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Factors associated with a reactive HIV blood self-test result among female sex workers and men who have sex with men in Yaoundé and Douala, Cameroon: a cross-sectional study

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Abstract

Background

In Cameroon, where same-sex practices and sex work are criminalised, stigma and fear of disclosure deter key populations — men who have sex with men (MSM) and female sex workers (FSWs) — from facility-based testing; HIV self-testing (HIVST), a triage test whose reactive results require confirmation, has been adopted as a differentiated strategy to reach them. However, the factors associated with a reactive HIV self-test among these populations in the country's largest cities remain poorly characterised, which limits the geographic and population targeting of prevention and testing. This study aimed to identify the factors associated with a reactive HIV self-test among FSWs and MSM in Yaoundé and Douala, Cameroon.

Methods

A cross-sectional analytical study was carried out from November 2021 to July 2022 in 17 community-based organisations (10 for MSM, 7 for FSWs) in Yaoundé and Douala. FSWs and MSM aged ≥ 21 years were recruited by voluntary sampling and performed an unassisted blood-based HIV self-test after counselling; data were collected by questionnaire. Associations with a reactive self-test were assessed by modified Poisson regression, yielding adjusted prevalence ratios (aPR) with 95% confidence intervals (CI).

Results

Of 789 participants, 435 (55.1%) were FSWs and 354 (44.9%) MSM. Overall, 23.3% (95% CI 20.5–26.4) had a reactive self-test (FSWs 23.2%; MSM 23.4%), and reactivity was more than three times higher in Yaoundé (38.3%) than Douala (12.2%). Among FSWs, reactivity was lower in Douala (aPR 0.22; 0.15–0.34) and, relative to unschooled women, at every level of education (primary 0.28 [0.16–0.50]; secondary 0.34 [0.21–0.54]; higher 0.44 [0.23–0.84]), and higher with a history of STI symptoms (aPR 3.13; 2.20–4.46). Among MSM, reactivity was lower in Douala (aPR 0.31; 0.20–0.50), with secondary education (0.37; 0.18–0.76) and with alcohol consumption (0.65; 0.43–0.98), and higher with each additional sexual partner over six months (aPR 1.03; 1.01–1.05).

Conclusion

A reactive self-test was frequent among MSM and FSWs, with a marked concentration in Yaoundé and among FSWs with no formal schooling. Strengthening geographically prioritised and differentiated HIV prevention strategies, combined with STI screening and linkage to confirmatory testing, would help reduce this burden.

Background

HIV infection in sub-Saharan Africa is increasingly concentrated among key populations, men who have sex with men (MSM) and female sex workers (FSWs). Pooled analyses illustrate the scale of this inequity: a meta-analysis of sub-Saharan studies estimated HIV prevalence among MSM at close to 18%, roughly five times that of men in the general population [1], and prevalence of 15% or higher has been reported for MSM and transgender women in about six of every ten countries in the region [2]. Among FSWs, the odds of living with HIV are more than thirteen times those of other women of reproductive age [3], with West and Central Africa consistently among the most affected sub-regions [4]. Several risk factors and behaviours remain important vectors of the circulation and spread of HIV infection within populations in general and among key populations in particular [5–7].

At the individual level, a high frequency of sexual partners, unprotected intercourse, the lifetime number of partners, substance use and low condom use are well-documented determinants of HIV acquisition [8, 5, 9–16], and the use of particular social and sexual networks further amplifies exposure to diverse partners and practices [17–20]. These behaviours, however, are shaped by a structural environment that is frequently hostile. Across ten sub-Saharan countries, including Cameroon, MSM living where same-sex acts are severely criminalised were nearly five times more likely to be living with HIV than those in non-criminalising settings, and criminalisation was also associated with lower testing and reduced awareness of HIV status [21]. Consistent with this, only about two-thirds of MSM in Africa have ever tested for HIV, and fewer than one in five of those living with the virus are aware of their status [22]. Criminalisation and stigma therefore act as barriers that delay diagnosis and, paradoxically, help to sustain onward transmission.

In Cameroon, HIV infection remains a major public health concern with an estimated prevalence of 2.7% in the general population [23]. This national average, however, conceals a far heavier burden among key populations. The most recent Integrated Bio-Behavioural Survey estimated HIV prevalence at 28.0% among MSM — reaching 48.2% in Yaoundé against 17.4% in Douala — and at 14.9% among FSWs, with broadly comparable levels across the two cities (15.8% in Douala and 12.8% in Yaoundé) [24]. These figures underline both the magnitude of the epidemic in these groups and its marked heterogeneity between cities and between populations. Access to HIV testing and care nevertheless remains limited: in Cameroon, those who engage in same-sex sexual activity or in sex work are subject to penalties under the country's penal code, which leaves many reluctant to use standard health facilities for fear of denunciation, stigma and discrimination [21, 25].

Meeting the global 95-95-95 targets by 2030 therefore requires scalable, high-impact and acceptable prevention strategies tailored to these populations. In its 2018–2023 national strategic plan against HIV and AIDS, Cameroon adopted several differentiated approaches aimed at key populations, including HIV self-testing (HIVST), the community-based oral pre-exposure prophylaxis (PrEP) programme and community-based initiation of antiretroviral therapy (ART). HIVST is particularly suited to hard-to-reach groups: a meta-analysis of randomised trials found that self-testing increased testing uptake by about

45% and improved the yield of new diagnoses without evidence of social harm [26], while its acceptability among men in sub-Saharan Africa is consistently high [27]. By offering privacy and autonomy, HIVST can circumvent some of the stigma that deters facility-based testing. Cameroon intends to leverage HIV self-testing to enhance access to PrEP among individuals at elevated risk of HIV infection, in line with current WHO guidance on HIV testing [28–30]. Yet the factors associated with a reactive self-test among key populations in Cameroon's two largest cities remain poorly characterised. The present study aimed to identify the factors associated with HIV self-test reactivity among FSWs and MSM in Yaoundé and Douala, Cameroon.

Methods

Study design, period and setting

This analytical cross-sectional study was conducted over a nine-month period, from November 2021 to July 2022. Data collection was carried out over eight days, from 11 to 22 June 2022, in 17 community-based organizations (CBOs) located in Yaoundé and Douala, including 10 CBOs serving men who have sex with men (MSM) and seven serving female sex workers (FSWs).

HIV self-test kits used in the study

The three blood-based HIV self-test devices used in the study were the Mylan HIV Self-Test (Mylan Pharmaceuticals Private Limited), the Sure Check HIV Test (Chembio Diagnostics Inc.), and the CheckNOW HIV Self-Test (Abbott Point of Care). Each device was provided with the manufacturer's instructions for use and all required kit components. To ensure a balanced distribution of the three self-test devices, participants were enrolled in triads. The first participant in each triad randomly selected one of the three devices (probability = 1/3), the second selected one of the two remaining devices (probability = 1/2), and the third received the remaining device (probability = 1/1). All three devices are WHO-prequalified blood-based HIV self-tests with high reported sensitivity and specificity [25].

Study population

The study population consisted of MSM and FSWs aged 21 and above, usually receiving free HIV testing services offered by CBOs in the cities of Yaoundé and Douala. Eligible participants had an unknown HIV status or had tested HIV-negative at least three months earlier. Individuals receiving pre-exposure prophylaxis (PrEP) or antiretroviral therapy, those reporting a known HIV-positive status, and those with an acute illness likely to interfere with the procedure were excluded. PrEP and ART users were excluded because their known status and scheduled testing would have biased positivity estimates for this analysis.

Site selection

The research was conducted in Cameroon, specifically in Yaounde and Douala, due to the numbers of their CBOs and the size of key populations. The CBOs selected for inclusion in the study were chosen based on two criteria: the size of the population they serve and the willingness of their leaders to participate. In sum, 17 CBOs on 30 (Yaounde CBOs, FSWs: 08 and MSM: 09; Douala CBOs, FSWs: 06 and MSM: 07), including 10/16 MSM CBOs (05 in Yaounde and 05 in Douala) and 07/14 FSWs CBOs (04 in Yaounde and 03 in Douala) were selected.

Sampling and sample size

Participants were recruited through voluntary, non-probability sampling. This approach is commonly used to reach hidden or stigmatized populations for whom no sampling frame exists; however, it does not support statistical generalization to the entire MSM and FSW populations of the two cities, a limitation considered in the discussion. Two days before data collection, potential participants were informed and invited by community peer-educators at CBOs and hot spots. The sample size was calculated following WHO recommendations, based on the proportion of HIV testing reported in previous national and regional studies [31, 32]; assuming an expected proportion of 81.7% among FSWs and 84.9% among MSM, an absolute precision of 4%, a 95% confidence level and no design effect (design effect = 1, consistent with the non-probability sampling strategy), the minimum sample size, adjusted for a 15% non-response rate, was 785 participants (423 FSWs and 362 MSM). Recruitment continued until the target was reached in each group; enrolment slightly exceeded the target among FSWs (461 enrolled).

Data collection measurements

Data collection

A structured questionnaire (Supplementary File 1) developed for this study; it was administered in French or English and pre-tested with a small number of FSW and MSM peers before deployment.

Data were collected by twenty trained investigator-observers (laboratory technicians, nurses and doctors) trained in the use of blood-based HIV self-tests. In each CBO, a dedicated, confidential space was prepared; in FSW hot spots, optimal confidentiality was harder to ensure because of the high mobility of the population. At recruitment, agents introduced themselves and the study authorisations, explained the study purpose, provided the information note and obtained written informed consent, and collected eligibility information. Each participant then performed the unassisted blood self-test under observation, with pre- and post-test counselling provided by CBO staff, and received condoms. After reading the result, the investigator-observer conducted a face-to-face interview using the questionnaire administered on tablets via the KoboCollect application. Participants with a reactive test were systematically referred to the health facility responsible for their CBO for confirmatory testing, in accordance with the national HIV screening and management algorithm.

Variables

The outcome was the blood-based HIV self-test result, a binary variable (reactive vs non-reactive), interpreted by trained health professionals. Independent variables were pre-specified from the literature and hypothesized confounders, comprising socio-demographic characteristics (city, age, educational level, employment status, marital status) and behavioural factors (alcohol consumption, psychoactive substance use, frequency of condom use, history of STI symptoms in the last 6 months, number of sexual partners, and sexual orientation among MSM). Psychoactive substance use was analysed as a binary variable (any use versus none).

Data analysis

Data were exported from KoboCollect and analysed using SPSS (version 27). Observations with an incomplete self-test or an invalid result interpreted by health personnel were excluded in the analysis (Fig. 1).

Categorical variables were summarised as frequencies and percentages; for the outcome of interest, 95% confidence intervals were added. Normality was assessed using the Shapiro–Wilk test [33] and all continuous variables departed markedly from normality (Supplementary File 2) and were summarised as medians with interquartile range (IQR). The chi-squared test [34] showed no significant association between the type of HIV blood self-test used and test results among either MSM or FSW (Supplementary File 2).

Because a reactive self-test was a common outcome (23.3%) in this study, we used Poisson regression with sandwich variance, yielding adjusted prevalence ratios (aPR) with 95% confidence intervals [35, 36]. Separate models were fitted for FSWs and MSM. All candidate variables were pre-specified from the literature and entered together in a single full multivariable model; no stepwise was applied following recommendations to avoid data-driven or p-value–based variable selection, which can lead to model instability and biased inference [37–39]. This strategy also ensures consistent model specification across the two multivariable models.

Model assumptions and adequacy were examined as follows. The linearity of each continuous predictor (number of sexual partners) with respect to the log of the outcome was assessed using the Box-Tidwell approach [40]; no departure from linearity was detected for variable “Age” and “number of sexual partners last six month”, so they were entered in the model on their original scale (Supplementary File 2). However, for the variable “number of sexual partners per day”, results indicate a violation of the linearity assumption; this variable was thus categorized in order to be able to integrate it into the multivariable model (Supplementary File 2).

Multicollinearity was examined using Variance Inflation Factors and Tolerance [41, 42]; Across the two regression models, multicollinearity was not a concern. All predictors displayed VIF values below 1.3 and tolerance indices above 0.84, well within accepted limits results shown no multicollinearity variables

(Supplementary File 2). No influential observations or outliers were identified. Cook's distance and leverage values were all below 1, and no observation had a leverage value exceedingly twice the mean leverage. In addition, all absolute DFBETA values were below 1 (Supplementary File 2). The adequacy of the models was assessed using goodness-of-fit statistics [43], and all models demonstrated a good fit to the data.

Missing data were handled by complete-case analysis within each model, and the analytical sample size is reported for each model. All tests were two-sided, with $p < 0.05$ considered statistically significant.

Results

Sociodemographic characteristics of FSWs and MSM

In total, 824 participants were enrolled in this study, 465 (56.4%) and 359 (43.6%) in Douala and Yaoundé respectively. Of these, 363 (44.0%) were MSM and 461 (56.0%) were FSWs. After excluding observations with missing data, invalid results and incomplete self-tests, the analysis focused on 789 participants including 435 FSWs (55.1%) and 354 MSM (44.9%), (Fig. 1).

A total of 789 participants were analysed, 435 FSWs and 354 MSM. FSWs were mainly recruited in Douala (62.1%), whereas MSM were evenly distributed between the two cities (Yaoundé 48.6%; Douala 51.4%). MSM were younger than FSWs, with a median age of 24 years (IQR 22–28) versus 30 years (IQR 25–37), and 57.9% of MSM were under 25 years compared with 24.6% of FSWs. A secondary level of education predominated in both groups (57.9% of MSM and 59.5% of FSWs), but higher education was five times more frequent among MSM (34.2%) than among FSWs (6.7%), while 33.8% of FSWs had primary education or none compared with 7.9% of MSM. The proportion in employment was comparable (55.1% of FSWs and 58.5% of MSM). Most participants were single, more so among MSM (86.7%) than among FSWs (71.2%), while 7.6% of FSWs and 5.1% of MSM were married. Overall, 10.0% of participants had never been tested for HIV, a proportion nearly five times higher among MSM (17.8%) than among FSWs (3.7%) (Table 1).

Table 1
Distribution of participants according to sociodemographic characteristics and history of HIV testing

Sociodemographic characteristics	Population		
	FSWs	MSM	FSWs & MSM
	n (%)	n (%)	n (%)
City			
Yaounde	165 (37.9)	172 (48.6)	337 (42.7)
Douala	270 (62.1)	182 (51.4)	452 (57.3)
Age			
Median age (IQR)	30 (25–37)	24 (22–28)	26 (22–33)
Under 25	107 (24.6)	205 (57.9)	312 (39.5)
25–30 years	136 (31.3)	89 (25.1)	225 (28.5)
Over 30 years	192 (44.1)	60 (16.9)	252 (31.9)
Educational level			
Unschooled	32 (7.4)	8 (2.3)	40 (5.1)
Primary	115 (26.4)	20 (5.6)	135 (17.1)
Secondary	259 (59.5)	205 (57.9)	464 (58.8)
Higher	29 (6.7)	121 (34.2)	150 (19.0)
Marital status			
Married	33 (7.6)	18 (5.1)	51 (6.5)
Single	309 (71.2)	307 (86.7)	616 (78.2)
Cohabitation	62 (14.3)	27 (7.6)	89 (11.3)
Divorced	23 (5.3)	2 (0.6)	25 (3.2)
Widow(er)	7 (1.6)	0 (0.0)	7 (0.9)
Occupation			
Unemployed	195 (44.9)	147 (41.5)	342 (43.4)
Public sector	5 (1.2)	11 (3.1)	16 (2.0)
Private sector	47 (10.8)	118 (33.3)	165 (20.9)
Self-employment	187 (43.1)	78 (22.0)	265 (33.6)

Sociodemographic characteristics	Population		
	FSWs	MSM	FSWs & MSM
	n (%)	n (%)	n (%)
History of HIV testing			
No	16 (3.7)	63 (17.8)	79 (10.0)
Yes	418 (96.3)	291 (82.2)	709 (90.0)

Risky behaviours among FSWs and MSM

Regular alcohol consumption was reported by 81.7% of participants (84.1% of FSWs and 78.8% of MSM), and psychoactive substance use by 31.8%, more frequently among MSM (37.6%) than among FSWs (27.1%). STI symptoms in the previous six months were reported by 31.4% of participants, more than twice as often among FSWs (41.4%) as among MSM (19.1%). Condom use differed markedly between the two groups: 61.6% of FSWs reported always using condoms compared with 33.1% of MSM, inconsistent use (never or rarely) was reported by 30.0% of MSM versus 17.9% of FSWs, and 13.0% of all participants never used condoms. FSWs reported a median of 5 sexual partners per day (IQR 3–8). MSM reported a median of 2 partners over the previous six months (IQR 1–4). Two thirds of MSM (67.2%) were bisexual (Table 2).

Table 2
Distribution of FSWs and MSM according to their behaviour

Risky behaviours	Population		
	FSWs	MSM	FSWs & MSM
	n (%)	n (%)	n (%)
Alcohol consumption			
No	69 (15.9)	75 (21.2)	144 (18.3)
Yes	365 (84.1)	278 (78.8)	643 (81.7)
Psychoactive substance use			
No	317 (72.9)	221 (62.4)	538 (68.2)
Yes	118 (27.1)	133 (37.6)	251 (31.8)
Use of condom during sexual intercourse			
Never	43 (9.9)	59 (16.9)	102 (13.0)
Rarely	35 (8.0)	46 (13.1)	81 (10.3)
Often	89 (20.5)	129 (36.9)	218 (27.8)
Always	268 (61.6)	116 (33.1)	384 (48.9)
History of STIs within the last 6 months			
No	255 (58.6)	284 (80.9)	539 (68.6)
Yes	180 (41.4)	67 (19.1)	247 (31.4)
Number of sexual partners			
Median per day among FSWs (IQR)	5 (3–8)	—	—
Median over last 6 months among MSM (IQR)	—	2 (1–4)	—
Sexual orientation among MSM			
Homosexual	—	115 (32.8)	—
Bisexual	—	236 (67.2)	—

Reactivity of HIV blood self-test in FSWs and MSM

Overall, 184 of 789 participants had a reactive self-test, giving a reactivity of 23.3% (95% CI 20.5–26.4). Reactivity was almost identical in the two populations, 23.2% (19.5–27.4) among FSWs and 23.4% (19.3–28.1) among MSM (Table 3).

Table 3
Distribution of results of the HIV blood self-test in FSWs and MSM

HIV blood self-test result	Population		
	FSWs	MSM	FSWs & MSM
	n (% [95% CI])	n (% [95% CI])	n (% [95% CI])
HIV blood self-test			
Non-reactive	334 (76.8 [72.6–80.5])	271 (76.6 [71.9–80.7])	605 (76.7 [73.6–79.5])
Reactive	101 (23.2 [19.5–27.4])	83 (23.4 [19.3–28.1])	184 (23.3 [20.5–26.4])

CI: confidence interval. 95% confidence intervals for proportions were computed using the Wilson score method, which performs better than the normal approximation for proportions away from 0.5 and for moderate sample sizes. No missing data for this variable.

Reactivity of the HIV blood self-test differed markedly between the two cities. Overall, 38.3% (95% CI 33.2–43.6) of participants in Yaoundé had a reactive result compared with 12.2% (9.5–15.5) in Douala, a threefold difference with no overlap between the confidence intervals ($p < 0.001$). This gradient was consistent across both key populations, with a prevalence ratio of 3.2 among FSWs (40.6% [33.4–48.2] vs 12.6% [9.2–17.1]) and 3.1 among MSM (36.0% [29.2–43.5] vs 11.5% [7.7–17.0]). Correcting the observed proportions for imperfect test performance using the Rogan-Gladen estimator changed these figures only marginally (38.0% in Yaoundé, 11.4% in Douala, 22.8% overall), indicating that non-differential misclassification cannot account for the contrast (Table 4).

Table 4
HIV blood self-test reactivity according to city of recruitment

Reactive HIV blood self-test	City of recruitment		
	Yaounde	Douala	Total
	n (% [95% CI])	n (% [95% CI])	n (% [95% CI])
FSWs	67 (40.6 [33.4–48.2])	34 (12.6 [9.2–17.1])	101 (23.2 [19.5–27.4])
MSM	62 (36.0 [29.2–43.5])	21 (11.5 [7.7–17.0])	83 (23.4 [19.3–28.1])
FSWs & MSM	129 (38.3 [33.2–43.6])	55 (12.2 [9.5–15.5])	184/789 (23.3 [20.5–26.4])

CI: confidence interval (Wilson score method).

Factors associated with reactive HIV blood self-test among FSWs

In the multivariable analysis, four variables remained significantly associated with HIV blood self-test reactivity (Table 5). Compared with sex workers in Yaoundé, those in Douala had a 78% lower prevalence of reactivity (aPR 0.22, 95% CI 0.15–0.34; $p < 0.001$). Relative to unschooled participants, reactivity was 56% lower among those with higher education (aPR 0.44, 95% CI 0.23–0.84; $p = 0.013$), 66% lower among those with secondary education (aPR 0.34, 95% CI 0.21–0.54; $p < 0.001$), and 72% lower among those with primary education (aPR 0.28, 95% CI 0.16–0.50; $p < 0.001$). A history of STIs within the previous six months was associated with a 213% higher prevalence of reactivity (aPR 3.13, 95% CI 2.20–4.46; $p < 0.001$).

Age, marital status, occupation, number of partners per day, condom use, alcohol consumption, psychoactive substance consumption, and history of HIV testing showed no significant association with reactivity ($p > 0.05$). (Table 5).

Table 5
Factors associated with a reactive HIV blood self-test among FSWs (modified Poisson regression, n = 423)

Variables	N	n	%	Adjusted PR	95% CI for PR		p
					Lower	Upper	
City							
Douala	270	34	12.6	0.22	0.15	0.34	< 0.001***
Yaoundé	165	67	40.6	1			
Age (in years)$							
median (IQR)	30 (25–37)			1.01	0.99	1.03	0.293
Educational level							
Higher	29	12	41.4	0.44	0.23	0.84	0.013*
Secondary	259	55	21.2	0.34	0.21	0.54	< 0.001***
Primary	115	17	14.8	0.28	0.159	0.496	< 0.001***
Unschooled	32	17	53.1	1			
Marital status				0.94	0.64	1.36	0.726
In union	95	26	27.4	1			
Single	339	75	22.1				
Occupation				0.76	0.54	1.08	0.128
Employed	239	38	15.9	1			
Unemployed	195	63	32.3				
Number of partners per day							
Over 5 partners per day	178	38	20.8	0.98	0.65	1.46	0.919
4–5 partners per day	102	17	16.7	0.92	0.58	1.47	0.726
1–3 partners per day	147	41	27.9	1			
Condom use							
Regular use	268	47	17.5	0.76	0.55	1.06	0.107
Irregular use	167	54	32.3	1			

Variables	N	n	%	Adjusted PR	95% CI for PR		p
					Lower	Upper	
City							
History of STIs within the last 6 months							
Yes	180	65	36.1	3.13	2.20	4.46	< 0.001***
No	255	36	14.1	1			
Alcohol consumption							
Yes	365	79	21.6	0.94	0.63	1.40	0.753
No	69	22	31.9	1			
Psychoactive substances consumption							
Yes	118	18	15.3	0.66	0.42	1.06	0.087
No	217	83	26.2	1			
History HIV testing							
Yes	418	98	23.4	1.27	0.55	2.93	0.581
No	16	3	18.8	1			

N. Total number included in multivariable analysis; **n**. Number in category “reactive HIVST”; **%**. Percentage in category “Reactive HIVST”; **PR**. Prevalence Ratio; **$**. For continuous variables, PR represent the change in prevalence per one-unit increase. **CI**. Confidence Interval; ***.** Significant at 5%; *****.** Significant at 0.1%. Pearson Khi square / degree of freedom = 0.745.

Factors associated with reactive HIV blood self-test among MSM

In the multivariable analysis, four variables remained significantly associated with HIV blood self-test reactivity among MSM (Table 6). Compared with participants in Yaoundé, those in Douala had a 69% lower prevalence of reactivity (aPR 0.31, 95% CI 0.20–0.50; p < 0.001). Relative to unschooled participants, reactivity was 63% lower among those with secondary education (aPR 0.37, 95% CI 0.18–0.76; p = 0.007). Alcohol consumption was associated with a 35% lower prevalence of reactivity (aPR 0.65, 95% CI 0.43–0.98; p = 0.039). Each additional sexual partner over the previous six months was associated with a 3% higher prevalence of reactivity (aPR 1.03, 95% CI 1.01–1.05; p = 0.002). Age, higher and primary educational levels, marital status, occupation, sexual orientation, condom use, history of

STIs within the previous six months, psychoactive substance consumption, and history of HIV testing showed no significant association with reactivity ($p > 0.05$).

Table 6
Factors associated with a reactive HIV blood self-test among MSM (modified Poisson regression, n = 343)

Variables	N	n	%	Adjusted PR	95% CI for PR		p
					Lower	Upper	
City							
Douala	182	21	11.5	0.31	0.20	0.50	**< 0.001*** **
Yaoundé	172	62	36	1			
Age (in years)$							
Median (IQR)	23.5 (22–28)			1.03	0.99	1.06	0.141
Educational level							
Higher	121	36	29.8	0.65	0.31	1.39	0.270
Secondary	205	39	19.5	0.37	0.18	0.76	**0.007*** **
Primary	20	4	20	0.58	0.20	1.70	0.324
Unschooled	8	4	50	1			
Marital status							
In union	45	12	26.7	0.64	0.36	1.15	0.139
Single	309	71	23	1			
Occupation							
Employed	207	54	26.1	1.36	0.91	2.03	0.136
Unemployed	147	29	19.7	1			
Sexual orientation							
Bisexual	236	66	28	1.38	0.88	2.16	0.163
Homosexual	115	17	14.8	1			
Condom use							
Regular use	116	27	23.3	1.30	0.87	1.95	0.203
Irregular use	234	56	23.9	1			
History of STIs within the last 6 months							
Yes	67	15	24.4	1.14	0.69	1.87	0.607

Variables	N	n	%	Adjusted PR	95% CI for PR		p
					Lower	Upper	
City							
No	284	68	23.9	1			
Alcohol consumption							
Yes	278	63	22.7	0.65	0.43	0.98	**0.039***
No	75	20	26.7	1			
Psychoactive substances consumption							
Yes	133	30	22.6	0.93	0.62	1.41	0.746
No	221	53	24	1			
History HIV testing							
Yes	291	71	24.4	1.41	0.78	2.56	0.250
No	63	12	19	1			
Number of sexual partners over the last 6 months$							
Median (IQR)	2 (1–4)			1.03	1.01	1.05	**0.002*****

N. Total number included in multivariable analysis; **n**. Number in category “reactive HIVST”; **%**. Percentage in category “Reactive HIVST”; **PR**. Prevalence Ratio; **$**. For continuous variables, PR represent the change in prevalence per one-unit increase. **CI**. Confidence Interval; ***.** Significant at 5%; *****.** Significant at 0.1%. Pearson Khi square / degree of freedom = 0.773.

Discussion

In this cross-sectional study of 789 members of two key populations recruited through community-based organisations in Cameroon's two largest cities, nearly one in four participants had a reactive blood-based HIV self-test, with almost identical proportions among FSW and MSM. The dominant signal was geographical: reactivity in Yaoundé was more than three times that in Douala (38.3% vs 12.2%), a gradient of comparable magnitude in both populations. After adjustment, reactivity among FSWs was independently associated with the city of recruitment (lower in Douala), with the level of education (relative to unschooled women, lower at every schooling level) and with a recent history of STI symptoms (aPR 3.13; 2.20–4.46). Among MSM, it was associated with the city of recruitment, secondary education, alcohol consumption (aPR 0.65; 0.43–0.98) and the number of sexual partners in the previous six months (aPR 1.03 per additional partner; 1.01–1.05).

The overall reactivity of 23.3% confirms that HIV remains heavily concentrated in these populations. It is consistent with the disproportionate burden documented across sub-Saharan Africa, where prevalence among MSM is close to five times that of the general male population [1] and reaches 15% or more in about six of every ten countries [2], where the odds of infection among FSWs exceed those of other women of reproductive age more than thirteenfold [3], and where West and Central Africa are among the most affected sub-regions [4]; key populations account for a share of people living with HIV far greater than their demographic weight [44].

A reactive self-test is, however, a triage result and not a confirmed diagnosis. Self-testers can nonetheless perform and read blood-based rapid tests with reliability approaching that of trained health workers [45], and the three finger-stick devices used here were previously shown to be usable in this population [46]; our estimates therefore provide a close approximation of undiagnosed infection – precisely the pool that self-testing is designed to identify and channel into confirmatory testing and care [26, 29, 30]. The near-identical reactivity in the two populations, set against clearly different sets of correlates, indicates that the two sub-epidemics are shaped by partly distinct determinants: structural (education) and clinical (STIs) among FSWs, and structural (city, education) together with exposure-related factors (number of partners) among MSM. The threefold difference between the two cities further indicates that these are local rather than national sub-epidemics, a pattern already described in the region [47].

The between-city gradient is unlikely to be a measurement artefact of the self-test itself: the type of device administered was recorded, and a chi-squared test showed no association between device type and the test result in either population [48]. A more plausible non-epidemiological contributor is the eligibility design. Because participants already diagnosed or receiving antiretroviral therapy or pre-exposure prophylaxis were excluded, better programme performance in one city would mechanically remove more known-positive individuals and lower measured reactivity there; given the documented variability of treatment coverage among key populations in the region [44], such differential exclusion could account for part of the gradient. Beyond this, denser and longer-established community-based prevention in Douala could plausibly reduce transmission or bring diagnosis forward.

The education gradient among FSWs is socially coherent: schooling plausibly operates through health literacy, greater power to negotiate condom use and access to alternative income, which together increase the capacity to refuse higher-risk transactions; the association was masked in crude comparisons because unschooled women were concentrated in lower-positivity Douala, emerging only after adjustment for city [49–51]. The strong association with STI symptoms among FSWs, contrasted with its absence among MSM, most likely reflects differential ascertainment rather than a different biology: our measure was symptom-based, and a large share of STIs in MSM is anorectal or pharyngeal and asymptomatic, and is therefore systematically missed by syndromic approaches [52], even though the cofactor effect of STIs on HIV acquisition is well established [53].

Among MSM, the association with the number of partners is consistent with a cumulative-exposure mechanism and with the long-standing links between partner number, unprotected anal intercourse, sexual networks and HIV in this population [54–59]; no such gradient was detectable among FSWs, in whom client turnover is uniformly very high and leaves little contrast across categories. The inverse association with alcohol among MSM (aPR 0.65) runs counter to the usual direction in the region, where alcohol use is associated with an increased risk of HIV (pooled OR 1.61) [60] and with high-risk sexual behaviour among key populations [61, 62]; lacking a plausible biological basis, and arising in a cross-sectional design, it is most consistent with residual confounding or reverse causation and should be read as hypothesis-generating rather than protective. Finally, the absence of any association with condom use is unsurprising for a prevalent outcome: current behaviour is a poor proxy for exposures that occurred years earlier, reverse causation is likely once individuals become aware of their risk, and self-reported behaviour is subject to social-desirability bias in a criminalised setting [63].

Our overall estimate falls within the range reported by regional syntheses for key populations [1–4, 44]. The magnitude of the geographical heterogeneity mirrors that seen among MSM in Malawi, where prevalence ranged from 4.1% to 24.5% across sites within a single survey [47]. For MSM, our city gradient closely reproduces the most recent national Integrated Bio-Behavioural Survey, which reported prevalence of 48.2% in Yaoundé against 17.4% in Douala [24], an independent corroboration that strengthens confidence in this finding. For FSWs, by contrast, our result diverges from national data: the same survey found comparable prevalence in the two cities (15.8% in Douala, 12.8% in Yaoundé) [24], and the 2016 survey reported higher respondent-driven-adjusted prevalence in Douala (30.3%) than in Yaoundé (21.1%) [49]; our finding of markedly higher reactivity among FSWs in Yaoundé should therefore be regarded as hypothesis-generating.

The education gradient we observed is concordant with sociostructural analyses of FSWs in Cameroon [49] and with cross-sectional studies elsewhere in sub-Saharan Africa [50, 51]. The under-detection of STIs among MSM is consistent with the high burden of asymptomatic and extragenital infection documented in Johannesburg [52] and with the self-reported STI proportions among key populations in Mozambique (33.6% versus 11.9%), which parallel ours (approximately 41% among FSWs versus 19% among MSM) [64]. The partner-number association aligns with the MSM risk-factor literature [54–56, 65], and the structural reading of our data is consistent with evidence that criminalisation is associated with higher HIV prevalence and with lower testing and status awareness among MSM in the region [21, 22].

Implications for public health

These findings support a shift towards geographically prioritised and differentiated services. The threefold difference between the two cities argues for allocating prevention and testing resources by locality rather than uniformly: Yaoundé warrants intensified investment, and the reasons for Douala's more favourable profile deserve documentation so that transferable elements can be replicated [24, 47]. Among FSWs, the strongest modifiable correlate was the absence of schooling rather than condom use, implying that programmes confined to behaviour-change messaging will miss the women at highest risk;

combining prevention with literacy support, income-generating alternatives and legal protection would address the underlying mechanism [49].

Because symptom-based screening substantially under-detects STIs in MSM, syndromic management alone is inadequate, and etiological or molecular screening including extragenital sites should be integrated into community services where feasible, with dual HIV–syphilis self-testing a plausible avenue in line with current WHO guidance [29, 52]. Self-testing should be scaled as an entry point to the cascade: it increases testing uptake by roughly 45% and improves the yield of new diagnoses without evidence of social harm [26], most people with a reactive result proceed to confirmatory testing and care [66], community-led distribution is cost-effective among key populations in neighbouring West African countries [67], and self-testing is now recommended to support pre-exposure prophylaxis [28–30]. The association between partner number and reactivity among MSM further identifies higher-turnover individuals for whom PrEP is particularly indicated, and the substantial share of MSM who reported never having previously tested is precisely the group these approaches are designed to reach [22, 27]. None of this removes the structural environment: criminalisation and stigma continue to depress testing and status awareness [21, 22], and community-based delivery mitigates but does not eliminate this barrier.

Strengths and limitations

This study covered more than half of the key-population community-based organisations in Cameroon's two largest cities and used an analytical strategy suited to a frequent outcome, reporting prevalence ratios from pre-specified multivariable models without automated variable selection [35, 68–70]. Robustness with respect to the measurement instrument is supported by the finding that the type of self-test device was recorded and was not associated with the test result in either population [48], and by prior evidence that self-testers read blood-based rapid tests reliably [45].

Several limitations nonetheless temper the findings. The voluntary, non-probability design precludes statistical generalisation to all FSWs and MSM in the two cities and may bias reactivity in either direction. The exclusion of participants already on antiretroviral therapy or pre-exposure prophylaxis means the estimates reflect undiagnosed rather than total infection, possibly unequally between cities. Confirmatory testing was not performed within the study, so a reactive result approximates but does not equal a confirmed diagnosis [26, 45]. Exposures were self-reported and STIs were ascertained by symptoms alone, and the cross-sectional design cannot establish temporality between the correlates identified and HIV acquisition.

Conclusion

In two of Cameroon's largest cities, nearly one in four female sex workers and men who have sex with men had a reactive blood-based HIV self-test, with no meaningful difference between the two populations but a striking concentration in Yaoundé, where reactivity was more than three times that of Douala. The correlates of a reactive test were largely structural: among FSWs, a lower level of education

and a recent history of STI symptoms; among MSM, the city of recruitment, the level of education, the number of recent sexual partners and — in a direction that warrants caution — alcohol consumption. Taken together, these findings suggest that social inequality, unmet sexual-health needs and cumulative sexual exposure shape the distribution of HIV in these groups more than the individual behaviours conventionally targeted by prevention messaging.

Because a reactive self-test is a triage result requiring confirmation, and because participants already diagnosed or receiving treatment were excluded, these proportions describe undiagnosed infection rather than total prevalence, and the cross-sectional design precludes causal interpretation. Even so, they make a clear case for geographically prioritised and differentiated services: intensified investment in Yaoundé, prevention combined with education and income-support interventions for the most disadvantaged FSWs, integration of etiological STI screening into community-based care, and the use of HIV self-testing as an entry point to confirmatory testing and pre-exposure prophylaxis. Consolidating these results will require linkage-to-care data and probability-based surveys to confirm the patterns observed here.

Abbreviations

aOR
adjusted Odds-ratio
CBO
Community Base Organization
CI
Confidence Interval
FSW
Female Sex Worker
HIV
Human Immunodeficiency Virus
HIVST
blood-based HIV self-test
IQR
Interquartile Range
MSM
Man Sex Man
NACC
National AIDS Control Committee
STI
Sexual Transmitted Infection
UNAIDS
United Nation HIV/AIDS Program
WHO

World Health Organization

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the principles of the Declaration of Helsinki and national regulations. Ethical approval from the National Ethics Committee for Human Health Research of Cameroon (reference number 2022/04/1448/CE/CNERSH/SP) and Administrative Research Authorization from the Operational Health Research Division of the Ministry of Health of Cameroon (reference number 031-16-22) were obtained. A written informed consent was obtained from each participant. All data collected was treated confidentially and restricting access to data.

Consent for publication

Not applicable.

Availability of data and materials

All relevant data are within the manuscript and its Supporting Information files.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Authors' contributions

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Figures

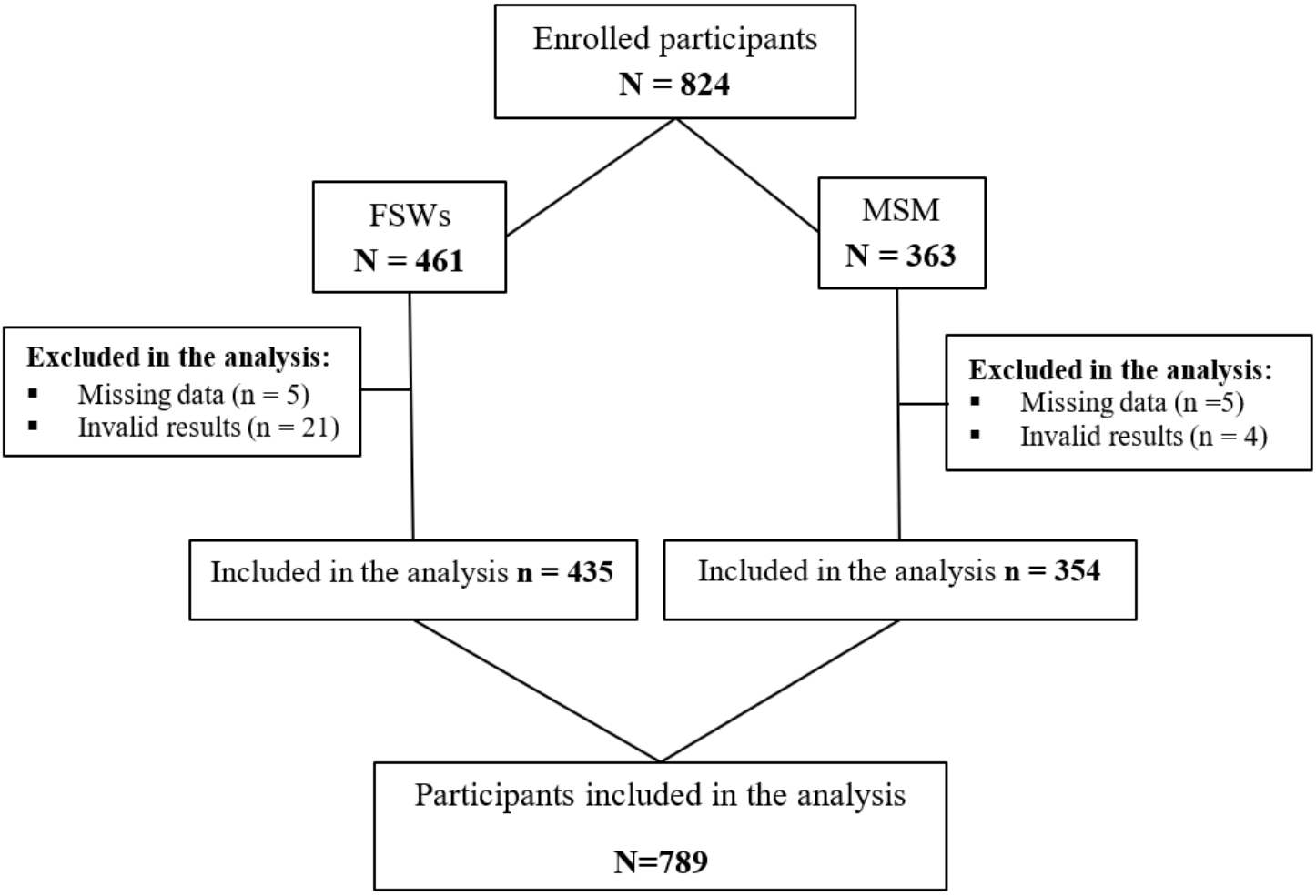


Figure 1

Participants enrolled in study and participants excluded from analysis

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- HIVbloodselftestquestionnaire.docx
- DatasetHIVbloodsefttest.xlsx
- AdditionalfileStatisticaldiagnostics.docx