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Progress toward HIV epidemic control in Lesotho

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Abstract

Objective: The Lesotho Population-based HIV Impact Assessment survey was conducted nationally and designed to measure HIV prevalence, incidence, and viral load suppression (VLS).

Design: A nationally representative sample of 9403 eligible households was surveyed between November 2016 and May 2017; analyses account for study design. Consenting participants provided blood samples, socio-demographic, and behavioral information.

Methods: Blood samples were tested using the national rapid HIV testing algorithm. HIV-seropositive results were confirmed with Geenius supplemental assay. Screening for detectable concentrations of antiretroviral analytes was conducted on dried blood specimens from all HIV-positive adults using high-resolution liquid chromatography coupled with tandem mass spectrometry. Self-reported and/or antiretroviral biomarker data were used to classify individuals as HIV-positive and on treatment. Viral load testing was performed on all HIV-positive samples at central labs. VLS was defined as HIV RNA below 1000 copies/ml.

Results: Overall, 25.6% of adults aged 15–59 years were HIV-positive. Among seropositive adults, 81.0% (male 76.6%, female 84.0%) reported knowing their HIV status, 91.8% of people living with HIV (male 91.6%, female 92.0%) who reported knowing their status reporting taking antiretrovirals, and 87.7% (male and female 87.7%) of these had VLS. Younger age was significantly associated with being less likely to be aware of HIV status for both sexes.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Conclusions: Findings from this population-based survey provide encouraging data in terms of HIV testing and treatment uptake and coverage. Specific attention to reaching youth to engage them in HIV-related interventions are critical to achieving epidemic control.

Keywords

Africa; ART; HIV; Lesotho; survey; viral load suppression

Introduction

Nearly two-thirds of HIV-positive persons live in sub-Saharan Africa, leaving the region disproportionately impacted by HIV [1]. In an effort to reduce the number of new infections and limit the further spread of HIV, the Joint United Nations Programme on HIV/AIDS (UNAIDS) declared the 90-90-90 strategy in 2014. The strategy aims for 90% of all persons living with HIV to know their status, 90% diagnosed as positive to be on antiretroviral therapy (ART), and 90% of those to be virally suppressed by 2020 with the goal of ending the AIDS epidemic by 2030 [2]. Viral suppression successfully reduces the risk of sexual and perinatal transmission of HIV [3–5]. If the 90-90-90 goals are met, the annual global incidence of HIV would reduce from the current two million annual infections to an estimated half million annual infections by 2020 [6,7].

Lesotho – a mountainous country surrounded by South Africa – has a population of approximately two million persons, with an estimated gross national income of $1280 per capita [8]. Lesotho has a generalized hyper-endemic HIV epidemic [9], where prevalence of HIV among persons aged 15–49 years was 24.6% in 2014, with an incidence of 1.9 new infections per 100 person-years of exposure [10]. As the leading cause of premature death, HIV/AIDS has contributed to Lesotho's reporting the second shortest life expectancy at birth among 195 countries and territories [11]. In 2015, ART coverage among all HIV-positive persons in Lesotho was estimated at 42% [12]. On 14 April 2016, Lesotho became the first country in sub-Saharan Africa to adopt the WHO recommendations for universal initiation of ART for all HIV-positive persons, regardless of $CD4^+$ cell count ('Treat All'), with nationwide implementation occurring on 1 June 2016 [13]. Before implementation of *Test and Start*, many persons living with HIV in Lesotho were not eligible to initiate treatment until their $CD4^+$ cell count fell below 500 cells/μl.

The Lesotho Population-Based HIV Impact Assessment (LePHIA) was a national cross-sectional, household-based survey conducted between November 2016 and May 2017 across all 10 districts and included persons aged 0–59 years. The primary survey objectives were to estimate national HIV incidence, and district-level prevalence and viral load suppression (VLS). The study presents Lesotho's progress towards achieving the 90-90-90 goals among adults aged 15–59 years.

Methods

Sample frame and design

The LePHIA utilized a two-stage, stratified cluster sample design. The sampling frame was comprised of all households in the country using preliminary 2016 census data. The first stage selected 418 enumeration areas (clusters) using a probability proportional to size method and were stratified by district. During the second stage, a sample of households was randomly selected within each enumeration area using an equal probability method, where the average number of households selected per cluster was 26 (range 15–35). The sample size was calculated *a priori* to provide representative national estimates of HIV incidence among women aged 15–24 years and adults aged 15–59 years with a relative standard error less than or equal to 30.0%, and also representative district estimates of VLS prevalence among HIV-positive persons 15–59 years of age with 95% confidence intervals (CIs) and ±10% bounds around the point estimates. The target sample size was 12 698 adults aged 15–59 years.

Recruitment and consent procedures

Selected households were approached, and after obtaining informed consent, heads of households completed a household questionnaire that included a roster of all persons who resided in or had slept in the household the previous night. Eligible household members were asked to provide consent to participate in an individual questionnaire that included socio-demographic and behavioral risk questions and to home-based rapid HIV testing. A guardian or parent provided permission for interviewers to approach 15–17-year-olds who were asked for assent. Written informed consent was documented via electronic signature. All eligible household members who provided consent were included in the survey. The LePHIA protocol and data collection tools were approved by the Lesotho Research and Ethics Committee and the institutional review boards at Columbia University Medical Center and the US Centers for Disease Control and Prevention (CDC).

Data collection and biomarker testing procedures

Survey staff administered the questionnaire to participants aged 15–59 years during face-to-face interviews in a private area using open data kit (ODK) data collection software on Google Nexus 9 tablets. The questionnaire included questions on lifetime and recent sexual behaviors, and on external migration, defined as having lived outside Lesotho for more than 1 month in the past year.

Venipuncture was performed by trained nurses, and rapid HIV testing was conducted using Determine HIV-1/2 Rapid Test (Alere, Chiba, Japan), confirmed with the Uni-Gold HIV Test (Trinity Biotech, Ireland). Capillary blood draws were used in cases of failed venous blood draws. Counseling was provided, with active referral to a preferred facility for all those who tested seropositive. A $CD4^+$ cell count was measured in the household using PIMA (Alere). Laboratory verification of all HIV-positive results was done using the Geenius HIV 1/2 supplemental assay (Bio-Rad, Hercules, California, USA) (Radin E, in preparation). HIV-1 RNA in plasma and dried blood spots (DBS) was measured using real-time PCR (Cobas Taqman, Roche, Indianapolis, Indiana, USA). Antiretroviral analytes for

the three most commonly prescribed antiretrovirals (lopinavir, nevirapine, and efavirenz) were tested on HIV-positive DBS using high-resolution liquid chromatography mass spectrometry at the University of Cape Town. The lower limit of detection was 0.02/ml and the number of days from ingestion to detectability at this threshold was 1.5–2.5 days for lopinavir, 8–9 days for nevirapine, and 12–28 days for efavirenz [14]. These three antiretrovirals were selected as markers for the most commonly prescribed first and second-line regimens, and because of their relatively long half-lives, allowing a longer period of detection following intake.

Statistical analyses

Design weights were calculated based on sampling design, including probability of household selection, adjusted for nonresponse at the household, individual and biomarker levels using the SI-CHAID software (Statistical Innovations, Belmont, Massachusetts, USA). Poststratification weights were calculated to reflect the age distribution of the 2016 Lesotho census [15]. Awareness, treatment coverage, and viral load suppression (90-90-90) targets were calculated as:

> Percentage who know their status (first 90) = HIV-positive persons self-reporting prior HIV status awareness and/or had detectable antiretroviral/ participants who tested HIV positive in the survey
>
> Percentage of HIV-positive persons on antiretrovirals (second 90) = HIV-positive persons currently receiving ART by self-report and/or with detectable antiretrovirals/ HIV-positive persons with documented prior awareness of HIV status
>
> Percentage virally suppressed (third 90) = HIV-positive persons with detectable antiretrovirals and/or who self-reported current antiretroviral usage with HIV RNA below 1000 copies/ml/HIV-positive persons currently receiving ART by self-report and/or with detectable antiretrovirals

All analyses were done in Stata version 15.1 (Stata Corp., College Station, Texas, USA) using weighted data, with jackknife replicate weights for variance estimation arising from nonresponse adjustments [16]. The association between factors included in the survey questionnaire and HIV awareness, ART status, and VLS (90-90-90) were assessed using logistic regression models. Multivariable logistic regression models for men and women were constructed and included variables known to be or could conceivably be associated with awareness of HIV infection, ART use, and viral load suppression.

Results

Of 10 892 target households, 9403 (86.3%) were enrolled and 8824 (93.8%) completed household interviews. Reasons for noninclusion included vacant housing and destroyed dwellings (13.7%), and refusal to participate (6.2%). In households surveyed, 14 028 adults (6135 men and 7893 women) aged 15–59 years were eligible to participate in the survey. Altogether, 92% (12 887) of eligible adults (86.8% of men and 95.1% of women) were interviewed and 91% (11682) of interviewed adults (88.2% of men and 91.3% of women)

provided blood for biomarkers to determine HIV status. Baseline characteristics of participants are presented in Table 1.

Annual incidence among persons aged 15–59 years was 1.10% (95% CI 0.68, 1.52). Women had an annual incidence of 1.22% (95% CI 0.69, 1.74) and men had an annual incidence of 1.00% (95% CI 0.42, 1.59). Prevalence among 15–59-year-olds was 25.6% (95% CI 24.7, 26.4), corresponding to approximately 306 000 persons aged 15–59 years living with HIV in Lesotho. Overall, women had a significantly higher prevalence (30.4%; 95% CI 29.3, 31.5) than men (20.8%; 95% CI 19.6, 22.0). The majority (56.1%; 95% CI 55.0, 57.2) of the population aged 15–59 years reported having HIV testing and receiving results in the 12 months preceding the survey (61.7%; 95% CI 60.5, 62.9 of women and 50.5%; 95% CI 48.9, 52.1 of men).

Overall, 3199 individuals were identified as HIV-seropositive (previously and newly diagnosed positive) during the survey. Among those aged 15–59 years who tested HIV-positive in LePHIA, 5.1% reported that they had never been tested or that they had never received their results. A significantly higher proportion of HIV-positive women (97.2%; 95% CI 96.3, 98.0) reported prior HIV testing, compared to men (91.4%; 95% CI 89.5, 93.3).

Among all HIV-positive participants, 11.5% (95% CI 10.2, 12.7) (men 16.0%; 95% CI 13.5, 18.4 and women 8.4%; 95% CI 7.2, 9.7) had a $CD4^+$ cell count below 200 cells/μl. Among persons who reported being HIV-negative, but tested HIV-positive during the survey, 15.7% (95% CI 12.3, 19.2) had a $CD4^+$ cell count of below 200 cells/μl (men 16.5%; 95% CI 11.0, 22.0 and women 15.0%; 95% CI 11.0, 19.0), whereas 44.6% (95% CI 40.1, 49.0) had a $CD4^+$ cell count of below 350 cells/μl (men 47.9%; 95% CI 41.1, 54.7 and women 41.2%; 95% CI 35.8, 46.5) μl. Overall VLS, regardless of treatment status, among persons aged 15–59 years, was 67.6% (95% CI 65.7, 69.5) (men 70.5%; 95% CI 68.3, 72.7 and women 63.4%; 95% CI 60.4, 66.4) (HIV-1 RNA < 1000 copies/ml). Overall VLS varied by age with the highest rates among women aged 45–49 years and men aged 55–59 years (82.4%; 95% CI 75.8, 89.0 and 86.6%; 95% CI 78.8, 94.5, respectively). The lowest rates were among women aged 15–19 years (50.8%; 95% CI 37.9, 63.7) and among men aged 25–29 years (95% CI 43.6%; 56.0, 68.5).

Progress toward reaching epidemic control

Among HIV-infected persons, 81.0% (95% CI 79.5, 82.5) were previously aware of their HIV-positive status (first 90). Of those, 91.8% (95% CI 90.5, 93.1) had detectable antiretrovirals and/or reported current ART usage. Among persons who self-reported being unaware of their HIV-positive status, 16.6% had detectable antiretrovirals in their system, and 12.7% of participants who denied taking ART, but reported a previous HIV diagnosis, had antiretrovirals detectable in their system (Table 2).

Among women, 84.0% (95% CI 82.3, 85.8) self-reported knowing their status and/or had detectable antiretrovirals, 92.0% (95% CI 90.4, 93.5) of those persons self-reported and/or had detectable antiretrovirals, and 87.7% (95% CI 85.9, 89.5) had VLS (Fig. 1). Significantly fewer men (76.6%; 95% CI 74.0, 79.1) self-reported testing and/or had

detectable antiretrovirals. Additionally, 91.6% (95% CI 89.5, 93.6) of those men self-reported and/or had detectable antiretrovirals and 87.7% (95% CI 85.0, 90.3) had VLS (Fig. 1). Progress toward the 90-90-90 goals was lowest among those less than 35 among both men and women (Table 3).

Factors associated with achieving testing, treatment coverage, and viral load suppression (90-90-90) targets

Among men, younger age was associated with lower awareness of HIV-positive status. Men aged 20–24 years [adjusted odds ratio (aOR) 0.13, $P < 0.001$], 25–29 years (aOR 0.09, $P < 0.001$), 30–34 years (aOR 0.18, $P < 0.001$), and 35–44 (aOR 0.35, $P < 0.001$) had significantly lower odds of being aware of their HIV-positive status compared to men aged 45–59 years. Men aged 20–24 years (aOR 0.26, $P = 0.03$) had lower odds compared to men aged 45–59 years to be on ART. Men who reported completing secondary school (aOR 0.24, $P = 0.02$) and grades 4–6 (aOR 0.21, $P = 0.002$) were at decreased odds of being on ART compared to men who reported university education. Higher education and older age were significantly associated with VLS. Men who completed secondary school (aOR 0.11, $P = 0.01$), grades 8–11 (aOR 0.17, $P = 0.02$), primary school (aOR 0.12, $P = 0.01$), and did not attend school or completed up to grade 3 (aOR 0.18, $P = 0.03$) compared to men who had a university education were less likely to be virally suppressed. Men between the ages of 15 and 24 years (aOR 0.26, $P = 0.03$) had significantly lower odds of being virally suppressed than men aged 45–59 years (Table 4).

Women aged 15–19 years (aOR 0.41, $P = 0.02$), 20–24 years (aOR 0.31, $P < 0.001$), 25–29 years (aOR 0.61, $P = 0.04$), or who had lived outside Lesotho for at least 1 month in the past 12 months (aOR 0.58, $P = 0.03$) had significantly lower odds of being aware of their HIV-positive status compared to women who were aged 45–59 years and those who had not lived outside Lesotho for at least 1 month in the past 12 months, respectively. Level of schooling and migration (away from residence for >1 month in the past 12 months) were significantly associated with taking antiretrovirals among HIV-positive women. Women who did not attend school or complete grade 3 (aOR 0.35, $P = 0.03$) and women who had recently been away from home for more than 1 month in the past 12 months (aOR 0.29, $P < 0.001$) had significantly lower odds of being on ART compared to women who had completed a university education or who had not been away from home, respectively. Younger women on antiretrovirals were also significantly less likely than older women to have VLS. Women aged 15–19 years (aOR 0.23, $P = 0.003$), 20–24 years (aOR 0.22, $P < 0.001$), 25–29 years (aOR 0.32, $P < 0.001$), and 30–34 years (aOR 0.35, $P < 0.001$), were less likely to have VLS than women aged 45–59 years. Women who had no school to grade three (aOR 0.29, $P = 0.008$) were also at decreased odds of achieving VLS than women who had completed a university education.

Discussion

Although significant progress has been made in Lesotho towards achieving treatment coverage and viral load suppression goals, there remains significant variation by age and sex with men and younger persons further from achievement. When UNAIDS launched the

90-90-90 strategy, it was estimated that 45% of people living with HIV in sub-Saharan Africa were aware of their status [2]. While Lesotho is nearing the first 90 goal, there is still an urgent need to improve the first 90 from the current 81.0% to reach epidemic control. There is a significant disparity between HIV-positive men (76.6%) and women (84.0%) being aware of their status, with nearly one quarter of HIV-positive men unaware of their positive status, despite extensive community and facility-based testing campaigns. Men may also be less likely to self-report that they have been tested in the prior 12 months than women (50.5 vs. 61.7%) [17]. HIV prevalence peaks among women aged 35–39 years (49.9%) and among men aged 40–44 years (46.9%); yet 14% of women and 20% of men are still unaware of their HIV status, which may increase the risk of sexual transmission, especially as women are still considered to be in their childbearing years during this age range [18]. The median ages for sexual debut in Lesotho are 18.5 years for women and 18.1 years for men [9] presenting an opportunity for sexual transmission of HIV, given lower ART adherence among younger men. Intergenerational sex is a risk factor for HIV among adolescent girls and young women and in Lesotho; older partners are more likely to be HIV-positive, and previous research demonstrates the increased risk of HIV infection within age-disparate relationships [19,20]. Creating additional youth and male-friendly services and ensuring pregnant women access ANC services to facilitate testing may increase awareness of status. Prevention programs that target factors facilitating age-disparate relationships are needed to reduce the transmission of HIV and improve awareness of HIV risk. Structural interventions such as economic empowerment among young women have been shown to have promising results in lowering STI and HIV risk in Malawi where young women were enrolled in cash transfer programs [21].

Once an individual was aware of their HIV status, treatment disparities by sex were no longer present and linkage to care and treatment, and viral load suppression was higher than within the first 90 among both men and women. However, younger age groups (15–34) lag behind across the three 90s. Among men aged 15–24 and 25–34 years, only 84.1 and 88.3%, respectively, are, at present, on antiretrovirals. Despite the high rate of HIV in Lesotho, emphasis should continue to be placed on stigma reduction towards HIV in general and when offering HIV services at health facilities. In a South African study, adolescents and young adults emphasized the importance of providing access to HIV testing and antiretrovirals within an environment that minimizes stigma. Stigma was noted as a primary barrier to HIV testing while potential side effects of medications that would prevent the appearance of being healthy as a primary barrier to ART adherence [22]. Incorporating testing strategies that minimize stigma and holistic approaches to HIV care that account for adolescent and young person’s lifestyles may improve testing and retention. Both men and women aged 15–24 years have the lowest VLS rates at 78.3 and 76.8%, respectively. This indicates a clear need for treatment-specific positive counseling tailored for the younger population for ensuring those on ART have high VLS. Suboptimal VLS in this age group may also be related to recent initiation of ART. Lesotho’s early adaptation of the ‘Treat All’ strategy has shown promising results increasing the number of people initiated on treatment. With continued implementation of ‘Treat All’ the country should reach the second 90 in both men and women across all age groups [23]. Overall VLS (regardless of ART use) is below the target 73%. VLS is a strong indicator of treatment access and retention in care, and can

be used as a proxy to measure the overall success of the HIV program in Lesotho. Lesotho's HIV incidence remains high and is proof of ongoing HIV transmission. Prior evidence demonstrates the substantial impact that VLS has on reducing sexual and maternal transmission of HIV [3–5].

Although high rates of national ART coverage and VLS indicate progress, LePHIA data still show a high rate of incidence, signaling concerning rates of ongoing HIV transmission. A renewed focus on and revised strategies to target age and sex differences will build on population-level progress in achieving the three 90s. While antiretroviral use remains high among both sexes, evidence of $CD4^+$ cell counts below 350 cells/μl in almost half the men and 40% of women who were unaware of their HIV-positive status during the survey indicate many people at risk of advanced HIV disease are in need of testing and treatment. Even more concerning, more than 10% of women had evidence of immunosuppression ($CD4^+$ cell count <200 cells/μl) at the time of HIV diagnosis. Identifying HIV-positive persons early and starting them on treatment at diagnosis is critical to preventing further transmission and maintaining personal health. Continued use of differentiated service delivery models, such as male-friendly health clinics, community-initiated treatment, and the option of voluntary same-day treatment initiation with the 'Treat All' strategy, should help to address late identification of HIV-positive individuals and ensure rapid treatment initiation.

Factors associated with meeting the 90-90-90 goals differ by sex. Among women, younger age was associated with being less likely to have VLS [24–26], which may be associated with age at diagnosis and length of time taking antiretrovirals. Migration was associated with women being less likely to be aware of their status and taking ART at present, and with men being less likely to be aware of their status. Given the high rate of migration, within Lesotho and to neighboring South Africa, for employment, policies covering cross-border antiretroviral prescriptions and multimonth scripting could be reviewed and updated to include 6 months of antiretrovirals as necessary to support treatment adherence. Ongoing discussions with South Africa to allow an increased amount of antiretrovirals to be carried across the border or for drug pick up in South Africa should continue. A rapid review of Southern African Development Community (SADC) migration and mobility policies found that these areas are not adequately addressed for health and that each of the SADC countries had different legislation pertaining to the rights of cross-border migrants to access healthcare including ART [27]. Additionally, testing programs/events at border areas, use of a patient health passport, providing patients with cross-border clinic locations, and mobile clinics could increase a person's ability to accessing HIV testing resulting in increased knowledge of status and adherence to treatment [28].

Among men, age was associated with being aware of HIV status and ART use. Younger men were less likely to be aware of their HIV status and on ART. Novel approaches to increase testing such as self-test kits or continuing to support men's clinics that offer extended hours or fast-track testing, or work-place testing could be further investigated and implemented.

Limitations of the current study include those common to studies relying on self-reported data. The survey asked questions about ART use and past HIV testing which may be subject to recall bias. Also, as the survey was household-based, persons who did not reside in the

house the night before or who were away from home at the time of the survey were not included; this may impact migration-related data as persons more likely to work away from home or travel may have been missed or excluded during the household visit.

Conclusion

Although Lesotho has made significant progress towards achieving epidemic control, as in other countries in sub-Saharan Africa, gaps remain in achieving the first 90 [29]. In addition, HIV prevalence and incidence in Lesotho are amongst the highest in the world. Targeted testing is needed for early diagnosis of persons unaware of their HIV-positive status. In addition to identifying someone who is HIV-positive, specific emphasis could be placed on finding people earlier given that almost half of people who were tested during the survey had a $CD4^+$ cell count below 350 cells/μl, despite Lesotho's policy of treatment for all. VLS is high, with minimal difference between men and women. Overall, Lesotho is nearing the epidemic control goals, but to see full achievement, age and sex disparities should be addressed. To sustain treatment and viral load suppression progress made, continued support of innovative prevention and treatment programs are vital to reach epidemic control in Lesotho.

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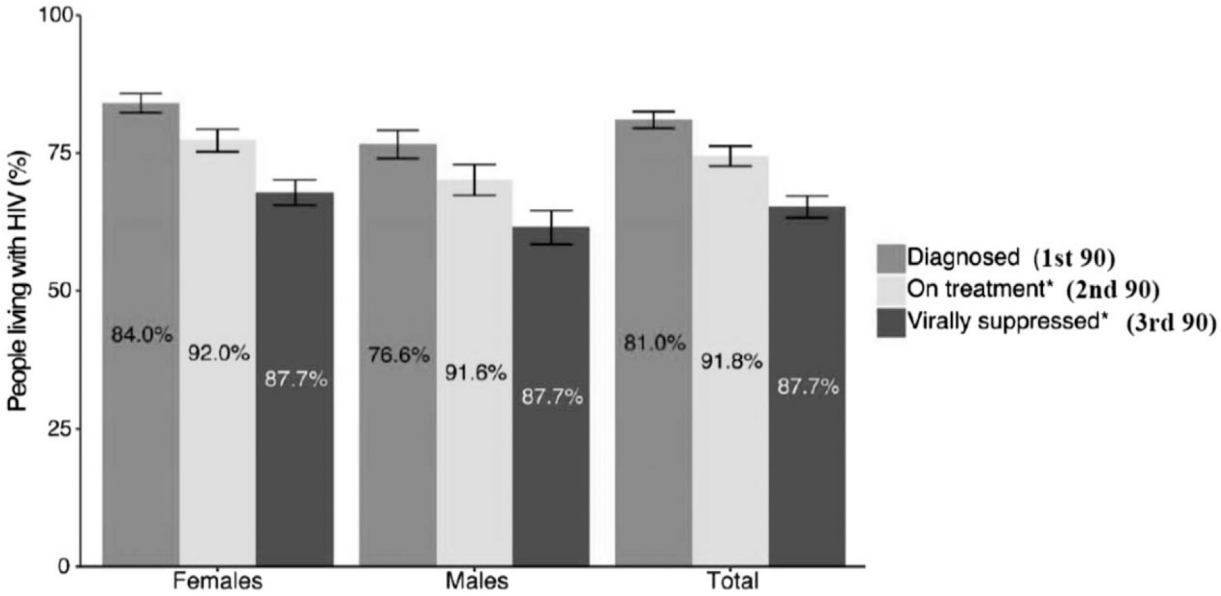

Fig. 1. Adult 90-90-90 indicators (conditional percentages; adjusted for laboratory antiretroviral data[1] among adults aged 15–59 years) – LePHIA 2016–2017.

In the antiretroviral-adjusted 90-90-90 participants were classified as "Aware" or "Diagnosed" if they self-reported HIV-positive before testing HIV-positive in LePHIA and/or had detectable antiretrovirals in their blood. Participants were classified as "On Treatment" if they self-reported that they were on treatment and/or if they had detectable antiretrovirals in their blood. *Inset numbers are conditional proportions. LePHIA, Lesotho Population-Based HIV Impact Assessment.

Table 1.

Baseline socio-demographic characteristics of participants, all participants, and HIV-positive participants, LePHIA 2016–2017.

	All participants (with blood draw) (*N* = 11 682)			HIV+ participants (*n* = 3199)		
Characteristics	**Male % (*n*)**	**Female % (*n*)**	**Total % (*N*)**	**Male % (*n*)**	**Female % (*n*)**	**Total % (*N*)**
Age, years						
15–19	17.7 (921)	17.3 (1156)	17.5 (2077)	2.4 (26)	3.2 (64)	2.9 (90)
20–24	16.5 (769)	16.8 (1202)	16.6 (1971)	3.2 (32)	9.2 (209)	6.8 (241)
25–29	16.0 (707)	15.6 (1054)	15.8 (1761)	9.9 (93)	16.1 (342)	13.6 (435)
30–34	14.6 (611)	13.5 (857)	14.0 (1468)	18.2 (166)	18.4 (374)	18.3 (540)
35–44	19.6 (876)	18.4 (1277)	19.0 (2153)	37.0 (352)	29.8 (651)	32.7 (1003)
45–59	15.7 (878)	18.5 (1374)	17.1 (2252)	29.3 (350)	23.3 (540)	25.8 (890)
Area of residence						
Urban	47.0 (2037)	50.7 (3182)	48.8 (5219)	48.2 (442)	51.6 (1035)	50.2 (1477)
Rural	53.0 (2725)	49.3 (3738)	51.2 (6463)	51.8 (577)	48.4 (1145)	49.8 (1722)
District						
Berea	14.1 (599)	14.4 (878)	14.3 (1477)	11.4 (106)	13.8 (273)	12.9 (379)
Botha-Bothe	5.2 (299)	5.0 (416)	5.1 (715)	3.2 (41)	3.8 (105)	3.6 (146)
Leribe	17.9 (803)	17.1 (1152)	17.5 (1955)	16.0 (153)	16.4 (344)	16.2 (497)
Mafeteng	8.6 (498)	8.55 (701)	8.6 (1199)	8.2 (101)	9.3 (236)	8.8 (337)
Maseru	32.3 (1215)	31.4 (1684)	31.8 (2899)	37.2 (301)	32.7 (563)	34.6 (864)
Mohale’s Hoek	5.5 (341)	6.0 (548)	5.7 (889)	6.6 (91)	6.5 (188)	6.6 (279)
Mokhotlong	4.7 (274)	4.8 (405)	4.7 (679)	5.2 (64)	4.6 (122)	4.8 (186)
Qacha’s Nek	2.3 (174)	2.6 (284)	2.5 (458)	2.4 (38)	2.6 (87)	2.5 (125)
Quthing	3.6 (243)	4.3 (399)	3.9 (642)	3.6 (50)	4.4 (126)	4.1 (176)
Thaba Tseka	5.8 (316)	5.8 (453)	5.8 (769)	6.1 (74)	5.8 (136)	5.9 (210)
Wealth quintile						
Lowest	17.4 (975)	17.0 (1372)	17.2 (2347)	19.7 (241)	16.6 (411)	17.8 (652)
Med-Low	20.1 (1028)	17.7 (1354)	18.9 (2382)	21.0 (232)	19.2 (456)	19.9 (688)
Medium	20.0 (946)	20.1 (1387)	20.1 (2333)	24.3 (233)	22.5 (485)	23.2 (718)
Med-High	21.1 (948)	20.8 (1369)	20.9 (2317)	19.7 (179)	21.5 (438)	20.8 (617)
Highest	21.1 (852)	24.0 (1419)	22.6 (2271)	15.1 (133)	20.1 (387)	18.1 (520)

Characteristics	All participants (with blood draw) (*N* = 11 682)			HIV+ participants (*n* = 3199)		
	Male % (*n*)	Female % (*n*)	Total % (*N*)	Male % (*n*)	Female % (*n*)	Total % (*N*)
Missing	0.3 (13)	0.3 (19)	0.3 (32)	0.1 (1)	0.1 (3)	0.1 (4)
Schooling completed, years						
None to grade 3	18.1 (971)	4.9 (381)	11.5 (1352)	28.8 (325)	6.6 (158)	15.6 (483)
Grade 4–6	17.4 (879)	12.8 (966)	15.1 (1845)	23.9 (245)	18.5 (424)	20.7 (669)
Primary	13.9 (684)	22.9 (1654)	18.4 (2338)	14.7 (152)	28.3 (621)	22.8 (773)
Grade 8–11	28.2 (1301)	35.8 (2447)	32.0 (3748)	20.9 (198)	31.3 (663)	27.0 (861)
Secondary	11.9 (533)	12.7 (855)	12.3 (1388)	6.8 (60)	9.1 (192)	8.2 (252)
Tertiary/postgraduate	10.5 (389)	10.9 (615)	10.7 (1004)	4.8 (37)	6.2 (122)	5.6 (159)
Refused/don’t know	0.1 (5)	0.0 (2)	0.1 (7)	0.2 (2)	0.0 (0)	0.1 (2)
Marital status						
Married	44.0 (2024)	51.9 (3607)	47.9 (5631)	60.9 (598)	50.2 (1080)	54.5 (1678)
Single	46.5 (2243)	30.6 (2035)	38.5 (4278)	16.3 (168)	17.2 (368)	16.8 (536)
Divorced/sep./widowed	9.2 (480)	17.5 (1272)	13.3 (1752)	22.1 (246)	32.6 (732)	28.4 (978)
Refused/don’t know	0.3 (15)	0.1 (6)	0.2 (21)	0.7 (7)	0.0 (0)	0.3 (7)
Worked for cash or goods during the past 7 days						
No	70.9 (3521)	78.6 (5584)	74.7 (9105)	67.9 (730)	74.6 (1676)	71.9 (2406)
Yes	29.1 (1241)	21.4 (1336)	25.3 (2577)	32.1 (289)	25.4 (504)	28.1 (793)
Away from home >1 month in past 12 months						
No	92.9 (4439)	95.0 (6561)	93.9 (11000)	92.5 (940)	93.4 (2033)	93.0 (2973)
Yes	7.1 (323)	5.0 (359)	6.1 (682)	7.5 (79)	6.6 (147)	7.0 (226)

Percentages are survey-weighted using jackknife replicate weights. Note that totals might not add to 100% due to rounding or due to missing data. Work was limited to employment for which compensation was received.

Table 2.

Concordance of self-reported treatment status versus presence of laboratory-detectable antiretrovirals, LePHIA 2016–2017.

	Male			Female			Total		
	Antiretroviral status			Antiretroviral status			Antiretroviral status		
Characteristic	**Not detectable %**	**Detectable %**	**Total, *N***	**Not detectable, %**	**Detectable, %**	**Total, *N***	**Not detectable, %**	**Detectable, %**	**Total, *N***
Self-reported treatment status									
Not previously diagnosed HIV+	80.9	19.1	284	86.0	14.0	371	83.4	16.6	655
Previously diagnosed, not on ART	85.8	14.2	75	88.4	11.6	155	87.3	12.7	230
Previously diagnosed, on ART	3.5	96.5	654	6.1	93.9	1619	5.2	94.8	2273

ART, antiretroviral therapy; LePHIA, Lesotho Population-Based HIV Impact Assessment.

Table 3.

Awareness of HIV, treatment, and viral suppression (90-90-90) targets among people living with HIV aged 15–59 years, by sex and age (laboratory antiretroviral data), LePHIA 2016–2017.

	Diagnosed: Percentage who self-reported HIV-positive and/or with detectable antiretrovirals						On treatment: Percentage with detectable antiretrovirals and/or who self-reported current antiretroviral usage						Virally suppressed: percentage with detectable antiretrovirals and/or who self-reported current antiretroviral usage					
	Men		Women		Total		Men		Women		Total		Men		Women		Total	
Age, years	%	*n*	%	*n*	%	*N*	%	*n*	%	*n*	%	*N*	%	*n*	%	*n*	%	*N*
15–24	71.3	58	66.4	272	67.6	330	84.1	41	92.8	186	90.6	227	78.3	35	76.8	173	77.2	208
25–34	58.7	258	82.5	715	73.9	973	88.3	149	89.0	594	88.8	743	83.5	132	83.6	531	83.6	663
35–49	82.2	493	89.8	851	86.3	1344	91.5	409	92.9	770	92.3	1179	88.1	373	91.3	716	89.9	1089
50–59	91.6	209	87.2	339	89.2	548	97.2	189	95.8	300	96.4	489	92.8	184	93.6	291	93.2	475
15–49	73.5	809	83.5	1838	79.5	2647	90.2	599	91.3	1550	90.9	2149	86.3	540	86.6	1420	86.5	1960
15–59	76.6	1018	84.0	2177	81.0	3195	91.6	788	92.0	1850	91.8	2638	87.7	724	87.7	1711	87.7	2435

LePHIA, Lesotho Population-Based HIV Impact Assessment.

Table 4.

Multivariate analysis of factors associated with meeting the 90-90-90 targets among men and women aged 15–59 years, LePHIA 2016–2017.

	Men						Women					
Variable	**aOR aware**	***P* value**	**aOR ART**	***P* value**	**aOR VLS**	***P* value**	**aOR aware**	***P* value**	**aOR ART**	***P* value**	**aOR VLS**	***P* value**
Age, years												
45–59	1		1		1		1		1		1	
15–19	0.32	0.17	0.43	0.42	-	-	0.41	0.02	0.62	0.44	0.23	0.003
20–24[a]	0.13	<0.001	0.06	0.007	0.26	0.03	0.31	<0.001	0.83	0.06	0.22	<0.001
25–29	0.09	<0.001	0.53	0.52	0.59	0.37	0.61	0.04	0.60	0.53	0.32	<0.001
30–34	0.18	<0.001	0.22	0.003	0.54	0.16	0.97	0.89	0.41	0.22	0.35	<0.001
35–44	0.35	<0.001	0.34	0.012	0.77	0.43	1.46	0.08	0.81	0.34	0.70	0.18
District												
Maseru	1		1		1		1		1		1	
Berea	1.36	0.30	2.35	0.13	1.37	0.53	1.04	0.85	1.15	0.69	0.98	0.94
Botha-Bothe	0.65	0.24	1.54	0.59	2.14	0.40	0.81	0.65	0.79	0.62	0.87	0.67
Leribe	0.89	0.64	3.03	0.05	1.04	0.92	1.23	0.30	1.61	0.14	1.23	0.47
Mafeteng	1.24	0.63	1.98	0.96	1.13	0.78	1.06	0.81	1.04	0.89	0.69	0.20
Mohale’s Hoek	0.62	0.17	3.55	0.28	0.69	0.42	1.21	0.53	1.50	0.47	1.20	0.57
Mokhotlong	0.59	0.07	0.83	0.83	2.44	0.39	0.67	0.21	3.15	0.15	0.79	0.57
Qacha’s Nek	1.07	0.89	2.20	0.03	0.50	0.14	1.14	0.71	1.59	0.41	1.30	0.52
Quthing	0.54	0.07	4.42	<0.001	0.71	0.51	0.60	0.08	4.74	0.07	0.73	0.30
Thaba Tseka	0.66	0.27	4.49	0.16	0.93	0.89	1.72	0.16	1.34	0.57	0.60	0.17
Wealth quintile												
Highest	1		1		1		1		1		1	
Medium-high	0.64	0.20	0.94	0.91	1.19	0.74	0.86	0.52	1.15	0.20	1.10	0.70
Medium	0.52	0.06	0.78	0.65	0.71	0.48	1.26	0.27	1.60	0.06	1.12	0.68
Medium-low	0.73	0.38	0.75	0.58	0.65	0.40	1.28	0.27	2.15	0.04	1.56	0.13
Lowest	0.59	0.18	0.47	0.26	0.87	0.81	0.90	0.68	1.60	0.26	1.03	0.93
Years schooling completed												
University	1		1		1		1		1		1	
Secondary	0.95	0.92	0.24	0.02	0.11	0.01	0.65	0.21	1.29	0.64	1.30	0.58

	Men						Women					
Variable	**aOR aware**	***P* value**	**aOR ART**	***P* value**	**aOR VLS**	***P* value**	**aOR aware**	***P* value**	**aOR ART**	***P* value**	**aOR VLS**	***P* value**
Grades 8–11	1.49	0.41	0.29	0.24	0.17	0.02	0.66	0.22	0.83	0.64	0.74	0.46
Primary	1.24	0.68	1.21	0.83	0.12	0.01	0.80	0.53	0.79	0.58	0.66	0.26
Grades 4–6	1.39	0.51	0.21	0.002	0.26	0.09	0.71	0.35	0.59	0.29	0.85	0.67
No school to grade 3	1.03	0.95	0.52	0.24	0.18	0.03	0.86	0.74	0.35	0.03	0.29	0.008
Marital status												
Married/living together	1		1		1		1		1		1	
Single	1.07	0.80	2.69	0.13	1.16	0.72	0.79	0.27	0.79	0.36	0.85	0.42
Separated/divorced	0.81	0.39	1.37	0.45	0.56	0.12	0.87	0.56	1.01	0.98	0.65	0.06
Widowed	1.83	0.18	0.90	0.85	0.87	0.77	1.13	0.53	1.28	0.41	1.26	0.37
Worked for cash or goods during past week												
No	1		1		1		1		1		1	
Yes	0.71	0.07	0.97	0.94	0.83	0.58	0.88	0.38	0.67	0.12	0.98	0.93
Away from residence for >1 month in the past 12 months												
No	1		1		1		1		1		1	
Yes	0.57	0.07	0.81	0.72	0.49	0.15	0.58	0.03	0.29	<0.001	0.86	0.66

aOR, adjusted odds ratio; ART, antiretroviral therapy; LePHIA, Lesotho Population-Based HIV Impact Assessment; VLS, viral load suppression.

[a]VLS for men aged 20–24 includes men aged 15–24 due to small sample size. Multivariable analysis adjusted for all variables included in table.

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