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HIV status awareness among people living with HIV and the effects of HIV disclosure on viral load suppression — Nigeria and Cameroon, 2017–2018

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Global Epidemiology

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HIV status awareness among people living with HIV and the effects of HIV disclosure on viral load suppression — Nigeria and Cameroon, 2017–2018

By

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Abstract

HIV status awareness among people living with HIV and the effects of HIV disclosure on viral load suppression — Nigeria and Cameroon, 2017–2018

By Everett Brown

Background:

Identifying awareness and disclosure among people living with human immunodeficiency virus (PLHIV) in Sub-Saharan Africa (SSA) is necessary to end the epidemic. Disclosure of HIV status raises awareness and improves health outcomes among PLHIV. We aimed to use nationally representative Population-based HIV Impact Assessment (PHIA) surveys conducted in Cameroon and Nigeria to describe differences in demographic characteristics by HIV awareness status and the prevalence of disclosure to both sexual partner/spouse and anyone. We further analyzed survey data to assess whether disclosure is associated with viral load suppression.

Methods

This study used pooled data from two nationally representative PHIAs between 2017 and 2018. HIV-seropositive samples were tested for HIV-1 viral load and antiretrovirals (ARVs). The sample was weighted to represent adults aged 15–64 years who were HIV positive. We used weighted chi-squared 95% confidence intervals (CIs) and p-values with significance set to $\alpha = 0.05$ to describe determinants of awareness. We fit weighted bivariable and multivariable logistic regression models to determine associations between VLS and disclosure.

Results

Among people living with HIV who were aware of their HIV-positive status by detectable ARVs, 1,295 (70.1%; 95% CI: 67.6-72.7) self-reported as HIV-positive. Among those, 553 (44.2%; 95% CI: 41.0-47.4) self-reported disclosing their HIV-positive status to a sexual partner/spouse, and 1,176 (90.2%; 95% CI: 88.4- 91.9) self-reported disclosing their HIV-positive status to anyone. Awareness was highest among women, older people (aged 35 years or older), people who resided in urban areas, and widowed people. The results of our disclosure analyses indicated no difference in the odds of viral load suppression (VLS) among those who disclosed to a sexual partner spouse compared to those who did not (adjusted OR (aOR) 1.18; 95% CI: 0.87-1.59), whereas disclosure to anyone was associated with VLS (aOR 1.65; 95% CI: 1.04–2.62).

Conclusion

Addressing disparities in the most unaware groups will require a comprehensive approach to raising awareness that considers these populations' distinctive experiences and needs. Interventions recommended should include counseling and support services for PLHIV who face stigma and other potential challenges to disclosure and awareness.

HIV status awareness among people living with HIV and the effects of HIV disclosure on viral load suppression — Nigeria and Cameroon, 2017–2018

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Introduction

HIV remains a significant public health threat, resulting in approximately 40.1 million AIDS-related deaths [1] since its discovery. Over two-thirds of all incident and prevalent HIV cases are in sub-Saharan Africa (SSA), where nearly 1 in 25 adults is seropositive [2]. The western and central African region of SSA has approximately 5,000,000 people living with HIV and accounts for 13% (190,000) of all new HIV diagnoses worldwide [1]. Here, progress toward ending the epidemic has slowed, particularly for the most vulnerable populations [3].

To end the HIV epidemic, the Joint United Nations Programme on HIV/AIDS (UNAIDS) introduced targets in 2014 which stipulated that by 2020, 90% of all people living with HIV (PLHIV) be aware of their status, 90% of those diagnosed initiate and sustain antiretroviral therapy (ART), and 90% of PLHIV on ART achieve viral load suppression [4]. In 2020, the targets were advanced to 95%, to increase coverage and capture populations experiencing slower progress [3,6]. Reaching the first target of awareness among PLHIV is the primary step to achieving the remaining targets and is considered a priority action per UNAIDS "Global AIDS Strategy 2021-2026" for the western and central African region [5].

Having awareness of one's HIV-positive status results in protective sexual behaviors, ART initiation, and viral suppression, all factors linked to reduced transmission [7,8,9,10,11]. Typically, when an individual tests positive for HIV, he/she

is enrolled in care and initiates an ART regimen, eventually resulting in viral load suppression, which prevents virus transmission to others. Despite this awareness benefit, compared to the rest of SSA, western and central Africa has the most significant gap in reaching the first 95% target: in 2021, an estimated 80% of people living with HIV in this region knew their status [3]. Innovative strategies are urgently needed to increase awareness. One proven approach to increasing overall awareness is disclosure of one's HIV status to sexual partners [10,12,14].

Disclosure of an HIV-positive status allows sexual partners to engage in conversation and make less risky decisions about their sexual practices. Disclosure may also reduce the risk of transmission, increase testing among serodiscordant partners, prompt PrEP initiation for those who test negative, improve ART adherence, and decrease fear of rejection from family, partners, and community members [7,12,15,16]. One study modeling the risk of transmission among men who have sex with men (MSM) living with HIV found that the risk of exposure significantly declined by 45% when disclosure occurred to sexual partners [12]. When a sexual partner knows his or her partner's status, risk-reducing seroadaptive strategies (i.e., seropositioning, withdrawal) are adopted, and condom use is increased [12,15]. Comparatively, investigations have shown that those who do not disclose more often engage in condomless sex with a status-negative or unknown partner [12]. Disclosure to a sexual partner is key for early detection and treatment. Estimates of partner testing after disclosure illustrate that most individuals get tested after learning their sexual partner is HIV positive [10,11]. Those individuals who test positive can then start ART and

eventually achieve viral suppression. Disclosure has also been shown to increase medication adherence [7,13]. Adherence is essential for PLHIV to achieve viral load suppression and prevent disease progression [3,6]. Despite the benefits of disclosure, a sizeable proportion of PLHIV in the western and central African region have not disclosed their HIV-positive status [12,15].

Few studies have measured progress towards the first target of awareness in western and central Africa, despite this region being the furthest from reaching the target in SSA. Most studies investigating awareness and disclosure were based on models or select populations that may not be nationally representative. Here, we aim to use nationally representative Population-based HIV Impact Assessment (PHIA) surveys in Cameroon and Nigeria to describe differences in demographic characteristics by HIV awareness status and the prevalence of disclosure to both sexual partner/spouse and anyone (including one's sexual partner/spouse, family/friends, doctor, and others). We further analyzed survey data to assess whether disclosure is associated with viral load suppression.

Methods

Study setting and design

Our analysis pooled data from Population-based HIV Impact Assessments (PHIAs) in Cameroon and Nigeria: the Cameroon Population-based HIV Impact Assessment (CAMPHIA) and the Nigeria HIV/AIDS Indicator and Impact Survey (NAIIS). PHIAs are nationally representative, cross-sectional, household-based, HIV-focused surveys that aim to estimate annual national HIV incidence and subnational

viral load suppression (VLS) prevalence and assess progress toward the UNAIDS 90-90-90 targets [17,18]. The CAMPHIA and NAIIS used a two-stage cluster sampling design; the first stage was the selection of enumeration areas (EAs) across each country, and the second stage consisted of randomly selecting an average of 25-30 households within each EA (depending on the country). CAMPHIA selected 11,623 households and was conducted from July 2017 to February 2018; NAIIS selected 83,909 households and was conducted from July to December 2018.

All individuals aged 15-64 years were eligible for survey participation (CAMPHIA N=28,635; NAIIS N=206,996) if they slept in a selected household the night before the survey and spoke one of the survey languages. Institutionalized adults were excluded from participation. In NAIIS, adults aged 18-64 years provided informed consent and minors aged 15–17 years provided assent after receiving permission from a parent or guardian; while in CAMPHIA, adults aged 21-64 years provided informed consent and minors aged 15–20 years provided assent after receiving permission from a parent or guardian.

The detailed methods for each survey may be found in the country's final report [17,18].

Data collection

Questionnaires and field laboratory data were collected on tablets by trained staff. Individual interviews were conducted face-to-face and captured demographic, clinical information, self-reported knowledge of HIV status, self-reported disclosure, and other key HIV treatment and care indicators. A household questionnaire was also conducted with the head of household and collected data on general family and household

characteristics [17,18]. Home-based HIV testing and counseling (HBTC) was performed by trained staff per each country's testing algorithm, with immediate return of results and linkage to care, if needed; participation was contingent upon agreeing to receive one's test results. Following HBTC, specimens with a positive result underwent confirmatory testing using Geenius-HIV 1/2 Supplemental Assay in a satellite laboratory. In NAIIS, HIV-1 viral load was measured in the central lab on plasma specimens using the Roche solutions for molecular diagnostics (COBAS® AmpliPrep/COBAS® TaqMan® HIV-1 Test, version 2.0, Roche Molecular Diagnostics, Indianapolis, Indiana, United States); for specimens with an insufficient volume of plasma, dried blood spot (DBS) specimens were measured on the Roche COBAS® AmpliPrep instrument and COBAS® TaqMan® 48 analyzer using the COBAS® AmpliPrep/COBAS® TaqMan® free virus elution (FVE) protocol [17]. In CAMPHIA, HIV-1 Viral load (HIV RNA copies per mL) was measured in the central lab on plasma specimens using the AbbotReal-time HIV-1 assay on the Abbott m2000 System and then the Abbott m2000rt; VL from DBS samples with insufficient volumes of plasma was measured using the open-mode protocol for the Abbott RealTime HIV-1 assay [18]. To qualitatively screen for detectable concentrations of four ARVs (efavirenz, lopinavir, atazanavir, and nevirapine) in NAIIS, high-resolution liquid chromatography coupled with tandem mass spectrometry (MS) was used. To qualitatively screen for detectable ARVs (efavirenz, lopinavir, and nevirapine) in CAMPHIA, a single DBS was eluted, and chromatographic separation was carried out on a Luna 5 µm column (110 Å, 50 x 2 mm) [18]. Both surveys used a detection limit of 0.02 µg/mL for each drug and a signal-

to-noise ratio of at least 5:1 for all drugs; samples above the detection limit were considered positive for ARVs [17,18].

Statistical analyses

Participants with a positive HIV confirmatory test were classified as having a final HIV-positive status. Participants who self-reported as aware of their HIV-positive status in the questionnaire or had ARVs detected in their blood were classified as aware, while those who self-reported as unaware and had either undetectable ARVs or missing ARV results were classified as unaware. PLHIV who self-reported as HIV-positive during the interview were asked additional questions about HIV care and treatment, including whether they had disclosed their status to their sex partner/spouse, doctor, friend, family member, or others. We created two dichotomous variables representing disclosure. The first represented disclosure to a sexual partner/spouse or not. The second disclosure variable represented disclosure to anyone (including sexual partner/spouse, doctor, friend, family member, or others) or not. Religion categories were defined as Christian (including Christian, protestant, and Catholic), Muslim, or Other/No religion (including traditional and Animist). Viral load suppression was defined as having viral load less than 1000 copies per mL.

CAMPHIA and NAIIS data were pooled. The sample was restricted to adults aged 15–64 years who received a confirmatory HIV-positive test result; the multivariable analyses sample was further restricted to those who disclosed their HIV-positive status to the interviewer. Data were weighted to adjust for individual interview and blood draw nonresponse and noncoverage and to account for selection

probabilities. Taylor series was used for robust variance estimation and to account for the complex survey data. We first described differences in demographic characteristics by HIV awareness status, using weighted chi-squared 95% confidence intervals (CIs) and p-values with significance set to $\alpha = 0.05$. Further, we fit weighted bivariable and multivariable logistic regression models to determine associations between VLS and disclosure to one's sexual partner/spouse and between VLS and disclosure to anyone (including sexual partner/spouse, doctor, friend, family member, or others), adjusting for co-variates of interest. We calculated weighted crude and adjusted odds ratios (ORs) using the maximum likelihood ratio test results with their corresponding 95% CIs; crude models included the primary disclosure predictors. Co-variates included in the adjusted models were based on existing literature and if they were present in both surveys. All analyses were conducted in SAS version 9.4.

Results

Our pooled sample contained 3,719 participants with a final HIV-positive status. The weighted prevalence of HIV was 3.69% (95% CI: 3.36–4.02) in Cameroon and 1.37% (95% CI: 1.29–1.44) in Nigeria. Among people living with HIV, 1,906 (49.4%; 95% CI: 47.3-51.5) were aware of their HIV status. Of those who were aware of their HIV-positive status, 1,295 (70.1%; 95% CI: 67.6-72.7) disclosed their HIV-positive status to the interviewer (self-reported as HIV-positive). Among those, 553 (44.2%; 95% CI: 41.0-47.4) self-reported disclosing their HIV-positive status to a sexual partner/spouse and 1,176

(90.2%; 95% CI: 88.4- 91.9) self-reported disclosing their HIV-positive status to anyone (sexual partner/spouse, doctor, friend, family member, or others).

Participant's characteristics

The socio-demographics of the HIV-positive population is shown in Table 1. Most PLHIV were women (65.4%; 95% CI: 63.6–67.1) and between the ages of 35-44 years (31.0%; 95% CI: 29.3–32.7). Most had secondary education (41.6%; 95% CI: 39.5–43.6) and resided in a rural area (53.2%; 95% CI: 50.6–55.8). The majority of PLHIV were married/living together (69.4%; 95% CI: 67.5–71.4) and Christian (77.1%; 95% CI: 75.4–78.9). Distribution of wealth among PLHIV was similar among all categories, except the lowest wealth quintile (10.7%; 95% CI: 9.4–11.9).

Awareness of HIV positive status

Table 1 also presents the distribution of socio-demographic characteristics by HIV awareness status. Higher awareness was found among females compared to males (52.4%; 95% CI: 50.2–54.7 and 43.5%; 95% CI: 40.1–47.0, respectively). There was a statistically significant difference in awareness by age group, $p < 0.0001$: more than half of participants aged 15-24 years and 25-34 years (71.2%; 95% CI: 65.7–76.7 and 59.0%; 95% CI: 55.3–62.6, respectively) were unaware of their status, and awareness was greater among those aged 35 years or older compared to younger age groups (35-44 years: 56.1%; 95% CI: 52.8-59.5, 45-54 years: 57.9%; 95% CI: 53.6-62.2, 55-64 years: 58.8%; 95% CI: 52.3-65.2). PLHIV residing in urban areas were more aware of their status (52.8%; 95% CI: 49.4–56.2) compared to those living in rural areas (46.3%; 95% CI: 43.6–49.0), $p<0.00385$. PLHIV who were widowed were more aware of their status compared

to other marital statuses, and differences were statistically significant (64.1%; 95% CI: 59.4–68.8; p<0.0001). Awareness was higher among PLHIV with more than a secondary education (55.7%; 95% CI: 51.0-60.4) compared to those with a secondary education (47.7%; 95% CI: 44.5-50.9); p<0.0332. There were no significant differences in awareness by wealth quintile and religion.

Association between disclosure and VLS

Findings of the bivariable (unadjusted) and multivariable (adjusted) regression models for the association between disclosure to sexual partner/spouse with VLS are presented in Table 2. We found, after adjustment, no difference in VLS between individuals who disclosed their status to a sexual partner/spouse compared to individuals who did not. However, we found that the odds of VLS among women is 1.50 (95% CI: 1.05–2.14) times the odds of VLS among men, after adjusting for disclosure and other co-variates.

Table 3 provides the results of the bivariable (unadjusted) and multivariable (adjusted) regression models for the association between disclosure to anyone with VLS. After adjusting for co-variates, the odds of VLS among those who disclosed their HIV status to anyone is 1.65 (95% CI: 1.04–2.62) times the odds of VLS among those who did not. Finally, we found that the odds of VLS among women were 1.44 (95% CI: 1.01–2.05) times the odds of VLS among men, after adjusting for disclosure and other co-variates.

Discussion

We examined the prevalence of HIV status awareness among PLHIV in Cameroon and Nigeria and the associations of HIV status disclosure and VLS. Our results demonstrate that approximately half of PLHIV in Cameroon and Nigeria were aware of their status. We found that women were more aware of their status than men, older people were more aware than younger people, people in urban areas were more aware than those in rural areas, and widowed people were more aware. These findings indicate there are untapped opportunities to address underlying factors that negatively impact awareness. Prior research points to disclosure as a mechanism for increasing awareness. When people become aware that a sexual partner is HIV-positive, they are more likely to test and learn their own status [9,10,11]. Disclosure has also been shown to decrease the viral load among PLHIV [13,30,31]. This is critical for reducing new infections as VLS means that a person living with HIV cannot transmit the virus. In this assessment, we found that less than half of those aware disclosed to a sexual partner/spouse, while most (90%) disclosed to anyone. We found no evidence that disclosure to a sexual partner/spouse is associated with VLS. However, our finding that disclosure to anyone is associated with VLS points to the need for broader social support for PLHIV as disclosure to anyone may have a greater impact on VLS than disclosure to a sexual partner/spouse.

The population-level estimates of unawareness of HIV infection indicate that interventions aiming to increase testing uptake and knowledge of one's HIV status should target males, young people, and residents in rural areas. We discovered that more men were unaware of their HIV-positive status than women. Prior research

corroborates this finding and suggests that men in Cameroon and Nigeria test for HIV less frequently than women [5,26]. A qualitative study in Western Africa indicated that a lower testing frequency among men might result from access; men described the nature of health facilities as primarily for women, as most services were related to women's reproductive health [19]. Men have also reported fearing the consequences of their status being revealed to others and the potential for judgment from having a positive test result [19]. User fees may also present a barrier to testing; a study in Cote d'Ivoire reported that financial costs deterred men from seeking care at local health facilities [19,20]. Punitive laws in Nigeria and Cameroon that criminalize and stigmatize same-sex sexual acts may also hinder MSM from seeking testing. As a result, MSM have stated they neglected facility-based testing because they fear being outed by a provider [5]. Our finding of higher unawareness among young adults aged 15-24 years is prevalent in the literature and rationalizes why this group is at high risk of transmission [3,4,5,6,21]. It supports UNAIDS' most recent publication on the state of the HIV epidemic, which lists addressing adolescents as a priority action for ending the HIV epidemic [5,6,22]. Reports suggest that lower awareness among adolescents may result from laws restricting testing access by requiring parental consent [3,5]. Adolescents may not want to report sexual activity to their parents or guardians, and requesting authorization for an HIV test will reveal that they are sexually active. Prior research has also suggested that adolescents aged 15-24 years living with HIV are more susceptible to the harmful effects of stigma and discrimination from relatives, friends, and strangers, which may contribute to low awareness among this group [23]. Higher

awareness in urban areas suggests that interventions to increase testing and knowledge of HIV status are not reaching those in rural areas. A possible explanation is that HIV testing centers may be more difficult to access, and the uptake of HIV self-testing is insufficient in these areas [24]. Higher awareness among those widowed may be explained by their increased vulnerability to illness and death, motivating them to seek testing [36].

Our finding that women were more likely to be virally suppressed is supported by our estimate of unawareness among men and other assessments in western and central Africa that show men are less likely to test, be aware of their status, and disclose their status compared to women [19,25,26]. Reduced testing and accessing care among men means that opportunities are missed to initiate treatment and achieve VLS. Other possible explanations for lower prevalence of VLS among men include stigma related to being HIV-positive, lack of linkage to care, lack of ART adherence and availability, and lower CD4 counts at time of diagnosis [19,27,28]. In 2018, UNAIDS estimated that 68% of men living with HIV in Cameroon and 84% of men living with HIV in Nigeria who knew their status were on ART, falling well short of targets [38]. Our finding that VLS is higher among women also shows promise in preventing mother-to-child transmission in Nigeria and Cameroon. Policymakers should seek to understand the contextual factors contributing to VLS among women so that mother-to-child prevention programs may be more effective in reducing new infections [3].

The lack of VLS among those who disclose to a partner may indicate high prevalence of HIV-related stigma in Nigeria and Cameroon. Recent estimates suggest

that stigma and discriminatory attitudes towards PLHIV in these countries can range from 30%-50% [34,39]. This amount of stigma and discrimination may adversely affect the comfortability of PLHIV discussing their status with a partner. Although most of the literature shows that disclosure to a partner results in positive health outcomes [13,14,15], such as VLS, there is a potential for negative reactions, i.e., rejection, abandonment, or relationship dissolution, factors associated with negative health outcomes [13,23,30,34]. Having to disclose one's status to a partner may also lead to stress, anxiety, and worry about a secret being revealed, which could negatively affect medication adherence and retention in care [31]. Our finding is concerning as disclosure is linked to increased partner awareness, early initiation in care and treatment, seroadaptive strategies, and PrEP initiation [7,12,15,16]. This further points to the need for interventions to disentangle the underlying reasons for partner non-disclosure as it is crucial for HIV epidemic control.

Our finding that VLS was associated with disclosure to anyone may suggest a higher overall level of support for PLHIV who reveal their status. This is corroborated by a study in Lagos, Nigeria where women living with HIV who disclosed their status to anyone (boyfriend, spouse, family member, friend, religious leader, colleague) found that 81% of participants disclosed to anyone and the first person they usually disclosed to was a family member (%63.7); more than half of the respondents disclosed to a partner (60.4%) [40]. Those who disclosed to anyone described their experience as more positive and reported that disclosure contributed to increased social support and acceptance compared to those who disclosed to a partner [40]. Their research provides a

potential explanation for our finding, as social support is associated with reduced internalized HIV-related stigma – a factor that affects the likelihood of testing, being prescribed ART, remaining in care, and VLS [14,23,30]. Greater odds of VLS among those who disclosed to anyone may also be explained by disclosure among adolescents. A study in Western Africa found general disclosure resulted in a higher probability of ART initiation and retaining in care among adolescents and young adults aged 10-21 years; disclosure also contributed to a higher survival rate [31]. This strengthens our finding and allows policymakers to reduce transmission among young adults, who have increasingly become predominant drivers of new cases of HIV in Western and central Africa [3].

This analysis has several strengths and limitations. One strength was the data source; PHIAs are nationally representative and provide population-level socio-demographic characteristics and behavioral statistics related to the HIV epidemic. Our analysis was also strengthened by laboratory testing for ARVs, which corrects for awareness of HIV status among those individuals who self-reported as negative but have detectable ARVs in their blood. Still, there are likely some aware PLHIV who were misclassified as unaware if they chose not to disclose their status to the interviewer and were not on ARVs or we did not test for the ARVs in their regimen. Our primary disclosure variable is based on self-reported data; therefore, the total number of PLHIV who disclosed may be underestimated, as PLHIV may not have revealed their status to the surveyor because of social desirability bias. Finally, since PHIA surveys are cross-sectional, we could not assess the temporality of disclosure and VLS.

Conclusions and public health implications

When taken together with prior literature, the population-level estimates presented here suggest that awareness in Nigeria and Cameroon is far from reaching the first 95 target by 2025; only 49% of PLHIV knew their status. As indicated by UNAIDS' targets, the key to preventing the spread of HIV is to raise both awareness and VLS among PLHIV on treatment to more than 95%. The results of this study suggest that HIV status awareness varies significantly by demographic group and that efforts to end the epidemic in these countries should focus on males, young people, and residents in rural areas. Addressing disparities in the most unaware groups will require a comprehensive approach to raising awareness that considers these populations' distinctive experiences and needs. Our results regarding disclosure highlight the importance of recognizing the complex factors that act as either facilitators or barriers to disclosing one's HIV-positive status and its effect on VLS. Interventions and healthcare providers should include counseling and support services for PLHIV who face stigma and other potential challenges to disclosure and awareness. By doing so, HIV prevention will improve. PLHIV may be diagnosed early and enrolled in treatment and counseling, which will have significant public health benefits for individuals, families, and communities in both Nigeria and Cameroon.

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Table 1. Characteristics of people living with HIV, by HIV awareness status, estimated from responses to a nationally representative sample of people aged 15-64 years in Cameroon and Nigeria, 2017-2018.(Weighted Percent, 95% CI).

Characteristic	**Total (HIV +)** Weighted % (95% CI) (n=3719)	**(HIV +) Aware** Weighted % (95% CI) (n=1906)	**(HIV +) Unaware** Weighted % (95% CI) (n=1784)	**p-value**
Gender				
Male	34.6 (32.9 – 36.4)	43.5 (40.1 – 47.0)	56.5 (53.0 – 59.9)	
Female	65.4 (63.6 – 67.1)	52.4 (50.2 – 54.7)	47.6 (45.3 – 49.8)	<0.0001
Age groups				
15-24	12.5 (11.1 – 13.8)	28.8 (23.3 – 34.3)	71.2 (65.7 – 76.7)	
25-34	26.5 (24.9 – 28.2)	41.0 (37.4 – 44.7)	59.0 (55.3 – 62.6)	
35-44	31.0 (29.3 – 32.7)	56.1 (52.8 – 59.5)	43.8 (40.5 – 47.2)	
45-54	20.6 (19.1 – 22.1)	57.9 (53.6 – 62.2)	42.1 (37.8 – 46.4)	
55-64	9.4 (8.3 – 10.5)	58.8 (52.3 – 65.2)	41.2 (34.8 – 47.7)	<0.0001
Education				
No education	13.8 (12.4 – 15.2)	50.5 (45.3 – 55.7)	49.5 (44.3 – 54.7)	
Primary	28.5 (26.8 – 30.2)	48.4 (44.8 – 51.9)	51.6 (48.1 – 55.2)	
Secondary	41.6 (39.5 – 43.6)	47.7 (44.5 – 50.9)	52.3 (49.1 – 55.5)	
More than secondary	16.2 (14.6 – 17.7)	55.7 (51.0 – 60.4)	44.3 (39.6 – 49.0)	0.0332
Residence				
Urban	46.8 (44.2 – 49.4)	52.8 (49.4 – 56.2)	47.2 (43.8 – 50.6)	
Rural	53.2 (50.6 – 55.8)	46.3 (43.6 – 49.0)	53.7 (51.0 – 56.4)	0.0038
Marital Status				
Married/Living together	69.4 (67.5 – 71.4)	50.0 (47.1 – 52.9)	50.0 (47.1–52.9)	
Widowed	16.9 (15.3-18.5)	64.1 (59.4 – 68.8)	35.9 (31.2–40.6)	
Divorced/Separated	13.7 (12.3-15.0)	53.5 (48.4 – 58.5)	46.5 (41.5–51.6)	<0.0001
Wealth Quintile				
Lowest	10.7 (9.4 – 11.9)	44.6 (38.9 – 50.3)	55.4 (49.7 – 61.1)	
Second	17.9 (16.1 – 19.6)	53.4 (48.8 – 58.0)	46.6 (42.0 – 51.2)	
Middle	23.8 (21.9 – 25.7)	49.1 (44.9 – 53.3)	50.9 (46.7 – 55.1)	
Fourth	24.6 (22.8 – 26.4)	51.7 (47.7 – 55.7)	48.3 (44.3 – 52.3)	
Highest	23.1 (21.1 – 25.1)	46.2 (41.4 – 51.0)	53.8 (49.0 – 58.6)	0.0740
Religion				
Christian	77.1 (75.4 – 78.9)	50.3 (48.0 – 52.7)	49.7 (47.3 – 52.0)	
Muslim	19.4 (17.7 – 21.1)	44.9 (39.5 – 50.3)	55.1 (49.7 – 60.5)	
Other/No religion	3.5 (2.9 – 4.1)	52.3 (43.4 – 61.2)	47.7 (38.8 – 56.6)	0.1072

Table 2. Unadjusted and adjusted logistic regression models assessing the association between disclosure of HIV-positive to spouse/sexual partner with viral load suppression, PLHIV15-64 years, Cameroon and Nigeria

Variables	Crude OR (95% CI)*	Adjusted OR (95% CI)
Disclosure of HIV status to:		
Sexual partner/spouse	1.13 (0.84-1.51)	1.18 (0.87-1.59)
No one**	REF	REF
Gender		
Male	REF	REF
Female	1.03 (0.74-1.42)	**1.50 (1.05-2.14)**
Age group (years)		
15-24	REF	REF
25-34	0.85 (0.44-1.64)	0.73 (0.33-1.63)
35-44	1.52 (0.83-2.81)	1.27 (0.57-2.83)
45-54	2.47 (1.31-4.65)	2.27 (0.97-5.31)
55-64	1.97 (0.91-4.27)	1.74 (0.66-4.58)
Education		
No education	REF	REF
Primary	0.65 (0.43-1.00)	0.66 (0.42-1.02)
Secondary	0.67 (0.43-1.04)	0.82 (0.51-1.32)
More than secondary	0.76 (0.44-1.32)	0.92 (0.51-1.66)
Marital Status		
Married/Living together	1.43 (0.95-2.13)	1.41 (0.94-2.11)
Widowed	1.49 (0.91-2.43)	1.14 (0.68-1.91)
Divorced/Separated	REF	REF
Wealth Quintile		
Lowest	REF	REF
Second	1.45 (0.93-2.25)	1.13 (0.71-1.79)
Middle	1.13 (0.70-1.83)	0.92 (0.56-1.50)
Fourth	1.15 (0.72-1.85)	0.88 (0.54-1.45)
Highest	1.04 (0.63-1.73)	0.78 (0.45-1.39)

*All crude models include the primary disclosure variable predictor.

**Disclosure to others includes doctor, friend, family member, no one, or others

Table 3. Unadjusted and adjusted logistic regression models assessing association between disclosure of HIV-positive to anyone with viral load suppression, PLHIV 15-64 years, Cameroon and Nigeria

Variables	Crude OR (95% CI)*	Adjusted OR (95% CI)
Disclosure of HIV status to:		
Anyone**	1.46 (0.96-2.21)	**1.65 (1.04 – 2.62)**
No one	REF	REF
Gender		
Male	REF	REF
Female	1.00 (0.72-1.38)	**1.44 (1.01-2.05)**
Age group (years)		
15-24	REF	RE
25-34	0.86 (0.44-1.70)	0.70 (0.31-1.59)
35-44	1.54 (0.81-2.92)	1.21 (0.53-2.76)
45-54	2.46 (1.27-4.75)	2.16 (0.89-5.21)
55-64	1.97 (0.89-4.36)	1.63 (0.60-4.40)
Education		
No education	REF	REF
Primary	0.67 (0.43-1.02)	0.67 (0.43-1.04)
Secondary	0.69 (0.44-1.07)	0.84 (0.52-1.36)
More than secondary	0.79 (0.46-1.37)	0.93 (0.51-1.69)
Marital Status		
Married/Living	1.32 (0.89-1.95)	1.39 (0.93-2.07)
together	1.48 (0.90-2.43)	1.12 (0.66-1.89)
Widowed	REF	REF
Divorced/Separated		
Wealth Quintile		
Lowest	REF	REF
Second	1.48 (0.95-2.31)	1.17 (0.74-1.85)
Middle	1.13 (0.70-1.84)	0.92 (0.56-1.51)
Fourth	1.15 (0.72-1.83)	0.87 (0.53-1.43)
Highest	1.08 (0.64-1.81)	0.82 (0.46-1.45)

*All crude models include the primary disclosure predictor variable.

** Disclosure to anyone - including sexual partner, doctor, friend, family member, or others