Characterising persons diagnosed with HIV as either recent or long-term using a cross-sectional analysis of recent infection surveillance data collected in Malawi from September 2019 to March 2020

Malango T Msukwa,1 Ellen W MacLachlan 2, Salem T Gugsa,3 Joe Theu,1 Ireen Namakhoma,1 Fred Bangara,1 Christopher L Blair,1 Danielle Payne,4 Kathryn G Curran,5 Melissa Arons,5 Khumbo Namachapa,6 Nellie Wadomba,4 Alinune N Kabaghe,4 Trudy Dobbs,3 Vedapuri Shanmugam,5 Evelyn Kim,4 Andrew Auld,4 Yusuf Babaye,1 Gabrielle O’Malley,2 Rose Nyirenda,6 George Bello1

ABSTRACT

Objectives In Malawi, a recent infection testing algorithm (RITA) is used to characterise infections of persons newly diagnosed with HIV as recent or long term. This paper shares results from recent HIV infection surveillance and describes distribution and predictors.

Setting Data from 155 health facilities in 11 districts in Malawi were pooled from September 2019 to March 2020.

Participants Eligible participants were ≥13 years, and newly diagnosed with HIV. Clients had RITA recent infections if the rapid test for recent infection (RTRI) test result was recent and viral load (VL) ≥1000 copies/mL; if VL was <1000 copies/mL the RTRI test result was reclassified as long-term. Results were stratified by age, sex, pregnancy/breastfeeding status and district.

Results 13 838 persons consented to RTRI testing and 12 703 had valid RTRI test results and VL results after excluding clients not newly HIV-positive, RTRI negative or missing data (n=1135). A total of 12 365 of the 12 703 were included in the analysis after excluding those whose RTRI results were reclassified as long term (n=338/784 or 43.1%). The remainder, 446/12 703 or 3.5%, met the definition of RITA recent infection. The highest percentage of recent infections was among breastfeeding women (crude OR (COR) 3.2; 95% CI 2.0 to 5.0), young people aged 15–24 years (COR 1.6; 95% CI 1.3 to 1.9) and persons who reported a negative HIV test within the past 12 months (COR 3.3; 95% CI 2.6 to 4.2). Factors associated with recent infection in multivariable analysis included being a non-pregnant female (adjusted OR (AOR) 1.4; 95% CI 1.2 to 1.8), a breastfeeding female (AOR 2.2; 95% CI 1.4 to 3.5), aged 15–24 years (AOR 1.6; 95% CI 1.3 to 1.9) and residents of Machinga (AOR 2.0; 95% CI 1.2 to 3.5) and Mzimba (AOR 2.4; 95% CI 1.3 to 4.5) districts.

Conclusions Malawi’s recent HIV infection surveillance system demonstrated high uptake and identified sub-populations of new HIV diagnoses with a higher percentage of recent infections.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This paper reports on HIV recent infections that are verified by viral load (VL); if the rapid test for recent infection (RTRI) test result is recent and VL ≥1000 copies/mL the RTRI recent result is considered valid and if VL is <1000 copies/mL the RTRI recent test result is reclassified as a long-term infection.

⇒ HIV recent infection surveillance in Malawi is integrated into HIV testing services so that all eligible persons who test HIV-positive, and provide consent, are tested with an RTRI.

⇒ When implementing HIV recent infection surveillance in Malawi, it is not possible to deduplicate HIV positive persons retesting for HIV because there are no unique national IDs at the moment that would allow deduplication.

⇒ Data reported in this paper include varying levels of implementation of HIV recent infection surveillance by district in Malawi and these differences in coverage could influence district-level HIV recent infection rates reported and the statistical significance of those findings.

INTRODUCTION

The East and Southern Africa regions bear the biggest burden of the global HIV/AIDS epidemic. In 2018, the number of people living with HIV (PLHIV) in these two regions was approximately 20.6 million, accounting for 47% of HIV infections worldwide.1 In 2018, the HIV prevalence in Malawi was estimated at 9.2%, with almost one million
PLHIV and 38 000 new HIV infections annually. This prevalence is a considerable decline of almost 5% from 2005, when the prevalence was 14.1% and there were 66 000 new infections annually.

Malawi has also made great progress in reaching the Joint United Nations Programme on HIV/AIDS (UNAIDS) 95-95-95 goals that were set in 2014. According to the 2020–2021, Malawi population-based HIV impact assessment (MPHIA), 88% of PLHIV knew their HIV status, 98% of PLHIV who knew their status were on treatment and 97% of those on treatment had achieved viral suppression. Expanded access to HIV treatment has resulted in a substantial 55% decrease in AIDS-related deaths, from 29 000 in 2010 to 13 000 in 2018, with more recent infections starting in April 2019, using RTRI and RITA. A plan for a nationwide surveillance system for recent HIV infection surveillance between September 2019 and March 2020 at 155 health facilities in 11 districts of Malawi. Data from April 2019 to August 2019 were excluded from the analysis due to variability in facility data collection during the 5-month startup phase of the surveillance system. Surveillance was implemented over time, so not all facilities and districts were collecting data during this entire time period; for the time period reported on, recency surveillance had expanded to 11 of 28 districts and to 155 of an envisioned 251 facilities. The districts were prioritised for surveillance based on numbers of HIV-positive diagnoses in 2018. All persons presenting for testing who reported being HIV negative or unknown (or having never tested HIV positive) and who were aged 13 years and older were eligible to consent to recent infection surveillance. Among those who provided consent, only those who were subsequently reactive for HIV using a rapid test were enrolled in recent infection surveillance. Persons were excluded from the analysis if they tested HIV-positive using self-testing, or were otherwise screened for HIV in the community and accessed the health facility only for HIV confirmatory testing.

All HIV testing was accompanied by pretest and post-test counselling and followed the national testing algorithm. As noted, only persons who were (1) reactive on the first HIV rapid test in the national algorithm (Determine) and (2) had provided verbal consent (ie, eligible for recency testing) were subsequently tested with Asanté HIV Rapid Recency Assay (Sedia Biosciences, Portland, Oregon, USA) simultaneously with the HIV rapid test UniGold. Verbal consent was the preferred consent format due to the low-risk nature of the surveillance and to better integrate recency testing into Government of Malawi-approved HIV testing guidelines. Persons under the age of 18 provided verbal consent to participate in recency testing, and assent was not used. Even though the Asanté assay is currently validated for persons 15 years and older, ethics committees approved verbal consent for persons 13 years and older because this age is also allowed to consent to HIV testing per Malawi Government HIV testing services (HTS) guidelines.

The protocol was approved by the National Health Sciences Research Committee in Malawi and by a U.S. Centres for Disease Control and Prevention institutional review board.

Both the UniGold and Asanté HIV Rapid Recency Assay results were entered into the study database via a tablet. Persons testing negative with UniGold were dropped from all analyses. A dried blood spot specimen for VL testing was collected from persons who tested both HIV-positive and recent on the RTRI assay to assess recent infection per the RITA. HIV plasma RNA VL was quantified using Abbott m2000 Real Time HIV Viral Load Assay according to manufacturer instructions.

Routinely collected HIV testing data, including demographics, self-reported HIV testing history, and RTRI results were recorded in a surveillance data register at each facility. We abstracted these data using ODK software and sent them to a central data repository. Once VL results were available from the National HIV Reference Laboratory, these data were merged with the RTRI

**METHODS**

This analysis includes persons enrolled in HIV recent infection surveillance between September 2019 and March 2020 at 155 health facilities in 11 districts of Malawi.
Patient and public involvement

Our study involved the analysis of routinely collected Government of Malawi surveillance data and thus involvement from patient or members of the public in the design, conduct, reporting and dissemination plans for the study was not possible. Starting in late 2021, investigations of locales with higher rates of recent infections, and initiation of public health interventions based on the results, have included more patient and public involvement.

RESULTS

Between September 2019 and March 2020, 14 022 eligible persons aged ≥13 were asked to participate in recency testing. Of these, 13 838/14 022 (98.7%) consented to recent HIV infection surveillance and were then tested using the RTRI assay (figure 1). Of these, a total of 1135/13 838 (8.2%) were excluded for the following reasons: an HIV-negative or invalid UniGold result (n=806), disclosure of a previous HIV-positive diagnosis during post-test counselling (n=184), missing VL results (n=80), missing data on previous HIV test (n=43) or a negative (or invalid) result on the RTRI assay (n=22) (figure 1). Of the 12 703 participants included in the analysis after these exclusions, 784/12 703 were RTRI recent (6.2%) and 11 919/12 703 were RTRI long term (93.8%). Of the 784 RTRI recent participants, 446/784 (56.9%) met the definition of RITA recent infection and 338/784 (43.1%) met the definition of RITA long-term infection. This corresponds to an overall RITA-recent rate of 3.5% (446/12 703) and a RITA long-term rate of 96.5% (12 257/12 704). The final analysis thus included 446 RITA-recent cases and 11 919 long-term infection cases (as classified by RTRI) or a total of 12 365 participants. The final analysis did not include RITA long-term cases since technically these cases could not be reclassified as RTRI long-term (338) (figure 1).

Characteristics of surveillance participants

Females accounted for 60.5% (n=7481) of the participants included in the analysis (table 1) and, among those of reproductive age, 70.2% were not pregnant (n=4974), 26.7% were pregnant (n=1893) and 3.1% were breast feeding (n=220). The overall median age for all participants was 31 years (IQR: 25–39 years), with the most common age group being 25–34 years (38.2%, n=4722). Participants were split almost equally between urban and rural settings. A large proportion of recent infection surveillance participants were from Blantyre district (47.3%, n=5851), followed by Zomba district (14.6%, n=1800), Lilongwe district (7.7%, n=949) and Machinga (7.6%, n=941). The proportion of participants who reported an HIV test within the previous 12 months (40.9%, n=5055) vs more than 12 months ago (40.7%, n=5030) were similar, while a lower proportion reported never having tested before (18.4%, n=2280; table 1).

Characteristics of persons with recent HIV infection

Breastfeeding women (crude OR, COR 3.2; 95% CI 2.0 to 5.0) had the highest proportion of recent infections, which was significantly higher than that of pregnant (COR 1.6; 95% CI 1.2 to 2.1) and non-pregnant women (COR 1.7; 95% CI 1.4 to 2.1) (table 2). By age group, recent HIV infections were highest in females (6.0%) and males (4.7%) aged 15–24 years (figure 2) and highest in the 15–24 age group overall (COR 1.6; 95% CI 1.3 to 1.9) (table 2). A larger percentage of recent infection among people with new HIV diagnoses was found in persons from rural settings (COR 1.3; 95% CI 1.0 to 1.8) compared with urban settings, although this was not statistically significant. Residents of Mzimba (COR 2.3; 95% CI 1.3 to 4.0), Machinga (COR 2.1; 95% CI 1.2 to 3.5), Balaka (COR 1.7; 95% CI 0.7 to 4.1), Lilongwe (COR 1.6; 95% CI 1.0 to 2.6) and Chikwawa (COR 1.6; 95% CI 1.0 to 2.6) districts had the highest proportions of recent infections, although not statistically significant in
Balaka, Lilongwe and Chikwawa. By HIV testing history, the highest percentage of recent infections (COR 3.3; 95% CI 2.6 to 4.2) was among persons who self-reported having had a negative HIV test within the 12 months prior (table 2). For a description of persons with long-term infections (n=338), please see additional online supplemental appendix.

Factors associated with recent HIV infection
After adjusting for age group and sex, urban/rural location of the participant’s residence, and district of participant’s residence, factors significantly associated with recent infection among newly diagnosed PLHIV included living in Mzimba (AOR 2.4; 95% CI 1.3 to 4.5) or Machinga (AOR 2.0; 95% CI 1.2 to 3.5) districts compared with Zomba district and being aged 15–24 years (AOR 1.6; 95% CI 1.3 to 1.9) compared with being aged 25–34 years. Women who were not pregnant (AOR 1.4; 95% CI 1.2 to 1.8) and women who were breastfeeding (AOR 2.2; 95% CI 1.4 to 3.5) compared with males were also at higher risk of recent infection (table 2).

DISCUSSION
Our results demonstrate an association of recency with plausible risks such as younger age (<25 years) and sex (women vs men), confirming successful implementation
of recency surveillance in Malawi. In addition, recency testing identified breastfeeding women and residents of certain districts as persons at higher risk of ongoing HIV transmission. In multivariable regression, factors that remained associated with recent infection included younger age and district of residence.

The proportion of recent infections found in this study, using RITA, was 3.5%. There have been no other national-level recent infection studies in Malawi to compare these findings to. A study in Kenya using similar methods, though with a much smaller sample size and using a laboratory-based recency test, reported a recent infection per cent of 8.6% in Nairobi and another recency study in Zimbabwe reported a recent infection percent of 10.5% among female sex workers. Our study likely has a comparatively lower recent infection rate given the large, national sample that constitutes the recent infection surveillance system in Malawi. For example, a larger surveillance study recently completed in Cambodia found a RITA recent rate of 5.0% and surveillance of 27,792 newly HIV-diagnosed individuals in Nigeria found an RITA recent rate of 2.4%. Furthermore, recency surveillance in Eswatini found an overall RITA recent rate of 3.1% and surveillance in DRC found an overall RITA recent rate of 5.0%. All of these surveillance studies were aided by the use of clinical information such as VL, history of prior HIV diagnosis, and ART-exposure to confirm that a recent infection was truly recently acquired and not a long-term infection. The validity of our recent infection rate in Malawi is also aided by the inclusion of VL testing to rule out long-term infections—without the VL testing, the percent HIV recent would have been 6.2%.

The percentage of recent infections among newly diagnosed females aged 15–24 years, or adolescent girls and young women (AGYW), in this study was lower than that found in previous studies in Malawi and in nearby countries. The differences in percentages may be attributed to factors such as the case definition of recent infection. For example, Kim et al, in Kenya, the case definition for recent infection included testing recent on LAg and having no evidence of ART use. This case definition for recent infection is different from what is used in this analysis, which used a point-of-care test and did not use ART use as an eligibility criterion.

The higher proportion of women currently breastfeeding who tested recent for HIV may similarly be explained by HIV testing practices in Malawi for pregnant and breastfeeding women. Women who test positive during

| Characteristic | Total | % (n) |
|---------------|-------|-------|
| **Sex**       |       |       |
| Male          | 39.5  | (4884)|
| Female        | 60.5  | (7481)|
| **Pregnancy and breastfeeding** | | |
| Not pregnant  | 70.2  | (4974)|
| Pregnant      | 26.7  | (1893)|
| Breast feeding| 3.1   | (220) |
| **Age, years**|       |       |
| 13–14         | 0.6   | (68)  |
| 15–24         | 22.2  | (2748)|
| 25–34         | 38.2  | (4722)|
| 35–44         | 26.0  | (3210)|
| 45–49         | 6.2   | (770) |
| ≥50           | 6.9   | (847) |
| **Median (IQR)** | 31 (25–39) | |
| **Residence** |       |       |
| Urban         | 48.5  | (5992)|
| Rural         | 51.5  | (7373)|
| **District of residence** | | |
| Balaka        | 2.3   | (283) |
| Blantyre      | 47.3  | (5851)|
| Chikwawa      | 6.2   | (763) |
| Lilongwe      | 7.7   | (949) |
| Machinga      | 7.6   | (941) |
| Mangochi      | 6.5   | (806) |
| Mzimba        | 1.7   | (214) |
| Zomba         | 14.6  | (1800)|
| Other         | 6.1   | (758) |
| **Previous HIV test** | | |
| ≤12 months    | 40.9  | (5055)|
| >12 months    | 40.7  | (5030)|
| Never tested  | 18.4  | (2280)|

*Data for all females in the reproductive age group (15–49 years). †≤12 months and >12 months represent client’s last self-reported HIV-negative test.
breastfeeding may have tested negative during pregnancy but seroconverted either later in the pregnancy or post-partum after becoming sexually exposed to HIV. Others might not have had their HIV status ascertained during pregnancy but tested positive during the breastfeeding period.40 The smaller number of women breastfeeding compared with women who were not pregnant or breastfeeding, or were currently pregnant, may have influenced the results and explain why this variable did not remain strongly significant in the multivariable model, though it does border on significance. Chagomerana et al conclude in their ANC cohort study in Malawi that mother-to-child-transmission (MTCT) occurred disproportionately among women with a last positive HIV test during breastfeeding. This means that testing delayed until the postpartum period may lead to higher MTCT and that prevention of MTCT programmes should focus on early ART initiation and providing targeted testing, prevention, treatment and support to breastfeeding women.40

### Table 2
Prevalence of RITA recent HIV infections by participant characteristic and factors associated with RITA recent HIV infection in persons with new HIV diagnoses among surveillance participants in Malawi, from September 2019 to March 2020 (n=12 365)

| Characteristic                  | Total     | Recent infections | Crude OR (95% CI) | Adjusted* OR (95% CI) |
|--------------------------------|-----------|-------------------|-------------------|-----------------------|
| Total                          | 12 365    | 3.6               | --                | --                    |
| Sex                            |           |                   |                   |                       |
| Male                           | 4884      | 2.5               | 1                 | 1                     |
| Female not pregnant            | 5362      | 4.3               | 1.7 (1.4 to 2.1)  | 1.4 (1.2 to 1.8)      |
| Female pregnant                | 1898      | 4.0               | 1.6 (1.2 to 2.1)  | 1.1 (0.8 to 1.5)      |
| Female breast feeding          | 221       | 7.7               | 3.2 (2.0 to 5.0)  | 2.2 (1.4 to 3.5)      |
| Age, years                     |           |                   |                   |                       |
| 13–14                          | 68        | 1.5               | 0.4 (0.1 to 2.7)  | 0.4 (0.1 to 2.6)      |
| 15–24                          | 2748      | 5.8               | 1.6 (1.3 to 1.9)  | 1.6 (1.3 to 1.9)      |
| 25–34                          | 4722      | 3.7               | 1                 | 1                     |
| 35–44                          | 3210      | 2.7               | 0.7 (0.6 to 0.9)  | 0.8 (0.6 to 0.9)      |
| 45–49                          | 770       | 1.7               | 0.5 (0.3 to 0.8)  | 0.5 (0.3 to 0.9)      |
| ≥50                            | 847       | 1.5               | 0.4 (0.2 to 0.7)  | 0.4 (0.2 to 0.7)      |
| Residence                      |           |                   |                   |                       |
| Urban                          | 5992      | 3.1               | 1                 | 1                     |
| Rural                          | 6373      | 4.1               | 1.3 (1.0 to 1.8)  | 1.0 (0.7 to 1.5)      |
| District of residence           |           |                   |                   |                       |
| Balaka                         | 283       | 5.7               | 1.7 (0.7 to 4.1)  | 1.7 (0.7 to 4.0)      |
| Blantyre                       | 5851      | 2.6               | 0.8 (0.5 to 1.2)  | 0.8 (0.5 to 1.2)      |
| Chikwawa                       | 763       | 5.2               | 1.6 (1.0 to 2.6)  | 1.5 (0.9 to 2.4)      |
| Lilongwe                       | 949       | 5.5               | 1.6 (1.0 to 2.6)  | 1.7 (1.0 to 2.8)      |
| Machinga                       | 941       | 6.8               | 2.1 (1.2 to 3.5)  | 2.0 (1.2 to 3.5)      |
| Mangochi                       | 806       | 3.5               | 1.0 (0.6 to 1.8)  | 1.0 (0.6 to 1.8)      |
| Mzimba                         | 214       | 7.5               | 2.3 (1.3 to 4.0)  | 2.4 (1.3 to 4.5)      |
| Zomba                          | 1800      | 3.4               | 1                 | 1                     |
| Other                          | 758       | 2.5               | 0.7 (0.4 to 1.2)  | 0.7 (0.4 to 1.2)      |

†Previous HIV test

| ≤12 months                     | 5055      | 6.1               | 3.3 (2.6 to 4.2)  |                       |
| >12 months                     | 5030      | 1.9               | 1                 |                       |
| Never tested                   | 2280      | 2.0               | 1.1 (0.7 to 1.5)  |                       |

*Adjusted for age group, sex, urban/rural location of the participant’s residence and district of participant’s residence.
†≤12 months and >12 months represent client’s last self-reported HIV-negative test.

RITA, recent infection testing algorithm.
testing of mothers at the measles vaccination visit (9–12 months) to increase the chances of finding incident infected mothers.  

There is a clear association in our survey between a history of HIV testing within the last 12 months and recent HIV infection. This finding is consistent with other studies that demonstrate a higher rate of HIV testing history among newly HIV-positive individuals, with as much as 70% of newly diagnosed individuals reporting previously testing either positive (meaning they were not truly newly diagnosed) or negative. Since recent infection assays are designed to detect HIV infections that have occurred during the previous 12 months, it seems reasonable that persons who tested positive with a recent infection during our surveillance were more likely to have perceived themselves at risk and sought HIV testing sometime during the previous 12 months when compared with those persons who had not, or who reported having never been tested for HIV. Also, people newly diagnosed with HIV and with a recent history of testing negative for HIV are likely to have seroconverted since their last test and thus are more likely to be recently infected. More needs to be done to enhance the quality of HIV prevention counselling, such as initiation of pre-exposure prophylaxis and a thorough assessment of factors that may have influenced the person to seek a test.

There are several implications from our findings. The high percentage of long-term infections among newly diagnosed PLHIV found in the surveillance is alarming given that these late diagnoses mean that a significant proportion of the population is unaware of their HIV status and likely transmitting infection. In addition, when these persons with long-term infections are then linked to treatment programmes, they are more likely to experience poor health outcomes, including in the younger age groups. This finding underscores the continued need for expanding HIV testing, as well as testing strategies that are narrowly focused on specific populations. Still, many of the long-term infections identified may be due to persons who reported testing negative on their last test but in truth were previously diagnosed with HIV and possibly had a history of ART use, as shown by the many people who tested RTRI recent but were subsequently reclassified as long-term when their VL test indicated they had a controlled VL. Given the high rate of retesting and rediagnosis in Malawi more research is needed to better understand stigma and misconceptions associated with revealing a history of testing positive, reasons why those who test positive will often retest even after starting treatment and how a person’s retesting history, including the length of time between tests, may influence HIV outcomes. Our study also points to the need for a unique identifier in Malawi that can be used during HTS to quickly identify and quantify HIV-positive retesters. This is increasingly important given that across sub-Saharan Africa, approximately 84% of people have knowledge of their HIV status.

AGYW continue to face the highest risk of HIV in Malawi. More needs to be done to expand HIV testing among AGYW in Malawi beyond traditional facility-based
testing to modalities that are preferred by adolescents.\textsuperscript{51,52} In a recent HIV testing study in Kenya, most AGYW participants (77.5\%) chose staff-aided testing either at home or at a mobile event; (22.4\%) chose self-testing; and only 2 (.2\%) chose facility referral.\textsuperscript{53} Even with the elevated risk that AGYW face, young men aged 15–24 in our surveillance also had high rates of new infections, and in multivariable analysis only young age remained significant, clearly indicating a need for renewed focus on HIV prevention in all youth aged 15–24 in Malawi.

The prevalence of recent infection was highest in four districts: Mzimba (in the northern region), Machinga and Chikwawa (in the southern region), and Lilongwe (in the central region). These findings provide new information to complement prevalence data from MPHIA studies that have found that southern districts had higher HIV prevalence compared with central and northern districts (even though the MPHIA was not powered to provide district-level prevalence estimates).\textsuperscript{3} Since recent HIV surveillance can generate a disaggregated summary of where recent HIV infections occur at more granular geographic sub-units, such as district and health facilities,\textsuperscript{16} the rapid identification of such HIV transmission clusters is the next important step in using the recent infection surveillance data in Malawi. This in fact has begun with a geospatial transmission ‘hotspot’ analysis using Malawi recency data.\textsuperscript{54} Continuing such analyses, and following them up with local facility-based investigations, may help explain our district-level recent infection findings more fully and can provide the basis for using recent infection surveillance to identify gaps in HIV prevention and care services.\textsuperscript{15,55,56}

The strength of this study includes the large sample of persons with new HIV diagnoses from districts in Malawi with high HIV prevalence. Since RITA was integrated into the national HTS model with high acceptability, these data are likely a good representation of the general characteristics of persons newly diagnosed with HIV seeking healthcare from health facilities in Malawi and similar settings. The study had some limitations. First, since the initial phase of the recent HIV infection surveillance system was focused on integrating recent HIV infection testing into routine HTS, additional data were not collected that may have helped identify factors associated with recent infection, such as marital status, cultural beliefs and socioeconomic status. Future surveillance may benefit from linking information generated from recent HIV infection testing data with other sociodemographic factors and triangulating additional factors such as clinical history that may be related to recent HIV infection.

Participation in this investigation relied on self-reported history of HIV testing among eligible persons. Hence, as noted above, it is possible that participants were reluctant to disclose a previous HIV-positive diagnosis and were inadvertently included as a new HIV diagnosis. Indeed, UNAIDS/WHO estimates that approximately up to 50\% of people testing positive in Malawi are re-diagnoses.\textsuperscript{50} This would result in an underestimation of the proportion of recent infections. An overestimation of the proportion of recent infections would result from our exclusion from the analysis of persons screening HIV-positive with a self-test or visiting the facility for confirmatory testing (and testing HIV-positive). Another limitation is that the included districts, and therefore participants, are likely not representative of all of Malawi especially since districts were prioritised for HIV recency surveillance based on the number of newly reported HIV cases the year before. In addition, during the time period reported additional districts and facilities were continuing to be added to the surveillance system and so these results cannot be generalised to all of Malawi. Finally, some validation studies of recency assays indicate a tendency to produce false-recent results, particularly for those individuals on ART,\textsuperscript{10–12} which would result in an overestimation of the proportion of recent infections. However, efforts have been made to reduce false-recent results through the addition of RITAs\textsuperscript{53} such as was used in this study.

CONCLUSION

Recent HIV infection surveillance can help to identify sociodemographic, clinical and geographical factors associated with recent HIV infection. Given that recent infection surveillance in Malawi confirms the high risk of HIV faced by AGYW, youth-focused programmes that aim to limit HIV acquisition and transmission among young people, especially young women, should remain a priority and be strengthened to sustain the gains made towards HIV epidemic control in Malawi. More data derived from triangulation and modelling with other data sources, as well as recent infection cluster analyses, are needed to allow for the targeting of HIV interventions at the district level in the country. The higher percentage of long-term infections than recent infections among newly diagnosed PLHIV underscores the continuing need for innovative ways to expand targeted HIV testing to ensure early diagnosis and treatment, especially among hard-to-reach populations.

Author affiliations

1Department of Global Health, I-TECH, University of Washington, Lilongwe, Malawi
2Department of Global Health, I-TECH, University of Washington, Seattle, Washington, USA
3Department of Global Health, University of Washington, Seattle, Washington, USA
4Centers for Disease Control and Prevention, Lilongwe, Malawi
5Centers for Disease Control and Prevention, Atlanta, Georgia, USA
6Department of HIV and AIDS, Ministry of Health, Lilongwe, Central Region, Malawi

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ORCID id Ellen W MacLachlan http://orcid.org/0000-0003-4106-8290

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