacy of a texting intervention that was added to medical case management for youth and young adults at high risk for poor HIV outcomes. The intervention, E-VOLUTION, sent automated text messages to youth participants living with HIV that reminded them to take prescribed medication and attend medical visits. Automated texts also asked clients about mood, housing, and ability to pay bills. Client responses to automated texts that indicated challenges triggered alerts for their medical case manager, who then followed up to address the issue. Participants (N = 100) were an average age between 22 and 23 years and most were Black (95%) and men who have sex with men (82%). Over a period of 26 months 89,681 automated texts were sent, resulting in 450 alerts. Additionally, clients and medical case managers exchanged more than 17,000 texts. Results of Spearman correlations indicated significant associations between greater frequency of alerts triggered and greater likelihood of kept medical appointments ($p < .05$). Findings also showed significant associations between greater frequency of texting with a medical case manager and greater likelihood of viral load suppression and kept medical visits at 12-month follow-up ($p < .01$). More frequent substance use was

associated with more alerts triggered ($p < .01$). Use of text messaging was acceptable to the participants and is a culturally responsive way to engage youth participants living with HIV in care. Future research may examine the use of structured behavioral health assessments in the automated texting framework, as well as compare outcomes between automated and two-way texting groups.

Keywords: HIV/AIDS; technology; sexual health; adolescent health

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► BACKGROUND

In the United States, youth have poor HIV care continuum outcomes, including lower rates of linkage to care, retention, and viral load suppression (VLS) than adults (Griffith & Agwu, 2017). Additionally, a 2018 report indicated that Black individuals with HIV were less likely to be on antiretroviral therapy or to experience sustained VLS than their White peers, with Black youth experiencing the lowest prevalence of sustained VLS across all age and racial groups (Crepaz et al., 2018). These disparities indicate that the current HIV care system does not work equally well for all populations living with HIV. Moreover, innovative adaptations to existing services to better engage and retain youth, especially youth of color, in HIV care are needed to improve these outcomes.

Numerous factors are associated with worse HIV outcomes among youth living with HIV (YLWH), including psychosocial (e.g., depression) and environmental factors, unstable housing, under- or unemployment, and low educational attainment (Griffith & Agwu, 2017; Saberi et al., 2019). Moreover, Black YLWH are subject to the racism and bias in health care that many Black Americans experience (Nelson, 2002), which in HIV treatment is associated with decreased odds of receiving and maintaining access to antiretroviral treatment (Landovitz et al., 2017). In addition, childhood adversity such as witnessing or experiencing family violence faced by many YLWH, especially Black youth and young men who have sex with men (YMSM), contributes to increased risk for poor health outcomes (Felitti et al. 1998/2019; Miller et al., 2013). Previous research has demonstrated that adults who reported experiencing four or more adverse childhood experiences were at significantly greater risk for increased morbidity and early mortality (Gilbert et al., 2015). These findings are especially concerning for YLWH as a recent study demonstrated that YLWH experience four or more adverse childhood experiences at a rate of more than triple that of the general population (33% vs. 9%; Saberi et al., 2019). Strategies that aim to improve engagement and retention of YLWH along the HIV care continuum must acknowledge and address these contextual factors.

The addition of mobile health technologies (mHealth) to traditional HIV care systems is one way in which some have attempted to increase engagement, adherence, and retention in HIV care. The most common mHealth platform used is mobile texting or text messaging (Henny et al., 2018). There are two common types of text messaging interventions: one-way texting, in

which a participant receives a text message and does not reply, and two-way texting in which a participant receives a text message and is asked to reply. The results of studies examining the implementation and effectiveness of these text messaging interventions are promising. One meta-analysis of nine studies found that using text messaging reminders doubled the likelihood that individuals with HIV would return to care (Jong et al., 2017). A second meta-analysis of eight studies examining text messaging interventions aimed at promoting adherence to antiretroviral therapy found that, overall, client participation in text messaging interventions was significantly associated with greater adherence and reduced viral load (Finitis et al., 2014). Moreover, studies have shown that interventions that utilize two-way text messaging are more effective for individual behavior change than those that use unidirectional “push” messages (Hall et al., 2015; Henny et al., 2018), and that text messaging is an effective intervention for increasing adherence to preexposure prophylaxis among men who have sex with men and transgender women (Moore et al., 2017). Although previous studies have examined the utility of automated text messaging and two-way text messaging independently, research on the use of two-way, automated text messaging interventions to improve HIV care outcomes among YLWH is limited.

Text messaging is likely an appropriate intervention to augment traditional HIV care for YLWH as texting is the preferred method of communication for youth in the United States. Recent studies indicated that approximately 33% of youth send more than 100 text messages a day (Schnall et al., 2013). Furthermore, 89% of racial and ethnically diverse YMSM surveyed recently accessed the Internet through their phone to find information about HIV and AIDS (Holloway et al., 2017) and 98% of YLWH in a recent study reported regular access to a cell phone (Saberi et al., 2019).

Even though the results of several studies have proven text messaging to be an effective intervention for improving HIV care outcomes among adults, there is limited literature that examines the effectiveness of text messaging interventions for YLWH in the United States. Additionally, though data indicates that psychosocial and environmental risk factors place YLWH at greater risk for poor outcomes, the literature examining the use of text messaging to address the multiple psychosocial and environmental needs, such as depression and housing, among YLWH is scarce. Furthermore, limited attention has been paid to the effectiveness of automated, two-way text message interventions for improved HIV outcomes. The E-VOLUTION program was designed to address these gaps in knowledge.

Conceptual Model

E-VOLUTION was based on the supportive accountability framework (Mohr et al., 2011). Developed from extant literature from the fields of organizational psychology, motivational theory, and computer-mediated communication, this framework explains that motivations toward medical treatment adherence in mHealth contexts is determined by three constructs: relationships between patients and health care providers, clarity of expectations, and performance monitoring. In this study, the patient–provider relationships are represented by medical case managers (MCMs) responding to alerts triggered by participant responses to automatic text messages. The construct of clarity is conveyed with medication adherence questions and appointment reminders, and performance monitoring is represented through the collection of client responses to automated text messages over time that can be reviewed with their MCMs as needed, as well as participants' regular receipt of these reminders. The supportive accountability framework differs from other contemporary theoretical frameworks for mHealth such as the behavior intervention technology model (Mohr et al., 2014) and the interactive behavior change technology model (Glasgow et al., 2004) in its focus on the patient–provider relationship as key in the adherence process (Donevant et al., 2018).

Study Aims

In response to the gaps in knowledge identified above, the aims of the current study were to (1) assess engagement and acceptability of YLWH with an automated, two-way text messaging intervention and (2) test the efficacy of an automated, two-way text messaging intervention by examining associations between engagement in a two-way text messaging intervention and psychosocial risk factors, viral load suppression, and kept medical visits among YLWH.

METHOD

Intervention Description and Procedures

Data were derived from the E-VOLUTION text messaging program, which aimed to improve HIV health outcomes among YLWH (ages 18–29 years) by increasing VLS rates, retention in HIV medical care, and assistance with overcoming barriers to improve health outcomes. This mHealth intervention was implemented in the Washington University School of Medicine's Ryan White Part C and D HIV care program by all MCMs who worked directly with YLWH or provided specialized services that matched the inclusion criteria. This included the

youth program MCMs, the youth and adult linkage to care MCM, the lost to care MCM, and the transitional MCM (an MCM who helps youth transition to adult services). The automated two-way text message system included daily medication reminders, appointment reminders as needed, semiweekly mood checks, and monthly questions about the participants' housing and utility needs. Participant responses to automated texts that indicated a challenge in any of these areas generated an alert to the MCM's cell phone or online dashboard and were responded to within 24 hours. These alert responses often lead to unstructured two-way text messaging between the participant and their MCM. Figure 1 provides an example text messaging exchange between the automated texting system and a participant who responds with an alert, and the resulting alert received by the MCM.

The development process for E-VOLUTION prioritized feedback from youth advisors, who were individuals from the target population. During group and individual feedback sessions, youth advisors were presented with technology demonstrations and provided critical feedback on digital interventions, the two-way text messaging system, and marketing materials. Key feedback included (1) text messages were preferred over phone calls for communication with care teams, (2) the care team should be mindful about the frequency and message content of text messages, (3) E-VOLUTION marketing materials should include images of youth that are age appropriate and look real but should not disclose a youth's HIV diagnosis, (4) confidentiality and security of technology systems is an important consideration, (5) the communication tool for the intervention should be able to be used on a WiFi connection without using data while maintaining security of information, and (6) connection mattered to the youth, including connection to their own health information and their health care team.

A convenience sample of participants ($N = 100$) was recruited into the intervention by study team members during medical or case management appointments, through medical case manager referral, and through outreach to linkage to care and lost to care youth clients at three HIV clinic sites at the Washington University School of Medicine Department of Pediatrics in St. Louis, Missouri. Study team members were staff of the HIV clinic sites from which we recruited and were hired through Ryan White Part D and had no clinical role in the care team. Recruitment and data collection occurred February 2017 through May 2019, with analysis completed in 2019. Self-report data were collected using audio-computer assisted surveys at time of consent and at 6 and 12 months postconsent. Additionally, viral load

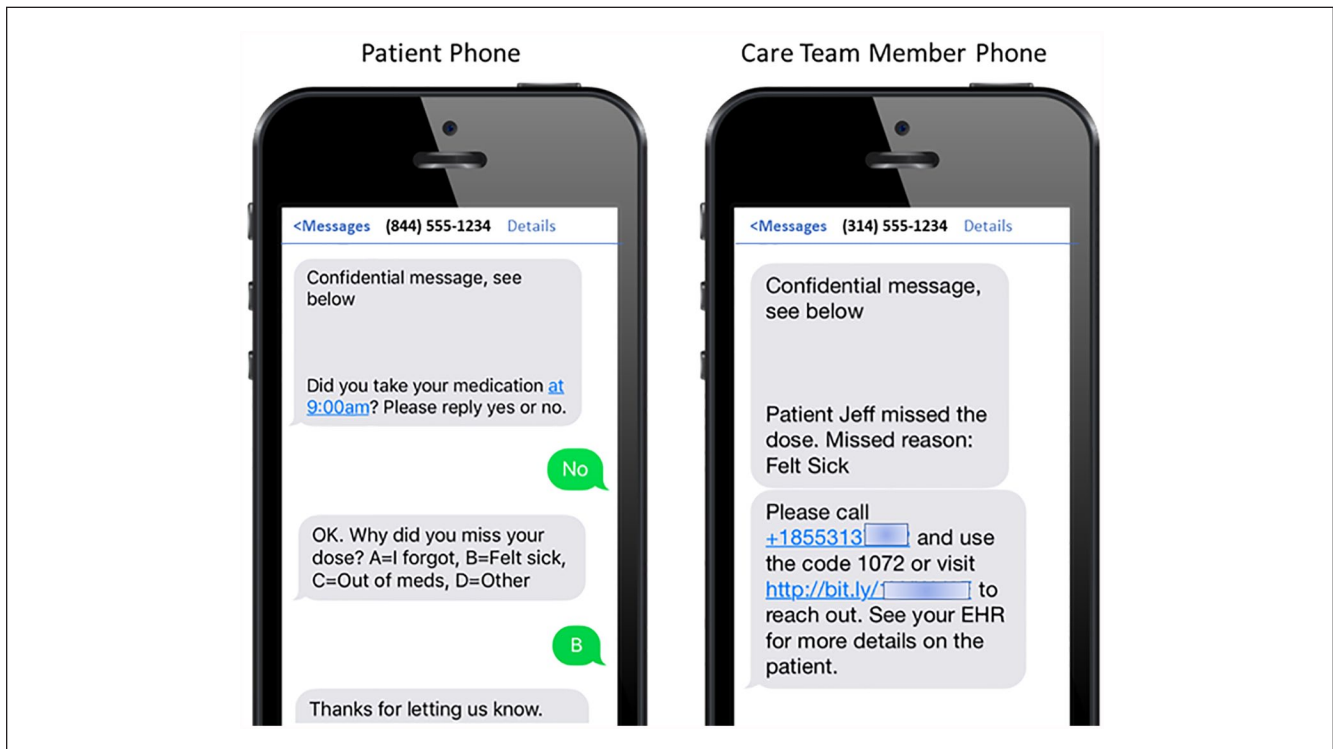


FIGURE 1 Example Automated Message and Resulting Alert

and medical appointment attendance was extracted from the electronic medical record at consent and 6 and 12 months postconsent.

To protect participant privacy, the E-VOLUTION study team consulted with the University's internal privacy office and information security teams to develop a MCM text messaging policy. This policy outlined specific actions that MCMs were required to follow to reduce the risk of unintentional disclosure of participant information over text message. In addition, the team implemented a Safety Appraisal screener that all participants completed during the enrollment process that asked participants to imagine how they would respond if other people saw the text messages sent to them by E-VOLUTION. The study team also discussed strategies for securing mobile phones and protecting private information during this screening process. If the results of the screener indicated that participants may be placed in a potentially unsafe situation were someone to see the text messages sent by E-VOLUTION, the study team discussed these concerns with the participants and explored whether they should complete enrollment into the program. The study was approved by the Human Research Protection Office (institutional review board) at Washington University in St. Louis.

Participants

Eligible participants for E-VOLUTION were 18 to 29 years old, English speaking, received HIV medical and case management services at the clinic sites during the study period, and self-reported access to a private cell phone with texting ability. Additionally, to be eligible to enroll in E-VOLUTION, participants needed to either be newly diagnosed with HIV within the past 12 months, not engaged in HIV care for more than 6 months in the past 24 months, and/or have a viral load greater than 200 copies/mL of blood, each of which places an individual at increased risk for poor HIV outcomes.

A total of 100 youth enrolled in the E-VOLUTION program. Of those who enrolled, 87 participated in the intervention for at least 6 months and 78 participated for at least 12 months. Participation was defined as being programmed into the automated messaging software and receiving automated text messages. The majority of those who participated in the intervention completed 6- and 12-month follow-up surveys; 84 completed surveys at 6 months and 75 completed surveys at 12 months. A summary of the number of participants who withdrew from the study at 6 and 12 months and reasons for withdrawal are provided in Figure 2. Due to the differences

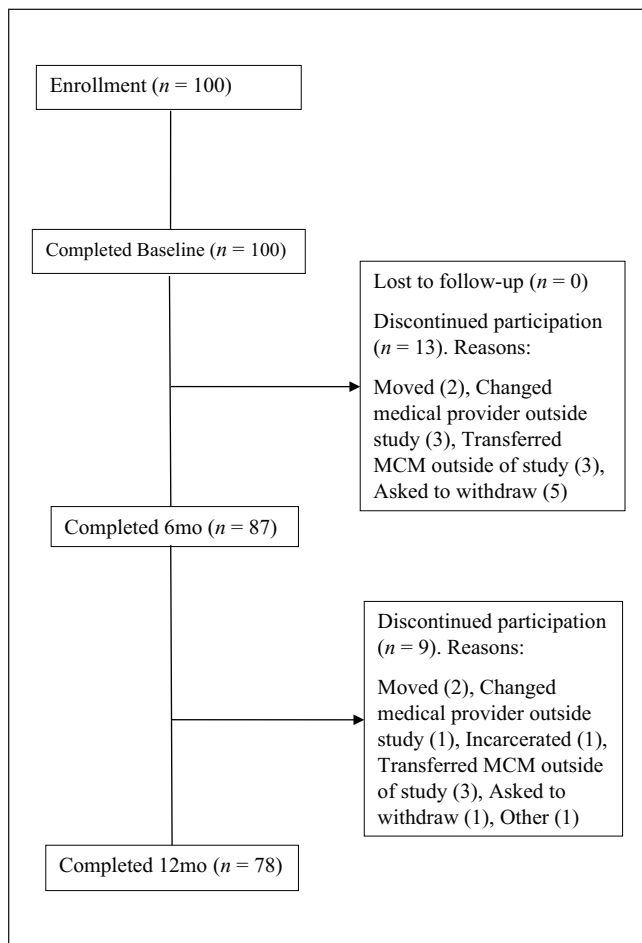


FIGURE 2 E-VOLUTION Participant Retention and Drop-Out Across Time Points

Note. MCM = medical case manager.

in the number of participants who participated in the intervention and the number who completed 6- and 12-month surveys, the sample sizes for analyses using medical record data differ from those using self-report survey data. Additionally, different sample sizes were observed for the outcomes of kept medical visits and viral load suppression because not all participants who attended medical visits completed lab work.

The majority of E-VOLUTION participants identified as Black (93%) and were young men who have sex with men (83%). Approximately 26% of participants scored above the clinical cutoff for depression, and nearly one third experienced physical intimate partner violence (28%) and/or sexual assault (34%) in their lifetime. Table 1 presents a detailed summary of participant demographics and risk factors at consent.

Measures

Sociodemographic Variables. Participants self-reported a number of sociodemographic characteristics at time of enrollment, including race, gender, education level, employment status, income, age, and mode of HIV acquisition (see frequencies in Table 1).

HIV Care Continuum Outcomes. Viral load (the number of viral copies/mL of blood), viral load suppression (fewer than 200 viral copies/mL of blood), and kept medical visits (whether or not participants attended regular semiannual HIV medical visits) were extracted from medical record data at time of enrollment and at 6-month and 12-month follow-ups.

Text Messaging. Automated text messaging data were collected through the text messaging platform and included number of automated texts received, number of responses to automated texts received, and number of each type of alert triggered by participants in response to automated texts received. Types of alerts included missed medication dose or medical appointment, worse mood than usual, and wanting to discuss housing/bills. Live two-way text messages were collected from MCMs' encrypted cell phones and converted into.txt files for analysis.

Psychosocial and Behavioral Risk Factors. Self-reported severity of depression symptoms (Patient Health Questionnaire-2; Kroenke et al., 2003) as well as frequency of alcohol, marijuana, methamphetamine, and opioid use in the past 6 months were collected at baseline, 6- and 12-month follow-ups. Substance use frequency was measured on a Likert-type scale where 0 = zero times, 1 = once a month or less, 2 = several times a month, 3 = once a week, 4 = several times a week, 5 = once a day, and 6 = more than once a day. In addition, participants were asked about lifetime experiences (yes/no) of physical intimate partner violence, sexual assault, trading sex, receiving money in exchange for sex, paying for sex, or spending time in jail or prison (see frequencies in Table 1).

Participant Acceptability of Automated Text Messaging. Participant satisfaction with the intervention was assessed using two self-report survey questions administered through the automated text messaging service. These surveys were sent every 4 weeks for the first 3 months of participation and then once every 6 months for the remainder of participants' time in the program. The questions measured perceived improvement in communication with MCM (1 = significantly worsened, 9 = significantly improved), and acceptability of text message frequency (1 = too few, 5 = perfect, 9 = too many).

TABLE 1
Intervention Participant Demographics and Risk Factors at Enrollment (N = 100)

<i>Demographics/risk factors</i>	<i>n (%)</i>
Demographics	
Race	
Black	93 (93)
White	7 (7)
Gender	
Male	91 (91)
Female	9 (9)
Education level	
Some high school	15 (15)
High school diploma of GED	39 (39)
Some college, professional, vocational, or trade school	38 (38)
Associates degree or trade certificate	5 (5)
Bachelor's degree	3 (3)
Current employment status	
Full-time employed	36 (36)
Part-time employed	26 (26)
Disabled	6 (6)
Unemployed—looking for work	32 (32)
Unemployed—not looking for work	2 (2)
Income levels	
At or below 100% of federal poverty line	53 (53)
Between 100% and 150% of federal poverty line	10 (10)
Between 151% and 200% of federal poverty line	8 (8)
HIV acquisition category	
Male-to-male sexual contact	82 (82)
Male-to-male sexual contact and intravenous drug use	1 (1)
Heterosexual contact	10 (10)
Perinatal	7 (7)
Age ^a (years)	22.87 (2.30)
Monthly income ^a (dollars)	1,430 (3,562)
Psychosocial risk factors	
Depression (PHQ-2 \geq 3; past 2 weeks) ^b	26 (26)
Experienced physical intimate partner violence (ever)	28 (28)
Used alcohol several times a week (past 6 months)	18 (18)
Used marijuana several times a week (past 6 months)	44 (44)
Used tobacco daily (past 6 months)	28 (28)
Misused prescription painkillers/opioids (ever)	13 (13)
Used methamphetamine (ever)	9 (9)
Experienced sexual assault (ever)	34 (34)
Traded sex (ever)	22 (22)
Received payment for sex (ever)	28 (28)
Paid for sex (ever)	6 (6)
Spent time in jail or prison (ever)	47 (47)

Note. PHQ-2 = Patient Health Questionnaire–2.

^aM (SD). ^bSee Kroenke et al. (2003).

Data Analysis

Frequencies and means were used to describe the sample and the number of types of alerts triggered by participants, as well as to analyze participant satisfaction with the program. Spearman correlations were used to test for significant associations between number and types of alerts triggered as well as substance use, depression, and HIV care continuum outcomes.

► RESULTS

Intervention Participation

Spearman correlations were computed to determine if there were any statistically significant demographic differences in the participants who withdrew from the program before 12 months and those who did not. Results indicated that withdrawal from the program was significantly associated with being White, $r_s(100) = -.33, p < .01$, and being older, $r_s(100) = -.22, p < .05$. There were no significant differences in withdrawal by gender, HIV acquisition risk factor, income, or whether or not the participant had spent time in jail or prison.

Participation in Text Messaging

A total of 89,681 automated messages were sent to participants over the course of the intervention, yielding 24,926 responses. This resulted in an automated text response rate of approximately 28%. The average automated text response rate decreased over the intervention period, with an initial rate of 36.6% during the first 3 months of the intervention that steadily fell over time. Participants triggered 450 alerts in response to automated text messages, the most common of which indicated participants were experiencing challenges with daily medication adherence ($n = 162$), housing stability ($n = 94$) and attending scheduled medical appointments ($n = 83$). A detailed summary of alert types and frequencies is provided in Table 2.

In addition to automated messages and alerts, 17,286 text messages were exchanged between 98 participants and 11 MCMs during the study period. Of those, 9,172 text messages were sent from case managers to clients and 8,114 were sent from clients to MCMs.

Associations Between Alerts Triggered and Substance Use, Depression, and HIV Care Continuum Outcomes

Results of Spearman correlations are summarized in Tables 3 and 4 and indicated that participants who

TABLE 2
Frequencies of Types of Alerts Triggered Via Automated Texts by Participants

Did not take medication (reasons below)	162
Out of medication	66
Felt sick	12
Felt better	1
Forgot	2
Other (not specified)	72
No reason	9
Stopped taking medication (reason below)	5
Felt sick	3
Doctor instruction	2
Mood check—Felt worse than usual	47
Housing—Want to discuss housing	94
Need to miss appointment (reasons below)	59
Work conflict	22
No childcare	1
Transportation problems	6
Other (not specified)	14
No reason	16
Missed appointment (reasons below)	83
Work conflict	17
No childcare	1
Transportation problems	13
Cancelled	10
Other (not specified)	28
No reason	14

reported greater alcohol use triggered more alerts overall at both 6 and 12 months. Greater alcohol use was also specifically associated with a greater number of triggered alerts related to missed appointments and worse mood at 6 months and a greater number of housing instability alerts at both 6 and 12 months. Using a greater amount of marijuana was significantly associated with a greater number of alerts triggered for missed doses of medication at 6 and 12 months. There were no significant associations observed between depression and alerts triggered in response to automated text messages. However, there was a significant association between more frequent responses to texts from one's MCM and scoring below the clinical cutoff for depression symptoms.

Regarding HIV care continuum outcomes, triggering a greater number of alerts at both 6 and 12 months was significantly associated with a greater likelihood

TABLE 3
Bivariate Associations Between Depression and Substance Use, Alerts Sent, and Texting With Medical Case Manager (MCM)

<i>Alert</i>	<i>Depression</i>	<i>Marijuana</i>	<i>Alcohol</i>	<i>Meth</i>	<i>Opioids</i>
6 months					
Total alerts	.11	.18	.39**	.27	.23
Med alerts	.16	.28*	.18	.19	.23
Appointment alerts	-.08	.04	.24*	-.02	.01
Mood alerts	.02	-.30	.27*	.00	.10
Housing alerts	.09	.16	.28*	-.15	.08
MCM text	-.15	-.11	.13	-.44	.03
Response to MCM	-.20*	-.17	.17	-.34	.11
12 months					
Total alerts	.09	.17	.32**	.26	.26
Med alerts	.14	.28*	.18	.25	.22
Appointment alerts	-.09	.07	.10	-.10	.10
Mood alerts	.02	-.00	.23	-.24	.21
Housing alerts	.10	.17	.31**	-.15	.07
MCM text	.01	-.07	.06	-.46	.10
Response to MCM	-.18	-.13	-.14	-.38	.12

* $p < .05$. ** $p < .01$.

of participants attending a scheduled medical visit at 12 months. Greater frequencies of texting with an MCM at 6 and 12 months were also significantly associated with an increased likelihood of attending medical appointments at 12 months. Results did not show a significant relationship between likelihood of achieving viral load suppression and alerts triggered. However, there was a positive association between viral load suppression at both 6 and 12 months and higher frequencies of bidirectional text messaging with an MCM. (A full correlation matrix that displays the bivariate associations among all study variables is available as an online supplement to this article.)

Attending medical appointments in the past 6 months was excluded from bivariate analysis due to lack of variability. All individuals involved in the program attended a medical visit in the 6-month timeframe.

Participant Acceptability

E-VOLUTION participants reported improved communication with case managers, with an average improved communication score of 6.79 ($SD = 2.39$) on a scale of 1 (*significantly worsened*) to 9 (*significantly*

improved). In addition, participants indicated that messages were sent at an ideal frequency, reflected by an average score of 5.47 ($SD = 1.64$) on a scale where 1 = *too few*, 5 = *perfect*, and 9 = *too many*.

DISCUSSION

This is one of the first studies to examine the acceptability, feasibility, and efficacy of an automated two-way text message intervention aimed at improving HIV care outcomes for YLWH in the United States. Findings indicated that the intervention was both acceptable and feasible. Participants viewed the automated text messages as a way to easily connect with their care team as well as a source for important medication and appointment reminders. These findings support efforts to continue to scale-up the automated text-messaging intervention in this population.

Additionally, findings demonstrated a clear relationship between substance use and alerts triggered. Those participants with more frequent substance use triggered more alerts in response to automated text messages. This relationship indicates that YLWH who use substances more frequently have a greater number of needs and may

TABLE 4
Bivariate Associations Between Alerts Sent and Texting With MCM, and HIV Outcomes

<i>Alert</i>	<i>VLS 6 months</i>	<i>VLS 12 months</i>	<i>Kept medical appointments 12 months</i>
6 months			
Total alerts	-.12	.01	.23*
Med alerts	-.10	-.15	.15
Appointment alerts	-.14	.11	.14
Mood alerts	.11	.12	.14
Housing alerts	-.10	-.06	.10
MCM text	.15	.17	.31**
Response to MCM	.38**	.49**	.29**
12 months			
Total alerts	-.07	.06	.24*
Med alerts	-.08	-.16	.12
Appointment alerts	-.13	.13	.15
Mood alerts	.18	.18	.18
Housing alerts	-.08	-.08	.11
MCM text	.17	.19	.27*
Response to MCM	.33**	.46**	.29**

Note. MCM = medical case manager; VLS = viral load suppression.
* $p < .05$. ** $p < .01$.

require more support to successfully engage in HIV care and adhere to their HIV medications. This finding is consistent with previous research that found substance use among YLWH to be associated with unstable housing and lower adherence to anti-retroviral medication (Gamarel et al., 2016). It is possible that the youth in this study who used substances more frequently, received more support through triggered alerts than they would have had they not been participating in E-VOLUTION. Further investigation is needed to understand the role of text-messaging interventions in assisting YLWH who use substances in accessing support that will ultimately lead to improved HIV care outcomes.

Furthermore, there was variability in the type of text messaging that was significantly associated with HIV care outcomes. Automated alerts alone were not related to VLS, yet there was a significant association between more frequent texting with MCMs and greater likelihood of VLS. In addition, higher frequencies of responses to both automated and live text messages were associated with greater likelihood of attending scheduled medical visits. These findings suggest that text messaging in general and the two-step texting process used in E-VOLUTION namely an automated system that pushes out messages, collects responses, and triggers alerts based on those responses, reinforces the theory of supportive accountability (Mohr et al., 2011). Akin to the

construct of performance monitoring, Odeny et al. (2014) conceptualize health promotion texts as “cues to action.” In the context of E-VOLUTION, those actions may include adhering to one’s treatment plan or reaching out to an MCM for support.

The limitations of this study must be considered when interpreting study results. Findings regarding the effectiveness of the E-VOLUTION intervention presented here are limited by the absence of a comparison group and control variables. Accordingly, we cannot surmise that participation in the E-VOLUTION intervention directly caused increased medical visit attendance among participants. That said, the findings are encouraging and provide a direction for future research to evaluate comparable interventions that includes comparison groups, such as that conducted by Garofalo et al. (2016). A second limitations is the use of a convenience sample recruited from HIV clinics in a mid-sized Midwestern city. Due to the sampling methodology, findings may not be generalizable to a broader population of YLWH. Even so, a majority of the study sample comprises those at highest risk for poor HIV care outcomes in the United States, namely young, lower income Black men who have sex with men, most of whom lived through adverse experiences as children and young adults, such as depression, incarceration, and family violence. Finally, a greater proportion of

White and older YLWH dropped out of the study. Although the statistically significant demographic differences between those who withdrew from the study versus those who completed 12 months are important to consider, it should be noted that less than 10% of the sample was White. Future research may wish to investigate ways in which to improve the cultural responsiveness of the intervention for YLWH of different racial identities.

Implications for Practice and Research

The practice implications from this study are numerous. Augmenting existing medical case management for YLWH with text-messaging interventions such as E-VOLUTION has the potential to increase client engagement in HIV care. This may be due, in part, to the quick response time to alerts triggered by youth. Clients may not be able to wait for clinic visits to address important psychosocial and environmental issues, such as potential loss of housing or a barrier to medication adherence. Triggering alerts from automated text-message responses provides YLWH a simple way to contact their HIV care team and seek solutions to these problems. Furthermore, automated texting may help YLWH overcome implicit racial bias and other identity-related factors that lead to unequal treatment and perpetuate health disparities (Zestcott et al., 2016). Since the messages are automated, all YLWH who are enrolled in the intervention, regardless of identity, receive automated messages and have equal opportunities to alert case managers to their needs. The MCM's time can focus on the most critical needs identified through alerts rather than on specific clients, helping to mitigate implicit bias. Finally, using text messaging is a component of culturally congruent care when serving young people. Many YMSM, including YLWH, use texting as a primary means of communication (Holloway et al., 2017). Thus, HIV care teams may need to use texting if they want to increase communication with their YLWH clients.

There are several factors that future research could address to advance our understanding of the effectiveness of text messaging interventions to improve HIV care outcomes among YLWH. First, the addition of a control or comparison group to future studies would increase the rigor of study findings. Furthermore, studies using comparison groups may wish to test the effectiveness of different types of text messaging interventions (e.g., automated text messaging vs. live text messaging vs. both). The relative effectiveness of these interventions would provide important information to organizations that provide HIV care to YLWH as these different types of texting interventions vary in cost. Additionally, future

research may wish to examine the impact of the source of a text message on the outcomes of the intervention. Potential sources of text messages may include machines (i.e., automated texts), MCMs, behavioral health workers, and peer health coaches. Last, researchers may wish to test a more structured version of behavioral health screenings using the automated text message feature. For instance, instead of asking a general question about mood, the automated texting program could be programmed to administer the Patient Health Questionnaire–2 (Arroll et al., 2010). In addition, given the significant relationships observed in this study between alerts triggered and substance use, future research may wish to examine the acceptability and feasibility of adding a substance use screener to the collection of automated text messages sent on a regular basis.

Conclusions

This study demonstrated that participation in a two-way, automated text messaging intervention increased appointment attendance for YLWH participants as well as helped those YLWH who also use substances to more readily access necessary support services from their HIV care team. Although automated texts were not directly associated with VLS, more frequent texting with a MCM was associated with VLS. In this two-step texting approach, automated texts may trigger more texting encounters with case managers that are associated with increased VLS rates.

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SUPPLEMENTAL MATERIAL

Supplemental material for this article is available at <https://journals.sagepub.com/home/hpp>.

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