HHS Public Access

Author manuscript

Lancet HIV. Author manuscript; available in PMC 2023 October 02.

Published in final edited form as:

Lancet HIV. 2023 September ; 10(9): e597–e605. doi:10.1016/S2352-3018(23)00144-3.

Trends in HIV prevalence, incidence, and progress towards the UNAIDS 95–95–95 targets in Malawi among individuals aged 15–64 years: population-based HIV impact assessments, 2015−16 and 2020−21

Danielle Payne, MPH,
US Centers for Disease Control and Prevention, Lilongwe, Malawi

Nellie Wadonda-Kabondo, PhD,
US Centers for Disease Control and Prevention, Lilongwe, Malawi

Alice Wang, PhD,
US Centers for Disease Control and Prevention, Lilongwe, Malawi

Joshua Smith-Sreen, MPH,
US Centers for Disease Control and Prevention, Lilongwe, Malawi

Alinune Kabaghe, PhD,
US Centers for Disease Control and Prevention, Lilongwe, Malawi

George Bello, PhD,
International Training and Education Center for Health, Lilongwe, Malawi

Felix Kayigamba, PhD,
ICAP, Lilongwe, Malawi

Lyson Tenthani, PhD,
ICAP, Lilongwe, Malawi

Alice Maida, MPH,
US Centers for Disease Control and Prevention, Lilongwe, Malawi

Correspondence to: Danielle Payne, US Centers for Disease Control and Prevention, Lilongwe, Malawi, ywb9@cdc.gov.
*Members listed in the appendix (p 6)

Contributors

DP, NW-K, GB, FK, LT, ACV, SJ, KB, EK, FO, and MF conceptualised and wrote the study protocols. DP, NW-K, GB, FK, LT, AA, ACV, SJ, KB, CAW, EK, FO, MF, TD, AJ, and RN oversaw data collection and survey implementation. ACV, SJ, and KB oversaw data curation. DP, ACV, and KB have directly accessed and verified the underlying data. DP, AW, JS-S, and KB analysed and visualised the data. DP, NW-K, AW, JS-S, and AK drafted the manuscript. All authors had access to the data and contributed to interpretation of results, critically reviewed and edited the manuscript, and had final responsibility for the decision to submit for publication.

Declaration of interests

We declare no competing interests.

Data sharing

De-identified individual participant data, data use manual, supplemental data manual, questionnaire, codebook, sampling and weighting technical report, and tabulation plan are available upon request after approval of a methodologically sound proposal. The Malawi PHIA 2015−16 dataset and materials are currently available. The Malawi PHIA 2020−21 dataset and materials will probably be available at the beginning of 2024, following de-identification. Data are accessible online with approved credentialled login.

Andrew Auld, PhD,
US Centers for Disease Control and Prevention, Lilongwe, Malawi

Andrew C Voetsch, PhD,
US Centers for Disease Control and Prevention, Atlanta, GA, USA

Sasi Jonnalagadda, PhD,
US Centers for Disease Control and Prevention, Atlanta, GA, USA

Kristin Brown, MPH,
US Centers for Disease Control and Prevention, Atlanta, GA, USA

Christine A West, PhD,
US Centers for Disease Control and Prevention, Atlanta, GA, USA

Evelyn Kim, PhD,
US Centers for Disease Control and Prevention, Lilongwe, Malawi

Francis Ogollah, MSc,
ICAP, Lilongwe, Malawi

Mansoor Farahani, MD,
ICAP, New York, NY, USA

Trudy Dobbs, BS,
US Centers for Disease Control and Prevention, Atlanta, GA, USA

Andreas Jahn, PhD,
Ministry of Health Malawi, Lilongwe, Malawi

Kelsey Mirkovic, PhD,
US Centers for Disease Control and Prevention, Lilongwe, Malawi

Rose Nyirenda, MSc,
Ministry of Health Malawi, Lilongwe, Malawi

MPHIA Study Team*

Summary

Background—In 2014, UNAIDS set the goal of ending the AIDS epidemic by 2030 through the achievement of testing and treatment cascade targets. To evaluate progress achieved and highlight persisting gaps in HIV epidemic control in Malawi, we aimed to compare key indicators (prevalence, incidence, viral load suppression, and UNAIDS 95–95–95 targets) from the 2015−16 and 2020−21 Malawi Population-based HIV Impact Assessment (PHIA) survey results.

Methods—The Malawi PHIAs were nationally representative, cross-sectional surveys with a two-stage cluster sampling design. The first survey was conducted between Nov 27, 2015, and Aug 26, 2016; the second survey was conducted between Jan 15, 2020, and April 26, 2021. Our analysis included survey participants aged 15−64 years. Participants were interviewed and a 14 mL blood sample was collected and tested for HIV infection using the national rapid testing algorithm. For each survey, we estimated key HIV epidemic indicators and achievement of 95–95–95 targets. The risk ratio (RR) of the indicators between surveys were computed and considered

significant at a confidence level of 0·05. All results were weighted, and self-reported awareness and treatment status were adjusted to account for detection of antiretrovirals.

Findings—Our analysis included 17 187 participants aged 15−64 years in 2015−16 and 21 208 in 2020−21 who participated in the surveys and blood draw. In the 2020−21 survey, 88·4% (95% CI 86·7–90·0) of people living with HIV were aware of their HIV-positive status; of those aware, 97·8% (97·1–98·5) were on antiretroviral therapy; and of those on treatment, 96·9% (95·9–97·7) were virally suppressed. Between surveys, the national HIV prevalence decreased significantly from 10·6% (10·0–11·2) to 8·9% (8·4–9·5) with RR 0·85 (95% CI 0·78–0·92; p<0·0001). The annual HIV incidence decreased from 0·37% (0·20–0·53) to 0·22% (0·11–0·34) with RR 0·61 (95% CI 0·31–1·20; p=0·15). The population viral load suppression increased from 68·3% (66·0–70·7) in 2015−16 to 87·0% (85·3–88·5) in 2020−21 (RR 1·27 [95% CI 1·22–1·32]; p<0·0001).

Interpretation—These results suggest that Malawi had already surpassed the UNAIDS viral load suppression target for 2030 (85·7%) by 2020−21. Through strategies and evidence-informed interventions implemented in the last half decade, especially scale-up of effective HIV treatment, Malawi has made tremendous progress, including decreasing HIV prevalence and incidence and achieving both the second and third 95 targets ahead of 2030. To address the first 95, efforts in HIV diagnosis should focus on males and younger age groups. There is a continued need for effective linkage to care, retention on antiretroviral therapy, and adherence support to maintain and build on progress.

Introduction

In 2014, UNAIDS set the goal of ending the AIDS epidemic as a public health threat by 2030, through the achievement of the 90–90–90 HIV testing and treatment cascade targets by 2020.[1] These cascade targets aimed for 90% of all people living with HIV to be diagnosed or aware of their HIV-positive status, 90% of those diagnosed with HIV to receive sustained antiretroviral therapy (ART), and 90% of people receiving ART to reach viral load suppression.[1] To accelerate progress towards this goal, revised fast-track targets focused on achieving 95% in each part of the same cascade by 2030 (also known as 95–95–95).[2]

Countries have evaluated their progress towards achieving the UNAIDS targets and reported varying levels of progress.[3–9] Kenya estimated their progress using data on the cascade indicators from a population-based household survey.[3] Other countries have used data from the demographic and health surveys and programme monitoring systems, either in isolation or combined, to model the progress towards achieving the previous 90–90–90 and current 95–95–95 target.[5–8] Eswatini evaluated national HIV epidemic progress by comparing results from two sequential population-based surveys.[5] These studies have generally shown that countries are on track for achieving the UNAIDS targets but have highlighted disparities by geography and subpopulations.

To enable governments to monitor their progress towards the 95–95–95 targets and epidemic control, the US President's Emergency Plan for AIDS Relief (PEPFAR) supported the design and implementation of the Population-based HIV Impact Assessment (PHIA) across 16 countries in Africa.[10] The PHIA surveys measure HIV prevalence, incidence, and viral load among those living with HIV. Given that viral load is the key predictor of disease

progression and HIV transmission, high viral load suppression at the population level is expected to have a profound effect on AIDS morbidity, mortality, and HIV transmission, and therefore is an important indicator to track.[11] Together, use of the cascade indicators, along with incidence and prevalence, can help to estimate the impact of national HIV prevention and treatment programmes, as well as measure progress towards reducing new infections to achieve epidemic control.[12]

Malawi PHIA surveys were implemented in 2015−16 and in 2020−21. Malawi is one of six countries with results from two PHIA surveys. The 2015−16 survey showed notable progress towards the UNAIDS 90–90–90 targets, but also identified coverage gaps in HIV diagnosis, ART access and retention, and viral load suppression. The 2015−16 survey showed a national HIV prevalence of 10·6% among adults (aged 15−64 years).[13] Among adults living with HIV, 76·8% were diagnosed, 91·3% of those diagnosed were on treatment, and 91·4% of those on treatment were virally suppressed.[13]

In response to the findings of the 2015−16 survey, targeted interventions were implemented by the Government of Malawi, PEPFAR, and other partners to close these gaps, including interventions to increase awareness of HIV status among youth and men. The 2020–21 survey, indicates that further progress was made in achieving the 95–95–95 targets.[14,15] Few countries have published results comparing sequential surveys.[5] We aimed to compare key indicators (prevalence, incidence, viral load suppression, and UNAIDS 95–95–95 targets) from the 2015−16 and 2020−21 survey results to evaluate progress and highlight persisting gaps in HIV epidemic control in Malawi.

Methods

Study design and participants

The Malawi PHIAs were nationally representative, cross-sectional surveys with a two-stage cluster sampling design. The surveys were designed to estimate HIV incidence and subnational viral load suppression. The first survey was conducted between Nov 27, 2015, and Aug 26, 2016, without any substantial pauses in data collection. The second survey was conducted between Jan 15, 2020, and April 26, 2021; data collection was paused on March 31, 2020, due to COVID-19 pandemic-related safety measures and was resumed on March 8, 2021. The surveys were led by the Government of Malawi through the Ministry of Health and the National AIDS Commission and implemented by the International Center for AIDS Care and Treatment Program at Columbia University in collaboration with the Government of Malawi at national and subnational levels. The Government of Malawi, local civil society organisations, and international development partners participated in steering committees and technical working groups during study implementation. Study procedures for the PHIA surveys, including questionnaire administration, consenting of participants, laboratory testing, and data management, have been previously described.[15–17] Each survey was approved by human subjects and institutional review boards at the cooperative agreement grantees and federal entities implementing the survey, and by the US Centers for Disease Control and Prevention (CDC).

Within households, all residents and visitors (who had slept in the house the previous night) in each participating household were enumerated. For both surveys, included individuals were aged 15 years or older, had slept in the house the previous night, and were able to provide verbal consent or assent or had a parent or guardian willing to provide verbal permission. Individuals who were unable to give consent or assent due to cognitive impairment or intellectual disability were not eligible to participate. Participants were also asked for verbal consent to receive their HIV test results to participate in the biomarker section of the survey. Both surveys were powered to address the primary objective of estimating the subnational prevalence of HIV viral load suppression. However, the 2015−16 survey targeted a population aged 0–64 years (including a paediatric population), whereas the 2020−21 survey targeted a population aged 15 years and older (including a population of older people). To enable comparison, this analysis was restricted to participants aged 15–64 years with HIV test results.

Procedures

Participants were interviewed and a 14 mL blood sample was collected and tested for HIV infection using the national rapid testing algorithm. Both surveys used similar questionnaires that included a core set of demographic, behaviour, and clinical questions related to HIV testing and treatment. Clinically relevant results were returned to participants. All HIV-positive samples were tested for recent infection, CD4 cell count, viral load, and presence of antiretrovirals. A suppressed viral load was defined as less than 1000 viral copies per mL. Recent infections were classified using an assay-based limiting antigen avidity enzyme immunoassay and the national recent infection testing algorithm.[18] Data for both surveys were collected on mobile tablet devices using an application programmed in Open Data Kit in 2015−16 and CSPro in 2020−21.

We estimated the prevalence of HIV infection, incidence of new HIV infections, prevalence of viral load suppression, and achievement of 95–95–95 indicators. HIV prevalence was defined as the proportion of adults with HIV among the total population interviewed and tested. Annual incidence was defined as the total number of new HIV infections (as calculated by the recent infection testing algorithm) per year and population size observed during the survey period.[18] High viral load prevalence was defined as the proportion of people with unsuppressed HIV viral load (≥1000 copies per mL) among the total population, regardless of HIV status. Population viral load suppression was defined as the proportion of adults with HIV with a suppressed viral load (HIV RNA of <1000 copies per mL). The first UNAIDS 95 target, awareness, was defined as the proportion of adults with HIV who were aware of their HIV status either by self-report or detectable antiretrovirals in their blood (appendix p 2). The second UNAIDS 95 target, conditional treatment status, was defined as the proportion of adults with HIV who were aware of their status and were on ART either by self-report of ART use, or detectable antiretrovirals in their blood, or both (appendix p 3). Conditional viral load suppression (or viral load suppression for the third UNAIDS 95 target) was defined as the proportion of adults with HIV on treatment with a suppressed viral load (appendix p 3).

Statistical analysis

This analysis was conducted by appending the 2015−16 and 2020−21 datasets for participants aged 15−64 years with HIV test results in Stata version 16.0. We calculated pooled weights for the two surveys using the Jackknife method with replicate weights to account for unequal probability of household selection, as well as non-response and non-coverage. For each survey, we estimated various HIV epidemic indicators, using the definitions described in the Procedures section. For each estimate, 95% CIs were computed by Jackknife estimation. For comparison between surveys, we used a Poisson regression model to compute the risk ratio (RR) of the indicators between surveys with 95% CIs ($p<0·05$ was considered statistically significant).

Role of the funding source

The surveys were conducted with funding from PEPFAR and technical assistance and partnership with the CDC. The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. CDC staff participated in study design, data collection, data analysis, data interpretation, and writing of the report.

Results

14 268 households were sampled in 2015–16 and 15 330 households were sampled in 2020−21. 11 386 (88·6%) households responded in 2015–16 and 12 815 (91·6%) responded in 2020–21. 19 652 (87·7%) of 22 405 eligible individuals in 2015–16 and 26 518 (88·3%) of 30 049 eligible individuals in 2020−21 responded to the interviews. 17 187 (87·5%) of 19 652 participants aged 15−64 years in 2015−16 and 21 208 (85·5%) of 24 692 in 2020−21 participated in the blood draw (table 1). A high proportion of participants in both surveys were 15−24 years old, and there were fewer participants as age increased (table 1). This age distribution was consistent across men and women. In both surveys, most participants were from rural areas and a high proportion were from the Central-West zone (table 1). Consistent with its relatively small population size, the North zone represented the fewest participants (table 1). In terms of sociodemographic characteristics, most participants were married or living with a partner and had received a primary education. There was a slight increase between surveys in those with at least secondary education (table 1).

Between surveys, the national HIV prevalence decreased by 1·7%, from 10·6% (95% CI 10·0–11·2) to 8·9% (8·4–9·5) with RR 0·85 (95% CI 0·78–0·92; $p<0·0001$) for individuals aged 15−64 years (table 2). HIV prevalence decreased in all zones and subgroups, except in the 45−54 year age group among women, the 50−64 year group among men and the fourth wealth quintile where it remained similar (figure 1, appendix p 4). HIV prevalence was higher among women than men in both 2015−16 and 2020−21 (table 2). Between surveys, the peak prevalence shifted from the 45–49-year age group to the 50–54-year age group in men and from the 40−44-year age group to the 45−49-year age group in women (figure 1). Overall HIV incidence also decreased between the surveys, although the change was not significant (table 2).

Between surveys, the overall high viral load prevalence in the surveyed population significantly decreased, and the proportions and risk ratios were similar for women and men (table 2). Population viral load suppression significantly increased between surveys, both overall and in the subgroups of men and women (table 2).

Overall, in 2020−21, 88·4% (95% CI 86·7–90·0) of people living with HIV were aware of their HIV-positive status compared with 76·8% (74·7–79·0) in 2015−16; of those aware, 97·8% (97·1–98·5) were on ART compared with 91·4% (89·8–93·0) in 2015−16; and of those on treatment, 96·9% (95·9–97·7) were virally suppressed compared with 91·3% (89·1–93·1; table 2) in 2015−16.

The increase in awareness of positive HIV status between the 2015–16 and 2020–21 surveys was significant, and was similar by sex but slightly larger among men than women (table 2). The gap in HIV awareness between sexes narrowed considerably between the two surveys (tables 2, 3). HIV awareness improved the most among the 15−24-year age group (table 3, appendix p 5). When stratified by age and sex, the greatest increase in awareness of positive HIV status between surveys was for young men aged 15−24 years (table 3). When stratified by marital status, the highest increase in awareness was among those who were never married (appendix p 5). The greatest increases in awareness of positive HIV status were observed in the lowest and highest wealth quintiles (appendix p 5). All zones surveyed had an increase in the proportion with an awareness of positive HIV status; however, only the South-East zone met the 90% benchmark for this target (figure 2A, appendix p 5).

The proportion of those on ART among those who were aware of their positive HIV status increased significantly between the 2015–16 and 2020–21 surveys; this increase was similar in both sexes, but slightly larger among men than women (table 2). By 2020–21, women who were aware of their positive HIV status had higher treatment rates than men (table 2). When stratified by age and sex, the proportion of those on ART among people who were aware of their positive HIV status increased the most between surveys for young men aged 15−24 years, although this increase was not significant (table 3). All zones and urban cities surveyed had an increase in the proportion of those on ART among people who were aware of their positive HIV status between surveys, except the North zone (figure 2B). By 2020–21, all except the Central-West zone had met the second 95 target.

The proportion of individuals who were virally suppressed among those on treatment and aware of their positive HIV status increased significantly between the 2015–16 and 2020–21 surveys (table 2). This increase was similar in both sexes, but slightly larger among men than women (table 2). By 2020–21, women on ART had only marginally higher suppression rates than men. When stratified by age and sex, the proportion of viral suppression among those on ART increased the most between surveys for both young men and young women aged 15−24 years, although neither difference was significant (table 3). All zones and urban cities surveyed had an increase in the proportion of those virally suppressed among those on treatment (figure 2C). By 2020–21, all zones had met the third 95 target.

Discussion

Overall, in the Malawi PHIA 2020−21 survey, 88·4% of people living with HIV were aware of their HIV-positive status; of those aware, 97·8% were on ART; and owf those on treatment, 96·9% were virally suppressed. Between surveys, the national HIV prevalence decreased significantly and annual HIV incidence decreased, although the change was not significant. Viral suppression significantly increased between the two surveys. Compared with other countries with a second completed PHIA survey (ie, Eswatini, Lesotho, Zambia, and Zimbabwe), Malawi had lower HIV incidence and prevalence, but similar achievement of the 95–95–95 targets.

HIV prevalence among adults decreased between the two surveys; however, this decrease was not uniform by age and sex. We observed a decrease in prevalence among younger age groups and an increase among some older age groups. This is probably explained by the dramatic decrease in new infections among younger people, and the survival and ageing of the population on ART in both men and women. This transition might better explain the UNAIDS targets achievements among older populations.[19] In addition, this decrease in prevalence is unlikely to be due to mortality. UNAIDS Spectrum estimates show a decrease in deaths among people living with HIV, from 22 523 in 2015 to 18 146 in 2021 (UNAIDS Spectrum Estimates for Malawi, 2021. Unpublished data).

Our findings suggest that HIV incidence has reduced by almost half from 0·37% to 0·22% among those aged 15−64 years between the two surveys, although this decrease was not significant. The observed decrease in HIV incidence could be attributed to increased ART coverage in Malawi. Studies have shown that ART treatment reduces the risk of HIV transmission.[20,21] Data from both surveys suggest that once people are aware of their HIV status, the majority (more than 90%) of those who tested positive will start and remain on treatment. Substantial investments in voluntary medical male circumcision and scaling-up of this practice might have also contributed to decreasing HIV incidence.[22] There were also substantial investments in primary HIV prevention, including male wellness clinics, the Determined, Resilient, Empowered, AIDS-Free, Mentored, and Safe programme, and improvement and scale-up of youth-friendly centres.

From the latest UNAIDS Spectrum model, adult prevalence and incidence in 2021 were estimated as 8·2% and 0·15% (UNAIDS Spectrum Estimates for Malawi, 2021. Unpublished data). This is slightly lower than the 8·9% prevalence and 0·22% incidence calculated from the Malawi PHIA 2020−21 results, but the uncertainty bounds of the model estimates and the CIs of the survey overlap with the UNAIDS Spectrum estimates. Both the Malawi PHIA survey and UNAIDS Spectrum model results, with and without the 2020−21 PHIA as a model input, suggest that prevalence and incidence are continuing to decline over time.

Various metrics have been recommended as HIV epidemic transition benchmarks by UNAIDS, governments, and experts. These measure progress in reducing HIV as a public health threat. One such metric is the incidence to prevalence ratio (IPR); an IPR of 0·03 indicates that a country is undergoing epidemic transition, meaning that the country is moving towards epidemic control.[12] The IPR in the 2015−16 PHIA was 0·035, compared

with 0·025 in the 2020−21 PHIA, suggesting that Malawi crossed the benchmark for epidemic transition in the time between the two surveys.

Performance against the 95–95–95 targets improved significantly between the two PHIA surveys, with the largest improvement being in HIV awareness. Programme data from the Malawi Department of HIV/AIDS are consistent with the PHIA survey results, showing more awareness or HIV testing among women than men and improved linkage to care over time. The Malawi Ministry of Health and its development partners designed and implemented interventions to respond to the gaps identified in the 2015−16 PHIA survey. To address low awareness of HIV status, innovative strategies for delivering HIV testing services to specified subpopulations, such as index HIV testing through follow-up and testing of HIV positive sexual partners and social network strategies, were implemented. Although the results suggest that Malawi has not yet achieved the first 95, we observed impressive improvements between the 2015−16 and 2020−21 PHIAs. Continued efforts should focus on younger age groups, particularly younger men aged 15−34 years.

The 2020−21 PHIA results suggest that Malawi has achieved the second 95 target. The estimated ART coverage among all people living with HIV, based on Ministry of Health programme data and the UNAIDS Spectrum model estimates, with and without the 2020−21 PHIA as a model input, were very similar to the 2020−21 PHIA estimates. These improvements in ART coverage might be attributed to strategies and evidence-informed interventions that Malawi conducted during the 5 years between the two surveys. Successful strategies have focused on improving linkage to care through peer-led, community-based services to reach and support adolescents and young people. In addition, there was a focus on increased psychosocial support, patient-centred care models, and providing multi-month refills of ART.

The 2020−21 PHIA survey results also suggest that Malawi has achieved the third 95 target. We found that Malawi is at 87·0% population viral load suppression, which also confirms achievement of the third 95 target by 2020−21 (85·7% population viral suppression if 95–95–95 targets are met). Improvement in viral load suppression might be attributed to interventions focusing on improved adherence to ART, follow-up of those not linked to care, improved treatment adherence through appointment reminders, and follow-up with those who missed appointments within a month of missing an appointment. However, viral load suppression rates in routine monitoring data were consistently lower than the 2020−21 survey estimates. During the survey period, programme data for viral load suppression were around 93−94%, compared with 96·9% in the 2020−21 PHIA. This difference might be explained by the lower specificity of dried blood spot samples and by the proportion of plasma versus dried blood spot samples tested during the PHIA compared with routine monitoring, leading to an increased proportion of results greater than 1000 copies per mL. When possible, the PHIA collected plasma samples, whereas in routine monitoring dried blood spots are preferred for ease of transport and storage. Viral load suppression rates from routine monitoring using plasma samples were consistent with the PHIA survey results. The UNAIDS Spectrum model estimates from 2022, using both programme and survey data, were consistent with 2020−21 PHIA HIV epidemic indicator findings.

Strengths of this study include the fact that data were from a large population-based and nationally representative survey with rigorous biomarker testing and high participation rates. Additionally, surveys were appended and weighted as one such that metrics could be compared across time and progress could be quantified. Limitations to the study include a pause during the implementation of the 2020−21 PHIA due to COVID-19, which might have affected participation. Additionally, in pooling together data from both PHIA surveys, we excluded those younger than 15 years and those aged 65 years and older because these age groups were not included in both surveys. Although steps were taken to account for survey differences, when combining datasets for the two surveys, pooled weighting might have minimised differences and variances between the two survey populations. There might also be residual bias in the survey estimate of people living with HIV aware of their status, as previously diagnosed participants who were not recently taking antiretrovirals and who did not disclose their testing history would be misclassified as unaware. Correction of the first 95 (awareness) was dependent on antiretroviral detection. However, some participants might have been aware of their positive HIV status but not have disclosed to the interviewer and not been on treatment, resulting in a potential underestimate of the proportion who were aware of their positive HIV status. In addition, the assay for detecting antiretrovirals was limited to first and second round ART regimens and might not detect all participants on treatment, resulting in a potential underestimate of the proportion aware of HIV status and the proportion on treatment. Finally, the Malawi PHIA surveys were not powered to measure change in incidence rates.

Through strategies and evidence-informed interventions implemented in the last half decade, Malawi has made tremendous progress on the UNAIDS HIV testing and treatment targets and has achieved both the second and third 95 targets ahead of 2030. To achieve the first 95 target, it will be important to consider implementing innovative HIV testing strategies, such as increasing the potential of a social network strategy and improved strategies for case finding and prevention. Additionally, with Malawi PHIA and programme data, reviewing and understanding gaps in the 95–95–95 could be used to guide more targeted, person-centred interventions across the care continuum.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This work was supported by PEPFAR through the CDC under the terms of cooperative agreement number U2GGH001226 and number U2GGH002173. The findings and conclusions are those of the authors and do not necessarily represent the official position of the funding agencies. We acknowledge participants of both Malawi PHIA 2015−16 and 2020−21 and are grateful for the team behind the tremendous work that goes into planning and implementing the surveys. We acknowledge our collaborating colleagues at institutions such as Malawi Ministry of Health, National AIDS Commission, PEPFAR, CDC, WESTAT, and ICAP at Columbia University. We especially want to acknowledge Charles Mwansambo, Masauso Nzima, and Blackson Matatiyo for their leadership and support in survey implementation, as well as Steven Kinchen, Stephen McCracken, and Paul Stupp for their statistical support.

Funding

US President’s Emergency Plan for AIDS Relief through the US Centers for Disease Control and Prevention.

References

1. UNAIDS. 90–90–90: an ambitious treatment target to help end the AIDS epidemic https://www.unaids.org/sites/default/files/media_asset/90-90-90_en.pdf (accessed Feb 7, 2022).
2. UNAIDS. Understanding fast-track: accelerating action to end the AIDS epidemic by 2030 https://www.unaids.org/sites/default/files/media_asset/JC2686_WAD2014report_en.pdf (accessed March 23, 2023).
3. Kim AA, Mukui I, Young PW, et al. Undisclosed HIV infection and antiretroviral therapy use in the Kenya AIDS indicator survey 2012: relevance to national targets for HIV diagnosis and treatment. AIDS 2016; 30: 2685–95. [PubMed: 27782965]
4. Huerga H, Van Cutsem G, Ben Farhat J, et al. Progress towards the UNAIDS 90–90–90 goals by age and gender in a rural area of KwaZulu-Natal, South Africa: a household-based community cross-sectional survey. BMC Public Health 2018; 18: 303. [PubMed: 29499668]
5. Nkambule R, Philip NM, Reid G, et al. HIV incidence, viremia, and the national response in Eswatini: two sequential population-based surveys. PLoS One 2021; 16: e0260892. [PubMed: 34855890]
6. Woldesenbet S, Cheyip M, Lombard C, et al. Progress towards the UNAIDS 95–95–95 targets among pregnant women in South Africa: results from the 2017 and 2019 national Antenatal HIV Sentinel Surveys. PLoS One 2022; 17: e0271564. [PubMed: 35862306]
7. Lima VD, St-Jean M, Rozada I, et al. Progress towards the United Nations 90–90–90 and 95–95–95 targets: the experience in British Columbia, Canada. J Int AIDS Soc 2017; 20: e25011. [PubMed: 29130644]
8. Bansi-Matharu L, Cambiano V, Apollo T, et al. 90–90–90 by 2020? Estimation and projection of the adult HIV epidemic and ART programme in Zimbabwe—2017 to 2020. J Int AIDS Soc 2018; 21: e25205. [PubMed: 30465689]
9. Thornton J Botswana's HIV/AIDS success. Lancet 2022; 400: 480–81. [PubMed: 35964598]
10. Birx D, Zaidi I. Forward: measuring progress toward epidemic control. J Acquir Immune Defic Syndr 2021; 87 (suppl 1): S1. [PubMed: 34166306]
11. Quinn TC, Wawer MJ, Sewankambo N, et al. Viral load and heterosexual transmission of human immunodeficiency virus type 1. N Engl J Med 2000; 342: 921–29. [PubMed: 10738050]
12. Ghys PD, Williams BG, Over M, Hallett TB, Godfrey-Faussett P. Epidemiological metrics and benchmarks for a transition in the HIV epidemic. PLoS Med 2018; 15: e1002678. [PubMed: 30359372]
13. Ministry of Health Malawi. Malawi population-based HIV impact assessment (MPHIA): 2015–2016. Final report Lilongwe, Malawi: Ministry of Health, 2018.
14. ICAP. Second population survey assessing HIV in Malawi shows progress toward epidemic control April 29, 2022. https://phia.icap.columbia.edu/second-population-survey-assessing-hiv-in-malawi-shows-progress-toward-epidemic-control/ (accessed Nov 16, 2022).
15. Ministry of Health Malawi. Malawi population-based HIV impact assessment 2020–2021: MPHIA 2020–2021. Final report Lilongwe, Malawi: Ministry of Health, 2022.
16. Sachathep K, Radin E, Hladik W, et al. Population-based HIV impact assessments survey methods, response, and quality in Zimbabwe, Malawi, and Zambia. J Acquir Immune Defic Syndr 2021; 87 (suppl 1): S6–16. [PubMed: 34166308]
17. Patel HK, Duong YT, Birhanu S, et al. A comprehensive approach to assuring quality of laboratory testing in HIV surveys: lessons learned from the population-based HIV impact assessment project. J Acquir Immune Defic Syndr 2021; 87 (suppl 1): S17–27. [PubMed: 34166309]
18. Voetsch AC, Duong YT, Stupp P, et al. HIV-1 recent infection testing algorithm with antiretroviral drug detection to improve accuracy of incidence estimates. J Acquir Immune Defic Syndr 2021; 87 (suppl 1): S73–80. [PubMed: 34166315]
19. Farley SM, Wang C, Bray RM, et al. Progress towards the UNAIDS 90–90–90 targets among persons aged 50 and older living with HIV in 13 African countries. J Int AIDS Soc 2022; 25 (suppl 4): e26005. [PubMed: 36176030]
20. Cohen MS, Chen YQ, McCauley M, et al. Prevention of HIV-1 infection with early antiretroviral therapy. N Engl J Med 2011; 365: 493–505. [PubMed: 21767103]

21. Rodger AJ, Cambiano V, Bruun T, et al. Risk of HIV transmission through condomless sex in serodifferent gay couples with the HIV-positive partner taking suppressive antiretroviral therapy (PARTNER): final results of a multicentre, prospective, observational study. Lancet 2019; 393: 2428–38. [PubMed: 31056293]

22. Hines JZ, Sachathep K, Pals S, et al. HIV incidence by male circumcision status from the population-based HIV impact assessment surveys—eight sub-Saharan African countries, 2015–2017. J Acquir Immune Defic Syndr 2021; 87 (suppl 1): S89–96. [PubMed: 33765683]

Research in context

Evidence before this study

We searched PubMed and Google Scholar from Jan 1, 2012, to Dec 31, 2022, using medical subject headings and keyword terms (“HIV”, “UNAIDS targets”, “HIV incidence”, “HIV prevalence”, and “95–95–95”) for English-language publications that reported on country progress on various HIV indicators over the past 10 years (2012−22). Countries have evaluated their progress towards achieving the UNAIDS 95–95–95 targets and reported varying levels of progress. To enable governments to monitor their progress towards the targets and epidemic control, the US President’s Emergency Plan for AIDS Relief (PEPFAR) supported the design and implementation of the Population-based HIV Impact Assessment (PHIA) across 16 countries in Africa. Malawi is one of six countries with results from two PHIA surveys. Malawi PHIA surveys were implemented in 2015−16 and in 2020−21. The 2015−16 survey showed notable progress towards the UNAIDS 90–90–90 targets, but also identified coverage gaps in HIV diagnosis, antiretroviral therapy (ART) access and retention, and viral load suppression. In response to the 2015−16 PHIA findings, targeted interventions were implemented by the Government of Malawi, PEPFAR, and other partners to close these gaps, including awareness of HIV status among youth and men. The 2020–21 Malawi PHIA indicates achievement of both the second and third 95 targets ahead of 2030. In closing the gap to achieving the first 95, continued efforts should focus on younger age groups, particularly younger men aged 15−34 years.

Added value of this study

To our knowledge, this is the first analysis comparing progress between Malawi’s first and second PHIA surveys. Our analysis was conducted on an appended Malawi PHIA survey dataset with calculated pooled weights. Additionally, we calculated risk ratios between surveys, which are not included in any final PHIA survey reports. Our findings show that the decrease in HIV prevalence and improvement on the 95–95–95 targets between the surveys was statistically significant. We calculated the risk ratios between surveys for assessed indicators (total and by sex) to show progress between surveys.

Implications of all the available evidence

Although tremendous progress has been made, this analysis identifies specific groups that need special efforts if we are to end AIDS as a public health threat by 2030. To address low awareness of HIV status, continued efforts should focus on men and younger age groups. Additionally, with increased HIV prevalence among older age groups, care and treatment should support the survival and ageing of both men and women with HIV who are on ART.

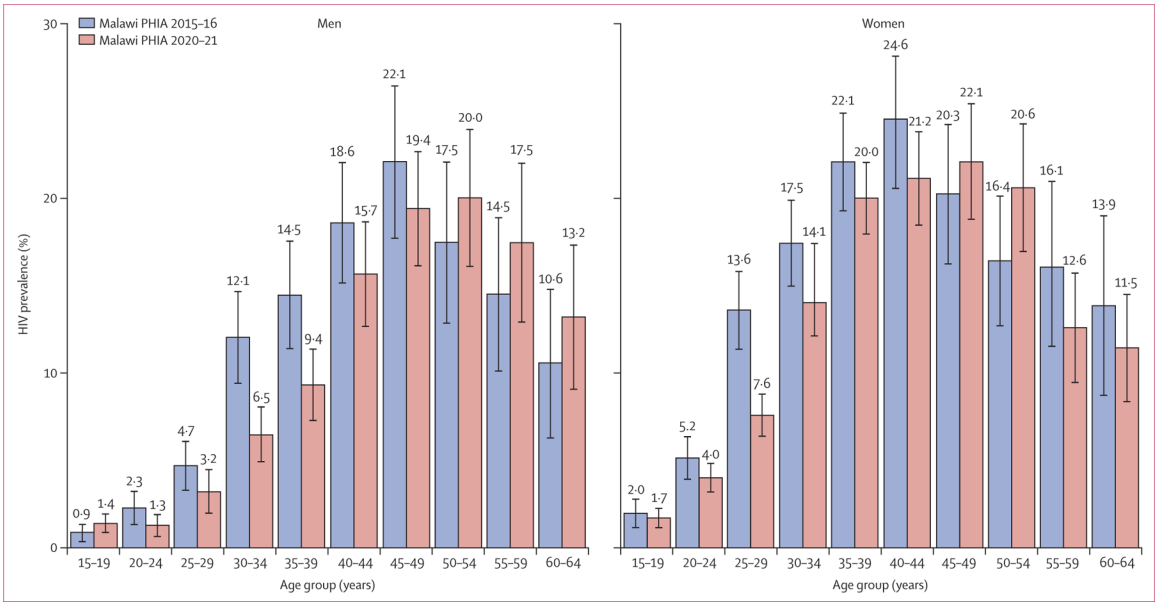

Figure 1: HIV prevalence by age and sex in the 2015–16 and 2020–21 Malawi PHIAs

PHIA=Population-based HIV Impact Assessment. Error bars are 95% CIs.

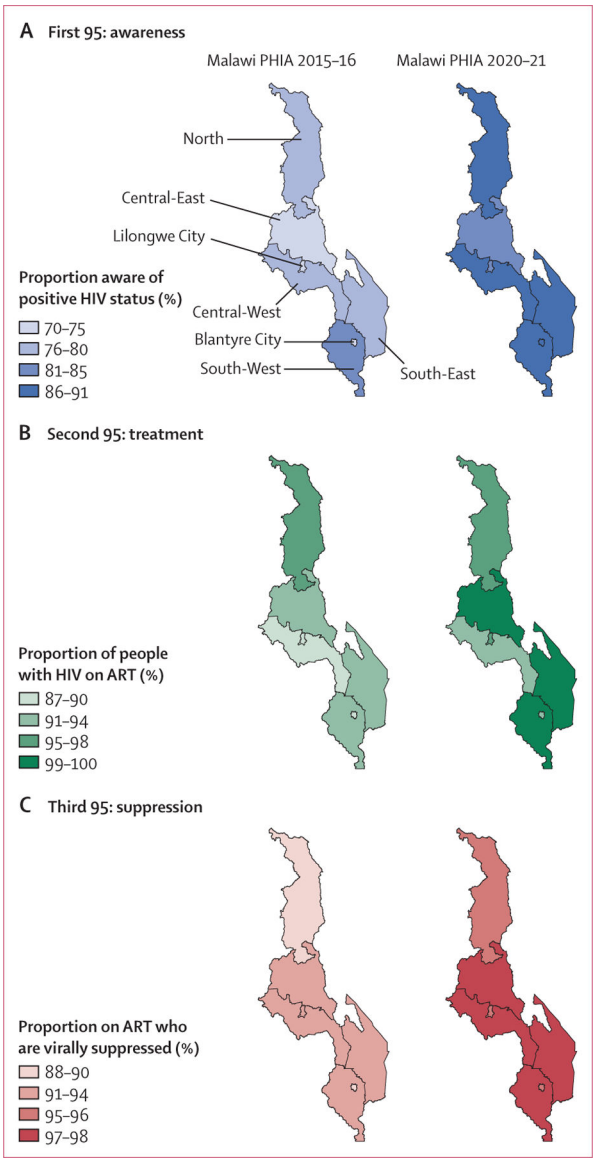

Figure 2: Comparison of progress towards 95–95–95 by zone in the 2015–16 and 2020–21 Malawi PHIAs

(A) Proportion of individuals in the 2015–16 and 2020–21 surveys who were aware of their positive HIV status. (B) Proportion of individuals in the 2015–16 and 2020–21 surveys with HIV who were on ART. (C) Proportion of individuals in the 2015–16 and 2020–21 surveys on ART who were virally suppressed. ART=antiretroviral therapy. PHIA=Population-based HIV Impact Assessment.

Table 1:

Participant demographics in the 2015–16 and 2020–21 Malawi Population-based HIV Impact Assessments

	Men		Women		Total	
	2015–16 (n=7208)	2020–21 (n=8953)	2015–16 (n=9979)	2020–21 (n=12 255)	2015–16 (n=17 187)	2020–21 (n=21 208)
Age, years						
15–24	2678 (39·2%)	3412 (38·6%)	3580 (38·4%)	4207 (38·2%)	6258 (38·8%)	7619 (38·4%)
25–34	1808 (26·8%)	2088 (26·5%)	2936 (27·0%)	3287 (26·9%)	4744 (26·9%)	5375 (26·7%)
35–44	1374 (17·6%)	1681 (17·4%)	1882 (17·8%)	2496 (17·6%)	3256 (17·7%)	4177 (17·5%)
45–54	801 (10·5%)	1126 (10·5%)	1020 (10·6%)	1412 (10·8%)	1821 (10·5%)	2538 (11·0%)
55–64	547 (5·9%)	646 (6·4%)	561 (6·3%)	853 (6·5%)	1108 (6·1%)	1499 (6·4%)
Residence						
Urban	2683 (20·9%)	1627 (18·2%)	3750 (18·9%)	2244 (18·2%)	6433 (19·9%)	3871 (18·2%)
Rural	4525 (79·1%)	7326 (81·8%)	6229 (81·1%)	10 011 (81·8%)	10 754 (80·1%)	17 337 (81·8%)
Zone						
North	1017 (14·4%)	1120 (13·1%)	1301 (13·5%)	1275 (11·2%)	2318 (14·0%)	2395 (12·1%)
Central-East	1160 (17·3%)	1674 (18·5%)	1341 (15·5%)	1957 (15·8%)	2501 (16·3%)	3631 (17·1%)
Central-West	860 (21·0%)	1284 (21·2%)	1149 (20·7%)	1610 (20·7%)	2009 (20·9%)	2894 (21·0%)
Lilongwe City	1265 (7·8%)	479 (5·5%)	1729 (6·6%)	723 (6·2%)	2994 (7·2%)	1202 (5·9%)
South-East	742 (16·4%)	1879 (17·5%)	1210 (19·0%)	3107 (20·6%)	1952 (17·7%)	4986 (19·1%)
South-West	1050 (16·5%)	1963 (18·6%)	1682 (19·0%)	2884 (20·1%)	2732 (17·8%)	4847 (19·4%)
Blantyre City	1114 (6·6%)	554 (5·6%)	1567 (5·7%)	699 (5·4%)	2681 (6·2%)	1253 (5·5%)
Marital status						
Never married	2611 (35·8%)	3074 (35·8%)	1997 (21·6%)	2114 (21·3%)	4608 (28·5%)	5188 (28·2%)
Married or living together	4230 (59·5%)	5388 (59·1%)	6311 (61·7%)	7649 (60·0%)	10 541 (60·7%)	13 037 (59·6%)
Divorced or separated	304 (4·1%)	430 (4·6%)	1150 (11·8%)	1802 (13·8%)	1454 (8·1%)	2232 (9·4%)
Widowed	53 (0·6%)	56 (0·5%)	510 (4·8%)	678 (4·9%)	563 (2·8%)	734 (2·8%)
Education						
No education	353 (5·3%)	524 (5·7%)	1032 (12·7%)	1441 (11·5%)	1385 (9·1%)	1965 (8·7%)
Primary	3963 (60·9%)	5318 (58·8%)	5994 (65·4%)	7947 (64·7%)	9957 (63·2%)	13 265 (61·9%)
Secondary	2473 (30·0%)	2704 (30·7%)	2559 (19·9%)	2579 (21·5%)	5032 (24·8%)	5283 (25·9%)
More than secondary	417 (3·8%)	400 (4·8%)	387 (2·0%)	276 (2·3%)	804 (2·9%)	676 (3·5%)

	Men		Women		Total	
	2015–16 (n=7208)	**2020–21 (n=8953)**	**2015–16 (n=9979)**	**2020–21 (n=12 255)**	**2015–16 (n=17 187)**	**2020–21 (n=21 208)**
Wealth quintile						
Lowest	769 (13·9%)	1428 (16·6%)	1202 (16·5%)	2219 (18·9%)	1971 (15·2%)	3647 (17·8%)
Second	1049 (18·4%)	1763 (19·4%)	1416 (18·1%)	2327 (19·0%)	2465 (18·2%)	4090 (19·2%)
Middle	1155 (20·0%)	1774 (19·5%)	1630 (20·4%)	2542 (20·1%)	2785 (20·2%)	4316 (19·8%)
Fourth	1568 (22·8%)	2035 (22·4%)	2032 (21·5%)	2610 (20·8%)	3600 (22·2%)	4645 (21·6%)
Highest	2667 (24·9%)	1951 (22·0%)	3699 (23·6%)	2555 (21·2%)	6366 (24·2%)	4506 (21·6%)
Pregnancy status						
Currently pregnant	··	··	562 (7·2%)	700 (5·9%)	··	··
Not currently pregnant	··	··	7570 (92·8%)	11 477 (94·1%)	··	··

Data are n (weighted %).

Table 2:

Prevalence and incidence of HIV, prevalence of viral suppression and high viral load, and 95–95–95 targets among men and women aged 15–64 years in the 2015−16 and 2020−21 Malawi Population-based HIV Impact Assessments

	2015–16		2020–21		Risk ratio comparing surveys (95% CI)	p value
	n	Weighted proportion (95% CI)	n	Weighted proportion (95% CI)		
HIV prevalence						
Total	17 187	10·6% (10·0–11·2)	21 208	8·9% (8·4–9·5)	0·85 (0·78–0·92)	<0·0001
Women	9979	12·5% (11·7–13·4)	12 255	10·6% (10·0–11·2)	0·85 (0·78–0·93)	0·0010
Men	7208	8·5% (7·8–9·3)	8953	7·1% (6·5–7·7)	0·83 (0·74–0·94)	0·0040
Annual HIV incidence						
Total	17 187	0·37% (0·20–0·53)	21 208	0·22% (0·11–0·34)	0·61 (0·31–1·20)	0·15
Women	9979	0·50% (0·25–0·75)	12 255	0·31% (0·13–0·48)	0·62 (0·29–1·32)	0·21
Men	7208	0·23% (0·04–0·43)	8953	0·13% (0·00–0·29)	0·57 (0·13–2·47)	0·45
High viral load prevalence						
Total	17 187	3·3% (3·1–3·6)	21 208	1·2% (1·0–1·3)	0·35 (0·29–0·41)	<0·0001
Women	9979	3·4% (3·0–3·8)	12 255	1·3% (1·1–1·5)	0·37 (0·30–0·46)	<0·0001
Men	7208	3·3% (2·9–3·8)	8953	1·1% (0·9–1·3)	0·32 (0·25–0·41)	<0·0001
Population viral load suppression						
Total	2220	68·3% (66·0–70·7)	2337	87·0% (85·3–88·5)	1·27 (1·22–1·32)	<0·0001
Women	1508	73·1% (70·3–75·7)	1614	88·2% (86·3–89·9)	1·21 (1·16–1·26)	<0·0001
Men	712	60·9% (56·8–64·9)	723	85·0% (82·2–87·5)	1·40 (1·30–1·50)	<0·0001
First 95: awareness						
Total	2217	76·8% (74·7–79·0)	2337	88·4% (86·7–90·0)	1·15 (1·11–1·19)	<0·0001
Women	1505	80·2% (77·7–82·4)	1614	90·4% (88·4–92·0)	1·13 (1·09–1·17)	<0·0001
Males	712	71·7% (67·6–75·4)	723	85·2% (81·9–88·0)	1·19 (1·11–1·27)	<0·0001
Second 95: on antiretroviral therapy						
Total	1720	91·4% (89·8–93·0)	2096	97·8% (97·1–98·5)	1·07 (1·05–1·09)	<0·0001
Women	1210	92·9% (91·2–94·6)	1473	98·1% (97·3–98·8)	1·06 (1·03–1·08)	<0·0001
Men	510	88·7% (85·1–91·6)	623	97·3% (95·8–98·8)	1·10 (1·05–1·14)	<0·0001
Third 95: viral load suppression						
Total	1564	91·3% (89·1–93·1)	2055	96·9% (95·9–97·7)	1·06 (1·04–1·09)	<0·0001
Women	1110	92·1% (89·6–94·0)	1446	97·0% (95·7–97·9)	1·05 (1·03–1·08)	<0·0001
Men	454	89·8% (85·6–92·9)	609	96·8% (95·0–98·0)	1·08 (1·03–1·12)	<0·0001

Table 3:

95–95–95 outcomes by age and sex in the 2015−16 and 2020−21 Malawi Population-based HIV Impact Assessments

	Women				Men			
	2015–16	2020–21	Risk ratio between surveys (95% CI)	p value	2015–16	2020–21	Risk ratio between surveys (95% CI)	p value
First 95: awareness								
Age 15–24 years	101/170 (57·6%)	115/150 (75·8%)	1·32 (1·08–1·60)	0·0070	20/44 (44·6%)	38/51 (77·2%)	1·73 (1·14–2·64)	0·013
Age 25–49 years	956/1151 (83·0%)	1113/1205 (91·6%)	1·10 (1·06–1·14)	<0·0001	360/513 (71·7%)	395/465 (83·6%)	1·17 (1·08–1·26)	<0·0001
Age ≥50 years	153/184 (81·8%)	245/259 (94·0%)	1·15 (1·05–1·25)	0·0030	130/155 (82·3%)	190/207 (91·1%)	1·11 (1·00–1·22)	0·050
Second 95: on antiretroviral therapy								
Age 15–24 years	89/101 (87·9%)	111/115 (96·2%)	1·09 (1·00–1·20)	0·061	17/20 (78·7%)	36/38 (95·4%)	1·21 (0·92–1·59)	0·16
Age 25–49 years	879/956 (93·0%)	1093/1113 (98·1%)	1·05 (1·03–1·08)	<0·0001	311/360 (87·4%)	387/395 (97·2%)	1·11 (1·06–1·17)	<0·0001
Age ≥50 years	142/153 (95·0%)	242/245 (98·9%)	1·04 (1·00–1·08)	0·034	126/130 (95·7%)	186/190 (97·9%)	1·02 (0·97–1·08)	0·41
Third 95: viral load suppression								
Age 15–24 years	72/89 (81·4%)	100/111 (90·7%)	1·11 (0·96–1·30)	0·16	14/17 (80·8%)	32/36 (90·6%)	1·12 (0·85–1·49)	0·41
Age 25–49 years	811/879 (92·6%)	1063/1093 (97·2%)	1·05 (1·02–1·08)	0·0010	281/311 (90·0%)	376/387 (97·2%)	1·08 (1·03–1·13)	0·0030
Age ≥50 years	137/142 (94·9%)	240/242 (99·3%)	1·05 (0·99–1·10)	0·089	113/126 (90·8%)	181/186 (97·3%)	1·07 (1·00–1·15)	0·039