Evaluation of text message reminders to encourage re-testing for chlamydia and gonorrhea among female patients at the municipal STD Clinic in Seattle, WA

Anna Unutzer

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Committee:

Christine Khosropour

Julie Dombrowski

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Anna Unutzer

University of Washington

Abstract

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Anna Unutzer

Chair of the Supervisory Committee:

Christine Khosropour

Department of Epidemiology

Chlamydia trachomatis (CT) and Neisseria gonorrhoeae (GC) are bacterial sexually transmitted infections and are the most commonly reported infections in the United States. Infections with CT or GC can lead to adverse health effects for women, including pelvic inflammatory disease (PID), tubal factor infertility, ectopic pregnancy, and chronic pelvic pain. Women are at high risk for re-infection with CT or GC after having a previous confirmed positive test for either CT or GC. Given the high probability of re-infection and data suggesting that the risk of adverse reproductive health outcomes increases with repeat infection, the CDC recommends that women with a previous positive test be re-tested 3-4 months after an initial positive test. However, re-testing rates have been found to be sub-optimal. This low re-testing rate has implications for re-infection, potential to spread chlamydia and gonorrhea infection to sex partners, and future health complications. This study seeks to evaluate a text message reminder intervention in a municipal STD clinic setting for effectiveness to encourage women to re-test for CT and GC after an initial infection.

Introduction

Chlamydia trachomatis (CT) and *Neisseria gonorrhoeae* (GC) are bacterial sexually transmitted infections and are the most commonly reported infections in the United States (US). In 2017, there were over 1 million cases of CT and over 200,000 cases of GC reported among women, with rates of 683 cases per 100,000 women and 140 cases per 100,000 women, respectively[1]. Infections with CT or GC can lead to adverse health effects for women, including pelvic inflammatory disease (PID), tubal factor infertility, ectopic pregnancy, and chronic pelvic pain [2].

Women diagnosed with CT or GC are at high risk for re-infection, with an estimated 14.7% and 11.7% of women, respectively, re-infected within six months of an initial infection [3]. Given the high probability of re-infection and data suggesting that the risk of adverse reproductive health outcomes increases with repeat infection[4], the Centers for Disease Control and Prevention (CDC) recommends that women are re-tested for CT and GC three to four months after an initial positive test [2]. However, re-testing rates are sub-optimal, with only 36-45% of women re-testing within six months of an initial infection [5,6].

Because undetected and untreated infections increase the risk of future reproductive tract disease and the risk of transmission to sex partners [5], several sexual health clinics have implemented reminder systems to alert patients when it is time to re-test. Text message or short message system (SMS) reminders have been one intervention explored to encourage re-testing, but data to support the effectiveness of this intervention are mixed, with several studies demonstrating success in increasing re-testing rates among participants who received a SMS reminder [8–10,12,14], while other studies have seen little to no effect of SMS reminders on screening rates [11]. Importantly, some of the most successful SMS reminder interventions required substantial resources to implement or were implemented in well-controlled research settings[9,10,13]. Thus, it remains unclear if these types of reminders integrated into routine clinical practice will promote re-testing for CT and GC among women within the recommended time frame.

In 2016, the Public Health – Seattle & King County (PHSKC) STD Clinic initiated an opt in, automated SMS reminder system integrated into the clinic's routine computerized clinical intake form to encourage re-testing among women diagnosed with CT or GC. The objectives of this study were to examine the acceptance of these opt in reminders and to evaluate the effectiveness of SMS reminders to promote re-testing for CT and/or GC and to identify re-infections among women who tested positive for these infections.

Methods

Study Design, Setting, and Population

We conducted a retrospective cohort study of data from the PHSKC STD clinic, a health department walk-in clinic. Our study population included cis-gender female STD clinic patients who attended the clinic for a new problem visit between May 16, 2016 (the start of the SMS reminder program) and December 31, 2017 and who completed a computerized clinical intake form (described below).

Primary Exposure and Outcome

The primary exposure in this study was opting in to receive SMS reminders for re-testing. The two primary outcomes were: (1) returning to the PHSKC STD Clinic for re-testing within 3-6 months of an initial positive CT or GC test; and (2) re-testing positive for CT or GC within 3-6 months of an initial test. To allow for 6 months of follow-up time to accrue after an initial test, we included outcome data for patients through June 30, 2018. We chose a follow-up window of 3-6 months with the rationale that repeat testing in that interval could be attributable to the SMS reminder sent at 3 months after an initial positive CT or GC test result.

Data Sources and Measures

At the PHSKC STD Clinic, patients presenting for a new problem visit are asked to complete an electronic clinical intake form prior to seeing a clinician, which queries patients on demographics, sexual

behavior history, STD and HIV history, and risk factors for HIV/STD; these data are stored within the STD clinic's electronic database. The SMS questions are integrated into this routine clinical intake. Based on responses provided within the intake, patients who fit the criteria listed below were asked the following question (henceforth referred to as "Question A"): *We recommend that you get tested for STDs [and HIV] every 3 months. Do you want us to send you a text message reminder or would you rather remember on your own?* Women who report having never tested positive for HIV or report any of the following in the past 12 months: methamphetamine or poppers use, history of GC, CT, or syphilis are presented with Question A. Women who self-report having been previously diagnosed with HIV are also presented with "Question A" if they do not report taking HIV medication, receiving HIV care in the past six months, or report that they have a detectable HIV viral load. Women who do not meet these criteria were presented with the following question (henceforth referred to as "Question B"): *If one of your tests today show that you have an STD, we recommend that you get STD testing in 3 months. Do you want us to send you a text message reminder or would you rather remember on your own?* Women who responded to either question that they would like to receive a SMS reminder are asked to provide a phone number to receive the reminder; these women are consider to have "opted in" to SMS reminders. Patient responses to these questions and their phone numbers are stored in the PHSKC STD Clinic's electronic database. Women who opted in to receive reminders were only actually sent an SMS if they tested positive for CT or GC during that clinic visit.

We used the PHSKC STD Clinic's electronic database to identify women who tested positive for CT or GC on the date that they completed the clinical intake and answered the SMS reminder questions. Women are screened for CT or GC per national guidelines[15] using nucleic acid amplification testing. During the study period we used the APTIMA Combo-2 assay (Hologic, Inc, Marborough, MA).

To identify women who re-tested positive for GC or CT within 3-6 months of an initial positive GC or CT test (i.e., our second outcome), we used the Washington State Department of Health's (DOH) electronic STD surveillance database (PHIMS-STD) for King County, which includes data from laboratories and medical providers. Chlamydia and gonorrhea are notifiable conditions in WA State; thus,

all healthcare providers and laboratories are required to report cases of CT and GC to local health authorities, who subsequently provide data to WA DOH via PHIMS-STD. We used a deterministic match based on name and date of birth to match patient records from the PHSKC STD Clinic to the STD surveillance database. Using surveillance data for all of King County allowed us to see if a woman tested positive for GC or CT after receiving the SMS reminder at a location in King County other than the PHSKC STD Clinic.

Statistical Analyses

We used chi-square tests for categorical variables and t-tests for continuous variables to compare characteristics of women who did and did not opt in to 3-month SMS reminders. We compared these characteristics among our overall study population and separately for those who tested positive for GC or CT at their initial visit.

To compare re-testing among women who did and did not opt in to reminders, we assessed the number and percentage of women who returned to the clinic within 3-6 months after an initial positive test among those who did versus did not opt in to receive reminders, and used Fisher's exact test to test for statistically significant differences in these numbers. We also used Fisher's exact test to compare the proportion of women who re-tested positive for CT or GC within 3-6 months of an initial positive, comparing those who did versus did not opt-in to receive SMS reminders.

All analyses were conducted using Stata/IC 15.1 (StataCorp, College Station, TX). Tests were performed at a significance level of 0.05. Study procedures and analyses were approved by the University of Washington Human Subjects Division.

Results

Of the 2,250 women who completed the computerized clinical intake form between May 2016 and December 2017, 2,067 (92%) women were presented with the SMS reminder questions (i.e., were

asked either question A or B). The mean age of these women was 32 years old, 44% were White, non-Hispanic, and nearly half reported three or more sex partners in the past 12 months (Table 1a).

Overall, 743 (36%) of 2,067 women opted to receive the SMS reminder and 1324 (64%) women did not opt in to receive the reminder. Compared to women who did not opt in to SMS reminders, women who opted in were significantly more likely to report three or more sex partner in the past 2 and 12 months but less likely to report a history of CT or GC in the past year (Table 1a). There were no other statistically significant differences between the two groups.

Of the 2,067 women asked about SMS reminders, 112 (5.4%) tested positive for CT (n=67), GC (n=41), or both CT and GC (n=4). Seventeen (15%) of these women provided invalid phone numbers; these women are excluded from further analyses.

The 95 women who tested GC or CT positive at their initial clinic visit and provided a valid phone number were younger than the overall study population (mean age=28 years). Less than 30% were White, non-Hispanic, and one-third reported contact to a partner with GC or CT (Table 1b). Of these 95 women, 32% (n=31) opted in to receive reminders and 67% (n=64) did not opt in to reminders. Differences between women who did and did not opt in to reminders were similar to those noted for the overall study population.

Over half of the women who tested positive for CT or GC at their initial visit (n=95) did not return to the clinic at any point during the study period (Table 2). Among women who opted in to receive SMS reminders (n=31), 23% returned to the clinic for re-testing within 3-6 months, compared to 9% among those who did not opt in to receive reminders (P=0.11) (Table 2).

Differences in re-test positive rates for CT or GC after an initial test positive were examined. 4 (4%) of 95 women re-tested positive within 3-6 months of an initial positive test, and 91 (96%) of women did not re-test positive within 3-6 months of an initial positive test (Table 3). 85 (89%) of 95 women who initially tested positive for CT and GC did not re-test positive during the study period of an initial positive test, including 25 women who opted in to receive reminders and 60 women who did not opt in to receive reminders (86 vs. 91%) (Table 3). 3 (3%) of 95 women re-tested positive between 28 days and 3 months,

including 1 woman who had opted in to receive reminders and 2 women who had not opted in to receive reminders (3% vs. 3%). 4 (4%) of 95 women re-tested positive within 3-6 months, including 2 women who had opted in to receive reminders and 2 women who had not opted in (7% vs 3%; P=0.58). 3 (3%) of 95 women re-tested positive greater than 6 months from the initial test positive, including 1 woman who had opted in to receive reminders and 2 women who had not opted in to receive reminders (3% vs. 3%).

Discussion

In this evaluation of an SMS reminder system to increase re-testing for CT and GC among female STD Clinic patients, we found that only about one-third of women opted in to receive SMS reminders for STD re-testing. Women who opted in were more likely to report 3 or more sex partners in the past year compared to those who did not opt in, but the two groups were otherwise similar. Among women who initially tested positive for CT or GC, those who received an SMS reminder were more likely to return to the clinic for re-testing within 3-6 months compared to those who did not opt in (23% vs 9%), but this difference was not statistically significant. Very few women (4%) re-tested positive for CT or GC 3-6 months after an initial infection and we did not observe a meaningful difference in retest positivity among women who did and did not opt in (7% vs 3%). This is potentially due to the small sample size of this study. Our findings suggest that SMS reminders for re-testing are not widely embraced by this patient population but may be differentially acceptable to women with more risk for reinfection and may have had a modest influence on women returning to the clinic for re-testing. This study highlights the need for more robust interventions to improve re-testing for GC and CT among women.

One of our study's objectives was to assess the acceptance of SMS reminders among female STD clinic patients. We found that 743 (36%) of 2,067 women opted to receive the SMS reminder, a number that is comparable to other studies of SMS reminders that have observed overall acceptance rates for SMS reminders of 31-68% [9,12,16,17]. Interestingly, the acceptance of SMS reminders in our study (acceptance=36%) – where we asked patients about opting in to SMS reminders *prior* to being tested for

GC or CT – is nearly identical to that noted in a Dutch study by Kampman and colleagues among STD clinic patients who were asked to enroll in SMS reminders *after* receiving a positive CT test (acceptance=39%). These studies highlight that, in general, SMS reminders for re-testing are not overwhelmingly popular, and may not necessarily be influenced by whether or not someone has tested positive for an STI.

Among women who initially tested positive for CT or GC in our study, the proportion of women who opted in to receive an SMS and who returned to the clinic for re-testing (23%) is similar to the low end of the range of previous studies, which have found that between 26% and 61% of women who received a SMS reminder returned to clinic to re-test [7–11,13]. However, the proportionate (i.e., absolute) difference in re-testing rates between women who did and did not opt in to receive reminders in our study (17%), is similar to other studies which have noted proportion differences of 9-33% in re-testing rates between women who did and did not receive an SMS re-testing reminder [7–10,13]. Although the difference in re-testing rates that we observed was not statistically significant, its consistency with other studies – which include those in research environments and public health clinics, those in Europe and Australia, and those that used a variety of study designs and different re-testing windows – highlights that these reminders may have an impact, albeit modest, on encouraging individuals to return for re-testing.

We were somewhat surprised that the proportion of women who re-tested positive for CT and GC within 6 months of their initial infection was only 7%, given that an estimated 12-15% of women re-test positive for these infections within 6 months of an initial diagnosis. This proportion was also well below that noted in the aforementioned study by Kampman and colleagues, where the proportion of patients who received an SMS reminder and re-tested positive for CT was 20%, though that study included outcomes beyond 12 months. However, similar to the Kampman study, we did not observe a large difference in retest positivity among women who did and did not opt in to receive SMS reminders (7% vs 3%). Of note, a large and methodologically rigorous study of men who have sex with men (MSM) STD clinic patients in Australia found that receipt of SMS was associated with higher detection rates for rectal GC and CT and urethral CT. Thus it is unclear if the apparent lack of an effect of SMS reminders on re-test

positivity among women is due to differences in study populations (i.e., MSM vs women) or methodologic considerations (e.g., prospective vs. retrospective design).

Given our study's observations of a relatively low uptake of SMS reminders for re-testing, of a relatively modest effect of SMS reminders to encourage re-testing, and of little or no effect of SMS reminders to identify repeat CT/GC infections, it is unclear if these reminders should continue to be implemented for women. In our clinic, these SMS reminders are integrated into our clinic's existing computerized clinical intake, and there are very few resources required to maintain the SMS system. Thus to the extent that these reminders may promote re-testing among a small group of women, it may be worthwhile and important to continue providing the service to our patients. However, clinics that would need to invest substantial resources to develop and maintain an SMS reminder system may wish to seek out additional evidence on the effectiveness and cost-effectiveness of these reminders before considering their implementation. It is also worthwhile for clinics to look further into the possibility of different digital interventions to promote re-testing or screening, as these could have a greater impact than the use of SMS alone.

This study has several strengths. First, we evaluated our existing SMS reminder system which is integrated into our clinic's routine clinical intake. This allowed us to examine the potential impact of the SMS intervention in a "real-world" clinical setting. Second, we utilized King County surveillance data to identify any positive CT tests among our study population that occurred within the follow-up window. By doing this, we captured all outcomes among women who re-tested CT or GC positive at any location in King County. This study also has several limitations. First, this was not a randomized trial, and women who chose to opt in to the SMS reminder for re-testing may have been more likely to re-test for CT or GC even in the absence of receiving a reminder. Second, we did not capture information on women who re-tested negative for CT or GC in another clinic outside of the PHSKC STD clinic; thus the re-testing rates we present are likely a minimum proportion of the women who re-tested. However, as mentioned above, we did capture *positive* tests on all women in the study with the use of surveillance data. Third, the PHSKC STD clinic has a large MSM patient population and the number of women seen at the clinic

annually is small. This resulted in a small sample size for this study. Fourth, and related to this, the small sample size limited our ability to conduct multivariate modeling to adjust for differences in characteristics between women who did and did not opt in to the SMS reminders. This has important implications because, as noted above, women who opted in to receive reminders may have been more likely to re-test than those who did not opt in. Fifth, we used a deterministic algorithm to match STD clinic data with King County surveillance data and it is possible that our match did not identify some women who truly re-tested positive.

In conclusion, we found that re-testing rates for CT and GC among women remained suboptimal even among women who received SMS reminders for re-testing. SMS reminders may encourage some patients to re-test, but they do not appear to be unanimously accepted nor are they a “silver bullet” solution to promoting re-testing for CT and GC among women. Given that STI rates are at an all-time high and that re-testing rates in the US are unacceptably low and do not appear to be improving, [1,5,6] our findings highlight the need to develop and implement innovate, low-cost, and patient-accepted methods to encourage STI re-testing, and to conduct methodologically rigorous studies to evaluate their effectiveness. These new methods are needed to bend the curve of the current STI epidemic in the US.

Table 1a. Comparison of characteristics of women who did and did not opt in to a 3-month text message reminder for re-testing* (N=2,067 total number of women)

	Total N=2,067	Opted in N=743	Did not opt in N=1,324	p-value
	N(%)	N(%)	N(%)	
Age, mean (SD)	31.7 (9.6)	31.5 (9.7)	31.7 (9.5)	
Race/ethnicity				0.06
White, non-Hispanic	912 (44)	315 (42)	597 (45)	
Black, non-Hispanic	524 (25)	183 (25)	341 (26)	
Asian, non-Hispanic	246 (12)	107 (14)	139 (11)	
Other, non-Hispanic	227 (11)	75 (10)	152 (12)	
Hispanic	158 (8)	63 (9)	95 (7)	
Injection drug use in the past year	94 (5)	41 (6)	53 (4)	0.11
Gender of sex partners in the past 12 months**				0.21
only men	1,752 (85)	617 (83)	1,135 (86)	
only women	11 (0.5)	5 (0.7)	6 (0.5)	
both men and women	299 (15)	120 (16)	179 (14)	
Number of male sex partners in the past 2 months				0.01
0	135 (7)	43 (6)	92 (7)	
1-2	1,497 (74)	515 (71)	982 (76)	
3+	387 (19)	165 (23)	222 (17)	
Number of male sex partners in the past 12 months				<0.0001
0	18 (1)	3 (0.4)	15 (1)	
1-2	1,012 (51)	322 (46)	690 (54)	
3+	957 (48)	383 (54)	574 (45)	
Number of new male partners in the past 2 months				0.01
0	725 (38)	238 (35)	487 (40)	
1-2	978 (52)	360 (53)	618 (51)	
3+	186 (10)	83 (12)	103 (9)	
Chlamydia or gonorrhea infection in the last year	298 (14)	92 (12)	206 (16)	0.05
Previously tested positive for HIV	8 (0.4)	4 (0.5)	4 (0.3)	0.41
Self-reported contact to gonorrhea or chlamydia	128 (6)	46 (6)	82 (6)	0.36
Text message question				
Question A	420 (20)	131 (18)	289 (22)	
Question B	1,647 (80)	612 (82)	1,035 (78)	

SD, standard deviation

*Includes women asked both question A and question B

** no one reported sex with transgender men, transgender women, or individuals who identify as gender non-binary or queer

Table 1b. Comparison of characteristics of women who did and did not opt in to a 3-month text message reminder for re-testing, among women who tested STD positive at initial visit * (N=112 total number of women)

	Total N=95	Opted in N=31	Did not opt in N=64	p-value
	N(%)	N(%)	N(%)	
Age, mean (SD)	27.9 (7.9)	27.9 (7.2)	27.9 (8.3)	
Race/ethnicity				0.42
White, non-Hispanic	27 (28)	10 (32)	17 (27)	
Black, non-Hispanic	34 (36)	14 (45)	20 (31)	
Asian, non-Hispanic	13 (14)	2 (6)	11 (17)	
Other, non-Hispanic	13 (14)	3 (10)	10 (16)	
Hispanic	8 (8)	2 (6)	6 (9)	
Injection drug use in the past year	4 (4)	2 (6)	2 (3)	0.45
Gender of sex partners in the past 12 months**				0.96
only men	86 (91)	28 (90)	58 (91)	
only women	0 (0)	0 (0)	0 (0)	
both men and women	9 (9)	3 (10)	6 (9)	
Number of male sex partners in the past 2 months				0.21
0	0 (0)	0 (0)	0 (0)	
1-2	62 (66)	16 (52)	46 (73)	
3+	32 (34)	15 (48)	17 (27)	
Number of male sex partners in the past 12 months				0.004
0	0 (0)	0 (0)	0 (0)	
1-2	46 (50)	8 (28)	38 (60)	
3+	46 (50)	21 (72)	25 (40)	
Number of new male partners in the past 2 months				0.13
0	34 (36)	7 (23)	27 (42)	
1-2	51 (54)	19 (61)	32 (50)	
3+	10 (11)	5 (16)	5 (8)	
Chlamydia or gonorrhea infection in the last year	21 (22)	8 (26)	13 (20)	0.55
Previously tested positive for HIV	1 (1)	1 (3)	0 (0)	0.15
Self-reported contact to gonorrhea or chlamydia	31 (33)	9 (29)	22 (34)	0.67
Text message question				
Question A	28 (30)	10 (32)	18 (28)	
Question B	67 (71)	21 (68)	46 (72)	

SD, standard deviation
*Includes women asked both question A and question B who tested STD positive at their initial visit
** no one reported sex with transgender men, transgender women, or individuals who identify as gender non-binary or queer

Table 2. Number and percentage of women who returned to the STD clinic for retesting among those who tested positive for STD at their initial visit, comparing those who did and did not opt in to a 3-month text message reminder (N=95) (Aim 2)

Timing of return to STD clinic since initial positive GC or CT test result	Total N= 95	Opted in N = 31	Did not opt in N = 64	P-value*
	N (%)	N (%)	N (%)	
Did not return**	54 (57)	11 (35)	43 (67)	
Returned <3 months	22 (23)	11 (35)	11 (17)	
Returned 3-6 months	13 (14)	7 (23)	6 (9)	0.111
Returned >6 months	6 (6)	2 (6)	4 (6)	

*p-value calculated comparing those who returned within 3-6 months to all others (aggregating those who did not return and those who returned in other time periods)
**During the follow-up period (through June 2018)

Table 3. Number and percentage of women who re-tested positive for chlamydia or gonorrhea among those who tested positive for STD at their initial visit, comparing those who did and did not opt in to a 3-month text message reminder (N=95) (Aim 3)

Timing of repeat GC or CT positive test since initial positive	Total N= 95	Opted in N = 29	Did not opt in N = 66	P-value*
	N (%)	N (%)	N (%)	
Did not re-test positive**	85 (89)	25 (86)	60 (91)	
Re-tested positive < 3 months	3 (3)	1 (3)	2 (3)	
Re-tested positive 3-6 months	4 (4)	2 (7)	2 (3)	0.58
Re-tested positive >6 months	3 (3)	1 (3)	2 (3)	

*p-value calculated comparing those who re-tested chlamydia or gonorrhea positive within 3-6 months to all others (aggregating those who did not re-tested chlamydia or gonorrhea positive and those who re-tested chlamydia or gonorrhea positive in other time periods)
**During the follow-up period (though June 2018)

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