Decrease in incidence of sexually transmitted infections symptoms in men who have sex with men enrolled in a quarterly HIV prevention and care programme in West Africa (CohMSM ANRS 12324-Expertise France)

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Original research

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Issifou Yaya ,[1] Fodié Diallo,[2] Malan Jean-Baptiste Kouamé,[3] Mawuényégan Kouamivi Agboyibor,[4] Issa Traoré,[5] Alou Coulibaly,[2] Kader Maiga,[2] Marion Mora,[6] Pamela Palvadeau,[7] Elias Ter Tiero Dah,[1,5,8] Ephrem Mensah,[4] Camille Anoma,[3] Bintou Dembélé Keita,[2] Bruno Spire,[6] Christian Laurent,[1] On behalf of the CohMSM Study Group

[1]IRD, Inserm, Univ Montpellier, TransVIHMI, Montpellier, France
[2]ARCAD-Santé Plus, Bamako, Mali
[3]Espace Confiance, Abidjan, Côte d'Ivoire
[4]Espoir Vie Togo, Lomé, Togo
[5]Association African Solidarité, Ouagadougou, Burkina Faso
[6]Aix Marseille Univ, Inserm, IRD, SESSTIM, Marseille, France
[7]Coalition PLUS, Pantin, France
[8]Centre Muraz, Bobo-Dioulasso, Burkina Faso

Correspondence to
Dr Issifou Yaya, IRD, Inserm, Univ Montpellier, TransVIHMI, Montpellier, France; iyayad@yahoo.fr

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ABSTRACT

Objective Although men who have sex with men (MSM) are at high risk of STI, their access to tailored healthcare services remains limited in West Africa. We assessed the change in STI symptoms incidence over time among MSM enrolled in a quarterly HIV prevention and care programme in four cities in Burkina Faso, Côte d'Ivoire, Mali and Togo.

Methods We performed a prospective cohort study in MSM followed up between 2015 and 2019. Men aged over 18 who reported anal sex with another man within the previous 3 months were offered quarterly syndromic diagnosis and treatment for STI, as well as HIV testing, peer-led counselling and support. Condoms and lubricants were also provided. The change in STI symptoms incidence during follow-up was investigated using a non-parametric trend test and mixed-effect Poisson regression models.

Results 816 participants were followed for a total duration of 1479 person-years. 198 participants (24.3%) had at least one STI symptom during follow-up. Overall, STI symptoms incidence was 20.4 per 100 person-years (95% CI 18.4 to 22.6), ranging from 15.3 in Abidjan to 33.1 in Ouagadougou (adjusted incidence rate ratio (aIRR) 2.39, 95% CI 1.55 to 3.69, p<0.001). STI symptoms incidence was 16.8 and 23.0 per 100 person-years in HIV-positive and HIV-negative participants, respectively (aIRR 0.77, 95% CI 0.57 to 1.04, p=0.087). STI symptoms incidence decreased significantly from 29.9 per 100 person-years in the first 6 months to 8.6 at 30–35 months of follow-up (aIRR per 6-month increase 0.84, 95% CI 0.77 to 0.92, p<0.001).

Conclusion STI symptoms incidence decreased over time but the overall burden of STI appeared to be very high in MSM followed up in West Africa. STI services including counselling, diagnosis and treatment should be reinforced. Laboratory tests that allow accurate diagnosis of STI are required. Strengthening STI services will be critical for controlling the HIV and STI epidemics in this vulnerable population and in the general population.

Trial registration number NCT02626286.

INTRODUCTION

Africa is disproportionally affected by STI. In 2016, the WHO African Region had the highest estimated prevalence worldwide for gonorrhoea and syphilis in both women and men, for chlamydia in men and for trichomoniasis in women. It also had the highest estimated incidences for gonorrhoea and trichomoniasis in both genders.[1] STI are a major public health problem because they negatively influence sexual and reproductive health.[2] STI are also associated with a greater risk of HIV infection (two-thirds of the world's 37.9 million HIV cases are in Africa).[3 4]

Men who have sex with men (MSM) living in Africa are at particular risk of STI, especially because of risky sexual behaviours (eg, multiple sexual partners and unprotected anal intercourse).[5–7] Several studies reported an STI prevalence of approximately 20% in this population.[8–10] In contrast, data on STI incidence are very scarce. Recently, studies in Kenya and South Africa reported incidence rates of gonorrhoea and chlamydia of at least 20 per 100 person-years (PY) in MSM.[11 12] Apart from the consequences of STI on their own health, African MSM also contribute to the spread of STI in the general population, as they often have sex with women.[9]

Access to STI prevention, care and treatment is very limited for this population because of stigmatisation, discrimination and condemnation of same-sex relationships. Despite improvements in care in recent years, MSM-friendly clinics are still few in number. These clinics provide targeted STI services including counselling, diagnosis and treatment of STI, HIV testing and provision of condoms and lubricants. MSM usually only attend them when they have related health complaints (eg, STI symptoms) or specifics needs (eg, HIV testing or condoms and lubricants).

The CohMSM study was designed to assess the feasibility and benefit of implementing a quarterly HIV prevention and care programme for MSM in West Africa. One of the specific objectives was to assess the change in sexual behaviours among MSM

during follow-up. In a previous analysis, we found that inconsistent condom use during receptive anal sex with male partners of unknown HIV status in the previous 6 months decreased in MSM who had the highest risk of HIV infection at enrolment.[13] Since self-reporting of condom use is subject to social desirability bias, we also planned to assess the change in STI symptoms incidence during follow-up, which is a more objective indicator of changes in sexual behaviours. The present study therefore aimed to assess the change in STI symptoms incidence over time in MSM enrolled in CohMSM in four West African countries.

METHODS

Study design

We conducted a prospective open-label cohort study in four major community-based clinics in Bamako (Mali), Abidjan (Côte d'Ivoire), Ouagadougou (Burkina Faso) and Lomé (Togo).

Participant recruitment

Enrolment in CohMSM was proposed to MSM clients attending one of the four clinics. Other potential participants were identified during mobile HIV screening campaigns and invited to attend the relevant clinic in order to enrol in the study. Inclusion criteria were as follows: over 18 years of age, anal sex with another man in the previous 3 months, HIV-negative or testing seropositive for the first time during the enrolment visit.

Study intervention

Participants visited their clinic for quarterly medical visits. As usual in the African setting, STI were diagnosed and treated in each clinic using the syndromic approach (according to national protocol of each study country, which all follow the WHO recommendations).[14 15] Combined treatment of urethral and/or anal discharge (ie, an indication for gonorrhoea, chlamydia and trichomoniasis) included the following: either intramuscular ceftriaxone 500 mg, oral cefixime 400 mg or oral ciprofloxacin 500 mg (single dose for each) plus either oral azithromycin 1 g (single dose) or oral doxycycline 100 mg (two doses daily for 7 days) plus metronidazole 2 g (single dose). Treatment of penile and/or anal ulceration (ie, an indication for syphilis, chancroid and herpes) included either intramuscular 2.4 million units of benzathine benzylpenicillin (single dose) or—in the case of medical contraindication to BPP—oral erythromycin 1 g (two doses daily for 14 days) plus oral azithromycin 1 g (single dose) plus oral acyclovir 400 mg (two doses daily for 5 days). In addition, the CohMSM prevention and care programme included HIV screening, personalised peer-led counselling and support, the provision of condoms and lubricants, vaccination against hepatitis B and antiretroviral therapy. With their consent, peer-educators could contact the participants by phone if they were 15 days late for their scheduled visits. Participants could also attend their clinic for unscheduled medical visits at any time according to their needs, especially in case of STI symptoms. All services were provided free of charge. Participants were compensated US$5 for transport costs for each scheduled follow-up visit.

Data collection and outcome definition

Data were collected between June 2015 and June 2019. Medical data were collected at each quarterly or unscheduled medical visit by the study's participating medical doctors, while sociodemographic and behavioural data were collected every 6 months by trained research assistants using a face-to-face questionnaire.

The outcome of the present study was the presence of at least one of the following STI symptoms reported by the participant and observed by a doctor: (1) anal ulceration, (2) penile ulceration, (3) anal discharge and (4) urethral discharge (according to national protocol of each study country, which all follow the WHO recommendations).[14 15] The participant was systematically questioned about the signs and symptoms of STI and, in the case of such events, was examined. For example, the participant was examined for urethral discharge if he reported either urethral discharge or dysuria. Similarly, complaints about rectal symptoms (eg, rectal bleeding or pain) led to an examination for anal ulceration or discharge. Ulcerations included herpetic and non-herpetic ulcerations. By contrast, condyloma were not considered, as they could be reported at several visits without mentioning whether it was a new event or not. Moreover, the surgical treatment of condyloma in the study clinics could be spread out over several visits.

A number of covariates were considered in the present analysis. Time-constant variables were collected at enrolment and included study site and sociodemographic characteristics (age, marital status, educational level, employment status and financial situation). Time-varying variables were collected every 6 months and included HIV status, self-defined sexual identity, sexual attraction, self-identified gender and sexual behaviours in the previous 6 months (number of sexual partners, transactional sex and condom use during anal sex). The AUDIT-C questionnaire was used to assess alcohol consumption during the previous 4 weeks, with a total score ranging from 0 to 12. Alcohol consumption was defined as 'hazardous' if it was ≥4 and 'moderate' if it was between 1 and 3.

Statistical analysis

Statistical analyses were performed using Stata software V.15.1 (StataCorp, College Station, Texas, USA). Analyses were performed globally on the total study population as well as separately in the HIV-negative and HIV-positive groups. We calculated the follow-up time for each participant, as the time in the study from enrolment to the last follow-up visit. For the HIV status-stratified analyses, seronegative participants who seroconverted during follow-up (n=95) contributed to the analysis in the HIV-negative group from enrolment to the first positive HIV screening test, and to the analysis in the HIV-positive group from the first positive HIV screening test to the last follow-up visit. STI symptoms present at enrolment were not included in the estimated incidence of STI symptoms during follow-up. Participants were considered lost to follow-up if they had not completed the last two scheduled quarterly visits. As participants with STI were provided effective, free-of-charge treatment (mostly single-dose), each episode of STI symptom was considered a new event. The presence of several simultaneous symptoms was considered as one episode.

To test the change in STI symptoms incidence over time, we first performed a non-parametric trend test (an extension of the Wilcoxon rank-sum test), using the *nptrend* command in Stata. We then investigated the association between STI symptoms incidence and follow-up time using mixed-effect Poisson regression models with robust error variance which take into account the correlation of the repeated measures. The incidence rate ratios (IRR) and their 95% CIs for follow-up time and other covariates were estimated using the method of penalised quasi-likelihood. The covariates were selected on the basis of published literature and our experience. Those that were associated with STI symptoms incidence with a p value of <0.25 in univariate analyses were fitted in a multivariate model. A manual backward selection using the Akaike information criterion was performed to determine the final model.

RESULTS

Characteristics of the study population

Of the 871 MSM enrolled in CohMSM, 55 (6.3%) did not attend a study clinic after the enrolment visit and were excluded from the present analysis. For most characteristics, they were comparable to the 816 study participants. However, they were slightly younger, less likely to self-define as homosexual/gay, and less likely to self-identify as women (online supplemental table 1).

Table 1 shows baseline characteristics of the study participants: 36.1% were recruited in Bamako, 23.7% in Abidjan, 20.6% in Ouagadougou and 19.6% in Lomé. Median age was 23.8 years. Eighty per cent of the participants were single, 13.3% in free union, 5.1% married to a woman, 0.9% divorced and 0.4% widowed. Just over half (54.9%) self-defined as bisexual, and 40.2% as homosexual. With regard to sexual behaviours in the previous 6 months, 87.2% and 84.8% of the participants reported receptive and insertive anal sex, respectively. The proportion of participants involved in transactional sex and group sex was 38.0% and 26.2%, respectively. Moreover, 74.6% of participants reported two or more male sexual partners. Inconsistent condom use during receptive and insertive anal sex was reported by 37.2% and 37.9% of the participants, respectively. Fifty participants (6.1%) had at least one STI symptom as follows: 28 (3.4%) had urethral discharge, 14 (1.7%) anal ulceration, 6 (0.7%) penile ulceration and 4 (0.5%) anal discharge. Online supplemental table 2 shows that there were differences in most baseline characteristics of participants between the study sites.

Participants were followed for a total duration of 1479 PY. Median follow-up duration was 22.2 months (IQR 14.9–30.1). Participants attended 6871 follow-up visits (ie, a mean of 8.4 visits per participant). Two hundred and thirty-one participants (28.3%) were lost to follow-up. They were comparable to the participants who remained in follow-up for almost all sexual behaviours (except group sex) and for the prevalence of STI symptoms. However, it should be noted that participants who were lost to follow-up differed from those who remained in follow-up with regard to the study sites (online supplemental table 3).

Comparison of participant characteristics according to HIV status

Among the 816 participants, 232 (28.5%) were HIV-positive at baseline (table 1). They were older than HIV-negative participants (median age 24.4 vs 23.7 years). They were also more likely to report sexual attraction to men exclusively (61.1% vs 52.1%), and—in the previous 6 months—two or more male sexual partners (87.4% vs 69.5%) and inconsistent condom use during receptive anal sex (50.3% vs 32.6%) or during insertive anal sex (48.0% vs 33.9%). They were also more likely to report no condom use during their most recent anal sexual intercourse (49.5% vs 31.3%). Finally, HIV-positive participants (diagnosed at enrolment or during follow-up) were followed for a shorter duration (median time 20.7 (IQR 14.9–30.1) vs 23.3 (IQR 16.5–30.0) months, p=0.004).

STI symptoms incidence

During follow-up, 198 participants (24.3%) had a total of 302 STI symptoms. More specifically, 134, 41, 16, 2 and 5 participants had STI symptoms at, respectively, 1, 2, 3, 4 and 5 visits. Only five participants had simultaneously two symptoms. Two hundred and nineteen symptoms (72.5%) were urethral discharges, 23 (7.6%) anal discharges, 33 (10.9%) penile ulcerations and 27 (8.9%) anal ulcerations. STI symptoms incidence was 20.4 per 100 PY overall (95% CI 18.4 to 22.6; figure 1). Incidence was 15.3 per 100 PY (95% CI 11.6 to 19.6) in Abidjan, 17.1 per 100 PY (95% CI 12.6 to 22.3) in Lomé, 19.3 per 100 PY (95% CI 16.3 to 22.6) in Bamako and 33.1 per 100 PY (95% CI 27.4 to 39.2) in Ouagadougou.

Overall STI symptoms incidence was 16.8 per 100 PY (95% CI 13.6 to 20.3) in HIV-positive participants and 23.0 per 100 PY (95% CI 20.5 to 26.0) in their HIV-negative counterparts (figure 1). Specifically, in both groups, STI symptoms incidence was 19.2 per 100 PY (95% CI 13.7 to 25.8) and 20.5 per 100 PY (95% CI 16.8 to 24.6) in Bamako, 7.2 per 100 PY (95% CI 3.3 to 13.1) and 21.9 per 100 PY (95% CI 15.7 to 27.4) in Abidjan, 35.6 per 100 PY (95% CI 25.7 to 46.3) and 32.3 per 100 PY (95% CI 25.2 to 40.1) in Ouagadougou and 8.8 per 100 PY (95% CI 4.3 to 15.7) and 23.9 per 100 PY (95% CI 17.1 to 31.9) in Lomé.

STI symptoms incidence in the total study population decreased from 29.9 per 100 PY (95% CI 24.6 to 35.6) in the first 6 months of follow-up to 8.6 per 100 PY (95% CI 3.8 to 16.2) at 30–35 months of follow-up (p=0.025; figure 2). Specifically, it decreased from 31.5 per 100 PY (95% CI 26.8 to 40.1) to 8.9 per 100 PY (95% CI 1.8 to 22.5) in HIV-negative participants (p=0.035) and from 28.9 per 100 PY (95% CI 19.1 to 40.5) to 7.7 per 100 PY (95% CI 2.5 to 17.0) in their HIV-positive counterparts (p=0.064). Figure 2 also shows the change in STI symptoms incidence over time according to study site.

With regard to the specific incidence of symptoms, the incidence of urethral discharges in the total study population decreased from 19.9 per 100 PY (95% CI 15.4 to 25.1) in the first 6 months of follow-up to 5.7 per 100 PY (95% CI 2.1 to 12.0) at 30–35 months of follow-up but the decrease was significant only in Abidjan (online supplemental figure 1). Incidence of other STI symptoms (ie, penile ulcerations, anal ulcerations and anal discharges) in the total study population decreased from 10.0 per 100 PY (95% CI 6.7 to 14.1) in the first 6 months of follow-up to 1.9 per 100 PY (95% CI 0.2 to 6.7) at 30–35 months of follow-up (p=0.025).

Determinants of STI symptoms incidence

Mixed-effect Poisson regressions showed that STI symptoms incidence was lower in HIV-positive participants than in their HIV-negative counterparts in both univariate (IRR 0.66, 95% CI 0.49 to 0.89, p=0.007) and multivariate analyses (adjusted IRR (aIRR) 0.77, 95% CI 0.57 to 1.04, p=0.087; table 2). With regard to the study sites, STI symptoms incidence was significantly higher in Ouagadougou than in Abidjan (aIRR 2.39, 95% CI 1.55 to 3.69, p<0.001), the difference being greater in HIV-positive participants (aIRR 4.95, 95% CI 2.15 to 11.44, p<0.001 vs aIRR 1.74, 95% CI 1.06 to 2.84, p=0.028). By contrast, STI symptoms incidence was significantly higher in Bamako than in Abidjan in HIV-positive participants only (aIRR 2.99, 95% CI 1.32 to 6.76, p=0.009). No significant difference was observed between Lomé and Abidjan. Importantly, STI symptoms incidence decreased significantly during follow-up in both univariate (IRR 0.84, 95% CI 0.77 to 0.91, p<0.001) and multivariate analyses (aIRR 0.84, 95% CI 0.77 to 0.92, p<0.001). The decline was significant in both HIV-negative (aIRR 0.87, 95% CI 0.63 to 0.97, p=0.010) and HIV-positive participants (aIRR 0.85, 95% CI 0.74 to 0.98, p=0.030). No significant interaction was observed between study sites and follow-up time.

In the multivariate analysis, STI symptoms incidence was also significantly higher in participants aged 24–27 years than in

Table 1 Baseline characteristics of the study participants, both overall and according to HIV status

	Total (n=816)		HIV– (n=584)		HIV+ (n=232)		
	N	n (%)	N	n (%)	N	n (%)	P value*
Study sites	816		584		232		**0.038**
Abidjan		193 (23.7)		133 (22.8)		60 (25.9)	
Bamako		295 (36.1)		229 (39.2)		66 (28.4)	
Ouagadougou		168 (20.6)		114 (19.5)		54 (23.3)	
Lomé		160 (19.6)		108 (18.5)		52 (22.4)	
Age in years (IQR)†	816	23.8 (21.2–27.4)	584	23.7 (21.2–26.9)	232	24.4 (21.6–28.1)	**0.022**
Secondary educational level or higher	780	647 (82.9)	560	473 (84.5)	220	174 (79.1)	0.073
Marital status	781		560		221		0.331
Single/Divorced/Widowed		637 (81.6)		452 (80.7)		185 (83.7)	
Married/Free union		144 (18.4)		108 (19.3)		36 (16.3)	
Employment status	775		555		220		0.290
Unemployed		50 (6.5)		36 (6.5)		14 (6.4)	
Student		297 (38.3)		222 (40.0)		75 (34.1)	
Employed		428 (55.2)		297 (53.5)		131 (59.5)	
Self-perceived financial situation	781		560		221		0.210
Uncomfortable		421 (53.9)		294 (52.5)		127 (57.5)	
Comfortable		360 (46.1)		266 (47.5)		94 (42.5)	
Self-defined sexual identity	789		562		227		0.157
Heterosexual		15 (1.9)		11 (2.0)		4 (1.7)	
Homosexual/Gay		317 (40.2)		212 (37.7)		105 (46.3)	
Transsexual/Transgender		24 (3.0)		19 (3.4)		5 (2.2)	
Bisexual		433 (54.9)		320 (56.9)		113 (49.8)	
Self-identified gender	809		579		230		0.108
A man/A boy		435 (53.8)		327 (56.5)		108 (47)	
Both a man and a woman		253 (31.3)		171 (29.5)		82 (35.6)	
More a woman		111 (13.7)		74 (12.8)		37 (16.1)	
Neither a woman nor a man		10 (1.2)		7 (1.2)		3 (1.3)	
Sexual attraction	809		580		229		**0.028**
Men		442 (54.6)		302 (52.1)		140 (61.1)	
Both men and women		338 (41.8)		253 (43.6)		85 (37.1)	
More women		29 (3.6)		25 (4.3)		4 (1.8)	
Alcohol consumption‡§	700		502		198		0.822
None		306 (43.7)		216 (43.0)		90 (45.5)	
Moderate		248 (35.4)		181 (36.1)		67 (33.8)	
Hazardous		146 (20.9)		105 (20.9)		41 (20.7)	
Number of female sexual partners¶	809		580		229		0.133
0		474 (58.6)		338 (58.3)		136 (59.4)	
1		236 (29.2)		163 (28.1)		73 (31.9)	
≥2		99 (12.2)		79 (13.6)		20 (8.7)	

Continued

Table 1 Continued

	Total (n=816)		HIV− (n=584)		HIV+ (n=232)		
	N	n (%)	N	n (%)	N	n (%)	P value*
Number of male sexual partners¶	810		580		230		**<0.001**
0		3 (0.4)		0 (0.0)		3 (1.3)	
1		203 (25.0)		173 (29.8)		30 (13.0)	
2		173 (21.3)		134 (23.1)		39 (17.0)	
3		122 (15.1)		81 (14.0)		41 (17.8)	
4		110 (13.6)		81 (14.0)		29 (12.6)	
5+		199 (24.6)		111 (19.1)		88 (38.3)	
Number of any anal intercourses with men‡	793		569		224		0.164
0		131 (16.5)		92 (16.2)		39 (17.4)	
1–4		392 (49.4)		293 (51.5)		99 (44.2)	
≥5		270 (34.1)		184 (32.3)		86 (38.4)	
Receptive anal sex¶	768	670 (87.2)	567	487 (85.9)	201	183 (90.8)	0.060
Inconsistent condom use during receptive anal sex¶	768	283 (37.2)	567	185 (32.6)	201	101 (50.3)	**<0.001**
Insertive anal sex¶	794	673 (84.8)	569	493 (86.6)	225	180 (80.0)	**0.019**
Inconsistent condom use during insertive anal sex¶	794	301 (37.9)	569	193 (33.9)	225	108 (48.0)	**<0.001**
Inconsistent condom use during anal sex¶	793	346 (43.6)	568	215 (37.8)	225	131 (58.2)	**<0.001**
Condom use during most recent anal intercourse	733	464 (63.3)	515	354 (68.7)	218	110 (50.5)	**<0.001**
Group sex¶	798	209 (26.2)	579	151 (26.1)	219	58 (26.5)	0.908
Transactional sex¶	798	303 (38.0)	579	215 (37.1)	219	88 (40.2)	0.428
History of HIV screening	816	625 (76.6)	584	482 (82.5)	232	143 (61.6)	**<0.001**
STI symptoms	816		584		232		
Anal ulceration		14 (1.7)		8 (1.4)		6 (2.6)	0.227
Penile ulceration		6 (0.7)		4 (0.7)		2 (0.9)	0.789
Anal discharge		4 (0.5)		3 (0.5)		1 (0.4)	0.879
Urethral discharge		28 (3.4)		19 (3.3)		9 (3.9)	0.658
At least one symptom		50 (6.1)		32 (5.5)		18 (7.8)	0.221
Number of STI symptoms	816		584		232		0.243
0		766 (93.9)		552 (94.5)		214 (92.2)	
1		48 (5.9)		30 (5.2)		18 (7.8)	
2		2 (0.2)		2 (0.3)		0 (0.0)	

Bold text indicates p value was <0.05.
*P value calculated using χ^2 test or two-sample Wilcoxon rank-sum (Mann-Whitney U) test.
†Data are median (IQR).
‡During the previous 4 weeks.
§Alcohol consumption (AUDIT-C score ranged from 0 to 12): 'no consumption (none)' if the score was 0, 'moderate' if the score ranged between 1 and 3 and 'hazardous' if it was ≥4.
¶During the previous 6 months.

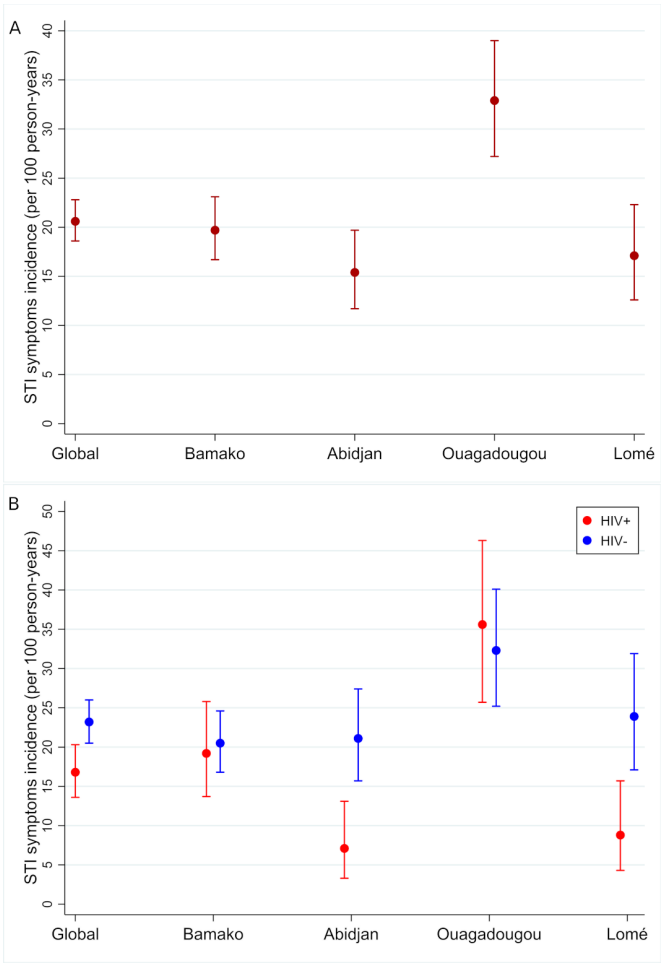

Figure 1 STI symptoms incidence (95% CI) (A) according to study site and (B) according to study site and HIV status.

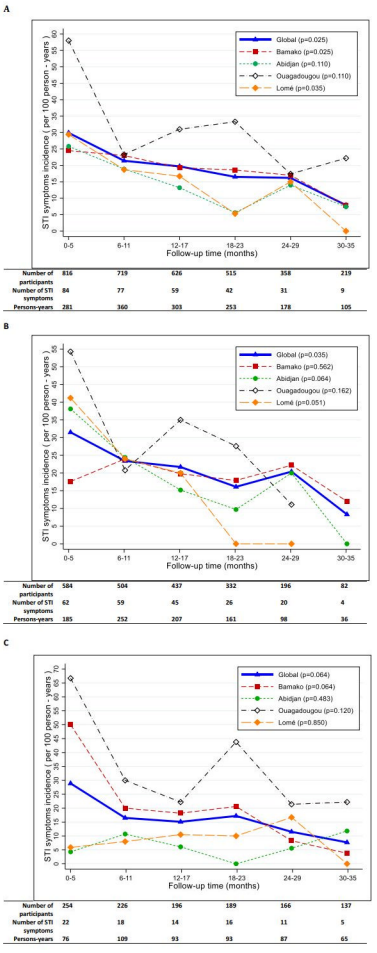

Figure 2 Change in STI symptoms incidence over time (A) in the total study population, (B) in HIV-negative participants, (C) in HIV-positive participants. P value calculated using a non-parametric test for trend.

those under 21 (aIRR 1.78, 95% CI 1.20 to 2.65, p=0.004), in participants who self-defined as bisexual than in those who did not (aIRR 1.34, 95% CI 1.01 to 1.77, p=0.045) and in participants who had transactional sex in the previous 6 months than in those who did not (aIRR 1.33, 95% CI 1.01 to 1.75, p=0.040). It was also significantly higher in HIV-positive participants who had group sex in the previous 6 months than in those who did not (aIRR 1.95, 95% CI 1.01 to 3.79, p=0.047). By contrast, it was significantly lower in participants who used condoms during their most recent anal sexual intercourse than in those who did not (aIRR 0.65, 95% CI 0.50 to 0.85, p=0.001).

DISCUSSION

This multicountry prospective cohort study in West Africa showed a decrease in STI symptoms incidence in MSM enrolled in a quarterly HIV prevention and care programme that included diagnosis and treatment of STI, HIV testing, peer-led counselling and support and the provision of condoms and lubricants. This decrease was observed in both HIV-negative and HIV-positive participants. Although the syndromic approach used in this study to diagnose STI (as is usual in African primary care settings) identified only a minority of STI (ie, symptomatic patients), our results most likely reflect the decrease in the overall incidence of STI (symptomatic and asymptomatic) in the four study sites. Our finding is consistent with our previous analysis of CohMSM data, which showed that MSM who had the highest risk of HIV infection at enrolment decreased their risky sexual behaviours during follow-up (ie, inconsistent condom use during receptive anal sex with male partners of unknown HIV status).[13] Our results are consistent with cross-sectional surveys conducted in 2004 and 2007 in Senegal, which showed an increase in condom use and a downward trend in gonorrhoea prevalence following prevention campaigns targeting MSM.[16]

The burden of STI appeared to be very high in MSM enrolled in CohMSM. It is important to underline that our estimate (20.4 per 100 PY after a median follow-up time of 22 months) only reflects the tip of the iceberg, and the overall STI incidence was likely much higher, given that 80%–90% of STI are asymptomatic and are therefore not identified using the syndromic approach.[8 9 11] By comparison, the incidence of urethral and/or rectal gonorrhoea and/or chlamydia was 19.8 per 100 PY over a 1-year study period in Kenyan MSM using laboratory tests.[11] In South Africa, the incidence of urethral and rectal infections was 14.6 and 29.7 per 100 PY for chlamydia and 8.0 and 19.1 per 100 PY for gonorrhoea, respectively, over a similar study period and also using laboratory tests.[12] In our study, the overall incidence of gonorrhoea and chlamydia could be higher because we did not use laboratory tests and urethral or anal discharges (ie, indications for gonorrhoea and chlamydia) represented 80% of STI symptoms. STI symptoms incidence was especially high in

Table 2 Determinants of STI symptoms incidence (univariate and multivariate analyses with mixed-effect Poisson regression models)

	Total				HIV-				HIV+			
	Univariate		Multivariate		Univariate		Multivariate		Univariate		Multivariate	
	IRR (95% CI)	P value	aIRR (95% CI)	P value	IRR (95% CI)	P value	aIRR (95% CI)	P value	IRR (95% CI)	P value	aIRR (95% CI)	P value
HIV status*												
Negative	1		1									
Positive	0.66 (0.49 to 0.89)	0.007	0.77 (0.57 to 1.04)	0.087								
Follow-up time (per 6-month increase)*	0.84 (0.77 to 0.91)	<0.001	0.84 (0.77 to 0.92)	<0.001	0.87 (0.78 to 0.96)	0.008	0.87 (0.63 to 0.97)	0.01	0.83 (0.71 to 0.95)	0.009	0.85 (0.74 to 0.98)	0.030
Study sites												
Abidjan	1		1		1		1		1		1	
Bamako	1.23 (0.83 to 1.84)	0.301	1.17 (0.79 to 1.75)	0.469	0.89 (0.58 to 1.39)	0.611	0.99 (0.63 to 1.54)	0.653	2.72 (1.19 to 6.23)	0.018	2.99 (1.32 to 6.76)	0.009
Ouagadougou	2.21 (1.43 to 3.42)	<0.001	2.39 (1.55 to 3.69)	<0.001	1.53 (0.93 to 2.54)	0.097	1.74 (1.06 to 2.84)	0.028	5.41 (2.31 to 12.71)	<0.001	4.95 (2.15 to 11.44)	<0.001
Lomé	1.03 (0.64 to 1.67)	0.901	1.11 (0.69 to 1.81)	0.893	1.04 (0.61 to 1.80)	0.870	0.99 (0.58 to 1.69)	0.973	1.14 (0.42 to 3.11)	0.804	1.16 (0.43 to 3.13)	0.763
Age (in years)												
<21	1		1		1		1		1			
21 to 23	1.40 (0.93 to 2.12)	0.108	1.42 (0.95 to 2.12)	0.085	1.40 (0.88 to 2.23)	0.156	1.42 (0.90 to 2.24)	0.127	1.48 (0.64 to 3.42)	0.360		
24–27	1.64 (1.09 to 2.46)	0.018	1.78 (1.20 to 2.65)	0.004	1.88 (1.19 to 2.97)	0.007	1.93 (1.23 to 3.02)	0.004	1.32 (0.58 to 2.99)	0.510		
>27	1.02 (0.65 to 1.58)	0.944	1.06 (0.69 to 1.64)	0.781	0.94 (0.56 to 1.59)	0.826	0.97 (0.58 to 1.62)	0.899	1.30 (0.58 to 2.94)	0.527		
Secondary educational level or higher												
No	1				1				1			
Yes	1.07 (0.72 to 1.58)	0.736			1.22 (0.77 to 1.96)	0.397			0.82 (0.41 to 1.64)	0.578		
Marital status												
Single/divorced/widowed	1				1				1			
Married/in free union	0.78 (0.53 to 1.16)	0.226			0.84 (0.53 to 1.32)	0.439			0.68 (0.32 to 1.46)	0.324		
Employed/self to employed												
No	1				1				1			
Yes	0.87 (0.65 to 1.17)	0.360			0.92 (0.66 to 1.29)	0.648			0.84 (0.48 to 1.47)	0.534		
Self-perceived financial situation												
Uncomfortable	1				1				1			
Comfortable	0.79 (0.59 to 1.06)	0.110			0.83 (0.59 to 1.16)	0.276			0.81 (0.46 to 1.42)	0.461		
Self-defined sexual identity as bisexual*												
No	1		1		1				1			
Yes	1.28 (0.97 to 1.69)	0.084	1.34 (1.01 to 1.77)	0.045	1.23 (0.89 to 1.70)	0.208			1.34 (0.80 to 2.27)	0.265		
Self-identified gender as man/boy*												
No	1				1				1			
Yes	1.34 (1.01 to 1.78)	0.041			1.36 (0.99 to 1.88)	0.058			1.46 (0.87 to 2.48)	0.155		
Sexual attraction to men*												
No	1				1				1			
Yes	0.82 (0.63 to 1.07)	0.142			0.90 (0.67 to 1.23)	0.513			0.65 (0.39 to 1.09)	0.103		

Continued

Table 2 Continued

	Total				HIV-				HIV+			
	Univariate		Multivariate		Univariate		Multivariate		Univariate		Multivariate	
	IRR (95% CI)	P value	aIRR (95% CI)	P value	IRR (95% CI)	P value	aIRR (95% CI)	P value	IRR (95% CI)	P value	aIRR (95% CI)	P value
Alcohol consumptiona*†‡												
None	1				1				1			
Moderate	1.12 (0.81 to 1.57)	0.477			1.16 (0.79 to 1.71)	0.441			1.03 (0.55 to 1.92)	0.922		
Hazardous	1.34 (0.97 to 1.84)	0.074			1.28 (0.89 to 1.85)	0.189			1.74 (0.78 to 2.71)	0.234		
Number of female sexual partners*§¶												
0	1				1				1			
1	0.99 (0.74 to 1.32)	0.936			1.35 (0.85 to 2.13)	0.201			1.06 (0.61 to 1.83)	0.848		
≥2	1.36 (0.97 to 1.91)	0.078			1.41 (0.90 to 2.33)	0.289			1.56 (0.79 to 3.08)	0.203		
Two or more male sexual partners*§												
No	1				1				1			
Yes	1.18 (0.89 to 1.57)	0.259			1.23 (0.88 to 1.71)	0.228			1.16 (0.67 to 2.03)	0.594		
Number of any anal sexual intercourses with men*†												
0	1				1				1			
1–4	1.37 (0.94 to 1.98)	0.099			1.49 (0.93 to 2.38)	0.099			1.11 (0.59 to 2.09)	0.742		
≥5	1.51 (1.02 to 2.24)	0.042			1.59 (0.97 to 2.62)	0.065			1.35 (0.69 to 2.66)	0.385		
Inconsistent condom use during anal sex*§												
No	1				1				1			
Yes	1.27 (0.97 to 1.65)	0.077			1.24 (0.91 to 1.69)	0.166			1.28 (0.76 to 2.15)	0.362		
Condom use during most recent anal sexual intercourse*												
No	1		1		1		1		1			
Yes	0.62 (0.47 to 0.81)	<0.001	0.65 (0.50 to 0.85)	0.001	0.63 (0.47 to 0.86)	0.004	0.62 (0.46 to 0.85)	0.002	0.66 (0.38 to 1.14)	0.137		
Group sex*§												
No	1				1				1		1	
Yes	1.71 (1.19 to 2.47)	0.004			1.42 (0.91 to 2.23)	0.123			2.44 (1.29 to 4.64)	0.006	1.95 (1.01 to 3.79)	0.047
Transactional sex*§												
No	1		1		1				1			
Yes	1.33 (1.02 to 1.75)	0.038	1.33 (1.01 to 1.75)	0.040	1.22 (0.89 to 1.67)	0.226			1.63 (0.95 to 2.81)	0.077		
History of HIV screening												
No	1				1				1			
Yes	0.93 (0.65 to 1.32)	0.667			0.87 (0.56 to 1.35)	0.529			0.86 (0.48 to 1.56)	0.629		

*Time-varying variables.
†During the previous 4 weeks.
‡Alcohol consumption (AUDIT-C score ranged from 0 to 12): 'no consumption (none)' if the score was 0, 'moderate' if the score ranged between 1 and 3 and 'hazardous' if it was ≥4.
§During the previous 6 months.

Ouagadougou but the reasons for this discrepancy with the other three study cities are unclear and require further investigation.

The high incidence of STI symptoms in our study population underscored the need for repeated screening and treatment of STI. However, retention in care was a challenge as in other African studies.[17] Indeed, a quarter of the participants were lost to follow-up, although MSM were offered a combination of prevention and care services in MSM-friendly community-based clinics as well as retention strategies such as reminder phone calls after outstanding follow-up visits and compensation for transport costs. Additional context-specific strategies are therefore needed to retain MSM in prevention programmes.

STI symptoms incidence was lower in HIV-positive participants than in their HIV-negative counterparts, which reflects results from the Kenyan study.[11] This would appear to run counter to the fact that HIV-positive participants were more likely to report risky sexual behaviours—such as multiple male sexual partners and inconsistent condom use during anal sex—at study enrolment in CohMSM. However, this apparent paradox could be accounted for by the fact that the psychological impact of the announcement of seropositivity together with the positive effect of repeated counselling, may have led to a greater reduction in risky sexual behaviours in HIV-positive participants than in their HIV-negative counterparts during follow-up.[18 19] Importantly, the difference in STI symptoms incidence according to HIV status was observed in Abidjan and Lomé but not in Bamako and Ouagadougou. Given that study protocol procedures were supposed to be similar in all four countries, this heterogeneity suggests that the local sociocultural context plays a role.

Transactional sex and group sex were risk factors for STI, which confirms findings from cross-sectional studies in African MSM.[18 20 21] Indeed, these behaviours were common in our participants (38% and 26%, respectively, at enrolment). This finding would suggest that MSM who engage in transactional or group sex require special management in terms of STI prevention, diagnosis and treatment. For instance, monthly or bimonthly screening should be considered. In addition, counselling should also focus on these behaviours for all MSM.

Condom use at most recent anal sexual intercourse was associated with a lower STI symptoms incidence. The protective effect of condom use in MSM against STI has long been known.[22–25] Unfortunately, condom use has decreased over the last decade in Africa as it has elsewhere.[26–28] Furthermore, this decline is expected to continue with the scaling up of HIV pre-exposure prophylaxis (PrEP) in the near future.[29 30] It is important that similar prevention programmes include promotion and provision of condoms and lubricants, and that counselling emphasises that PrEP does not protect against STI and consequently that condom use is still essential to protect against these infections.

One of the main strengths of our study is that it was performed in several different West African settings. This allowed us to highlight differences in STI symptoms incidence throughout the region. However, our findings should be interpreted taking into account the following limitations. First, the study was performed in MSM enrolled and followed up in MSM-friendly community-based clinics. Accordingly, participants might not be fully representative of the global MSM community in the four study countries. Second, as mentioned above, STI incidence was underestimated because STI were diagnosed using the syndromic approach. Third, the loss to follow-up for a quarter of participants might have influenced the estimate of the change in STI symptoms incidence over time. However, participants lost to follow-up were comparable to participants who remained in follow-up for almost all sexual behaviours and for the baseline prevalence of STI symptoms. Finally, participants' responses may have been affected by social desirability bias (eg, regarding sexual behaviours, condom use and STI symptoms).

In conclusion, STI symptoms incidence decreased over time but the overall burden of STI appeared to be very high in MSM followed up in West Africa. STI services including counselling, diagnosis and treatment should be reinforced. Laboratory tests that allow accurate diagnosis of STI are required. Strengthening STI services will be critical for controlling the HIV and STI epidemics in this vulnerable population and in the general population.

Key messages

- STI symptoms incidence decreased over time but the overall burden of STI appeared to be very high in men who have sex with men followed up in West Africa.
- STI services including counselling, diagnosis and treatment should be reinforced.
- Laboratory tests that allow accurate diagnosis of STI are required.
- Strengthening STI services will be critical for controlling the HIV and STI epidemics in this vulnerable population and in the general population.

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Contributors IY contributed to data collection, analysed the data and wrote the first draft of the manuscript. FD, MJBK, MKA, IT, AC, KM and MM contributed to data collection. PP contributed to study implementation. TTED coordinated the study in Burkina Faso. EM coordinated the study in Togo. CA coordinated the study in Côte d'Ivoire. BDK coordinated the study in Mali and was the co-principal investigator of the study. BS coordinated the social science component. CL was the co-principal investigator of the study, and supervised the analysis and interpretation of the data and the writing of the manuscript. All authors reviewed the manuscript.

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ORCID iD
Issifou Yaya http://orcid.org/0000-0002-2554-6515

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