Evaluating feasibility and potential impact of text messages to increase HIV testing among young women in rural Kenya: a pilot study

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Abstract

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Background: More than half of HIV infected individuals in Kenya are unaware of their status and young women carry a disproportionate burden of incident HIV infections. We sought to increase HIV testing in young Kenyan women through a text messaging (SMS) intervention.

Methods: We conducted a randomized quasi-experimental study to increase HIV testing among women 18-24 years old. Four technical training colleges in Central Kenya were randomized to have their study participants receive either weekly SMS on HIV and reproductive health topics or no SMS. Monthly 9-question SMS surveys were sent to all participants for 6 months to collect data on HIV testing, sexual behavior, and HIV risk perception. We used multivariate Cox proportional hazards regression to detect differences in the time to the first HIV test reported by women during the study period.

Results: We enrolled 600 women between September 2013 and March 2014 of whom 300 received weekly SMS and monthly surveys and 300 received only monthly surveys. On average,

women were 21 years of age (interquartile range [IQR] 20-22), 68% had ever had sex and 73% had never tested for HIV. A total of 356 women reported testing for HIV within the 6 months of follow up: 67% from the intervention arm and 51% from the control arm (hazard ratio=1.57, 95% confidence interval 1.28-1.92).

Conclusions: Use of weekly text messages about HIV prevention and reproductive health significantly increased rates of HIV testing among young Kenyan women and would be feasible to implement widely among school populations.

Key words: SMS, HIV, young women, text messages

INTRODUCTION

An estimated 35 million people globally were living with HIV at the end of 2013, with the majority (70%) residing in Sub-Saharan Africa where women account for 58% of infections[1,2]. HIV testing is a fundamental component of HIV prevention programs and the entry point into HIV care. Yet in sub-Saharan Africa only 15% of women 15-24 years old are aware of their HIV status, despite having the highest HIV incidence rates and being a priority population for HIV prevention programs[2,3]. In a recent population-based survey, the majority (53%) of HIV-infected Kenyans were not aware of their status and one-third of these reported not testing because they did not perceive themselves to be at high risk[4]. Additionally, only half (54%) of young Kenyan women had comprehensive knowledge of HIV/AIDS[5], including routes of transmission and prevention strategies.

Kenya currently has 33.6 million mobile phone subscribers, representing an 82.6% country penetration[6] and subscribers prefer to use text messages (also known as short message service or SMS) rather than calling[7]. Text messages have been used successfully in Kenya to increase antiretroviral (ART) adherence[8], retain HIV-exposed infants into care[9], improve childhood vaccination campaigns[10], retain men in post-operative care following medical male circumcision[11] and provide contraceptive information to young people[12]. Despite successes in mobile-based applications to improve issues in health, applications to date have been implemented on a small scale and there remains great potential for widespread use and substantial public health impact in Kenya[13].

Strategies with expansive coverage are needed to increase HIV testing among young women in Kenya and provide opportunities to engage in discussions about their personal HIV risk, risk behaviors, and improve their autonomy to reduce their HIV risk. We sought to increase HIV testing by improving HIV awareness, enhancing HIV risk perception and reducing high risk behaviour among young women in a rural region of Kenya through automated text messages.

METHODS

Study design

This was a randomized quasi-experimental study utilizing text messages to increase HIV testing . A coin toss was used to assign all participants at two colleges to receive weekly HIV related text messages (intervention group) while participants at the other two colleges did not receive such messages (control group). Since study participants were boarding at their college, there was high potential for participants to discuss the study with one another, which influenced the decision to randomize institutions, rather than individuals and avoid bias from cross-contamination.

Study population

Participants were enrolled between September 2013 and March 2014 from four 2-year colleges located in Kiambu County in Central Kenya, a predominantly rural area. Eligible participants were women ages 18-24, were HIV uninfected or unaware of their HIV status, had not tested for HIV in the preceding 12 months, owned a mobile phone and had regular access to electricity to charge their mobile phone, and knew how to send and receive text messages.

Study procedures

The college administrative bodies granted permission to conduct the study within the college compounds, suggested appropriate times to contact students for study recruitment, and designated areas to conduct study screening and enrollment procedures. Study staff approached potential participants, described the study and offered enrollment during the same day. At screening and enrollment, demographic and eligibility data were collected via face-to-face standardized quantitative interviews in a private area. Staff verified that each participant could read and respond to SMS and provided training on SMS survey questions and procedures, including instructions to delete the messages after responding as a privacy measure. Participants selected a four-digit numeric password and a preferred time to receive the survey and messages (for the intervention group) and completed a practice survey on their phone.

Participants at colleges assigned to the intervention arm received weekly messages on HIV and reproductive health related topics that were developed following interactive discussions with area college students during formative community entry activities. Six categories of topics (with 63 total messages) were developed: pregnancy, contraceptives, sexually transmitted infections, condoms, anal and oral sex, and HIV risk (Table 1). Messages were not static and evolved throughout the study to avoid repetition and maintain participant interest. All messages ended with the statement "Get tested for HIV." Recipients had the option to send a return SMS requesting additional messages on the same topic or access a menu enabling exploration of the other topics. Each woman could request up to 3 additional messages per week.

All participants received monthly SMS surveys to collect data on HIV testing and sexual behavior. SMS surveys were automated to begin the day after enrollment and continue once a month for 5 consecutive months. The survey comprised of nine questions, including password verification, HIV testing, number of new and recurrent sex partners, sexual frequency and condom use, pregnancy and pregnancy intent, and perceived risk of HIV during the past one month. Survey questions were re-sent if responses were not one of the designated codes. Participants were not charged for their survey responses and on completion of the survey, they were compensated with 50 KSH (~0.50 USD).

SMS survey platform

An automated SMS system was developed for delivery, receipt and recording of SMS surveys and weekly messages (mSurvey Inc., Nairobi, Kenya) and the database was hosted on cloud-based technology. SMS messages were sent out directly through the mobile provider's network. Study staff accessed the SMS survey operational metrics online in real time to view participants' responses, track survey completion, and weekly message responses.

Statistical analysis

The study sample size of 600 was designed to have 80% power to detect a 20% increase in reported HIV testing between the participants in the two study groups. Descriptive statistics were used to summarize participant characteristics and survey responses. Chi square statistics were used to describe differences in sexual behavior between study arms. Our primary analytic method was an intent-to-treat analysis using Cox proportional hazards regression to compare the time elapsed from enrollment to the first reported HIV test between participants in the two study

arms. Cumulative probability curves with a log rank test were used to describe the proportion of women testing by arm. Because of our quasi-experimental design that did not individually randomize women, we also conducted a multivariate analysis with adjustment for covariates determined *a priori* - age, number of sex partners and condom use with all sex acts - due to their known associations with HIV testing behaviors. Additional demographic and medical characteristics were considered as potential confounders and included in final models if they substantially changed the hazard ratio (by ≥10%). In separate statistical models, generalized estimating equations were used to determine associations between HIV testing and sexual behaviour on a per visit basis and whether women who were consistently sexually active reported more instances of testing. Data were analyzed using STATA version 13.1 (College Station, TX, USA).

Regulatory

The Kenyatta National Hospital Ethics Review Committee approved the study protocol and all participants provided written informed consent.

RESULTS

Participant characteristics

A total of 1044 women were screened for the study: 600 were enrolled into the study, 424 were ineligible due to having tested for HIV within the previous 12 months and 10 were eligible but did not enroll (Figure 1). Half (300) were from the colleges allocated to control arm and 300 were from colleges allocated to intervention arm. The median age of participants was 21 years

(interquartile range [IQR] 20-22, Table 2) with similar age distribution between the two groups. Most women were unmarried (93%), had engaged in vaginal and/or anal sex at least once in their lifetime (64% in control arm and 79% in intervention arm), had never tested for HIV (72%) and approximately half were in their first year of college (56%). The majority of the participants had been sexually active in the past month (62.7% in intervention arm and 57.7% in control arm) and nearly half of these women reported having new sexual partners (40.0% in intervention arm and 45.4% in control arm) and using condoms for all sexual encounters in the previous month (Table 2).

Monthly survey and weekly message response rates

Of 3600 monthly surveys sent out over 6 months, 3272 received a response (90.8%) and 3136 (87.2%) were fully completed. 434 (72.3%) participants completed all the survey questions sent to them while 5 (0.008%) participants did not respond to any questions throughout the study period. Of the 166 participants without complete survey data, 114 (48.9%) completed 3 or more surveys while 17 (0.1%) partially responded to at least one question from 3 or more surveys (Figure 2). There was no substantial difference in survey response rates between the two arms.

Of 7200 weekly surveys sent out to intervention arm participants, 7078 (98.3%) were delivered to the participants' phones. Of these, 63.1% of participants re-engaged once for more information, 59.1% re-engaged twice and 55.5% re-engaged three times.

HIV testing

A total of 356 women reported testing at least once for HIV in the 6 months of study follow up: 201 (67%) in the intervention arm and 155 (51%) in the control arm (log rank $p<0.0001$) indicating a 57% increase in reported HIV testing by the intervention arm compared to the

control arm (95% CI: 28-92%) (Table 3). Adjusting for age, condom use and number of sex partners did not substantially change the point estimate (adjusted HR 1.54, 95% CI: 1.25-1.90). The median time to first HIV test was 12 weeks for women in the intervention arm and 20 weeks for women in the control arm (Figure 3).

Overall, there were 883 monthly SMS surveys in which participants reported HIV testing during the past month, 543 reports by intervention arm participants and 342 reports by control arm participants. Of the 356 participants who reported testing for HIV at least once during study follow up, 106 (17.7%) women reported testing only once during study follow up, 102 (17%) tested twice and 148 (24.7%) tested three or more times.

Sexual behaviour and HIV testing

Among 3228 answered survey questions about sexual behavior, sexual partners were reported 2043 times (63%). Women reporting a current sex partner were 1.42 times as likely to report testing for HIV during the previous month (95% CI: 1.15-1.76, p=0.001) compared to those without a partner. However, there was no association between HIV testing at each visit and having a new sex partner, condom use or HIV risk perception (Table 4).

DISCUSSION

In this quasi-experimental study, women receiving weekly text messages tested for HIV in significantly higher numbers than women who did not receive weekly messages. Approximately half of the participants receiving intervention messages tested within 12 weeks of

the intervention, a rate that almost twice as fast as those participants not receiving intervention messages.

HIV testing and counseling is the gateway to HIV prevention and care yet there remains a wide HIV testing gap, especially for young women. In this study, 71.5% of participants had ever had sex in their lifetime, a rate that was higher than the country average of 66.1%[4]. Of all sexually experienced women in this study, 30.6% had never tested for HIV at study enrollment. HIV testing remains critical for the identification of new infections, linkage to HIV care and as a widely accepted prevention intervention. HIV testing and counseling is a free service in Kenya and is widely available and yet many young women engage in condomless sex without testing and with limited perception of risk of HIV, pregnancy and other consequences. Kenyan women predominantly report having their first HIV test at antenatal care clinics and more than half of all HIV infected women learning their status during pregnancy[4]. Interventions targeting young women at the onset of sexual activity have reduced numbers of sex partnerships, improved condom use, and increased HIV testing[14] . In our study, women who reported a sex partner were more likely to test for HIV, further highlighting the need for HIV prevention and testing interventions early in young women's sexual and reproductive life when they are often most vulnerable.

Our intervention demonstrated a high degree of feasibility for programs to send SMS messages and conduct health behavior surveys via SMS. The Kenyan school curriculum includes HIV/AIDS education with teachers being the primary means to disseminate information for the students. A recent review of the implementation of the HIV/AIDS education policy revealed various shortcomings, including an absence of a plan to implement the behaviour change component to prevent HIV acquisition among young people[15]. This SMS study utilized a

suite of tailored messages to provide targeted information to college women and encourage them to test for HIV. A personalized SMS school-based education intervention program is a feasible option to increase awareness of HIV risk, improve HIV testing and reduce risky behaviour among young women, prior to sexual debut or early in their sexual lives. In this study, one quarter of women reported testing for HIV three or more times, more frequent than the recommended national guidelines. Thus, routine SMS messages may also have a role to play in increasing repeat HIV testing with future studies potentially requiring follow up for less than six months for optimal testing frequency among young women

In our dataset, we were unable to account for underlying differences in the student body at each college or the frequency of additional testing interventions at the colleges. However, adjusting for baseline characteristics in analyses did not alter the results. Data were not collected about other ongoing testing interventions, such as mobile testing campaigns, within the colleges where the study was conducted but all four colleges were government-affiliated institutions with similar curricula and practices and thus, the content and timing of any testing interventions were likely to be similar. There were several instances of server outages and variations in mobile network availability causing delays in message delivery to recipients. These were transient and relatively few, however, with negligible impact on the study. Finally, there may be some inaccuracy in participant's reports about their testing and sexual behavior although the use of SMS provides an anonymous means of self-expression and dialogue and is expected to minimize social desirability bias[16].

Strategies targeting young women for HIV prevention and reproductive and sexual health messaging, especially those that reach women prior to their first pregnancy, are imperative. SMS are a low cost health intervention that can be leveraged to increase the frequency of HIV

testing among a geographically diverse population. The SMS strategy that delivers messages to young women attending college without disrupting their normal routines has the potential to spark conversation between women within their social networks and could potentially have an effect beyond the individual[17]. Kenya has a high rate of mobile phone use and SMS is near ubiquitous among young people. The use of SMS messaging strategies in Kenya to increase HIV testing is scalable and the current network capabilities offer a large opportunity to reach intended targets.

Table 1: Examples of weekly HIV sensitization messages

Topic	Example
Contraceptives	Abstinence is the only 100% effective way to prevent pregnancy. The 2nd best way is to use contraceptives.
	Contraceptives are safe for use by young women. However, only condoms can reduce your risk of acquiring HIV.
	Emergency contraceptive pills are for emergency use only. They do not protect against HIV and other STIs.
Sexually Transmitted Infections (STIs)	Did you know that not all STIs (eg HIV) have symptoms? Use a condom to prevent acquisition of STIs.
	It's possible to have a sexually transmitted infection e.g. HIV and not have any symptoms.
	You are at higher risk of getting HIV if you're infected with a Sexually Transmitted Infection (STI).
Condoms	You risk getting HIV if you have sex without a condom even if your partner removes his penis before ejaculation.
	Did you know that you can get HIV infected the first time you have sex without a condom if your partner is infected?
	There is some fluid released from the penis before ejaculation which contains HIV if the man is infected.
Pregnancy	Protect yourself against HIV and unwanted pregnancy by using condoms correctly and consistently during sex.
	Did you know that you are at increased risk of getting HIV when you are pregnant?
	You can transmit some STIs to your baby if you're pregnant (eg HIV, herpes, syphilis and gonorrhea).
Anal and oral sex	Did you know that there's a higher risk of getting HIV through anal sex than vaginal sex?
	It is possible to become infected with HIV by giving or receiving oral sex. Use a condom during oral sex.
	Use condoms during anal/vaginal sex if your partner's HIV infected or of unknown status or you may get HIV.
Your risk of getting HIV	Did you know that women have a higher risk of acquiring HIV from men?
	Young women 15-24 years old are four times at higher risk of being HIV infected than young men the same age.
	Excessive alcohol use may cause you to have risky sexual behaviour thus increase your risk of getting HIV.

Table 2: Baseline characteristics of study participants collected by interview and SMS survey

Baseline characteristics collected by interview	**Control arm (N=300)**	**Intervention arm (N=300)**
Age overall (median, IQR)	21 (20-22)	20 (19-22)
18-20 years old (n, %)	131 (46.0)	154 (54.0)
21-24 years old (n, %)	169 (53.6)	146 (46.4)
Married or cohabiting (n, %)	12 (6.1)	15 (6.3)
Year of college (median, IQR)	1 (1-2)	1 (1-2)
Average monthly income in USD (median, IQR)	16.4 (10.9-32.8)	10.9 (5.5-30.6)
Drinks alcohol (n, %)	40 (13.4)	45 (15)
1-3 drinks per week (n, %)	26 (65)	25 (56)
≥4 drinks per week (n, %)	14 (35)	20 (44)
Ever tested for HIV (n, %)	81 (27.1)	83 (27.7)
Ever sexually active (n, %)	192 (64)	237 (79)
Age at sexual debut (median, IQR)	19 (17-20)	19 (18-20)
No of lifetime partners (median, IQR)	1 (1-2)	1 (1-2)
No of partners last 12 months (median, IQR)	1 (1-2)	1 (1-2)
Baseline characteristics collected by SMS survey		
Tested for HIV previous month (n, %)	17/300 (5.7)	24/272 (8.8)
Gotten pregnant previous month (n, %)	11/293 (3.8)	14/266 (5.3)
Pregnancy unintentional (n, %)	9/11 (81.8)	12/14 (85.7)
HIV risk perception (n, %)		
No or low risk	239/292 (81.9)	204/262 (77.9)
Medium or high risk	53/292 (18.1)	58/262 (22.1)
Sexually active previous month (n, %)[†]	172/298 (57.7)	168/268 (62.7)
Among sexually active, frequency of new sex partners in previous month (n, %)	78/172 (45.4)	68/170 (40.0)
Among sexually active, number of sex partners in previous month (median, IQR)	1 (0-1)	1 (0-1)
Among sexually active, frequency of using a condom always in previous month (n, %)	81/172 (47.4)	99/168 (58.9)

[†]Missing data not shown.

Table 3: Comparison of HIV testing incidence by study arm and other demographic and behavioral factors

	N testing at least once	Person years contributed	Incidence of HIV testing*	HR (95% CI)	p-value	Adjusted† HR (95% CI)	p-value
Study arm							
Intervention	201	64.66	310.84	1.57 (1.28, 1.92)	<0.0001	1.54 (1.25, 1.90)	**<0.0001**
Control	155	78.75	196.83	1.00		1.00	
Age							
18-20 years	172	66.05	260.40	0.92 (0.75-1.13)	0.434		
>=21 years	184	77.35	237.85	1			
Married/cohabiting							
Yes	15	6.95	215.95	0.82 (0.49-1.38	0.46		
No	246	98.16	250.61	1			
Ever tested for HIV							
Yes	255	39.54	252.92	1.01 (0.81-1.26)	0.926		
No	100	103.87	245.49	1			
Presence of sex partnerships and condom use							
No sex partner	106	51.82	204.54	1			
Had sex partner(s) and inconsistent condom use	92	36.82	249.87	1.21 (0.92-1.58)	0.174		
Had sex partner(s) with consistent condom use	142	47.87	296.64	**1.47 (1.15-1.88)**	**0.002**		
Ever had sex							
Yes	256	103.62	247.05	0.99 (0.79-1.25)	0.949		
No	100	39.79	251.34	1			

Alcohol use							
Yes	62	25.07	247.27	0.99 (0.78-1.30)	0.999		
No	293	118.18	247.92	1			
Income							
≤15 USD per month	175	74.87	233.73	1.14 (0.93-1.39)	0.215		
>15 USD per month	181	68.53	264.09	1			
*per 100 person years †adjusted for, age, presence of sex partnerships and condom use							

Table 4: Association of HIV testing with longitudinal sexual behavior and HIV risk perception

	N (%) of visits with HIV test	OR	95% CI	p-value	Adjusted OR (95%CI)†	p-value
Sex partner(s) during study Yes No	 244 (11.97) 109 (9.2)	1.42	1.15-1.76	0.001	1.37 (1.11-1.69)	0.003
New sex partner(s) during study (N=441) Yes No	 113 (11.69) 126 (11.79)	1.05	0.84-1.33	0.659	1.04 (0.83-1.31)	0.716
Condom use during study (N=436) Yes No	 142 (12.08) 92 (11.12)	1.25	0.98 -1.59	0.074	1.21 (0.96-1.54)	0.113
HIV risk perception during study (N=584) High or medium risk Low or no risk	 73 (12.25) 264 (10.39)	1.17	0.92-1.48	0.192	1.10 (0.87-1.39)	0.439
† Adjusted for age, arm, study month						

Flow Diagram

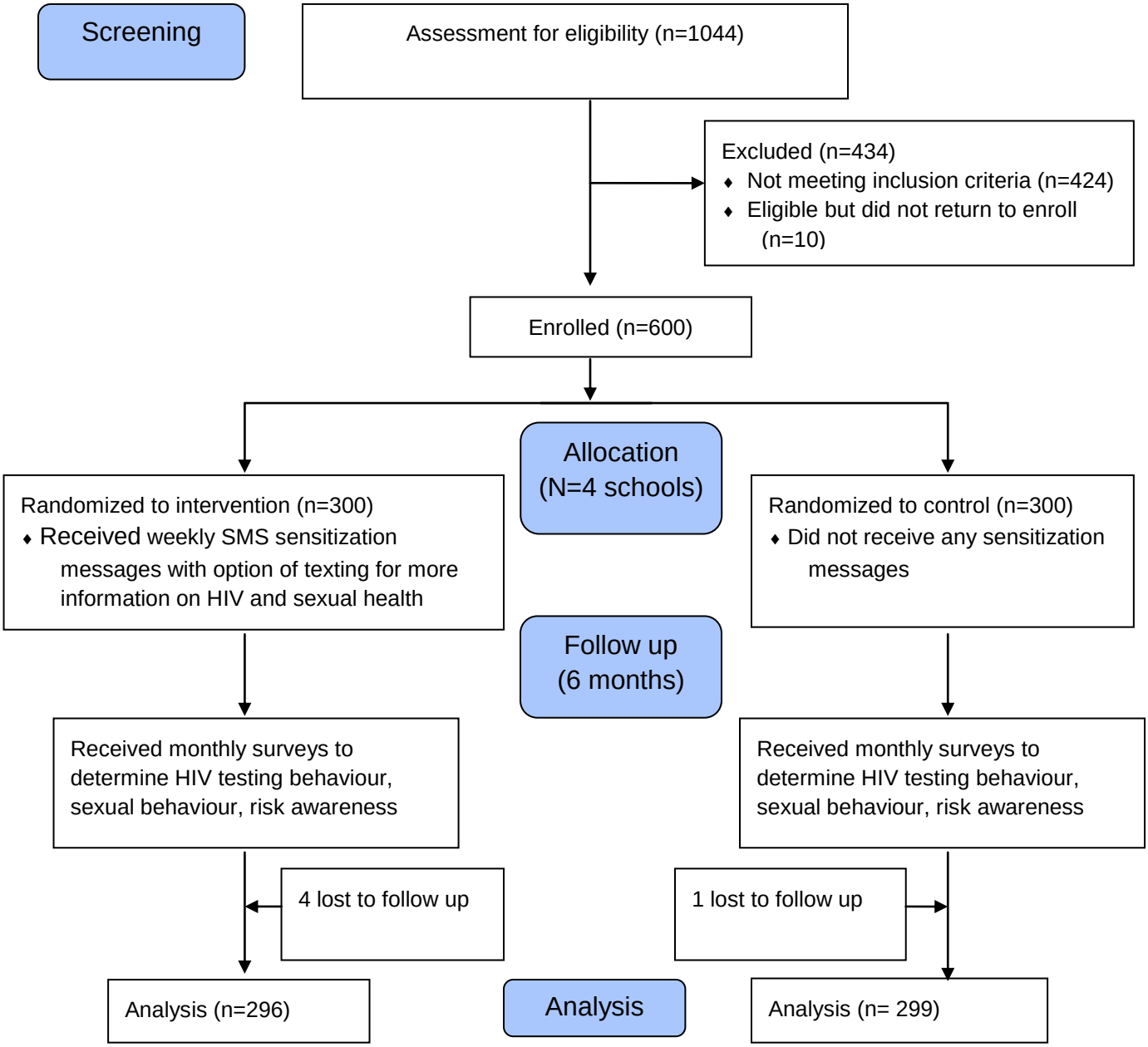

Figure 1: Consort diagram of study design

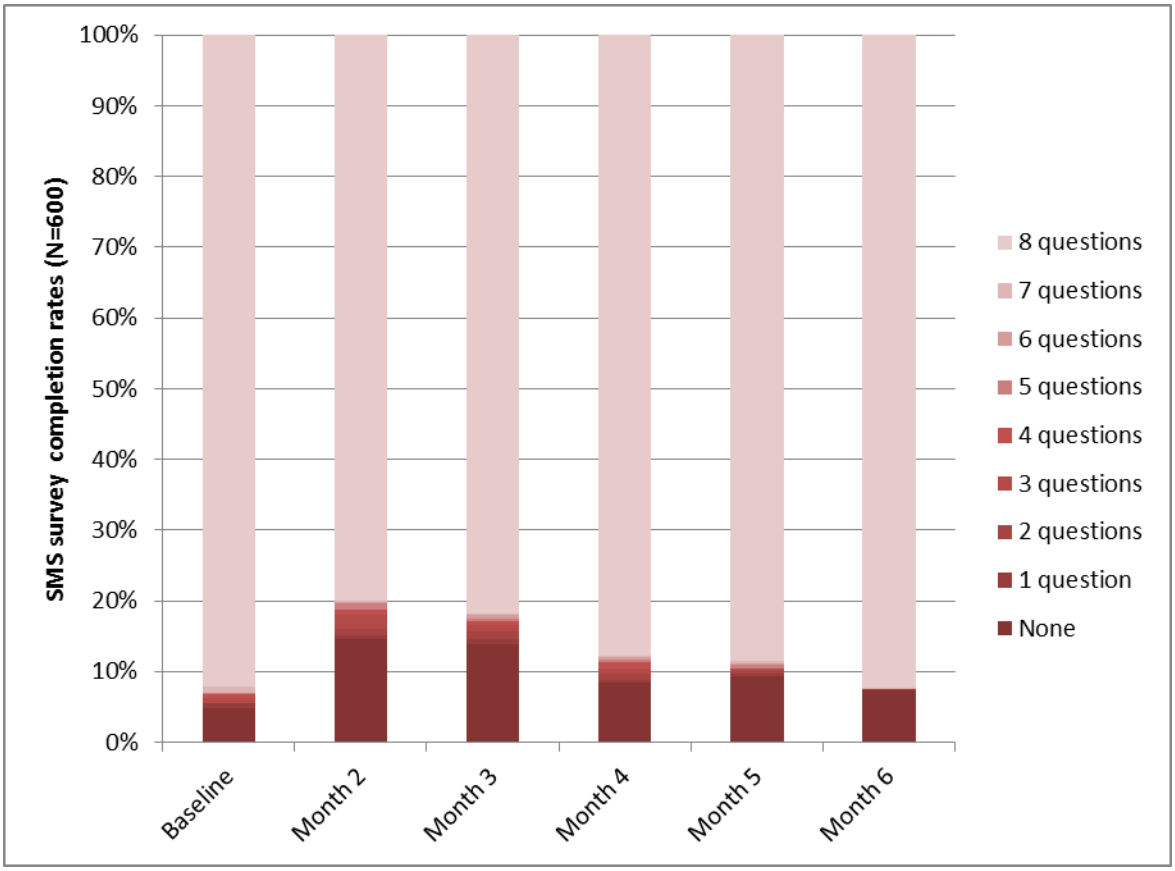

Figure 2: SMS survey completion rates by study month

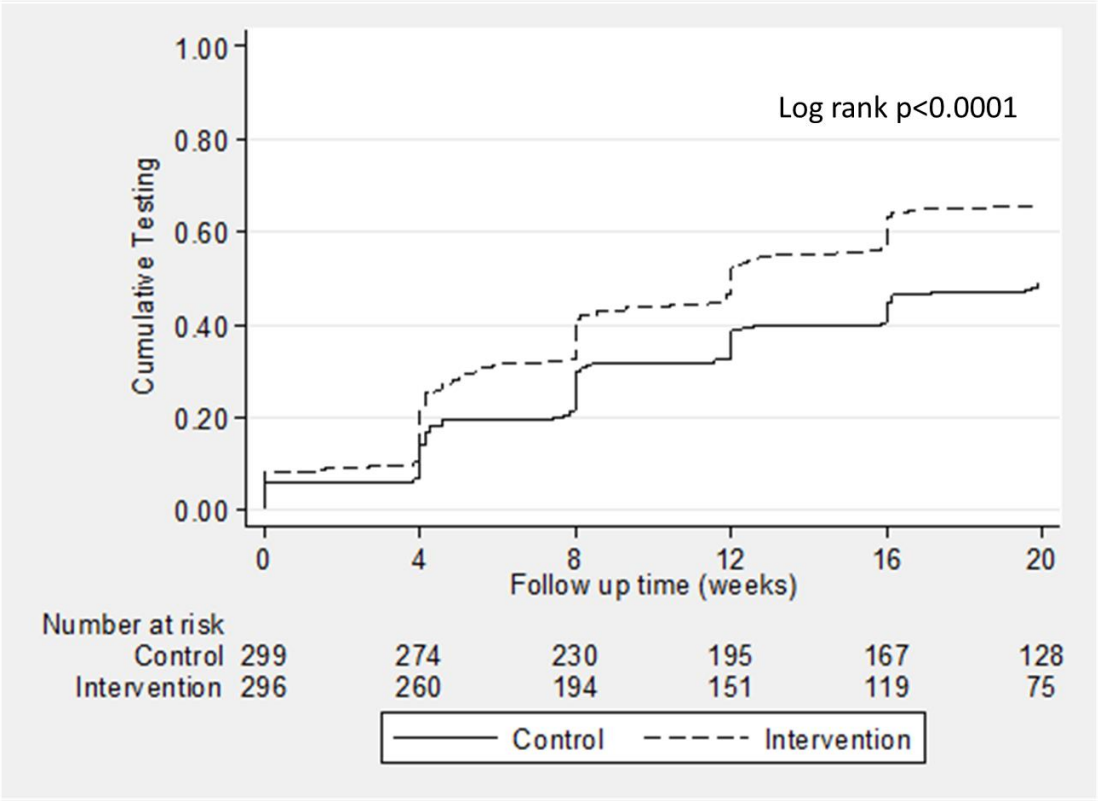

Figure 3: Cumulative probability curve of HIV testing by study arm

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