



Original article

Time to change the paradigm: limited condom and lubricant use among Nigerian men who have sex with men and transgender women despite availability and counseling



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ABSTRACT

Purpose: This study characterized availability and uptake of condoms and condom-compatible lubricants (CCLs) at community-engaged condom education and distribution programs serving cisgender men who have sex with men and transgender women in Abuja and Lagos, Nigeria.

Methods: Condoms and water-based CCLs were freely available to participants in the TRUST/RV368 cohort. Factors associated with their consistent use were assessed using Poisson regression with robust error variance to estimate relative risks (RRs) and 95% confidence intervals (CIs).

Results: From March 2013–November 2017, 2090 cisgender men who have sex with men and transgender women enrolled with HIV prevalence 40.4% and incidence 12.8 cases per 100 person-years. Fifteen months after enrollment, the proportion who reported consistent condom and CCL use increased during receptive anal sex (21.7%–67.1%, $P < .001$) and insertive anal sex (25.4%–67.8%, $P < .001$). Multivariable analyses demonstrated independent impact of 15 months in care on uptake during both receptive (RR 2.62 [95% CI 2.29–3.00]) and insertive (RR 2.27 [95% CI 2.01–2.57]) sex.

Conclusions: Engagement in care improved condom and CCL uptake over time but inconsistent use remained common. Novel approaches to further increase uptake must be pursued alongside complementary strategies, such as sustained access to antiretroviral therapy for those living with HIV and provision of pre and postexposure prophylaxis for those at risk.

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Introduction

Despite global declines in HIV incidence, cisgender men who have sex with men (hereafter referred to as MSM) and transgender women (TGW) remain disproportionately affected by HIV [1,2]. One factor that increases HIV risk is the efficiency of HIV transmission via anal sex, particularly receptive anal sex with serodiscordant and viremic sexual partners [3–5]. The use of latex condoms during anal sex is therefore a mainstay of HIV prevention efforts. Condom-

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compatible lubricants (CCLs) decrease condom breakage when used with latex condoms, thereby further reducing the risk of HIV acquisition and transmission [6]. In contrast, petroleum-based lubricants can promote condom breakage and increase the risk of HIV and other sexually transmitted infections (STIs) [7–11].

Across sub-Saharan Africa, resource constraints and stigma often create barriers to engagement in health care by MSM and TGW, limiting their access to condoms and CCLs [12–16]. Before 2011, CCLs were not included in HIV prevention packages in sub-Saharan Africa supported by the President's Emergency Plan for AIDS Relief (PEPFAR) [17]. Inadequate knowledge of CCL use impedes uptake [18] and poses a challenge for Nigeria's residents, who account for an estimated 9% of all persons living with HIV and 10% of new infections worldwide [19]. The Joint United Nations Programme on HIV/AIDS estimates that, as of 2017, the HIV prevalence among all reproductive age males was 2.5%, whereas the prevalence among MSM was almost 10-fold higher at 23% [20]. Among Nigerian MSM and TGW accessing care at trusted community health centers, we have previously reported HIV prevalence of 44%–66% [21]. This disproportionate burden of disease underscores the need for HIV prevention interventions that specifically engage MSM and TGW.

For MSM and TGW, community-building activities that establish trusting relationships between patients and health care providers, feature same-sex oriented public events, and promote comfort with one's sexual identity have been shown to increase condom uptake and decrease HIV transmission [22–24]. However, even intensive interventions that successfully increase condom uptake do not uniformly decrease HIV incidence [25]. Combination approaches that include behavioral interventions, condom promotion, pre-exposure prophylaxis, and test-and-start initiatives may more effectively reduce HIV acquisition among at-risk MSM and TGW [26–28].

This study characterizes the availability and uptake of condoms and water-based lubricants among participants in a longitudinal HIV prevention and treatment study at two community-engaged clinics catering to MSM and TGW populations in Nigeria.

Methods

Study population

TRUST/RV368 is a prospective cohort study that enrolls MSM and TGW in Abuja and Lagos, Nigeria, using respondent-driven sampling (RDS) [29,30]. Several initial participants are each given three coupons to distribute to other individuals who may be eligible for the study. Each new participant is given another three coupons and recruitment continues in this manner. Each participant must be an adult cisgender man or TGW (over 16 years old in Abuja or over 18 years old in Lagos), present with a valid RDS coupon and report receptive or insertive anal sex with a male partner in the 12 months before enrollment. This recruitment method has been shown to reach highly marginalized populations of MSM and TGW [30,31].

The study is conducted at community-engaged health centers that offer comprehensive HIV treatment and prevention services catering to the specific needs of MSM and TGW in colocated clinical care facilities. These pre-existing facilities were developed by local nongovernmental organizations with support from PEPFAR to engage key populations in HIV prevention and treatment according to the local standard of care, which includes syndromic management of STIs and HIV screening up to four times annually. Through TRUST/RV368, key opinion leaders are engaged to actively encourage participants to present for scheduled visits that include universal STI and HIV screening every 3 months for up to

18 months. Screening is accompanied by pretest and post-test counseling by study staff who are trained in MSM and TGW health care needs and provide individualized counseling tailored to participants' baseline knowledge, sexual practices, and other factors. This includes education about the benefits and proper use of condoms with lubricants. Condoms and water-based lubricants are made freely available for participants to take from waiting areas, examination rooms, nonclinical community spaces, and other areas. Reimbursements are provided for participation in study visits (N 2000–3400/USD 6–11, depending on visit) and for referrals (N 1500/USD 5). HIV testing is performed according to package inserts using a parallel algorithm of two rapid tests with Determine (Alera, Waltham, MA) and Uni-gold (Trinity Biotech, Wicklow, Ireland) kits.

Participants who enrolled before November 2017 were included in these analyses. All participants provided written informed consent before enrollment. The study protocol was approved by institutional review boards at the Nigerian Federal Capital Territory and Nigerian Ministry of Defense, Abuja, Nigeria; the University of Maryland, Baltimore, MD; and the Walter Reed Army Institute of Research, Silver Spring, MD.

Sexual behaviors, condoms, and lubricants

Sexual behaviors were assessed at every study visit by trained interviewers. The structured interview at enrollment included questions about insertive and receptive anal sex with men during the preceding 12 months. At subsequent visits, interviews captured behaviors during the 3-month interval between visits.

At the enrollment, 9-month and 15-month study visits, the interview included questions about condoms and lubricants. Participants were asked “Do you have access to condoms when you need them?” and “Do you have access to lubricants when you need them?” Answer choices included very difficult access, somewhat difficult access, neither difficult nor easy access, somewhat easy access, and very easy access. Participants who provided an answer other than very difficult access for both questions were considered to have access to both condoms and lubricants.

Participants were asked, “In the last 12 months, of the times you had receptive anal sex with a man, how often were condoms used?” and “In the last 12 months, of the times you had insertive anal sex with a man, how often were condoms used?” Answer choices included never, almost never, about half the time, almost always, and always. Participants were then asked “Do you use lubricants with condoms for anal sex with men?” If they answered in the affirmative, they were asked, “Which type of lubricant do you most often use for anal sex with men?” and provided answer choices that included petroleum jelly, body creams/fatty creams, water-based lubricant, saliva, and cooking oil.

Responses were extracted from paper forms using TeleForm (Hewlett-Packard Inc., Palo Alto, CA) and the accuracy of the capture was confirmed by a trained data verifier.

Statistical analyses

Answers to questions about access to condoms and lubricants, consistent (always or almost always) use of condoms, use of lubricants with condoms, and use of water-based lubricants with condoms were tallied separately as percentages among participants reporting receptive and insertive anal sex. Responses were evaluated as a cascade and inclusion in the tally for each step in this cascade required affirmative responses for each preceding step. Comparisons of answers at enrollment, after 9 months, and after 15 months in care were made using Pearson's χ^2 test [32]. “Complete-case” sensitivity analyses were conducted using only

participants with available data from all three visits of interest: enrollment, 9 months, and 15 months.

Factors associated with consistent use of condoms and CCLs during receptive and insertive anal sex were explored using separate Poisson regression models with robust error variance to estimate relative risks (RRs) and 95% confidence intervals (CIs) [33]. Generalized estimating equations were used to account for repeated observations of the same individual. Multivariable models estimated the independent effects of duration of study participation, age, gender identity, sexual orientation, HIV status, education level, occupation, marital status, internet use, and clinical care site. For all analyses, a two-sided type I error of 5% was considered statistically significant. Analyses were performed using Stata 14.2 (StataCorp LP, College Station, TX).

Results

Study population

From March 2013–November 2017, 2090 MSM and TGW enrolled in the TRUST/RV368 cohort (Table 1). Receptive anal sex in the 12 months before enrollment was reported by 1530 (73.2%) participants, and insertive anal sex was reported by 1592 (76.2%) participants. After 9 months, 636 participants were retained in care, including 386 (60.7%) who reported receptive and 365 (57.4%) who reported insertive anal sex. After 15 months, 513 remained in care, including 316 (61.6%) who reported receptive and 289 (56.3%) who reported insertive anal sex.

A total of 492 participants had data available from all three visits of interest (enrollment, 9 months, and 15 months) and were included in “complete-case” sensitivity analyses. As compared to participants excluded from the sensitivity analyses, those included were demographically distinct in a number of ways including increased likelihood of being older, gay/homosexual, HIV-infected, highly educated, and located in Lagos (Supplementary Table 1).

During follow-up, 67 HIV seroconversions were observed with incidence 12.8 (95%CI 9.7–15.8) cases per 100 person-years.

Access and use of condoms and condom-compatible lubricants

Of the 1530 participants who reported receptive anal sex at enrollment, 962 (62.9%) reported access to both condoms and lubricants, including 469 (30.7%) who reported use of condoms always or almost always during receptive anal sex with men, 447 (29.2%) who reported lubricant use with condoms, and 332 (21.7%) who reported use of water-based CCLs. After 9 months of participation in the study, the proportion of participants reporting each step in the cascade increased significantly and remained higher at 15 months as compared to enrollment (Fig. 1A). Consistent use of condoms with water-based CCLs during receptive anal sex was reported by 238 of 386 (61.7%) participants after 9 months and 212 of 316 (67.1%) after 15 months in the study.

Of the 1592 participants who reported insertive anal sex in the 12 months before enrollment, 1013 (63.6%) reported access to both condoms and lubricants, including 578 (36.3%) who reported use of condoms always or almost always during insertive anal sex with men, 545 (34.2%) who reported lubricant use with condoms, and 404 (25.4%) who reported use of water-based CCLs. The proportion of participants reporting each step in the cascade increased over time (Fig. 1B). Consistent use of condoms with water-based CCLs during insertive anal sex was reported by 205 of 365 (56.2%) participants after 9 months and 196 of 289 (67.8%) after 15 months in the study.

In the complete-case sensitivity analyses, consistent use of condoms with water-based CCLs during receptive anal sex increased from 27.3% at enrollment to 66.6% after 15 months in the

Table 1
Characteristics of Nigerian men who have sex with men and transgender women

Characteristics	Overall (n = 2090)	Abuja (n = 1418)	Lagos (n = 672)	P-value
Age				
Median (IQR)	23 (20–27)	24 (21–28)	22 (20–25)	<.001
≤21 y	695 (33.3)	418 (29.5)	277 (41.2)	<.001
22–30 y	1179 (56.4)	826 (58.3)	353 (52.5)	—
>30 y	216 (10.3)	174 (12.3)	42 (6.3)	—
Gender identity				
Man	1671 (80.0)	1156 (81.5)	515 (76.6)	.001
Woman	234 (11.2)	134 (9.4)	100 (14.9)	—
Other/Unknown	185 (8.9)	128 (9.0)	57 (8.5)	—
Sexual orientation				
Gay/Homosexual	704 (33.7)	422 (29.8)	282 (42.0)	<.001
Bisexual	1372 (65.6)	985 (69.5)	387 (57.6)	—
Other/Unknown	14 (0.7)	11 (0.8)	3 (0.4)	—
HIV status*				
Uninfected	855 (40.9)	603 (42.5)	252 (37.5)	<.001
Infected	844 (40.4)	485 (34.2)	359 (53.4)	—
Unknown	391 (18.7)	330 (23.3)	61 (9.1)	—
Education level				
Junior secondary or less	306 (14.6)	284 (20.0)	22 (3.3)	<.001
Senior secondary	1092 (52.2)	632 (44.6)	460 (68.5)	—
Higher than senior secondary	684 (32.7)	494 (34.8)	190 (28.3)	—
Unknown	8 (0.4)	8 (0.6)	0 (0)	—
Occupation				
Unemployed	342 (16.4)	195 (13.8)	147 (21.9)	<.001
Student	400 (19.1)	212 (15.0)	188 (28.0)	—
Professional/Self-Employed	403 (19.3)	315 (22.2)	88 (13.1)	—
Entertainment/Hospitality	215 (10.3)	135 (9.5)	80 (11.9)	—
Driver/Laborer	43 (2.1)	24 (1.7)	19 (2.8)	—
Other/Unknown	687 (32.9)	537 (37.9)	150 (22.3)	—
Marital status				
Single/Never married	1853 (88.7)	1238 (87.3)	615 (91.5)	<.001
Married/Living with a woman	141 (6.7)	129 (9.1)	12 (1.8)	—
Living with a man	29 (1.4)	3 (0.2)	26 (3.9)	—
Divorced/Widowed/Separated/Other	67 (3.2)	48 (3.4)	19 (2.8)	—
Internet use				
Never	482 (23.1)	467 (32.9)	15 (2.2)	<.001
Less than daily	406 (19.4)	261 (18.4)	145 (21.6)	—
Almost every day	1183 (56.6)	673 (47.5)	510 (75.9)	—
Unknown	19 (0.9)	17 (1.2)	2 (0.3)	—

All data are presented as n (%) unless otherwise specified. P-values were calculated using Student's *t* test for age as a continuous variable and Pearson's χ^2 test for all other variables. Statistically significant P-values (<.05) are in bold.

IQR = interquartile range.

* HIV status at enrollment was determined by a parallel algorithm of rapid tests performed as part of baseline assessments spread over two study visits; participants with unknown HIV status did not undergo this testing for reasons such as failure to present for the second scheduled set of evaluations. Negative results from follow-up testing were carried backward.

study (Fig. 2A). Consistent use of condoms with water-based CCLs during insertive anal sex increased similarly from 34.5% to 67.5% (Fig. 2B).

Types of lubricants

Among 1083 participants who reported receptive anal sex without consistent use of condoms at enrollment, 786 (72.6%) reported lubricant use; of these 457 (58.1%) used water-based lubricants, 164 (20.9%) petroleum jelly, and 104 (13.2%) body creams. Among 1047 participants who reported insertive anal sex without consistent use of condoms at enrollment, 720 (68.8%) reported

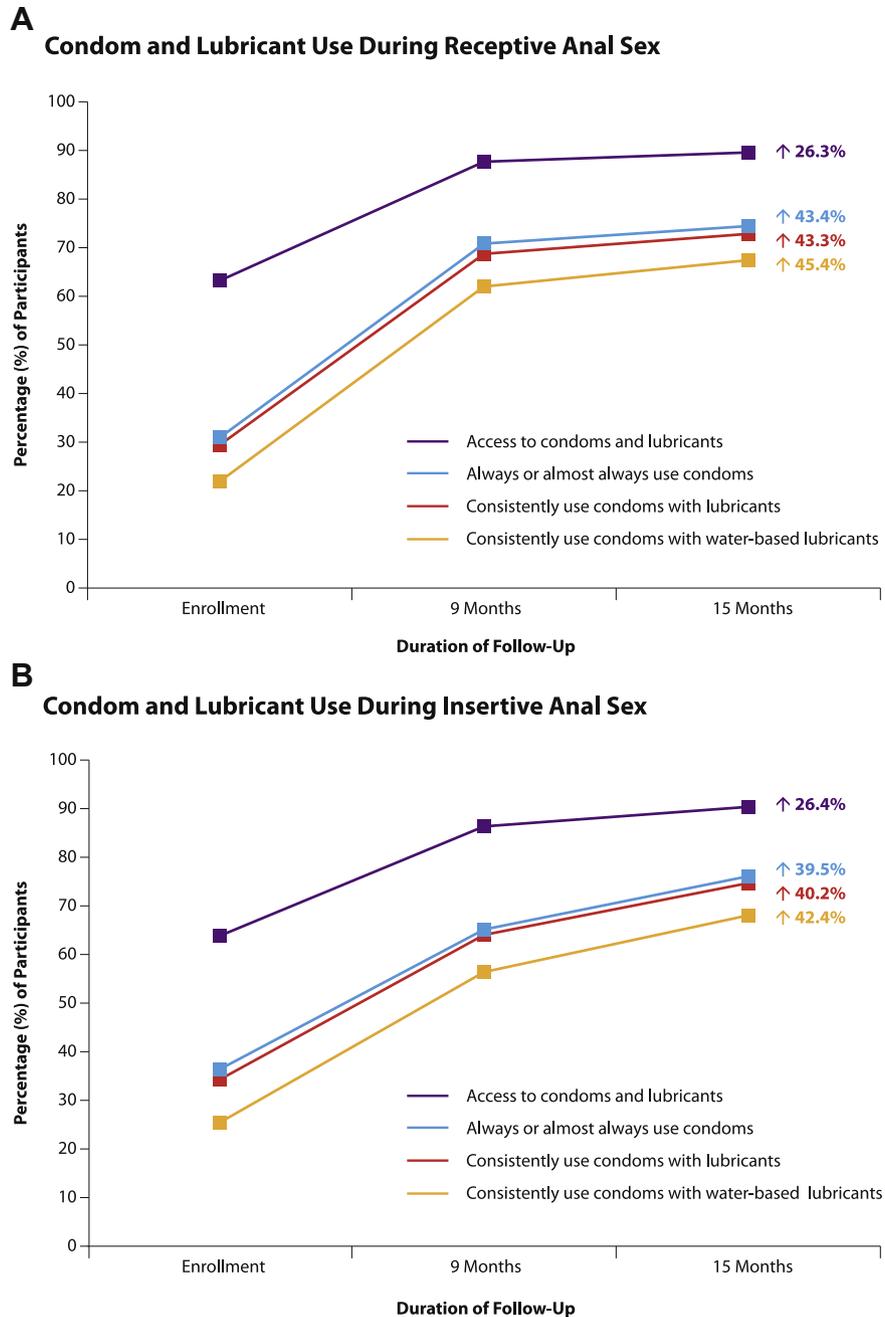


Fig. 1. Access and use of condoms and lubricants. The percentage of participants who reported access to condoms and lubricants, “always” or “almost always” use of condoms, use of lubricants with condoms, and use of water-based lubricants with condoms is shown for the enrollment, 9-mo, and 15-mo study visits. Panel A includes participants who reported receptive anal sex and Panel B includes participants who reported insertive anal sex. Inclusion in each percentage tallied required an affirmative response for all preceding questions. Pearson’s χ^2 test was used to compare the frequency of responses at the enrollment visit and each subsequent visit. All comparisons to the enrollment visit revealed statistically significant differences at 9 mo and 15 mo ($P < .001$ for all comparisons).

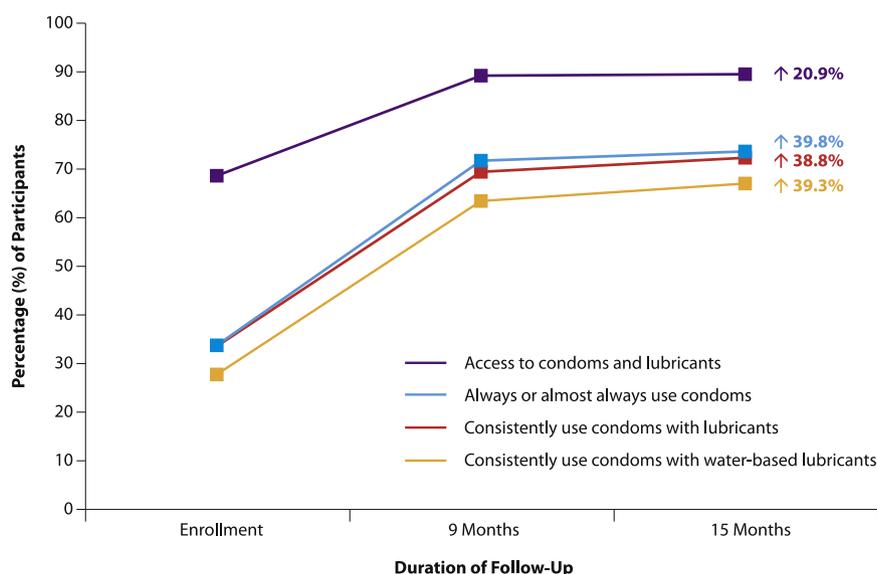
lubricant use; of these 419 (58.2%) used water-based lubricants, 146 (20.3%) petroleum jelly, and 87 (12.1%) body creams.

Of the 447 participants who reported routine use of condoms and lubricants during receptive anal sex at enrollment, 115 (25.7%) reported use of non-water-based lubricants, with petroleum jelly being the most common alternative lubricant (Table 2). After 15 months, the proportion of participants reporting use of non-water-based lubricants decreased to 17 of the 229 (7.4%) participants who reported routine lubricant use during receptive anal sex ($P < .001$). In the complete-case sensitivity analysis, the percentage reporting use of water-based lubricants during receptive anal sex with

condoms increased from 82.4% at enrollment to 92.6% at 15 months ($P = .006$, Supplementary Table 2).

Of the 545 participants who reported routine use of condoms and lubricants during insertive anal sex at enrollment, 141 (25.9%) reported use of non-water-based lubricants, with petroleum jelly again being the most common alternative lubricant (Table 3). After 15 months, the proportion of participants reporting use of condoms and non-water-based lubricants decreased to 19 of the 215 (8.8%) participants who reported routine lubricant use during insertive anal sex ($P < .001$). In the complete-case sensitivity analysis, the percentage reporting use of water-based lubricants during insertive

A Condom and Lubricant Use During Receptive Anal Sex



B Condom and Lubricant Use During Insertive Anal Sex

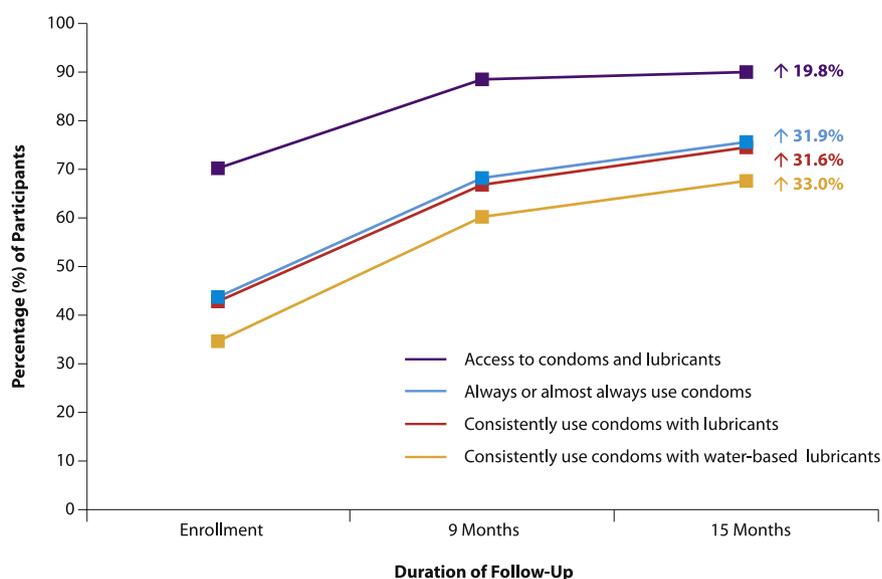


Fig. 2. Access and use of condoms and lubricants (complete-case sensitivity analysis). In this complete-case sensitivity analysis, the population was limited to participants with data available from all three study visits of interest: enrollment, 9 months and 15 months. The percentage of participants who reported access to condoms and lubricants, “always” or “almost always” use of condoms, use of lubricants with condoms, and use of water-based lubricants with condoms is shown for the enrollment, 9-month, and 15-month study visits. Panel A includes participants who reported receptive anal sex, and Panel B includes participants who reported insertive anal sex. Inclusion in each percentage tallied required an affirmative response for all preceding questions. Pearson’s χ^2 test was used to compare the frequency of responses at the enrollment visit and each subsequent visit. During receptive anal sex, all comparisons to the enrollment visit revealed statistically significant differences at 9 months and 15 months ($P < .001$ for all comparisons). During insertive anal sex, comparisons to the enrollment visit revealed statistically significant differences for all variables at 15 months ($P < .001$ for all comparisons), but at 9 months, the only statistically significant differences were observed with access to condoms and lubricants ($P < .001$) and consistent use of condoms with water-based lubricants ($P < .001$).

anal sex with condoms increased from 80.8% at enrollment to 90.8% at 15 months ($P = .006$, [Supplementary Table 3](#)).

Factors associated with consistent use of condoms and condom-compatible lubricants

After controlling for other factors, increased duration of study participation was associated with an increased likelihood of

consistent condom and CCL use during both receptive and insertive anal sex among participants reporting each sexual behavior ([Table 4](#)). HIV-infected participants, participants with higher education levels, and participants who used the internet almost daily also demonstrated an increased likelihood of condom and CCL use. In complete-case sensitivity analyses restricted to participants with data from all three visits of interest, participants remained more likely to report consistent condom and CCL use after 15 months of

Table 2
Types of lubricants used during receptive anal sex by participants who also reported consistent use of condoms

Lubricant type	Enrollment <i>n</i> = 447 (%)	9 mo <i>n</i> = 264 (%)	15 mo <i>n</i> = 229 (%)
Water based	332 (74.3)	238 (90.1)	212 (92.6)
Petroleum jelly	58 (13.0)	10 (3.8)	9 (3.9)
Body creams	29 (6.5)	9 (3.4)	4 (1.7)
Oil based	3 (0.7)	3 (1.1)	2 (0.9)
Saliva	2 (0.4)	0 (0)	0 (0)
Other/Unknown	23 (5.1)	4 (1.5)	2 (0.9)

Among participants reporting consistent use of condoms and lubricants during receptive anal sex, the type of lubricant used was tallied at enrollment and after 9 and 15 mo of study participation.

study participation, as compared to enrollment, during both receptive (RR 2.43 [95%CI 2.03–2.92]) and insertive (RR 1.97 [95%CI 1.67–2.32]) anal sex after controlling for potentially confounding factors (Supplementary Table 4).

Discussion

Engagement in care at trusted community health centers improved key steps in the uptake of condoms and water-based lubricants over time by cisgender MSM and transgender women, including increased use of condoms during both receptive and insertive anal sex. Lubricant use was reported by the majority of participants, including many participants who used lubricants without consistent use of condoms. Uptake of lubricants may pose a lesser challenge than uptake of condoms. However, only about two-thirds of participants reported consistent use of both condoms and CCLs after 15 months. There may be continued room for improvement in the promotion of these important interventions to prevent HIV and STI acquisition; however, incomplete uptake despite a cost-free, community-engaged condom education, and distribution program also suggests that alternative risk reduction strategies are needed for some individuals.

Prior studies have shown that various behavioral interventions can be employed to successfully increase condom use, including integration of HIV services with routine care, provision of group-based and one-on-one risk reduction education and counseling, and distribution of condoms [34–36]. Although many studies of these behavioral interventions have been conducted in sub-Saharan Africa, few have focused on MSM or TGW [18]. The TRUST/RV368 study incorporates each of the aforementioned strategies and demonstrates a significant reduction in condomless anal sex among Nigerian MSM and TGW. This provides proof of the feasibility and effectiveness of the trusted community health center as a model for providing these important risk reduction interventions despite barriers such as stigmatization and criminalization of same sex practices.

Table 3
Types of lubricants used during insertive anal sex by participants who also reported consistent use of condoms

Lubricant type	Enrollment <i>n</i> = 545 (%)	9 mo <i>n</i> = 233 (%)	15 mo <i>n</i> = 215 (%)
Water based	404 (74.1)	205 (88.0)	196 (91.2)
Petroleum jelly	62 (11.4)	14 (6.0)	9 (4.2)
Body creams	49 (9.0)	9 (3.9)	5 (2.3)
Oil based	5 (0.9)	2 (0.8)	0 (0)
Saliva	3 (0.6)	0 (0)	1 (0.5)
Other/Unknown	22 (4.0)	3 (1.3)	4 (1.9)

Among participants reporting consistent use of condoms and lubricants during insertive anal sex, the type of lubricant used was tallied at enrollment and after 9 and 15 mo of study participation.

Discomfort and pain with condom use during anal sex are barriers to condom uptake that can be ameliorated by the use of CCLs [37–39]. However, accessibility of CCLs and knowledge of their use remain challenges to uptake. A prior cross-sectional survey of Nigerian MSM showed that the use of non-condom-compatible and improvised lubricants was common, with only 36% of participants reporting use of water-based lubricants with male partners, compared to 33% who used body creams and 17% who used petroleum jelly [40]. Other studies among MSM across Africa have documented the use of saliva, soap, butter, yogurt, and cooking oils as lubricants [37–39]. In our study, almost all participants who used condoms consistently also used water-based CCLs. Provision of free water-based CCLs to participants coincided with a reduction in the use of non-water-based lubricants such as petroleum jelly and body creams after enrollment. Making such lubricants available and educating MSM and TGW about their use may facilitate condom uptake.

Despite promising trends in the uptake of condoms and lubricants during participation in the TRUST/RV368 study, a substantial minority of participants still did not report consistent use of these products. Continued education and counseling are warranted, but novel efforts may be required to further increase uptake of these important risk reduction strategies and supplement them with biologic prevention interventions [41]. For example, making a variety of condoms available—with various sizes and textures—may increase their acceptability [42]. In high-transmission foci settings such as the one studied here, provision of postexposure prophylaxis or pre-exposure prophylaxis may be beneficial for individuals who are unable to use other risk reduction techniques [43]. Ensuring consistent access to antiretroviral therapy for HIV-infected individuals will also help prevent transmission to uninfected partners [44].

This study recruited a highly marginalized population with a high burden of HIV using a combination of engagement with key opinion leaders, recruitment via respondent-driven sampling, and care delivery at facilities sensitized to the unique needs of MSM and TGW. However, retention was suboptimal and it is important to note that there was some attenuation of the impact of continued engagement in care when looking only at the subpopulation of participants who remained in care through 15 months. This suggests that some, but not all, of the observed improvement in condom and lubricant use over the course of the study was attributable to changing composition of the population rather than changing behaviors. Participants who were younger, HIV uninfected, and reported less condom and CCL use at baseline were more likely to be lost to follow-up and, simultaneously, are among those in greatest need of HIV prevention education and interventions. Additional modalities will need to be employed to not only reach these individuals with HIV prevention packages but also keep them engaged. Enhanced peer-based outreach [45–48] and decentralization of care [47–49] may facilitate retention. Internet and social media-based engagement strategies represent a promising new mechanism for reaching key populations, particularly younger individuals at risk for HIV and other STIs, but it is unclear how accessible they may be to certain populations in resource-limited settings [50,51]. These analyses have several limitations. Administration of standardized questionnaires and structured interviews enabled collection of detailed information about sexual practices and access to resources but was subject to biases inherent in the self-reporting of sensitive information. It is possible that participants learned the “correct” answers to questions about sexual risk behaviors without actually adapting their behaviors. Participants were specifically queried about use of condoms in combination with lubricants; however, follow-up questioning about the types of lubricant used did not distinguish between use

Table 4
Factors associated with self-reported consistent use of condoms and condom-compatible water-based lubricants

Characteristics	During receptive anal sex		During insertive anal sex	
	Unadjusted RR (95% CI)	Adjusted RR (95% CI)	Unadjusted RR (95% CI)	Adjusted RR (95% CI)
Visit				
Enrollment	Reference	—	—	—
9 mo	2.76 (2.46–3.10)	2.46 (2.16–2.79)	2.12 (1.88–2.39)	1.90 (1.67–2.16)
15 mo	3.01 (2.67–3.40)	2.62 (2.29–3.00)	2.60 (2.32–2.91)	2.27 (2.01–2.57)
Age				
≤21 y	Reference	—	—	—
22–30 y	1.33 (1.11–1.58)	1.06 (0.93–1.22)	1.33 (1.13–1.55)	1.10 (0.95–1.29)
>30 y	1.24 (0.96–1.61)	0.96 (0.75–1.22)	1.40 (1.13–1.73)	1.18 (0.96–1.46)
Gender identity				
Man	Reference	—	—	—
Woman	1.14 (0.96–1.36)	1.03 (0.88–1.20)	0.94 (0.72–1.22)	0.89 (0.70–1.13)
Other/Unknown	1.06 (0.85–1.33)	0.97 (0.79–1.19)	0.97 (0.77–1.22)	0.91 (0.73–1.12)
Sexual orientation				
Gay/Homosexual	Reference	—	—	—
Bisexual/Other/Unknown	1.07 (0.92–1.24)	1.08 (0.96–1.22)	1.08 (0.93–1.26)	1.10 (0.96–1.25)
HIV status				
Uninfected	Reference	—	—	—
Infected	1.67 (1.42–1.97)	1.20 (1.03–1.40)	1.47 (1.28–1.68)	1.18 (1.03–1.34)
Unknown	0.74 (0.55–0.99)	1.06 (0.80–1.40)	0.68 (0.52–0.88)	0.88 (0.68–1.14)
Education level				
Junior secondary or less	Reference	—	—	—
Senior secondary	2.48 (1.76–3.47)	1.59 (1.13–2.24)	1.77 (1.32–2.37)	1.30 (0.97–1.74)
Higher than senior secondary	3.18 (2.26–4.47)	1.82 (1.28–2.59)	2.30 (1.72–3.08)	1.56 (1.15–2.10)
Unknown	5.62 (3.13–10.07)	2.48 (1.30–4.73)	4.27 (2.77–6.56)	2.09 (1.22–3.57)
Occupation				
Professional/Self-Employed	Reference	—	—	—
Unemployed	1.02 (0.75–1.39)	1.10 (0.88–1.36)	1.03 (0.80–1.33)	1.04 (0.84–1.29)
Student	1.09 (0.84–1.43)	0.96 (0.80–1.16)	1.09 (0.86–1.38)	0.97 (0.81–1.17)
Entertainment/Hospitality	0.91 (0.63–1.31)	0.91 (0.72–1.14)	1.16 (0.90–1.49)	1.06 (0.87–1.28)
Driver/Laborer	0.40 (0.12–1.28)	0.60 (0.34–1.08)	0.55 (0.20–1.51)	0.62 (0.36–1.08)
Other/Unknown	1.24 (0.96–1.60)	0.99 (0.84–1.16)	1.15 (0.93–1.42)	0.89 (0.77–1.03)
Marital status				
Single/Never married	Reference	—	—	—
Married/Living with a woman	0.80 (0.56–1.13)	1.00 (0.73–1.38)	0.76 (0.56–1.02)	0.86 (0.65–1.13)
Living with a man	1.12 (0.74–1.69)	0.98 (0.71–1.36)	1.43 (1.08–1.89)	1.12 (0.87–1.46)
Divorced/Widowed/Separated/Other	1.58 (1.21–2.06)	1.32 (1.04–1.66)	1.49 (1.15–1.94)	1.19 (0.93–1.51)
Internet use				
Never	Reference	—	—	—
Less than daily	1.93 (1.45–2.58)	1.29 (0.98–1.71)	1.20 (0.93–1.54)	0.96 (0.75–1.23)
Almost every day	2.49 (1.93–3.20)	1.51 (1.17–1.94)	1.83 (1.50–2.24)	1.28 (1.04–1.58)
Unknown	2.92 (1.56–5.48)	1.63 (0.84–3.15)	2.27 (1.35–3.83)	1.31 (0.76–2.25)
Site				
Abuja	Reference	—	—	—
Lagos	1.41 (1.24–1.60)	1.13 (0.99–1.28)	1.35 (1.19–1.53)	1.18 (1.04–1.34)

Separate models were run for participants reporting receptive anal sex and insertive anal sex to evaluate consistent condom and lubricant use during each sexual behavior. Unadjusted and adjusted risk ratios with 95% confidence intervals were calculated using Poisson regression with robust variance estimators, unstructured working correlation, and generalized estimating equations clustered on participant.

The adjusted model for each outcome of interest included all listed variables. Statistically significant risk ratios ($P < 0.05$) are in bold.

Abbreviations: CI = confidence interval; RR = risk ratio.

with and without condoms. It was assumed that participants who reported both consistent condom use and use of water-based lubricants used them in combination, but misclassification of participants was possible. Differential loss to follow-up in this study may have confounded analyses of condom and lubricant use over time, but findings of complete-case sensitivity analyses generally confirmed the findings of the primary analyses, including an approximate doubling of the likelihood of consistent condom and CCL use after controlling for potentially confounding factors. Finally, the RDS recruitment strategy enabled characterization of a highly marginalized population of Nigerian MSM and TGW in two large urban centers [52,53], but findings of this study may not be generalizable to other MSM and TGW communities.

In conclusion, engagement in care at trusted community health centers improved the uptake of condoms and water-based lubricants by MSM and TGW, but inconsistent use of these products remained common. Education, nonstigmatizing counseling, and safe availability of condoms and CCLs are necessary to promote

their uptake and reduce the risk of HIV and STI acquisition. However, these interventions alone are insufficient to eliminate risk. Complementary strategies, such as sustained access to antiretroviral therapy for those living with HIV as well as provision of postexposure prophylaxis and pre-exposure prophylaxis for those at risk of HIV acquisition, are necessary to further mitigate HIV risk, prevent new infections, and achieve an AIDS-free generation among MSM and TGW in Nigeria.

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Appendix

Supplementary Table 1

Characteristics of Nigerian men who have sex with men and transgender women, stratified by inclusion in complete-case sensitivity analyses

Characteristics	Overall (n = 2090)	Excluded (n = 1598)	Included (n = 492)	P-value
Age				
Median (IQR)	23 (20–27)	23 (20–27)	24 (21–27)	<.001
<21 y	695 (33.3)	558 (34.9)	137 (27.8)	.003
22–30 y	1179 (56.4)	889 (55.6)	290 (58.9)	—
>30 y	216 (10.3)	151 (9.4)	65 (13.2)	—
Gender identity				
Man	1671 (80.0)	1282 (80.2)	389 (79.1)	.124
Woman	234 (11.2)	168 (10.5)	66 (13.4)	—
Other/unknown	185 (8.9)	148 (9.3)	37 (7.5)	—
Sexual orientation				
Gay/homosexual	704 (33.7)	513 (32.1)	191 (38.8)	.018
Bisexual	1372 (65.6)	1073 (67.1)	299 (60.8)	—
Other/unknown	14 (0.7)	12 (0.8)	2 (0.4)	—
HIV status*				
Uninfected	855 (40.9)	714 (44.7)	141 (28.7)	<.001
Infected	844 (40.4)	493 (30.9)	351 (71.3)	—
Unknown	391 (18.7)	391 (24.5)	0 (0)	—
Education level				
Junior secondary or less	306 (14.6)	277 (17.3)	29 (5.9)	<.001
Senior secondary	1092 (52.2)	832 (52.1)	260 (52.8)	—
Higher than senior secondary	684 (32.7)	485 (30.4)	199 (40.4)	—
Unknown	8 (0.4)	4 (0.3)	4 (0.8)	—
Occupation				
Unemployed	342 (16.4)	240 (15.0)	102 (20.7)	<.001
Student	400 (19.1)	288 (18.0)	112 (22.8)	—
Professional/self-employed	403 (19.3)	306 (19.1)	97 (19.7)	—
Entertainment/hospitality	215 (10.3)	154 (9.6)	61 (12.4)	—
Driver/laborer	43 (2.1)	29 (1.8)	14 (2.8)	—
Other/unknown	687 (32.9)	581 (36.4)	106 (21.5)	—
Marital status				
Single/never married	1853 (88.7)	1421 (88.9)	432 (87.8)	.002
Married/living with a woman	141 (6.7)	117 (7.3)	24 (4.9)	—
Living with a man	29 (1.4)	16 (1.0)	13 (2.6)	—
Divorced/widowed/separated/other	67 (3.2)	44 (2.8)	23 (4.7)	—
Internet use				
Never	482 (23.1)	427 (26.7)	55 (11.2)	<.001
Less than daily	406 (19.4)	308 (19.3)	98 (19.9)	—
Almost everyday	1183 (56.6)	848 (53.1)	335 (68.1)	—
Unknown	19 (0.9)	15 (0.9)	4 (0.8)	—

All data are presented as n (%) unless otherwise specified.

To be included in the complete-case sensitivity analyses, participants had to have attended all three study visits of interest (enrollment, 9 mo, and 15 mo).

The P-values were calculated using Student's *t*-test for age as a continuous variable and Pearson's chi-squared test for all other variables.

Statistically significant P-values (<.05) are in bold.

IQR = interquartile range.

* HIV status at enrollment was determined by a parallel algorithm of rapid tests performed as part of baseline assessments spread over two study visits; participants with unknown HIV status did not undergo this testing for reasons such as failure to present for the second scheduled set of evaluations. Negative results from follow-up testing were carried backward.

Supplementary Table 2

Types of lubricants used during receptive anal sex by participants who reported consistent condom use (complete-case sensitivity analysis)

Supplementary lubricant type	Enrollment N = 131 (%)	9 Mo N = 209 (%)	15 Mo N = 217 (%)
Water-based	108 (82.4)	191 (91.4)	201 (92.6)
Petroleum jelly	8 (6.1)	6 (2.9)	8 (3.7)
Body creams	8 (6.1)	6 (2.9)	4 (1.8)
Oil-based	2 (1.5)	2 (1.0)	2 (0.9)
Saliva	2 (1.5)	0 (0)	0 (0)
Other/unknown	3 (2.3)	4 (1.9)	2 (0.9)

In this complete-case sensitivity analysis of participants who attended all three study visits of interest (enrollment, 9 mo, and 15 mo) and who reported consistent use of condoms and lubricants during receptive anal sex, the type of lubricant used was tallied at each visit.

Supplementary Table 3

Types of lubricants used during insertive anal sex by participants who reported consistent condom use (complete-case sensitivity analysis)

Supplementary lubricant type	Enrollment N = 156 (%)	9 Mo N = 184 (%)	15 Mo N = 206 (%)
Water-based	126 (80.8)	166 (90.2)	187 (90.8)
Petroleum jelly	10 (6.4)	9 (4.9)	9 (4.4)
Body creams	12 (7.7)	6 (3.3)	5 (2.4)
Oil-based	2 (1.3)	0 (0)	0 (0)
Saliva	2 (1.3)	0 (0)	1 (0.5)
Other/unknown	4 (2.6)	3 (1.6)	4 (1.9)

In this complete-case sensitivity analysis of participants who attended all three study visits of interest (enrollment, 9 mo, and 15 mo) and who reported consistent use of condoms and lubricants during insertive anal sex, the type of lubricant used was tallied at each visit.

Supplementary Table 4

Factors associated with self-reported consistent use of condoms and condom-compatible water-based lubricants (complete-case sensitivity analysis)

Characteristics	During receptive anal sex		During insertive anal sex	
	Unadjusted RR (95% CI)	Adjusted RR (95% CI)	Unadjusted RR (95% CI)	Adjusted RR (95% CI)
Visit				
Enrollment	Reference	—	—	—
9 mo	2.32 (1.97–2.74)	2.32 (1.95–2.75)	1.73 (1.48–2.03)	1.75 (1.49–2.07)
15 mo	2.43 (2.05–2.89)	2.43 (2.03–2.92)	1.95 (1.67–2.28)	1.97 (1.67–2.32)
Age				
≤21 y	Reference	—	—	—
22–30 y	1.04 (0.88–1.23)	0.92 (0.79–1.07)	1.07 (0.89–1.29)	0.96 (0.80–1.16)
>30 y	0.95 (0.72–1.26)	0.83 (0.64–1.07)	1.18 (0.94–1.48)	1.07 (0.85–1.34)
Gender identity				
Man	Reference	—	—	—
Woman	1.05 (0.86–1.28)	1.00 (0.84–1.21)	0.88 (0.65–1.21)	0.82 (0.60–1.13)
Other/unknown	1.09 (0.85–1.40)	1.10 (0.88–1.39)	1.01 (0.78–1.31)	1.06 (0.82–1.36)
Sexual orientation				
Gay/homosexual	Reference	—	—	—
Bisexual/other/unknown*	1.07 (0.92–1.24)	1.18 (1.03–1.34)	1.08 (0.93–1.26)	1.14 (0.98–1.32)
HIV status				
Uninfected	Reference	—	—	—
Infected	1.01 (0.84–1.22)	0.94 (0.80–1.11)	0.98 (0.83–1.14)	0.95 (0.82–1.11)
Unknown	0.53 (0.08–3.55)	0.49 (0.14–1.74)	1.16 (0.72–1.76)	0.89 (0.53–1.49)
Education level				
Junior secondary or less	Reference	—	—	—
Senior secondary	1.33 (0.90–1.98)	1.21 (0.83–1.76)	1.06 (0.76–1.46)	0.95 (0.67–1.35)
Higher than senior secondary	1.44 (0.97–2.16)	1.36 (0.93–1.98)	1.21 (0.87–1.68)	1.10 (0.77–1.57)
Unknown	2.28 (1.34–3.88)	2.46 (1.70–3.57)	1.80 (1.09–2.97)	1.65 (0.98–2.77)
Occupation				
Professional/self-employed	Reference	—	—	—
Unemployed	0.70 (0.52–0.94)	0.85 (0.64–1.12)	0.83 (0.63–1.09)	0.96 (0.73–1.25)
Student	0.94 (0.76–1.17)	0.86 (0.70–1.05)	1.06 (0.86–1.31)	1.00 (0.82–1.23)
Entertainment/hospitality	0.88 (0.68–1.15)	0.87 (0.68–1.10)	1.00 (0.80–1.26)	1.08 (0.87–1.34)
Driver/laborer	0.31 (0.13–0.74)	0.39 (0.19–0.79)	0.50 (0.23–1.08)	0.52 (0.27–1.01)
Other/unknown	1.15 (0.96–1.38)	0.94 (0.79–1.11)	1.15 (0.96–1.36)	0.97 (0.82–1.14)
Marital status				
Single/never married	Reference	—	—	—
Married/living with a woman	0.87 (0.58–1.30)	0.83 (0.56–1.23)	0.91 (0.66–1.27)	0.93 (0.66–1.30)
Living with a man	1.05 (0.74–1.49)	1.03 (0.76–1.39)	1.12 (0.90–1.39)	1.06 (0.81–1.37)
Divorced/widowed/separated/other	1.40 (1.10–1.78)	1.34 (1.10–1.64)	1.41 (1.13–1.76)	1.37 (1.11–1.69)
Internet use				
Never	Reference	—	—	—
Less than daily	1.24 (0.90–1.71)	1.05 (0.76–1.45)	0.97 (0.73–1.29)	0.93 (0.67–1.30)
Almost everyday	1.32 (1.00–1.76)	1.12 (0.84–1.51)	1.18 (0.94–1.48)	1.09 (0.82–1.45)
Unknown	1.50 (0.75–3.01)	1.83 (0.86–3.89)	0.91 (0.38–2.16)	0.80 (0.27–2.42)
Site				
Abuja	Reference	—	—	—
Lagos	1.13 (0.97–1.31)	1.24 (1.06–1.46)	1.16 (1.00–1.33)	1.29 (1.11–1.50)

In this complete-case sensitivity analysis, the population was limited to participants with data available from all three study visits of interest: enrollment, 9 mo, and 15 mo. Separate models were run for participants reporting receptive anal sex and insertive anal sex to evaluate consistent condom and lubricant use during each sexual behavior. Unadjusted and adjusted risk ratios with 95% confidence intervals were calculated using Poisson regression with robust variance estimators, unstructured working correlation, and generalized estimating equations clustered on participant.

The adjusted model for each outcome of interest included all listed variables. Statistically significant risk ratios ($P < .05$) are in bold.

CI = confidence interval; RR = risk ratio.

* Because initial models failed to converge, self-reported sexual orientation of “bisexual” or “other/unknown” was collapsed into a single category.