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Improving sexually transmitted infection results notification via mobile phone technology

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Abstract

Purpose—To improve adolescent notification of positive sexually transmitted infection (STI) tests using mobile phone technology and STI information cards.

Methods—A randomized intervention among 14-21 year-olds in a pediatric emergency department (PED). A 2×3 factorial design with replication was used to evaluate the effectiveness of six combinations of two factors on the proportion of STI-positive adolescents notified within 7 days of testing. Independent factors included: method of notification (call, text message, or call + text message) and provision of an STI information card with or without a phone number to obtain results. Covariates for logistic regression included age, empiric STI treatment, days until first attempted notification and documentation of confidential phone number.

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Results—Approximately half of the 383 females and 201 males enrolled were ≥ 18 years. Texting only or type of card was not significantly associated with patient notification rates, and there was no significant interaction between card and notification method. For females, successful notification was significantly greater for call + text message (OR 3.2 [95% CI 1.4, 6.9]), and documenting a confidential phone number was independently associated with successful notification (OR 3.6 [95% CI 1.7, 7.5]). We found no significant predictors of successful notification for males. Of patients with a documented confidential phone number who received a call + text message, 94% of females and 83% of males were successfully notified.

Conclusions—Obtaining a confidential phone number and using call + text message improved STI notification rates among female but not male adolescents in a PED.

Keywords

emergency medicine; healthcare quality improvement; adolescents; sexually transmitted disease; text messaging

INTRODUCTION

In the United States (US), 15-24 year olds represent half of all newly acquired sexually transmitted infections (STI), and high STI rates are seen among pediatric emergency department (PED) patients at many institutions [1-3]. Previous literature has shown that communication of positive STI test results to adolescents subsequently improved self-reported future condom use, abstinence rates and partner notification [4, 5]. However, women treated empirically with antibiotics but unaware they tested positive for STIs did not change their behavior [6]. This suggests that interventions, including improved notification of test results, are needed to decrease adolescent STI rates [7].

Despite national guidelines for STI control and treatment, emergency department (ED) clinical practices related to diagnosis, treatment, and prevention of STIs among adolescents are suboptimal [8, 9]. Often, those who have positive STI results untreated at the time of testing are lost to follow-up and remain untreated [10]. Additionally, many who test positive and were empirically treated in the ED are not routinely notified regarding their positive STI results. These deficiencies in clinical practice are often driven by barriers to effectively communicate STI results to patients. Historically, in our institution, less than half (45%) of STI positive (gonorrhea (GC), Chlamydia (CT) or trichomoniasis (trich)) female ED patients were notified and treated within 7 days [11]. With our previous interventions to improve electronic medical record (EMR) documentation of a confidential phone number, the distribution of STI patient information cards with a phone number to call for test results and a dedicated mobile phone for STI follow-up calls, we were able to increase STI positive female patients notified from 45% to 65% which was still suboptimal [11].

Text messaging is a promising method for communicating health-related information to adolescents as many report owning a cell phone and using text messaging [12-14]. Patients report that receiving text messages for sexual health care related information is highly acceptable [14, 15]. While text messaging has been used increasingly in sexual health promotion, the clinical effectiveness of text messaging to communicate STI results in the US

has not been evaluated [16-18]. If text messaging is effective in improving notification of infected individuals, this contact method could lead to improved patient outcomes including decreasing rates of overtreatment and increasing rates of appropriate treatment. ED physicians routinely over treat patients for STI infections fearing they will be lost in follow-up [19]. In order to assure appropriate treatment, it is necessary to first assure that one can be contacted in follow-up to provide the appropriate prescription or appointment necessary to receive treatment. This in turn may contribute to decreasing the prevalence of STIs, and the cost of overtreatment and secondary clinical complications related to STIs [20, 21].

The specific aim of this study was to test the effectiveness of PED system interventions, including mobile phone call and texting technologies and STI information cards, in improving notification of positive STI (GC, CT or trich) test results among adolescents.

METHODS

Study Design

This study was a planned experiment with a 2x3 factorial design. Factorial design has been used successfully in healthcare research for improving complex processes and was chosen over the classic randomized controlled trial because it is an efficient methodology for studying the effect of multiple components of an intervention (factors) on an outcome as well as providing estimates of interaction effects [22, 23].

Because our previous work had focused on female adolescents, and they have significant risk for complications associated with untreated STIs, this study was initially done among females. **We then obtained additional funding** and included the male population in a second study using the same study design. Both studies are presented in this manuscript.

Based on our previous work, we anticipated that two factors may have an impact on results notification [11]. The first factor was the method of contact which included either: call, text message, or call + text message. The second factor was an STI patient information card given at the time of the PED visit consisting of 2 versions. Both versions (card 1 and 2) indicated the patient was tested for STIs and would be notified of positive results. Card 2 also included a mobile phone number to call for results **between 9am and 5pm.**

Figure 1 depicts the experimental design. The method of notification was randomized at the patient level when the tests were resulted after the patient visit. Since the card was a system level intervention that was distributed by the healthcare provider at the time of the visit, randomization at the patient level was not feasible. Thus we randomized the type of card to one of two blocks of time. As a result, the type of card would have been confounded with time. Thus, we repeated the experimental design (replications 1 and 2). Each intervention combination was tested until a sufficient sample size was obtained for each gender. The study was submitted to the Institutional Review Board (IRB) at Cincinnati Children's Hospital Medical Center, was determined to not be human subjects research and was exempt from further IRB review.

Based on preliminary data, we anticipated that over a 12-month time period approximately 400 females and 245 males would test STI positive. For the female population, a sample size of 420 would result in 70 patients receiving each of the 6 intervention combinations and 140 receiving each of the 3 contact methods. From our previous female studies, we anticipated that we would be able to improve the percent of successful contacts as follows: call only (65%), text only (75%), both text and call (82%).[11] We did not have previous data regarding male contact rates, but we expected that the rates would be similar. Therefore, a total sample size of 420 would result in a power of 84% to detect these differences. In the event that there would be fewer patients (n= 360), we would have a power of 78% to detect those differences.

Setting

This study was conducted in the ED of a tertiary care, urban, pediatric hospital that has 90,000 yearly visits, of which approximately 20% are adolescents. Approximately 45% of ED users are Black, 46% White and 9% other; 29% have private insurance, 66% Medicaid and the remainder are self-pay.

Selection of Participants

Our population included 14 to 21 year olds who tested positive for CT, GC or trich during their PED visit between April 2011 - August 2012 (females) and July 2011 - June 2013 (males). Those that had EMR documentation that they were unable to receive text messages were excluded; however, those with no documentation were included.

Study Protocol

In contrast to our historical ED clinical practice which involved notifying only STI positive patients who were untreated, the clinical nurse or nurse practitioner (NP) attempted to notify all STI positive patients regardless of ED treatment. The state of Ohio allows minors to consent for STI services and does not require parental notification, thus all communication was done between a healthcare provider and the adolescent. During the first half of replication 1, each patient received STI information card 2 with a dedicated mobile phone number to call for results. Female cards were pink and male cards were blue to assure the correct distribution during overlapping time periods. As soon as test results were available, notification attempts began. All positive test results were placed in chronologic order according to the date and time of ED arrival, and patients received one of the three notification methods. During the second half of replication 1, each patient received STI information card 1 *without* a phone number for test results. Similarly, patients with positive results during this block of time received one of the three notification methods. The study was replicated for both genders using the same methods as previously described.

Our previous improvement work had resulted in an EMR system where providers were encouraged to document a confidential phone number (provided by the adolescent to use only to relay test results) and its ability to accept text messages [11]. The confidential phone number was attempted first, but if not listed, the number given at registration was used. The nurse/NP used a designated mobile phone for all calls/texts as this was ED standard practice. For call attempts, voicemail messages were left if there was no voice-to-voice contact.

Standardized text messages were sent stating "Please call (study staff name) at Children's Hospital for your test results at (phone number)." Laboratory results or protected health information were never relayed via text message. If the patient was randomized into the call + text message group, she/he received a call followed immediately by a text message at each attempt. Similarly, patients randomized into the call group only received a call, and those in the text group only received text messages. The goal was to have voice-to-voice contact; thus, if a patient responded to a text or a call with a text message, the nurse/NP responded with a text instructing the patient to call. After three failed notification attempts on three consecutive days, a letter was mailed. If the nurse/NP made voice-to-voice contact, she followed recommended STI prevention guidelines: i.e. gave patients test results and inquired about completion of treatment, abstinence, and partner notification/treatment. If the patient had not been treated, the nurse/NP offered three options: 1) calling a prescription to a pharmacy, 2) returning to the ED, or 3) returning to her/his primary care provider or health department. The nurse/NP documented treatment and counseling information as well as the number of attempts and the date of notification on a standard follow-up form and in the EMR. The main outcome measure was the percentage of patients notified by voice-to-voice interaction within 7 days of STI testing (cervical or urine nucleic acid amplification test for GC and CT, and trichomonas antigen testing for trich). In our institution, GC and CT tests were resulted only three times a week. Thus, the time period of 7 days was based on good clinical practice, the limits of our institutional practices and previous literature [24].

Primary Data Analysis

A t-test was used to test for age differences among those who were included versus those excluded. For included patients, exploratory analyses using descriptive statistics, frequency distributions and graphical methods were conducted for all study variables. A logistic regression (LR) model was developed to estimate the main and interaction effects of the two experimental factors; type of card and method of notification. The dependent variable was the dichotomous outcome of successful notification within 7 days. The independent variables included the two experimental factors, their interaction and replication. We also included covariates to control for 1) age as a continuous variable, 2) empiric treatment in the ED, 3) number of days to first notification attempt, and 4) documentation of a confidential phone number.

RESULTS

A total of 2536 patients (1887 females and 649 males) were tested for STIs and 584 (23%) were positive. Thus, 383 female patients and 201 male patients were included in the analysis. Patient characteristics are depicted in Table 1. An additional twenty-nine females (7%) and twenty-three males (10%) were STI positive during the study period but were excluded as their phones did not receive text messages. Mean age did not differ between those included vs. those excluded in the study for females (17.6 vs. 17.3, p= 0.52) or males (17.7 vs. 17.3, p= 0.29). The average number of contact attempts among females and males respectively in each study arm included: call group = 1.80, 1.72, text group = 1.75, 1.77 and call + text group = 1.50, 1.75.

Figure 2 displays the unadjusted percentage of adolescents successfully notified in each of the six intervention combinations. There was no significant interaction (females: p=0.53; males: p=0.45) between the type of STI information card distributed and patient notification method.

Figure 3 displays the percent of successful notification by each notification method and replication. Although notification rates were slightly higher during the second replication, the association of replication with successful notification rates was not significant for females (p=0.11) or males (p=0.26).

Table 2 summarizes the adjusted and unadjusted odds ratios for the experimental factors and covariates. Because the interaction effect between card type and notification method was not significant for either gender, it was not included in the final LR models. The type of card distributed or texting alone was not significantly associated with patient notification rates. Among females, the odds of successful notification were significantly greater when notification included a call + text message compared to a call only, and documenting a confidential phone number was the only covariate that was independently associated with successful notification. There were no significant main effects for males. The unadjusted percentage of those patients who had a documented confidential phone number, received both a call + text message and were successfully notified within 7 days of their ED visit was 94.5% for females and 83.3% for males.

DISCUSSION

Improving our ability to notify and appropriately treat adolescents with STIs is critical in stemming the STI epidemic in this population. In our community as well as other cities, many young men and women use the ED for primary care issues including STI evaluation [25]. Those who have positive STI results, and not treated in the ED, are often lost to follow-up and remain untreated [10, 19]. Therefore, it is important to ensure that adolescents with a positive STI result are contacted, counseled and treated. To our knowledge, this is the first study in the US to demonstrate that using a dedicated mobile phone to call and text adolescents is a successful intervention to inform female adolescents of their positive STI results.

The addition of text messaging to the continued documentation of confidential phone numbers in the EMR resulted in an almost 12% improvement in adolescent notification rates among females. Because we didn't have previous baseline data among males, we are unable to report the change. Previous literature has suggested that text messaging among adolescents may be a contact method that would allow us to significantly improve STI notification and treatment rates [26]. Lenhart, et al. report that few adolescents have unlimited voice minute plans; however, 75% have unlimited texting plans [13]. Consequently, they choose not to check voice messages because this "wastes" minutes, and voice messages cannot be left when the phone is "out of minutes". Skinner, et al. identified this cost as a barrier for adolescents using cell phones in the traditional way [27]. Lenhart, et al. also endorsed adolescents recognizing that receiving a text message is less expensive than voicemail [13]. Other authors have demonstrated text messaging success in managing

adolescent chronic health issues and providing STI prevention and sexual health messages [28, 29]. However, previous studies examining text messaging as a notification method for positive STI testing, show mixed results with regards to notification rates and time to treatment [30-32]. These studies were conducted in sexual health clinic settings among various age groups in countries (New Zealand and the United Kingdom) with very different healthcare systems from the US. In the US, adolescent girls ages 14-17 years are most active in regards to texting, averaging 100 or more daily text messages [33]. Boys typically only average 30 daily texts [33]. This difference in use may explain in part why we demonstrated significant improvement in notification rates for females but not males. Additionally, in this ED study, patients tested for STIs all presented either due to the presence of symptoms or a possible STI exposure. A majority of the males were empirically treated with a lesser number of females receiving empiric treatment. Because many males already received treatment, perhaps they were not as concerned about knowing their STI status as compared to the females who may have had persistent symptoms thus were more interested in obtaining test results and receiving treatment. The gender differences in empiric treatment rates may have had an effect on those we were able to successfully contact. Despite ED treatment, messages need to be designed to stress the importance of follow-up with a healthcare provider. Literature has also shown that beginning in late adolescence, males have a significantly lower number of primary care visits as compared to females [34]. Our results may suggest that successful contact is a proxy for gendered socialization regarding who seeks or pursues health care.

Our demonstrated success in notifying patients through a combination of mobile phone calls and texting technology has several implications. First, inadequate systems for communicating test results often lead to STI overtreatment in ED settings where adolescents are empirically treated. Prior to our interventions, approximately 70% of our ED female patients received empiric antibiotic treatment after being tested for STIs and only 22% of those tested were STI positive, demonstrating significant overtreatment [11]. ED providers practice in this manner due to difficulty predicting who will have positive STI results, difficulty in contacting patients after ED discharge, and the presumption that a patient will not fill a prescription or receive treatment if they are not treated at the time of the visit [19]. This practice may contribute to antibiotic resistance, unnecessary antibiotic side effects, increased health care costs and adverse psychosocial consequences including stigma and shame [10]. In our institution, after information from the current study regarding our successful notification rates was communicated to ED providers, it resulted in a decrease in empiric treatment among STI patients tested in the ED [35]. Despite the decrease in overtreatment, this change has not resulted in under-treatment of true positives, but instead, more accurate treatment of true positives [35]. There are, however, some symptomatic patients who are clinically diagnosed with PID or cervicitis and may subsequently have negative test results. Thus there will always be the need for immediate treatment based on clinical findings.

Additionally, by improving post-visit contact rates, we are improving our communication with adolescents regarding their STI results. We now have increased opportunities to counsel regarding the importance of safe sex behaviors and partner notification. It has been demonstrated in previous studies that ED telephone follow-up improves patient compliance,

and allows for further clarification of discharge instructions which is requested in over 40% of patients contacted [36, 37]. Perhaps this intervention should be expanded to all patients tested for STIs regardless of their results as this is an opportune teachable moment to relay further sexual prevention messages.

This intervention was low cost as we only had to pay for the cell phone and use and a dedicated NP/nurse to make follow-up phone calls/texts. Our division now has daily dedicated nurses whose sole responsibility is to contact and assure treatment among all patients with positive ED test results, including STI results. Nurses have been trained to provide confidential test results, treatment, and sexual prevention advice to the STI positive adolescents. Thus it was relatively easy to transition this care from that of the study NP/nurse to that of nurses providing this service for all ED patients.

There are several limitations to this study. Since this study was integrated into a clinical setting as a real-world effectiveness intervention, we cannot be sure that every patient received an STI patient information card at his/her ED visit. However, all staff were trained in card distribution and only one “type” of STI information card was available at any one time. Additionally, we closely monitored the number of patients tested as compared to the number of cards distributed and those numbers were similar. We did not document the number of patients calling in for their test result prior to the nurse/NP contacting them. In these cases, often patients called prior to result availability, thus the nurse/NP would have to make another contact attempt when results were available. However, these limitations are typical of real-world clinical effectiveness interventions. Although contacting adolescents for STI follow-up is a common challenge across institutions and EDs, this intervention was conducted at a single academic center, which may limit overall generalizability. Contacting patients within three days would have been preferable; however, in our institution, test results among some patients are not available until up to three days after their visit. Lastly, all adolescents in this study who were contacted and untreated at the initial visit had either a prescription called in to a pharmacy (positive for trich or CT) or were instructed to return for an intramuscular injection (positive for GC). In these patients, contact was a proxy to treatment as we were unable to assure the patient actually picked up the prescription at the pharmacy or returned to a healthcare system for treatment. Future interventions need to include further follow-up with these patients to assure appropriate outpatient treatment.

CONCLUSION

Using a combination of mobile phone call and text messaging improved our ability to notify STI positive adolescent females within 7 days of STI testing. Additionally, this study reinforced that EMR documentation of confidential phone numbers increases the likelihood of successfully notifying STI positive ED patients. Because these system changes are easily implemented and can make use of existing personnel, institutions can readily adapt these changes to improve STI care and impact the adolescent STI epidemic.

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Abbreviations

STI	sexually transmitted infection
PED	pediatric emergency department
ED	emergency department
EMR	electronic medical record
US	United States
NP	nurse practitioner
LR	logistic regression
OR	odds ratio
IRB	Institutional Review Board

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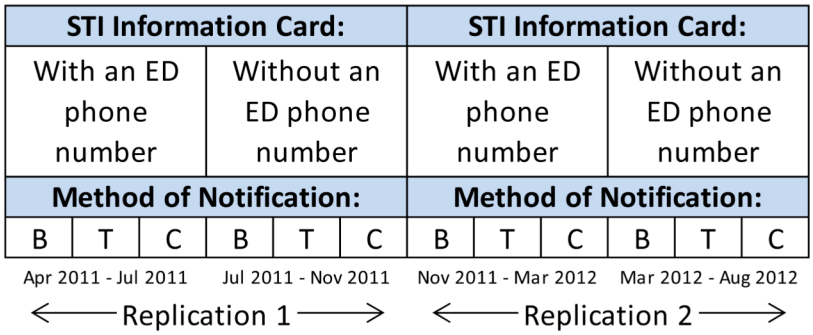
IMPLICATIONS AND CONTRIBUTION

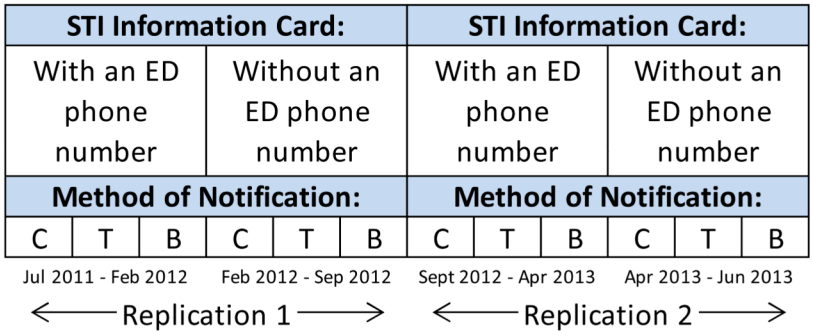
Communicating sexually transmitted infection (STI) results in an emergency department setting is a challenge. The addition of text messaging and confidential phone number documentation in the medical record is an effective method to notify STI positive adolescent females regarding their results. Institutions can adapt these interventions to improve STI care.

A



C= call, T= text message, B= both call and text message

B



C= call, T= text message, B= both call and text message

Figure 1.
Experimental Design (A: Females, B: Males)

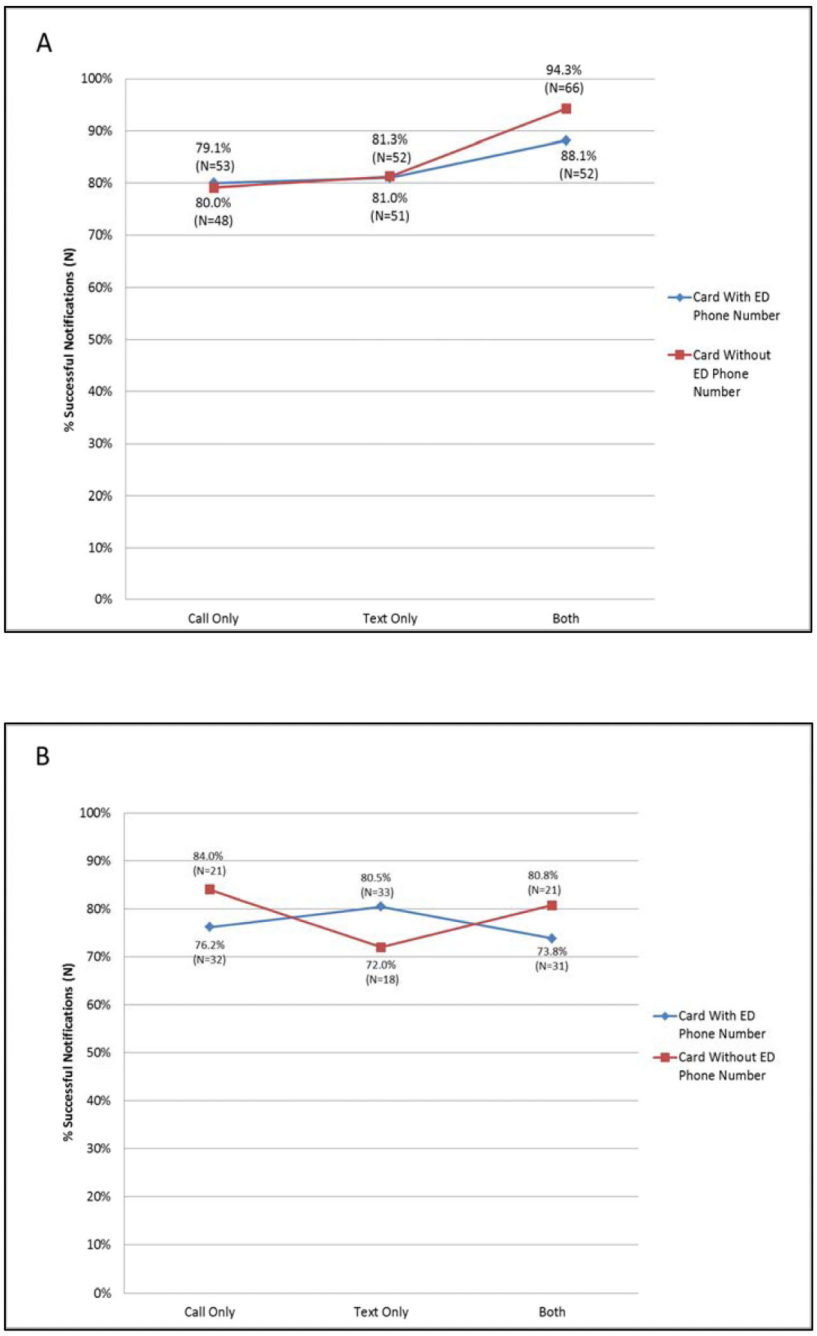


Figure 2.

Unadjusted percentage of adolescents successfully notified by notification method and card type (A: Females p=0.53, B: Males p=0.45)

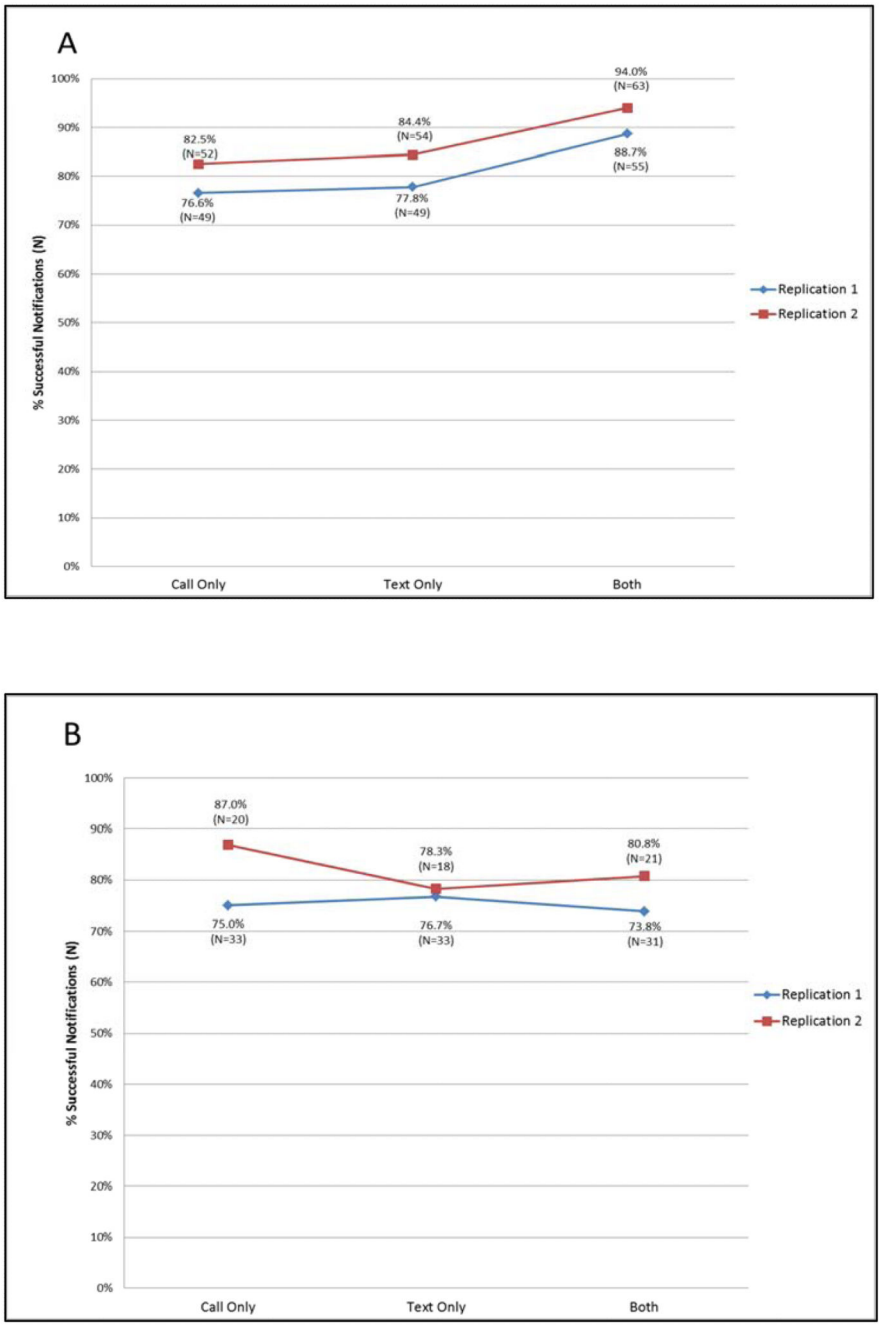


Figure 3.

Unadjusted percentage of adolescents successfully notified by notification method and replication (A: Females p=0.11, B: Males p=0.26)

Table 1

Demographic Characteristics and covariates by gender

	Females (n = 383) n (%)	**Males (n = 201) n (%)**
Age (years)		
14 - 15	53 (13.8%)	19 (9.5%)
16 - 17	134 (35.0%)	70 (34.8%)
18 - 21	196 (51.2%)	112 (55.7%)
Race		
White	25 (6.5%)	8 (4.0%)
Black	336 (87.7%)	188 (93.5%)
Multiracial	11 (2.9%)	1 (0.5%)
Other	11 (2.9%)	4 (2.0%)
STI positive test results [a]		
Chlamydia	250 (65.3%)	135 (67%)
Gonorrhea	123 (32.1%)	97 (48.3%)
Trichomonas	94 (24.5%)	0 [b]
Number of attempts to successful contact		
One attempt	219 (57.2%)	109 (54.2%)
Two attempts	63 (16.4%)	20 (10%)
Three attempts	24 (6.3%)	19 (9.5%)
Within 7 days but after third attempt [c]	1 (0.3%)	8 (4%)
No successful contact	76 (19.8%)	45 (22.3%)
Empiric treatment	266 (69.5%)	185 (92.0%)
Empiric treatment and successfully contacted	225 (58.7%)	146 (72.6%)
No empiric treatment and successfully contacted	97 (25.3%)	10 (5%)
Provided a confidential number	334 (87.2%)	169 (84.1%)
Days to first contact attempt		
Mean	2.6	2.5
Standard deviation	1.4	1.2
Min	0	0

	Females (n = 383) n (%)	**Males (n = 201) n (%)**
Max	6	6

[a] Some patient were positive for more than one STI

[b] Males were not tested for trichomonas

[c] These patients either received a letter and contacted the nurse/NP in response to the letter or called back in response to one of the texts or voicemail messages they received.

Table 2

Adjusted and unadjusted odds ratios for the experimental factors

Females: Adjusted and Unadjusted Odds Ratios		
Experimental Factors	Unadjusted OR (95%CI)	Adjusted OR (95% CI)
Text vs. call	1.1 (0.6, 2.1)	1.1 (0.6, 2.1)
Call + text message vs. call	2.7 (1.3, 5.8)	**3.2 (1.4, 6.9)**
Card (referent = no ED[a] phone number)	0.9 (0.5, 1.5)	0.9 (0.5, 1.6)
Replication (referent = Replication 1)	1.6 (0.9, 2.8)	1.5 (0.8, 2.9)
Covariates		
Documentation of confidential phone number	-	**3.6 (1.7, 7.5)**
Empiric treatment in the ED[a]	-	0.8 (0.4, 1.6)
Age	-	1.1 (0.9, 1.3)
Number of days to first contact attempt	-	1.0 (0.8, 1.2)
Males: Adjusted and Unadjusted Odds Ratios		
Experimental Factors	Unadjusted OR (95%CI)	Adjusted OR (95% CI)
text vs. call	0.9 (0.4, 2.0)	0.8 (0.4, 2.0)
Call + text message vs. call	0.8 (0.4, 1.9)	0.9 (0.4, 2.1)
Card (referent = no ED[a] phone number)	0.9 (0.4, 1.7)	1.0 (0.5, 2.0)
Replication (referent = Replication 1)	1.5 (0.7, 3.1)	1.2 (0.6, 2.7)
Covariates		
Documentation of confidential phone number	-	2.2 (0.9, 5.2)
Empiric treatment in the ED[a]	-	2.4 (0.8, 7.5)
Age	-	1.1 (0.9, 1.4)
Number of days to first contact attempt	-	0.9 (0.6, 1.2)

[a]ED- emergency department