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Engagement in HIV continuum of care: Another step needed to close the gap toward UNAIDS 90-90-90 targets among younger men in Rwanda

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Abstract

In this study, we measured Rwandan men's engagement in HIV services based on the UNAIDS 90-90-90 targets and assessed factors associated with linkage to HIV services. We analyzed the Rwanda Population-based HIV Impact Assessment (RPHIA) data for 15- to 64-year-old males. We conducted bivariate analysis to assess the distribution and association of sociodemographic characteristics with UNAIDS 90-90-90 targets. We adjusted multivariable models to understand the effect measurement of associated factors and determine the factors that best predict the achievement of UNAIDS 90-90-90. Of 13 780 males aged 15–64 years who participated in the RPHIA and consented to the blood draw and HIV testing, 302 had a positive HIV result, while 301 had valid responses to all variables analyzed in this paper and were included in the analysis. We found that age group was an explanatory and predictive factor for achievement of UNAIDS 90-90-90. Younger men living with HIV (MLHIV) are less likely to have achieved UNAIDS 90-90-90 compared to MLHIV 50–64 years old: adjusted odds ratio (aOR) for MLHIV aged 15–34 years was 0.21 (0.08–0.53) and aOR for MLHIV aged 35–49 years was 0.77 (0.36–1.66). To close the UNAIDS 90-90-90 gap in Rwanda, innovative service delivery strategies are needed to support young MLHIV to reach 90-90-90.

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AUTHOR CONTRIBUTIONS

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

Keywords

engagement; HIV service; men; Rwanda

1 | INTRODUCTION

Rwanda, a small, land-locked country in East Africa, faces a generalized human immunodeficiency virus type 1 (HIV-1) epidemic since 1983. With a resident population estimate of almost 13 million people,[1] over 210 000 adults were living with HIV in 2018.[2] Recent data showed that Rwanda is among the few countries that have achieved the global UNAIDS 90-90-90 targets and are expected to achieve HIV epidemic control in the next 5 years.[3] The UNAIDS 90-90-90 targets were announced in 2014, and called for 90% of people living with HIV (PLHIV) knowing their status, 90% of those diagnosed on treatment, and 90% of those on treatment achieving viral load suppression (VLS) by 2020.

Despite the achievements of the Rwanda HIV National Response, the gender discrepancy in the access to HIV services and engagement into the HIV continuum of care remains an important public health problem. Data from the 2018–2019 Rwanda Population-based HIV Impact Assessment (RPHIA) show that 85.6% of HIV-positive women and 80.4% of HIV-positive men were already aware of HIV status when tested in RPHIA; out of these, 97.6% of women and 97.2% men were on ART; and out of these, 92.4% of women and 85.4% of men reached VLS.[3,4]

To decrease the gender disparities, Rwanda HIV program has supported and scaled up various interventions to encourage male engagement in HIV testing, including HIV self-testing kits and home-based HIV testing but still, the gender disparity remains.[5–7] The gender discrepancy in access to HIV services is observed globally. In 2019, treatment coverage globally was 12 percentage points higher among women living with HIV than among men living with HIV (MLHIV), and VLS was 10 percentage points higher.[8] This treatment gap among MLHIV is an important driver of the higher number of new HIV infections among women in sub-Saharan Africa. Recent evidence has shown that closing these gaps contributes to the decline in the incidence of HIV among women.[9–11] Therefore, prioritizing the male population's access to HIV services is a key component of an HIV response.

The factors contributing toward poor uptake of HIV services among men are multifaceted.[12] Lack of confidentiality, stigmatizing beliefs, and fear of discrimination in the event of a positive test, transport difficulties, and low perceived risk of HIV infection have been reported as some of the deterrents to the uptake of HIV testing services among men.[13,14] These obstacles have a direct impact on their flow throughout the HIV continuum of care, with studies persistently reporting lower VLS rates among males compared to their female counterparts.[15]

To better guide the HIV response efforts in Rwanda, our paper aims to provide updated data on male engagement in the HIV continuum of care and to identify the associated and predictive factors of the male engagement in HIV services in Rwanda.

2 | MATERIALS AND METHODS

We analyzed secondary data from 15- to 64-year-old males that participated in the RPHIA conducted from October 2018 to March 2019. Details on the RPHIA data used for the analysis and on the secondary analysis conducted in this study are described below.

The main aim of the RPHIA is to estimate the current HIV prevalence and incidence, HIV risk behaviors, attitude toward HIV transmission, evaluating the HIV program impact from the self-awareness of HIV status to the VLS at national and subnational level in Rwanda. A summary of the RPHIA methods is presented in this paper, but this information can be found in detail in the survey final report.[4]

The 2018–2019 RPHIA was a nationally representative, cross-sectional, two-stage, population-based survey of households (HHs) located in 375 selected enumeration areas (EAs) across all the districts of Rwanda. An average of 30 HHs was randomly selected per EA. Individuals 10–64 years of age who were usual HH members or visitors who slept the night before in the sampled HH were eligible to participate in the survey. Human subjects and ethical approval for the RPHIA survey was granted by the Rwanda National Ethics Committee (Ref: IRB-00001497), and the Institutional Review Boards at the Centers for Disease Control and Prevention (CDC; Ref: #6760) and at the Columbia University (Ref. IRB-AAAR8357).

The RPHIA survey collected data through HH and individual questionnaires and through collection of blood sample for HIV related tests. The HH questionnaire included questions on the members of the HH, assets, economic status, death occurred, and so on. The individual questionnaire covered all demographics characteristics, HIV risks behaviors, exposure to HIV intervention measures, sexual behaviors, social norms, HIV knowledge, HIV testing experience, HIV stigma, and parental support.

HIV rapid test was conducted at the HH following the Rwanda HIV testing algorithm, which includes two tests: first, Alere Combo (Alere Determine™ HIV-1/2 Ag/Ab Combo) (Alere Inc.) followed by the HIV 1/2 Stat-Pak™ (Chembio Diagnostic Systems). Individuals with a nonreactive result on the first test were classified as HIV negative and those with a reactive result on both tests were classified as HIV positive. Individuals who had a reactive result on the first test and nonreactive on the second test were classified as inconclusive. The specimens that tested HIV positive and inconclusive at the HH were confirmed using the Geenius™ HIV 1/2 Supplemental Assay (Bio-Rads). A positive Geenius result was used as the final HIV-positive status for the survey.

Individuals with a positive Geenius result, had their plasma samples tested to measure viral load (HIV RNA copies/mL), using COBAS® TaqMan® Analyzer on the COBAS AmpliPrep/COBAS TaqMan HIV-1 Test, v2.0 instrument (Roche Molecular Diagnostics). If plasma was insufficient, their dried blood spots (DBS) samples was tested to measure viral load with the COBAS AmpliPrep/COBAS TaqMan HIV-1 Test v2.0 free virus elution protocol. Additionally, all the HIV-positive participants had qualitative screening for detectable concentrations of the antiretrovirals (ARVs: efavirenz, tenofovir, nevirapine and atazanavir), conducted on DBS specimens by means of high-resolution liquid chromatography coupled with tandem mass spectrometry.

2.1 | Data analysis

Anonymized data from 15- to 64-year-old males that consented for the biomarker procedures in the RPHIA and had valid responses to variables on self-report of awareness of HIV status and on ART uptake were used for this analysis.

First, we conducted a bivariate analysis to assess the distribution and association of sociodemographic characteristics with each one of the three indicators used to measure the conditional, laboratory-based UNAIDS 90-90-90 targets, separately: MLHIV who reported knowing their HIV status, defined by self-report and/or detectable ARVs in the blood (first 90); of these, men that are on ARV therapy (ART), defined by self-report and/or detectable ARVs in the blood (second 90); and among these, men that achieved VLS, defined as HIV-1 RNA copies per mL lower than 1000 copies/mL (third 90). Sociodemographic characteristics were considered associated with each of the three outcomes of interest if the chi-square p value was lower than 0.05.

Second, we conducted a bivariate analysis to assess the distribution and association of sociodemographic characteristics to an indicator named “achievement of UNAIDS 90-90-90,” defined as the percentage of MLHIV that were aware of their status and were on ARVs and had achieved VLS.

Finally, two multivariable models were built to understand both the effect measurement of the associated factors to the achievement of UNAIDS 90-90-90 (Model 1) and for determining the factors that best predict the achievement of UNAIDS 90-90-90 (Model 2). The prediction model provides information that helps us identify people or groups at high or elevated risk of not having achieved UNAIDS 90-90-90, so that they can be offered proven interventions, or other mitigation can be implemented.

Model 1 included previously known confounding variables (marital status, geographical location (province of residence), residence status (urban/rural)) in the association between age group and the indicator achievement of UNAIDS 90-90-90. Model 2 was built using Akaike Information Criterion (AIC) to assess model fit.[16] Logistic regression was utilized to compute adjusted odds ratios (aORs) for both models. All results presented in the analysis are based on weighted estimates. Analysis weights account for sample selection probabilities and adjusted for nonresponse and noncoverage. All the analysis was conducted using SAS 9.4.

3 | RESULTS

Out of the 14 025 eligible 15- to 64-year-old male participants, 13 821 consented to the individual interview and, of these, 13 780 also provided consent for the biomarker procedures, which included pre- and posttest counseling, blood draw and HIV test at the HH level, and other HIV related blood tests, described in the methods section. Among participants that were tested, 302 had a final positive HIV status in the survey, of which 301 had complete self-reported data on awareness of HIV positive status and ART intake and were included in this analysis (Figure 1).

Table 1 shows the results of the bivariate analysis conducted to identify social demographic characteristics associated with each of the UNAIDS 90-90-90 indicators, namely: percentage of MLHIV that are aware of their positive status (first 90); percentage of MLHIV that are aware of their positive status and are on ART (second 90); and percentage of those on ART that have reached VLS (third 90). In the bivariate analysis, marital status (p value < 0.001) and age (p value = 0.004) were significantly associated with awareness of positive HIV status (first 90) among the 15- to 64-year-old males in Rwanda. Among MLHIV that are married or living together with a partner, a higher proportion (89.4%) know their HIV status, compared to those that were never married (54.7%) and that are divorced, widowed, or separated (67.8%). Only 56.6% of the younger MLHIV, aged 15–34 years old were aware of their HIV status compared to those aged 35–49 years old (87.2%) and 50–64 years old (89.2%). None of the variables assessed in the bivariate analysis were significantly associated with being on ART (second 90) or achieving VLS (third 90).

Table 2 shows the results of the bivariate analysis conducted to identify social demographic characteristics associated with the achievement of the UNAIDS 90-90-90 targets, defined as the percentage of MLHIV that have achieved the first, second, and third UNAIDS targets. The bivariate analysis showed that age (p value < 0.0001) and marital status (p value < 0.003) were associated with the achievement of the UNAIDS 90-90-90 targets and these variables were included in Model 1. Other previously known confounding variables—marital status, province, and residence (urban/rural)—were also included and kept on Model 1, even if not significantly associated with the outcome of interest in the bivariate analysis. Model 1 shows that, when adjusted for marital status, residence, and province, younger MLHIV are less likely to have achieved the UNAIDS 90-90-90 targets when compared to MLHIV who are 50–64 years old: aOR for the 15- to 34-year-old age group is 0.21 (0.08–0.53) and aOR for the 35- to 49-year-old age group is 0.77 (0.36–1.66).

Table 3 illustrates the process used to adjust the prediction model (Model 2). The model described on Step 2, that includes age group and province, presents the lowest AIC and therefore was selected as the best fit model. Similar to the results presented in Model 1, Model 2 shows that the younger the MLHIV, the less likely they are to achieve UNAIDS 90-90-90. When compared to the MLHIV aged 50–64 years old, the aOR for the 15- to 34-year-old age group is 0.15 (0.07–0.33) and the aOR for the 35- to 49-year-old age group is 0.73 (0.35–1.54). The age group variable is, therefore, both an explanatory and a predictive factor for the achievement of UNAIDS 90-90-90.

4 | DISCUSSION

According to the UNAIDS model, reaching the 90-90-90 target would reduce the annual number of new infections by 90% by 2030.[17] The number of AIDS-related deaths would also fall by 80% by 2030.[17] The model was based on available diagnostic and treatment technologies in 2015, with the expectation that the likely emergence and uptake of additional medical innovations (such as improved diagnostic tools and longer-acting antiretrovirals) will ensure at least a 90% reduction in AIDS-related deaths by 2030.[17]

The RPHIA survey provided the first population-level estimates of VLS among men in Rwanda.[4] Although it is encouraging that among MLHIV, 80% were aware of their HIV-positive status, 97% of those were on ART and 85% had achieved VLS, more remains to be done. Other studies have consistently reported lower VLS among men in Rwanda.[6,18,19] In Namibia, although the country achieved the 90-90-90 targets by 2020, lower VLS among men delayed achievement of these targets.[20–22] Men, in general have been reportd to have lower uptake of HIV services. This pattern is also observed in key hard-to-reach groups among men, for example, men who have sex with men (MSM). In countries were MSM are criminalized, their uptake of HIV testing services is lower and, often, there is limited research in this population. Information gaps in the HIV epidemics among the MSM affects the effectiveness of the HIV response interventions for the sub-group,[23] and hence slowing progress toward 90-90-90 as interventions will not be based on empirical evidence. In Rwanda, a study conducted in 2018 among MLHIV who have sex with men in Rwanda, showed that only 59% reach VLS suggesting suboptimal ART linkage, retention, and adherence; as well as potential acquired and transmitted ART resistance.[18]

Among MLHIV that were married or lived together with a partner, a higher proportion (89.4%) know their HIV status, compared to those that were never married (54.7%) and that are divorced, widowed, or separated (67.8%). Being married has been associated with receiving an HIV test among men in South Africa[24] and Uganda.[25] Similar findings have also been reported in a multicountry analysis of Demographic and Health Survey data among men from Chad, Ghana, Malawi, Nigeria, Tanzania, Uganda, Zambia, and Zimbabwe.[26] This may be attributed to the mature couple testing strategies[27] and community-based interventions that promote partners testing through secondary distribution of HIV self- test kits.[28,29] Further, HIV status disclosure strategies may also account for the improved testing rates among married men compared.[25]

Our findings indicated that only 56.6% of the younger MLHIV, aged 14–35 years old were aware of their HIV status compared to those aged 35–49 years old (87.2%) and 50–64 years old (89.2%). Similar findings have been reported inTanzania[30] and Côte d'Ivoire.[31] Previous studies have revealed that older men have higher HIV-related knowledge and have had more time to get tested than younger men.[31] Our findings further revealed that the younger the MLHIV, the less likely they are to achieve UNAIDS 90-90-90.

5 | CONCLUSIONS

Although Rwanda has made significant progress toward achieving the UNAIDS 90-90-90 targets, in the context of HIV services, younger men remain an underserved population. There is a need to better understand the more complex, multilevel factors that contribute to young men's low uptake of HIV-related services to design and implement health system policies, programs, and service delivery strategies to ensure better provision of HIV services for this population.

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DATA AVAILABILITY STATEMENT

Data from the 2018–2019 Rwanda Population-based HIV Impact Assessment (RPHIA) can be requested from the PHIA data manager at https://phiadata.icap.columbia.edu/datasets?country_id=11.

REFERENCES

1. NISR. Size of the Resident Population. Assessed October 27, 2021. https://www.statistics.gov.rw/publication/size-resident-population
2. UNAIDS. AIDSInfo: Global Data on HIV Epidemiology and Response. 2020. Accessed 2 January 2022. http://aidsinfo.unaids.org/
3. ICAP. Summary Sheet: Preliminary Findings: Rwanda population-based HIV Impact Assessment RPHIA 2018–2019. 2019. Accessed October 27, 2021. https://phia.icap.columbia.edu/wp-content/uploads/2019/10/RPHIA-Summary-Sheet_Oct-2019.pdf
4. Rwanda Biomedical Center (RBC). Rwanda Population-Based HIV Impact Assessment (RPHIA) 2018–2019: Final Report. Kigali: RBC. September 2020. Assessed October 27, 2021. https://phia.icap.columbia.edu/wp-content/uploads/2020/11/RPHIA-Final-Report_Web.pdf
5. Rich ML, Miller AC, Niyigena P, et al. Excellent clinical outcomes and high retention in care among adults in a community-based HIV treatment program in rural Rwanda. J Acquir Immune Defic Syndr. 2012;59(3):e35–e42. [PubMed: 22156912]
6. Ntwali JDDN, Decroo T, Ribakare M, et al. Viral load detection and management on first line ART in rural Rwanda. BMC Infect Dis. 2019;19(1):1–9. [PubMed: 30606108]
7. Dzinamarira T, Muvunyi CM, Kamanzi C, Mashamba-Thompson TP. HIV self-testing in Rwanda: awareness and acceptability among male clinic attendees in Kigali, Rwanda: a cross-sectional survey. Heliyon. 2020;6(3):e03515. [PubMed: 32181390]
8. UNAIDS. Global AIDS Update 2020. Assessed February 21, 2022. https://www.unaids.org/sites/default/files/media_asset/2020_global-aids-report_en.pdf
9. Vandormael A, Akullian A, Siedner M, de Oliveira T, Bärnighausen T, Tanser F. Declines in HIV incidence among men and women in a South African population-based cohort. Nat Commun. 2019;10(1):5482. [PubMed: 31792217]
10. Vandormael A, Cuadros D, Kim HY, Bärnighausen T, Tanser F. The state of the HIV epidemic in rural KwaZulu-Natal, South Africa: a novel application of disease metrics to assess trajectories and highlight areas for intervention. Int J Epidemiol. 2020;49(2):666–675. [PubMed: 31930292]
11. Nakigozi G, Chang LW, Reynolds SJ, et al. Rapidly declining HIV incidence among men and women in Rakai, Uganda. Conference on Retroviruses and Opportunistic Infections (CROI), March 8–11, 2020. Abstract 150.
12. UNAIDS. Addressing a Blind Spot in the Response to HIV-Reaching Out to Men and Boys. Nations Programme on HIV. AIDS. 2017.
13. Dzinamarira T, Mulindabigwi A, Mashamba-Thompson TP. Co-creation of a health education program for improving the uptake of HIV self-testing among men in Rwanda: nominal group technique. Heliyon. 2020;6(10):e05378. [PubMed: 33163663]
14. Siu GE, Wight D, Seeley JA. Masculinity, social context and HIV testing: an ethnographic study of men in Busia district, rural eastern Uganda. BMC Public Health. 2014;14(1):33. [PubMed: 24417763]

15. UNAIDS. 90-90-90 An Ambitious Treatment Target to Help End the AIDS Epidemic. October 2014. UNAIDS. Geneva. Accessed November 4, 2021. https://www.unaids.org/sites/default/files/media_asset/90-90-90_en.pdf
16. Akaike H A new look at the statistical model identification. IEEE Trans Autom Control. 1974;19(6):716–723.
17. Sidibé M, Loures L, Samb B. The UNAIDS 90–90–90 target: a clear choice for ending AIDS and for sustainable health and development. J Int AIDS Soc. 2016;19(1):21133. [PubMed: 27424601]
18. Twahirwa Rwema JO, Lyons CE, Herbst S, et al. HIV infection and engagement in HIV care cascade among men who have sex with men and transgender women in Kigali, Rwanda: a cross-sectional study. J Int AIDS Soc. 2020;23(Suppl 6):e25604. [PubMed: 33000912]
19. Ross J, Ribakare M, Remera E, et al. High levels of viral load monitoring and viral suppression under Treat All in Rwanda – a cross-sectional study. J Int AIDS Soc. 2020;23(6):e25543. [PubMed: 32536033]
20. Agolory S, de Klerk M, Baughman AL, et al. Low case finding among men and poor viral load suppression among adolescents are impeding Namibia’s ability to achieve UNAIDS 90-90-90 targets. Open Forum Infect Dis. 2018;5(9):ofy200. [PubMed: 30211248]
21. Vu L, Burnett-Zieman B, Stoman L, et al. Effects of the implementation of the HIV Treat All guidelines on key ART treatment outcomes in Namibia. PLoS One. 2020;15(12):e0243749. [PubMed: 33370313]
22. Hong SY, Winston A, Mutenda N, et al. Predictors of loss to follow-up from HIV antiretroviral therapy in Namibia. PLoS One. 2022; 17(4):e0266438. [PubMed: 35421126]
23. Dzinamarira T, Mapingure M, Murewanhema G, et al. Conducting research among key populations in settings with discriminatory laws, policies, and practice: the case of men who have sex with men in Zimbabwe. Public Health Pract. 2022;4:100337.
24. Peltzer K, Matseke G, Mzolo T, Majaja M. Determinants of knowledge of HIV status in South Africa: results from a population-based HIV survey. BMC Public Health. 2009;9(1):174. [PubMed: 19500373]
25. Nangendo J, Katahoire AR, Armstrong-Hough M, et al. Prevalence, associated factors and perspectives of HIV testing among men in Uganda. PLoS One. 2020;15(8):e0237402. [PubMed: 32764820]
26. Stephenson R, Miriam Elfstrom K, Winter A. Community influences on married men’s uptake of HIV testing in eight African countries. AIDS Behav. 2013;17(7):2352–2366. [PubMed: 22677974]
27. Wall KM, Bayingana R, Ingabire R, et al. Rwandan stakeholder perspectives of integrated family planning and HIV services. Int J Health Plann Manage. 2018;33(4):e1037–e1049. [PubMed: 30047594]
28. Sharma M, Barnabas RV, Celum C. Community-based strategies to strengthen men’s engagement in the HIV care cascade in sub-Saharan Africa. PLoS Med. 2017;14(4):e1002262. [PubMed: 28399122]
29. Masters SH, Agot K, Obonyo B, Napierala Mavedzenge S, Maman S, Thirumurthy H. Promoting partner testing and couples testing through secondary distribution of HIV self-tests: a randomized clinical trial. PLoS Med. 2016;13(11):e1002166. [PubMed: 27824882]
30. Conserve D, Sevilla L, Mbwambo J, King G. Determinants of previous HIV testing and knowledge of partner’s HIV status among men attending a voluntary counseling and testing clinic in Dar es Salaam. Am J Mens Health. 2013;7(6):450–460. [PubMed: 23221684]
31. Jean K, Anglaret X, Moh R, Lert F, Dray-Spira R. Barriers to HIV testing in Côte d’Ivoire: the role of individual characteristics and testing modalities. PLoS One. 2012;7(7):e41353. [PubMed: 22815995]

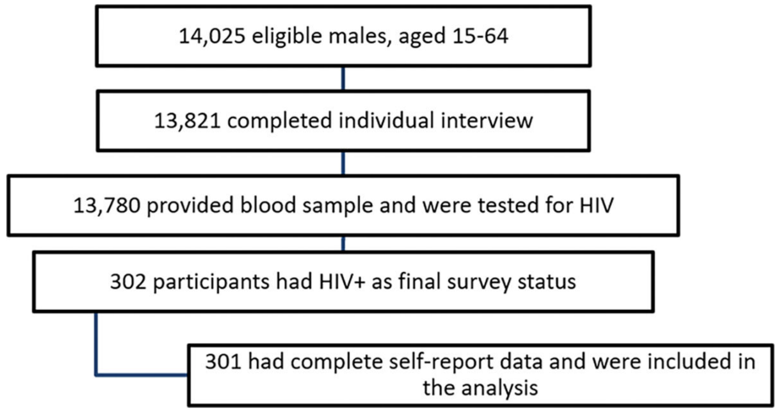

FIGURE 1.

RPHIA male participant flowchart. Rwanda, 2018–2019. RPHIA, Rwanda Population-based HIV Impact Assessment.

TABLE 1

Sociodemographic characteristics by conditional UNAIDS 90-90-90 targets (MLHIV that are aware of their HIV positive status, MLHIV that are aware of their positive status and are on ART, and MLHIV on ART that have reached VLS) among male participants aged 15–64 years, RPHIA 2018–2019.

	MLHIV that are aware of their positive status (1st 90)[a]			MLHIV aware of their positive status and on ART (2nd 90)[b]			MLHIV on ART that are Virally Suppressed (3rd 90)[c]		
Social demographic characteristic	**%**	***n***	***p* Value**	**%**	***n***	***p* Value**	**%**	***n***	***p* Value**
Residence			0.264			0.185			0.150
Urban	84.5	109		94.9	92		90.6	87	
Rural	78.7	192		98.4	153		83.1	150	
Province			0.480			*d*			0.183
City of Kigali	82.3	81		93.9	67		87.5	63	
South	80.2	60		97.8	48		92.5	47	
West	77.7	74		98.3	58		92.0	57	
North	89.6	39		94.1	35		88.0	33	
East	78.0	47		100.0	37		65.5	37	
Marital status			**<0.001**			*d*			0.325
Never married	54.7	56		88.9	32		84.4	28	
Married or living together	89.4	207		98.2	186		84.5	182	
Divorced, separated, or widowed	67.8	37		100.0	26		93.3	26	
Education			0.146			*d*			0.651
No education or nursery	66.5	44		100.0	31		90.3	31	
Primary	82.5	192		97.2	159		84.2	154	
Secondary or more	84.4	64		95.5	54		85.9	51	
Wealth quintile			0.554			*d*			0.303
Lowest	75.7	47		97.9	36		89.7	35	
Second	72.8	38		100.0	29		93.3	29	
Middle	82.6	54		95.2	45		79.0	43	
Fourth	85.7	70		98.6	59		84.5	58	
Highest	81.2	91		95.7	75		84.6	71	
Age group			**0.004**			0.163			0.325

	MLHIV that are aware of their positive status (1st 90)[a]			MLHIV aware of their positive status and on ART (2nd 90)[b]			MLHIV on ART that are Virally Suppressed (3rd 90)[c]		
Social demographic characteristic	**%**	***n***	***p* Value**	**%**	***n***	***p* Value**	**%**	***n***	***p* Value**
15–34	56.6	73		89.9	42		77.0	37	
35–49	87.2	139		98.4	124		85.0	122	
50–64	89.2	89		99.2	79		89.9	78	

Note: Weighted figures calculated using final blood test weights (btwt0).

Abbreviations: ART, antiretroviral therapy; MLHIV, men living with HIV; RPHIA, Rwanda Population-based HIV Impact Assessment; VLS, viral load suppression.

[a]Defined as those who self-reported HIV positive AND/OR had detectable ARVs in their blood sample. Relates to GAM 1.1 and PEPFAR DIAGNOSED_NAT.

[b]Defined as percentage with detectable ARVs AND/OR who self-reported current ARV usage. Relates to GAM 1.2 and PEPFAR TX_CURR_NAT/SUBNAT.

[c]Relates to GAM 1.4 and PEPFAR VL_SUPPRESSION_NAT.

[d]Cell size is less than 25 and estimates have been suppressed due to inadequate sample size.

TABLE 2

Results of the bivariate and multivariated analysis of the sociodemographic characteristics with the achievement of UNAIDS 90–90-90 targets among MLHIV aged 15–64 years old, RPHIA 2018–2019.

	Bivariate analysis		Multivariate analysis: Model 1[a]		Multivariate analysis: Model 2[b]	
Social demographic characteristics	**OR (95% CI)**	***p* Value**	**aOR (95% CI)**	***p* Value**	**aOR (95% CI)**	***p* Value**
Age group		**<0.001**		**0.003**		**<0.001**
15–34	0.17 (0.08–0.36)		0.21 (0.08–0.53)		0.15 (0.07–0.33)	
35–49	0.69 (0.33–1.47)		0.77 (0.36–1.66)		0.73 (0.35, 1.54)	
50+	Ref		Ref		Ref	
Marital status		**0.003**		0.293		
Never married	Ref		Ref			
Married or living together	4.13 (2.25–7.59)		1.79 (0.84–3.83)			
Divorced, separated, or widowed	2.48 (1.00–6.16)		1.30 (0.50–3.36)			
Residence		0.236		0.289		
Urban	1.48 (0.76–2.86)		1.74 (0.69–4.37)			
Rural	Ref		Ref			
Province		0.302		0.137		0.152
City of Kigali	Ref		Ref		Ref	
South	1.27 (0.53–3.04)		1.69 (0.50–5.67)		1.19 (0.43–3.38)	
West	1.13 (0.50–2.54)		1.61 (0.52–4.96)		1.13 (0.49–2.57)	
North	1.38 (0.56–3.37)		1.78 (0.47–6.75)		1.25 (0.47–3.34)	
East	0.50 (0.20–1.24)		0.54 (0.15–1.95)		0.37 (0.14–1.01)	
Education		0.609				
No education	Ref					
Primary	1.39 (0.67–2.87)					
Secondary or more	1.50 (0.62–3.65)					
Wealth quintile		0.835				
Lowest	1.03 (0.43–2.45)					
Second	1.10 (0.44–2.75)					
Middle	0.85 (0.36–2.01)					

	Bivariate analysis		Multivariate analysis			
			Model 1[a]		Model 2[b]	
Social demographic characteristics	**OR (95% CI)**	***p* Value**	**aOR (95% CI)**	***p* Value**	**aOR (95% CI)**	***p* Value**
Fourth	1.30 (0.62–2.70)					
Highest	Ref					

Note: Weighted figures calculated using final blood test weights (btwt0).

Abbreviations: AIC, Akaike Information Criterion; aOR, adjusted odds ratio; ART, antiretroviral therapy; CI, confidence interval; MLHIV, men living with HIV; RPHIA, Rwanda Population-based HIV Impact Assessment.

[a]Model 1 was used to identify factors associated with an individual being aware of their HIV status, on ART, and virally suppressed.

[b]Model 2 was built to measure the effects of the predictive factors of an individual being aware of their HIV status, on ART, and virally suppressed.

Variables were entered into this model in the order presented in Table 3. A change of AIC ± 2 indicated a significant change in model fit.

TABLE 3

Results of AIC to obtain best model fit when applying different mathematical models to estimate the predictive factors' relationship with meeting UNAIDS 90–90-90 targets among men aged 15–64, RPHIA 2018–2019.

Step 1			Step 2			Step 3		
Model input	**Wald *p* value**	**AIC**	**Model input**	**Wald *p* value**	**AIC**	**Model input**	**Wald *p* value**	**AIC**
Age group	<0.001	**404.0**	-	-	-	Age + Province + Wealth	0.007	404.3
Marital status (Married)	<0.001	417.1	Age + Married	<0.001	404.9			
Residence	0.236	437.2	Age + Residence	<0.001	403.4			
Province	0.302	435.3	**Age** + **Province**	**<0.001**	**397.7** [a]			
Education	0.609	439.2	Age + Education	<0.001	403.2			
Wealth quintile (Wealth)	0.835	443.5	Age + Wealth	<0.001	409.1			

Abbreviations: AIC, Akaike Information Criterion; RPHIA, Rwanda Population-based HIV Impact Assessment.

[a]The model in Step 2, having Age and Province, is the model with the best fit.