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A Randomized Controlled Trial of a Text Messaging Intervention to Promote Virologic Suppression and Retention in Care in an Urban Safety-Net Human Immunodeficiency Virus Clinic: The Connect4Care Trial

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Background. Text messaging is a promising strategy to support human immunodeficiency virus (HIV) care engagement, but little is known about its efficacy in urban safety-net HIV clinics.

Methods. We conducted a randomized controlled trial of a supportive and motivational text messaging intervention, Connect4Care (C4C), among viremic patients who had a history of poor retention or were new to the clinic. Participants were randomized (stratified by new or established HIV diagnosis status) to receive either of the following for 12 months: (1) thrice-weekly intervention messages, plus texted primary care appointment reminders and a monthly text message requesting confirmation of study participation or (2) texted reminders and monthly messages alone. Viral load was assessed at 6 and 12 months. The primary outcome was virologic suppression (<200 copies/mL) at 12 months, estimated via repeated-measures log-binomial regression, adjusted for new-diagnosis status. The secondary outcome was retention in clinic care.

Results. Between August 2013 and November 2015, a total of 230 participants were randomized. Virologic suppression at 12 months was similar in intervention and control participants (48.8% vs 45.8%, respectively), yielding a rate ratio of 1.07 (95% confidence interval, .82–1.39). Suppression was higher in those with newly diagnosed infection (78.3% vs 45.3%). There were no intervention effects on the secondary outcome. Exploratory analyses suggested that patients with more responses to study text messages had better outcomes, regardless of arm.

Conclusions. The C4C text messaging intervention did not significantly increase virologic suppression or retention in care. Response to text messages may be a useful way for providers to gauge risk for poor HIV outcomes.

Clinical Trials Registration. NCT01917994.

Keywords. HIV/AIDS; retention in care; mobile health; text messaging (SMS); vulnerable populations.

Interventions are urgently needed to achieve virologic suppression and sustained retention in care for Human Immunodeficiency Virus (HIV) infected individuals who are at risk for lapsing in care [1, 2]. In the United States, those with diagnosed HIV infection who are poorly retained in care not only have higher mortality rates [3, 4] but also account for twice the amount of onward HIV transmission as those unaware of their HIV infection [5].

Mobile health interventions, particularly text messaging, represent promising strategies to increase engagement with HIV care [6–9]. Text messaging has been found to improve antiretroviral (ART) adherence and virologic suppression in sub-Saharan Africa, particularly in those starting ART [10–12], and in the United States has shown mixed success for ART adherence in youth, substance users, and those with psychiatric illness [13–17]. However, there have been few rigorous evaluations of the efficacy of clinic-based text messaging to support HIV care engagement in the United States, particularly in safety-net clinics. Safety-net clinics provide care, regardless of ability to pay, to uninsured and publicly insured individuals who are low income and racially/ethnically diverse [18]. Safety-net clinics also care for other vulnerable populations, including those who use substances, have psychiatric illness, or are homeless. Two small clinic-based texting studies that included patients without private insurance were challenged by phone disconnection and lack of response [19, 20]. A nonrandomized study in a vulnerable Canadian clinic population demonstrated a decrease in mean viral load (VL) but also decreased likelihood of attending appointments [21].

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To fill the evidence gap on the use of text messaging to promote HIV care engagement in vulnerable populations, the National Institute on Drug Abuse funded the Connect4Care (C4C) trial as part of the "Seek, Test, Treat, Retain" research initiative [22]. The aim was to test the efficacy of an easily scalable, theory-based, bidirectional text messaging intervention designed to foster a sense of connectedness to one's health and health care in patients with detectable VLs at high risk of continued viremia and care disengagement. We hypothesized that, relative to texted appointment reminders alone, the C4C intervention would improve virologic suppression and retention in care.

METHODS

Study Design

This study was a single-site, parallel arm, randomized controlled trial with 1:1 allocation to the C4C intervention arm versus an appointment reminder control condition delivered over 12 months and evaluated for 12-month efficacy. The randomization was stratified on whether participants had newly diagnosed HIV infection (ie, within the past year). Details regarding randomization have been published elsewhere [23].

Participants and Setting

Participants were recruited from the HIV clinic at Zuckerberg San Francisco General Hospital, Ward 86, which has offered universal ART since 2010 [24] and serves approximately 2500 patients as part of San Francisco County's medical safety-net. Study visits took place at a research site in the community so as not to influence the retention in care outcome. Eligibility criteria included the following: HIV infection, age ≥18 years, Ward 86 primary care patient, English speaking, in possession of a cell phone, able to read a text message and willing to send/receive 1–25 text messages per month, VL >200 copies/mL in past month, and either new to the clinic (≤2 primary care visits) or poorly retained (defined as in care at the clinic for ≥12 months with either ≥1 missed visit or lack of 6-month visit constancy). If patients expressed interest in participation but did not possess a cell phone, the study provided referrals to the federal Lifeline Assistance program, which assists low-income individuals to obtain cell phones. The Committee on Human Research at the University of California San Francisco approved this study, and all participants provided written informed consent.

Intervention and Control Conditions

The clinic standard of care during the study consisted of a reminder phone call the day before a primary care appointment. However, because this practice was dependent on clinic staffing and therefore not consistent, the study texted all participants reminders 48 hours before primary care appointments. To engage all participants via 2-way text messaging regardless of study arm and to minimize loss to follow-up, the study also sent a monthly check-in message that requested a reply confirming participation. Participants also received check-in phone calls at 3 and 9 months. Control arm participants received only the texted appointment reminders and study check-in texts/calls, whereas intervention arm participants received these texts/calls plus C4C intervention text messages.

The development and theoretical underpinning of the C4C intervention text messages have been described elsewhere [23]. The goals were to support enhanced psychosocial adjustment, promote intrinsic motivation for engaging in care, and provide information about resources for healthy living. There were 6 content domains: improving a sense of social support, ameliorating negative affect, bolstering positive affect and coping, fostering empowerment, supporting healthy behaviors and health maintenance, and emphasizing the value of ART adherence and persistence. Intervention messages were sent thrice weekly at a time of the participant's choosing and used 1 of 3 response request structures (not asking for a response, asking whether the message was helpful, or asking if the participant wanted more information, which was then sent in a follow-up text), such that participants were asked to respond at least once per week. All study text messages and appointment reminders were sent via an automated platform (Mobile Commons by Upland Software).

Measures and Outcomes

VL values and primary care appointment attendance were abstracted from the electronic medical record (EMR). If a participant was known to have transferred care, outside VL results were sought. Enrolled participants completed a baseline survey that used audio computer-assisted self-interviewing to collect data on demographics, technology use, subsistence needs, psychosocial well-being and quality of life [25–30], service utilization, ART adherence [31], sexual risk behavior, and substance use [32, 33] before assignment to study arm. Follow-up study visits occurred at 6 and 12 months and included repeat surveys as well as phlebotomy if no EMR VL measurement was available from the past month. Participants were compensated $30 for study visits. The text messaging vendor provided time-stamped documentation of text messages sent to and received by participants, with "failed to send" status noted.

Primary Outcome

The primary outcome was virologic suppression at 12 months, defined as VL < 200 copies/mL.

Secondary Outcomes

The secondary outcome was retention in care. Given the lack of a reference standard measurement [34] and to facilitate comparison with the literature [35], 2 definitions were used: (1) the visit adherence rate (number of primary care appointments kept among the number scheduled, excluding cancelled or rescheduled appointments) and (2) a visit constancy measure

that calculated kept visit percentages within each 6-month study period and then categorized individuals into 3 levels: high (attended all scheduled primary care appointments in both 6-month study periods), moderate (attended ≥1 scheduled primary care appointment in both periods), and low (attended no scheduled primary care appointments in ≥1 period). Individuals in the "high" or "moderate" groups were considered to have achieved 6-month visit constancy.

Process Outcomes: Exposure to and Engagement With Study Text Messages

For face-to-face behavioral interventions, methods exist for measuring intervention fidelity [36]. Determining whether text messages have been delivered as intended is more challenging, because lack of a message send failure notification does not necessarily mean the message was received and read. Counting responses to text messages that ask questions has been proposed as a way to measure intervention delivery [37]. We defined *exposure* to study text messages as the proportion of text messages sent successfully. We defined *engagement* with study text messages as the number of months in which a requested response to a study text message was received. We also assessed the last month in which participants received and replied to study text messages.

Acceptability of Intervention Text Messages

At the 12-month study visit, intervention arm participants were asked to rate on a scale of 0 (not at all) to 10 (definitely) how likely they would be to recommend the intervention messages to a friend. Open-ended questions asked what they liked most and least about messages.

Sample Size and Statistical Analysis

The study was designed to detect a 15% end-of-trial improvement in the primary outcome between arms, similar to other studies of HIV care engagement [38, 39]. Assuming a virologic suppression rate of 60% in the control arm based on clinic data, we calculated that 152 participants per arm would provide 80% power using a 2-sided .05-level *t* test.

All analyses were consistent with the intention-to-treat principle. Descriptive statistics were used to summarize baseline characteristics of participants by study arm. Deaths during follow up were counted as failures [40]. We conducted 4 analyses to address the effect of other missing VL values. We calculated simple proportions of virologically suppressed participants at 12 months by arm, based on complete cases and after imputing missing VL values as detectable. We then used repeated-measures log-binomial models [41] to estimate suppression rates by arm, based on complete cases and following multiple imputation. Multiple imputation was conducted using the Stata (version 15) *mi chained* procedure to fill in missing follow-up $\log_{10}$ VL values in 40 imputed data sets (see Supplementary Material). Owing to few participants in the newly diagnosed stratum, we adjusted for rather than stratified models by this factor, which precludes estimation of stratum-specific rate ratios. We report estimated arm-specific 6- and 12-month virologic suppression rates overall and by strata, and base the primary outcome efficacy rate ratio on 12-month data.

Mean visit adherence rates and rate ratio were estimated using a repeated-measures Poisson model of the number of appointments kept by arm, offset by $\log_e\{\text{No. scheduled} + 0.01\}$, adjusted for new-diagnosis status. After categorizing the kept-visit percentage within each 6-month study period, we used an ordinal proportional odds logistic regression model, adjusted for new-diagnosis status, to determine whether visit constancy was higher in the intervention arm (odds ratio [OR] >1). Because retention in care was defined over the length of the study, we based efficacy results on study-long data.

We used repeated-measures Poisson models to estimate arm-specific means of (1) the number of text messages received by participants, offset by $\log_e\{\text{No. sent} + 0.01\}$, by message type and (2) the number of months a reply was received. We estimated medians (with interquartile range) for the last of month of receipt of and reply to study text messages.

We conducted 2 exploratory analyses using mPlus software (version 8) to examine whether the extent of study engagement mediated the effect of study arm on study outcomes (see Supplementary Material). Except where specified, analyses were conducted using SAS software (version 9.4).

RESULTS

Between August 2013 and November 2015, we screened 569 patients (Figure 1), of whom 227 (40%) were ineligible, largely because of virologic suppression. Of 293 eligible patients, 230 (78%) presented to the research site and were randomized, 114 to the control arm and 116 to the intervention arm. Patients eligible but not randomized were similar in median age, sex, and clinical characteristics to those randomized (Supplementary Table S1). More randomized participants were black than those eligible but not randomized (32% vs 14%).

Poorly retained patients made up 75% of participants; 11% had newly diagnosed infection, and 14% were new to the clinic but established diagnoses. There were no differences in baseline characteristics between study arms (Table 1). Rates of kept study visits at 6 and 12 months were 88% and 86% in the intervention arm, and 83% and 82% in the control arm. Some participants had EMR abstraction of VLs without study visits and others had study visits but no phlebotomy. Twelve-month VL data were available for 88% of intervention and 83% of control participants; with inclusion of 6-month outcomes, 95% of intervention and 94% of control participants contributed data to the complete-case repeated-measures model.

With regard to the primary outcome, success was achieved by 51 of 102 intervention participants (50.0%) and 45 of 94 control participants (47.9%), based on complete cases; slightly lower suppression rates were observed when missing 12-month

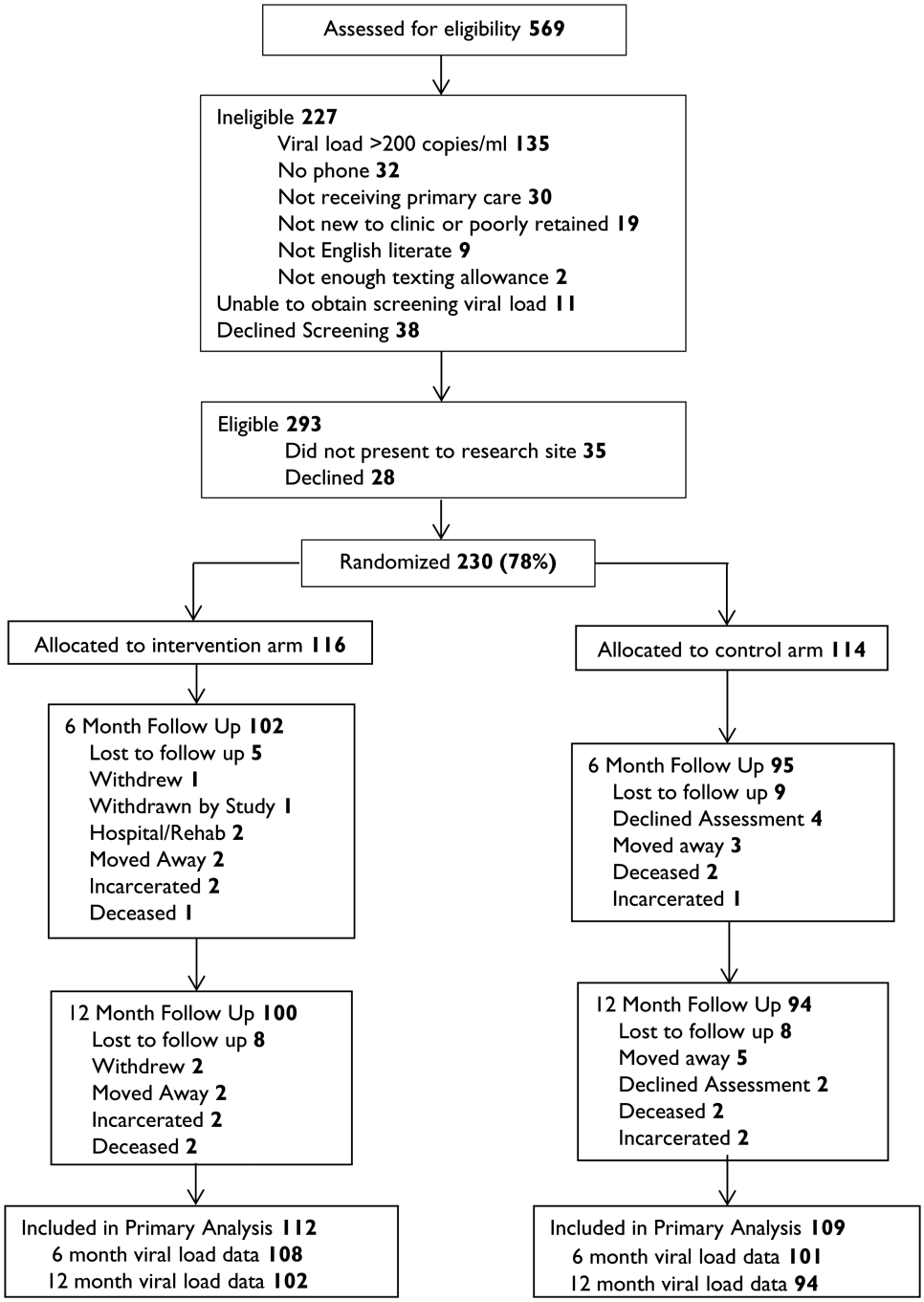

Figure 1. Participant flow. Viral load (VL) could not be measured in 2 control participants at 6-month follow-up and in 5 intervention and 2 control participants at 12-month follow-up. VL was obtained from the electronic medical record without a study visit for 6 intervention and 6 control participants at 6 months and for 5 intervention and 4 control participants at 12 months. The primary analysis included VL data for 2 participants who withdrew from receiving intervention text messages and 1 for whom texts were suspended by the study but who completed study follow-up; 100 intervention and 86 control participants had both 6- and 12-month VL data. Deaths during study follow-up were counted as failures. Finally, 16 participants transferred care to other clinics in San Francisco during the study; all completed study follow-up, but VL data could not be measured in 2 control and 2 intervention participants at the 12-month visit.

VL values were imputed as detectable (Table 2). In the complete-case repeated-measures model, intervention and control 12-month suppression rates were 48.8% and 45.8% respectively, yielding a rate ratio of 1.07 (95% confidence interval [CI], .82–1.39) and representing negligible change from the 6-month estimates (Figure 2). Virologic suppression rates were significantly higher among participants with newly diagnosed infection ($P < .001$). According to the analogous multiple imputation

Table 1. Baseline Characteristics of Connect4Care Participants, by Study Arm, 2013–2016 (N = 230)

Characteristic	Participants, No. (%)[a]	
	Intervention (n = 116)	Control (n = 114)
Age, median (IQR; range), y	45.5 (38–50; 22–65)	44 (35–51; 21–74)
Gender		
Male	97 (84)	93 (82)
Female	13 (11)	17 (15)
Male-to-female transgender	6 (5)	4 (3)
Race/ethnicity		
White	40 (34)	40 (35)
Black	36 (31)	36 (31)
Latino	21 (18)	27 (24)
Asian-Pacific Islander/mixed race/other	19 (16)	11 (10)
Sexual orientation		
Heterosexual	36 (31)	40 (35)
Homosexual/gay/lesbian	58 (50)	55 (48)
Bisexual/other	22 (19)	19 (17)
Education		
Less than high school	17 (15)	18 (16)
High school or equivalent	28 (24)	35 (31)
Some college/trade school	51 (44)	51 (45)
College/postgraduate	20 (17)	10 (9)
Employment		
Employed full or part time/student	27 (23)	24 (21)
Laid off/unemployed	32 (28)	35 (31)
Disabled	52 (45)	49 (43)
Retired/homemaker	5 (4)	6 (5)
No money for basic necessities		
Daily	13 (11)	13 (11)
Weekly	29 (25)	17 (14)
Monthly	17 (15)	29 (25)
Occasionally	34 (29)	33 (29)
Never	23 (20)	22 (19)
Homeless in past 6 mo	55 (47)	56 (49)
Current residence		
Housed	40 (35)	41 (36)
Marginal/unstable	68 (59)	67 (59)
Homeless	8 (7)	6 (5)
Injection drug use[b]		
Ever	60 (52)	59 (52)
Past 30 days	27 (24))	24 (22)
Stimulant use in past 6 mo[b]	77 (67)	74 (65)
Hazardous drinker (AUDIT score ≥7)	26 (22)	26 (23)
Problem/dependent drug user (TCU drug screen score ≥3)[c]	40 (35)	43 (38)
Depressive symptoms (CES-D score >15)	80 (69)	77 (67)
Health-related quality of life RAND 36 score, mean (SD)		
Physical	56.8 (25.2)	51.2 (24.2)
Mental	49.2 (24.3)	51.7 (24.2)
Time since HIV diagnosis, median (IQR), y	11 (4–18)	11 (5–20)
CD4 cell count, median (range), cells/μL[b]	353 (7-1019)	335 (3-1041)
Log_{10} VL, median (range), copies/mL	3.9 (2.4–7.0)	4.0 (2.3–6.6)
Care status		
Poorly retained	83 (72)	88 (77)
New to clinic, established diagnosis	19 (16)	14 (12)
New to clinic, new diagnosis	14 (12)	12 (11)
Currently taking ART[b]	85 (75)	83 (75)

The characteristic is "Smartphone" and the intervention is 79 (68%) and the control is 79 (69%).

Abbreviations: ART, antiretroviral therapy; AUDIT, Alcohol Use Disorders Identification Test; CES-D, Center for Epidemiologic Studies–Depression; HIV, human immunodeficiency virus; IQR, interquartile range; SD, standard deviation; TCU, Texas Christian University; VL viral load.

[a]Data represent No. (%) of participants unless otherwise specified.

[b]Some participants were missing values for injection drug use ever (n = 1) or in the past 30 days (n = 8), stimulant use (n = 1), CD4 cell count (n = 9), current ART (n = 5) and type of phone (n = 5).

[c]Drugs included were heroin, cocaine/crack, marijuana, inhalants, hallucinogens, Ecstasy/club drugs, methamphetamine, nonprescription stimulants, sedatives, opiates, and methadone.

repeated-measures model, similar suppression rates and intervention effects were observed (Table 2).

There were no statistically significant intervention effects on the secondary outcome of retention in care. Mean visit adherence was estimated at 63.5% for intervention and 68.2% for control participants (Table 2), yielding a rate ratio of 0.93 (95% CI, .84–1.03). Visit adherence was slightly higher in the new-diagnosis stratum, but the stratum effect was not statistically significant ($P = .35$). Visit constancy was similar by study arm, with 68.1% of intervention and 67.5% of control participants having ≥1 kept visit in each 6-month study period (OR, 1.03; 95% CI, .62–1.71).

The proportion of messages sent successfully and the last month of successful send were high overall, with little variation among message types (Table 3). The intervention arm responded a month longer in each study period ($P < .001$) and had a later last month of response (Table 3). Mediation models demonstrated that each additional month of engagement with study text messages in the second study period was marginally significantly associated with increased likelihood of virologic suppression at month 12 (OR, 1.10; 95% CI, .996–1.221; $P = .057$) and ≥1 kept visit in that period (1.10; .995–1.225; $P = .06$), whereas the direct effect of study arm remained statistically nonsignificant ($P = .74$ and $P = .64$, respectively).

Acceptability of Intervention Text Messages

Intervention text messages were highly acceptable, with 80% of participants rating them ≥7, 15% rating them a 5–6, and 5% rating them a 2–3. One participant wrote "they made me feel like I wasn't alone—someone was texting me about my health." Another stated, "It made me feel like somebody was there." Two-thirds of participants had no negative comments. About 10% critiqued message content; less common critiques included message timing/repetition, the response process, and a desire for more personalization.

Table 2. Primary and Secondary Outcomes by Study Arm, Six-Month Study Period, and Across Study Periods

Outcome	Period 1: Months 1-6		Period 2: Months 7-12		Rate Ratio (95% CI) Active vs. Control	Mean Across Periods		
	Active	Control	Active	Control		Active	Control	
Primary Outcome[a]	% Virologically Suppressed (No. of Participants)							
Complete case	–	–	50.0 (102)	47.9 (94)	1.04 (0.80, 1.36)			
Missing = detectable	–	–	44.0 (116)	39.5 (114)	1.10 (0.85, 1.42)			
Adjusted analyses[b]								
Complete case								
All	52.6	47.7	48.8	45.8	1.07 (0.82, 1.39)	46.4	43.7	
Not newly diagnosed	49.1	44.6	45.6	42.8		45.4	41.5	
Newly diagnosed	89.7	81.4	83.2	78.0		81.3	74.5	
Multiply imputed								
All	50.5	45.1	46.4	43.7	1.06 (0.81, 1.40)	49.9	45.2	
Not newly diagnosed	47.3	42.2	43.5	40.9		45.8	41.1	
Newly diagnosed	84.8	75.7	77.9	73.3		82.4	73.7	
Secondary Outcome[c]	% Scheduled Primary Care Appointments Kept							Rate Ratio (95% CI) Active vs. Control
Visit adherence rate								
All	63.5	65.8	63.4	70.6		63.5	68.2	0.93 (0.84, 1.03)
Not newly diagnosed	63.0	65.6	62.9	70.0		63.0	67.6	
Newly diagnosed	67.6	70.0	67.5	75.1		67.5	72.5	
Kept Visit Percentage[d]						% of Participants		Odds Ratio (95% CI) Active vs. Control
0% kept of scheduled	16.5	18.0	24.0	23.1		36.6	37.3	1.03 (0.62, 1.71)
1%–99% kept of scheduled	53.3	54.0	54.7	54.7		56.7	56.3	
100% kept of scheduled	30.2	28.0	21.3	22.2		11.4	11.2	

Since the primary study outcome was determined at 12 months, only 12 month results are presented for the complete case analysis.

Abbreviation: CI, confidence interval.

[a]Viral load measurements were used to ascertain the primary outcome if they were available within 60 days of target follow-up days for Month 6 (183 days) and Month 12 (265 days) assessments. If more than one viral load measurement qualified, the one closest to the target was used.

[b]Analyzing arm*period, adjusting for new diagnosis status.

[c]For those with no appointments scheduled during a study period, the minimum number of scheduled appointments was set to 0.01 for estimating visit adherence rate via a Poisson model. This modification affected both periods for 4 participants and one period for 6.

[d]Kept visit percentages are categorized within periods as: kept 0% in one or both periods (low), kept >0% in both periods (moderate), and kept 100% in both periods (high). The odds ratio examines the achievement of higher levels of kept visit percentages by the active arm. Those in the moderate or high categories are considered to have met 6-month visit constancy.

Note: All arm*period, period, arm, and diagnosis strata *P* values > 0.10.

DISCUSSION

In the C4C trial, study retention and intervention satisfaction were high; however, there was no intervention effect on the virologic suppression rate at 12 months, which in both arms was slightly under 50% and comparable to findings in other studies with high-risk viremic patients [39, 40]. Efficacy estimates were consistent across methods that considered missing VL values. In keeping with San Francisco surveillance estimates [42], virologic suppression was higher in individuals with newly diagnosed infection than in with those with established diagnoses (78.3% vs 45.1%), highlighting the challenge of suppression in individuals with poor retention, especially given the stability between overall and stratum-specific 6- and 12-month estimates.

Visit adherence rates reflected that about two-thirds of scheduled primary care appointments were kept, which is comparable to the standard of care arm in a large multiclinic trial of outreach by trained staff for poorly retained patients [43]. Although the visit adherence rate slightly favored the control arm and individuals with newly diagnosed infection, these effects were not statistically significant. Given that intervention text messages encouraged communication with providers and the clinic, it is possible that some issues were resolved outside the scheduled appointment, resulting in a no-show visit. Six-month visit constancy was nearly identical by study arm, at roughly 68%.

Our sample size of 230 was smaller than anticipated, probably due to high levels of virologic suppression in the clinic [44] and the inception of Covered California under the Affordable Care Act in October 2013. The clinic was not contracted with Covered California during the study period, which decreased new patient intakes.

Exit question responses suggested that the intervention was operating as intended. A qualitative substudy is exploring the role of intervention messages in participant lives. It is possible that C4C enhanced psychosocial adjustment but that this did not translate into an effect on virologic suppression. In addition, study participation and regular contact with study staff may have promoted virologic suppression in the control arm. With regard to retention, appointment reminders are a powerful tool for increasing visit

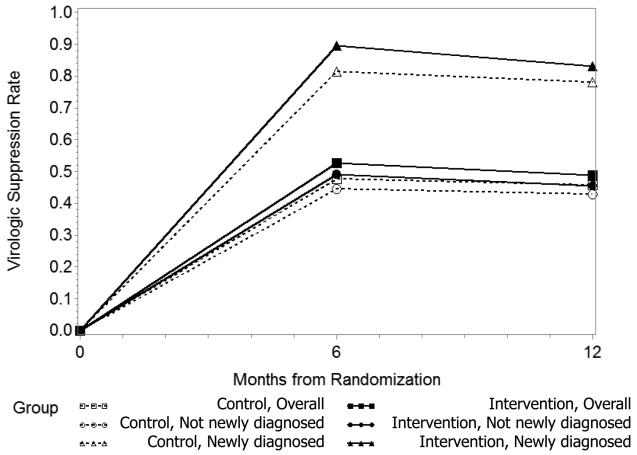

Figure 2. Virologic suppression rates by study arm, overall, and by strata.

adherence, and the intervention messages may not have yielded additional effect because of the strength of this control condition.

Interruptions in phone service were common, and turnover in phone numbers was high—only 52% of participants had the same phone number throughout the study [45]. Although exposure to study text messages was high, engagement varied greatly. Exploratory analyses suggest that greater engagement with study text messages was associated with improved outcomes, regardless of arm, which may represent a "complier" effect. Nevertheless, failure to respond to text messages may be a useful way to distinguish patients who could benefit from additional outreach, especially because EMR systems now have the ability to send text message appointment reminders that ask for confirmation.

It is worth noting the extreme socioeconomic vulnerability of the study population, which lacked money for basic necessities and had high levels of stimulant/injection drug use and recent homelessness. It is possible that engagement with study text messages was overshadowed by the formidable challenges posed by housing insecurity, economic instability, and substance use. Indeed, several other trials in the "Seek, Test, Treat, Retain" consortium that used text messaging as a component of interventions to promote virologic suppression in similarly vulnerable populations have reported no significant intervention effects [46, 47]. One limitation of the C4C intervention was the absence of messages on substance use, because our formative work found that these messages offended some patients [23]. Future analyses will consider the effect of socioeconomic vulnerabilities on engagement with study text messages and study outcomes. Since the C4C trial was designed, more evidence has emerged in support of tailored, rather than one-size-fits-all, text messaging interventions [7] as well as the role of real-time follow-up after a missed clinic visit [43]. Although individualized texting may not be practical clinic wide, it could potentially be deployed for small groups of high-risk patients.

In summary, this randomized trial of an intervention consisting of supportive, motivational, and informational text messages did not significantly increase virologic suppression or retention in care for the hardest to treat safety-net HIV clinic

Table 3. Exposure to and Engagement With Study Text Messages by Study Arm, by 6-Month Study Period, and Across Study Periods

	Period 1: Months 1–6		Period 2: Months 7–12		Across Periods	
Exposure and Engagement	Intervention	Control	Intervention	Control	Intervention	Control
Study text exposure: messages sent[a]						
Appointment reminders						
Participants with ≥1 successfully sent, No. (%)	106 (91)	105w	90 (78)	85 (75)	113 (97)	107 (94)
Proportion successfully sent, mean, %	92.0	96.2	87.4	96.2	89.6	96.2
Last month of successful send, median (IQR)[b]	5 (3–6)	5 (3–6)	10 (7–11.5)	10.5 (0–12)	10 (7–11.5)	10.5 (6–12)
Study check-in texts (monthly × 12)						
Participants with ≥1 successfully sent, No. (%)	115 (99)	113 (99)	111 (96)	108 (95)	115 (99)	113 (99)
Proportion of 12 successfully sent, mean, %	94.2	92.6	92.1	92.1	93.1	92.3
Last month of successful send, median (IQR)[b]	6 (6–6)	6 (5–6)	12 (12–12)	12 (12–12)	12 (12–12)	12 (12–12)
Intervention texts, thrice weekly × 52[c]						
Participants with ≥1 successfully sent, No. (%)	116 (100)	…	112 (97)	…	116 (100)	…
Proportion of 156 successfully sent, mean, %	93.4	…	91.5	…	92.5	…
Last month of successful send, median (IQR)[b]	6 (6–6)	…	12 (12–12)	…	12 (12–12)	…
Study text engagement: participant responses						
Participants responding ≥1 time, No. (%)	110 (95)	101 (89)	99 (85)	84 (74)	113 (97)	104 (91)
No. of months ≥1 response received, mean	4.8	3.7	4.3	3.2	9.1	6.9
Last month response received, median (IQR)[b]	6 (5–6)	5 (3–6)	12 (10.5–12)	11 (0–12)	12 (10.5–12)	11 (6–12)

Abbreviation: IQR, interquartile range.

[a]We truncated exposure counts at the planned maxima: 12 check-ins and 156 intervention texts.

[b]Values represent numbered study months (from 1 to 12).

[c]Due to a systems glitch early in the study, 11 participants in the control arm accidentally received an intervention text.

patients with detectable viremia, those newly establishing care, or those with poor retention. More work is needed to understand whether there is a role for texting as part of the intensive, multipronged interventions this population is likely to need.

Supplementary Data

Supplementary materials are available at *Clinical Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

Notes

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Potential conflicts of interest. K. A. C. has been a community advisory board member for Gilead and a scientific advisory board member for Roche; she has also received investigator-initiated grant support from Gilead. All other authors report no potential conflicts. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

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