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Improving HIV Case Finding Through Index Testing: Findings from Health Facilities in 12 Districts of South Africa, October 2019–September 2021

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Abstract

To assess the importance of index testing in HIV case finding, we analyzed quarterly data from October 2019 to September 2021 from 371 facilities in 12 districts in South Africa. Index testing accounted for 2.6% of all HIV tests (index and non-index) (n = 163,633), but 17.8% of all HIV-positive results, with an HIV-positivity 4-times higher than non-index testing modalities (4.1%). Despite twice as many adult females ≥ 15 years accepting index testing (n = 206,715) compared to adult males ≥ 15 years (n = 102,180), females identified fewer contacts (n = 91,123) than males (n = 113,939). Slightly more than half (51.2%) of all contacts elicited were tested (n = 163,633/319,680), while 19.7% (n = 62,978) of elicited contacts were previously diagnosed as HIV-positive and not eligible for further testing. These findings indicate index testing can be effective in increasing HIV diagnoses in South Africa. Further operational research is needed to address gaps identified in the index testing cascade, including elicitation and testing of contacts.

Keywords

HIV; Index testing; Partner notification; South Africa; Prevention

Introduction

As of 2021, only 85% of people living with HIV (PLHIV) worldwide knew their status [1]. Targeted testing modalities, such as index testing, are recommended by the World Health Organization (WHO) to reach undiagnosed PLHIV [2]. Index testing is defined as offering HIV testing services to the biological children and partners (both needle-sharing and sexual) of PLHIV and has been established as an effective HIV case finding strategy [3]. Index testing has been shown to help identify more new undiagnosed individuals living with HIV

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compared to other facility-based testing modalities, within prevention of mother-to-child transmission (PMTCT) services, inpatient departments and emergency wards [4, 5]. It also has proven to be effective in community and facility settings among adults, adolescents, and children [4–7].

In 2021, South Africa had the largest HIV-positive population in the world with 7.3 million adults 15–49 years living with HIV and 270,000 children (< 14 years old) living with HIV (CLHIV) [1]. In 2014, The Joint United Nations Programme on HIV/AIDS (UNAIDS) launched the 95–95–95 strategy to accelerate progress towards ending the HIV epidemic, aiming for 95% of PLHIV to know their HIV status, 95% of all people with diagnosed HIV to receive sustained anti-retroviral treatment (ART), and 95% of all people on treatment to achieve viral suppression by 2030 [8]. As of 2021, 94% of South African adults living with HIV knew their HIV status, 79% were on treatment, and 91% were virally suppressed (HIV RNA < 1000 copies/ml) [1]. However, CLHIV in South Africa remained behind on progress towards the 95–95–95 targets at 83%–58%–69% [1].

In 2016, index testing was introduced in South Africa through the National HIV Counseling and Testing Policy [9]. However, index testing uptake was variable, including in public health facilities supported through the U.S. President's Emergency Plan for AIDS Relief (PEPFAR). Data from 20 PEPFAR-supported country programs between 2016 and 2018 indicated that index testing was an effective HIV case finding strategy, identifying a total of 4985 adults living with HIV (12.4% HIV-positivity) and 138 children living with HIV (6.9% HIV-positivity) in South Africa despite incomplete scale-up among both populations [10].

Throughout 2018, with the support of PEPFAR, the South African National Department of Health (NDOH) facilitated trainings and consultations to enhance the quality of index testing services and ensure better alignment with national and global guidelines in collaboration with Provincial and District Health Departments, PEPFAR District Support Partners (DSPs), and health facility staff. The NDOH has continued to support the scale up of index testing in South Africa through "Operation Phuthuma" or "*Operation Hurry*," which was launched in 2018 and collaborates with all levels of the health systems from national to facility level, in order to accelerate HIV prevention and treatment interventions, including index testing [11]. Clients can test for HIV through a variety of entry points ("modalities"), which include index testing, PMTCT services, provider-initiated testing and counseling (PITC), and voluntary counseling and testing (VCT), among others.

This analysis aimed to determine the effectiveness of index testing as a HIV case finding strategy by comparing the number of new HIV diagnoses identified from index testing to other testing modalities from October 2019 to September 2021, and to identify programmatic gaps in the index testing cascade to inform quality improvement efforts.

Methods

This analysis includes quarterly data reported to PEPFAR's monitoring, evaluation, and reporting (MER) database by DSPs supported by the U.S. Centers for Disease Control and Prevention (CDC) in South Africa. Data were collected between October 2019 and

September 2021 in 12 CDC-supported districts of South Africa, including Amathole, Chris Hani, and Oliver Tambo Districts in Eastern Cape Province; Ekurhuleni and Tshwane Districts in Gauteng Province; eThekwini, uMgungundlovu, uThukela, and Zululand Districts in KwaZulu-Natal Province; and Bojanala, Dr Kenneth Kaunda, and Ngaka Modiri Molema Districts in North West Province. These districts represent a combination of rural and urban areas and comprise some of South Africa's districts with the highest HIV disease burden. This project was reviewed in accordance with CDC human research protection procedures and was determined to be non-research.

All public health facilities that offered index testing in these districts during each quarter of the analysis period were included (n = 371). No PEPFAR-supported community sites or key population venues were included in this analysis. All index tests included in this analysis were administered at facilities or outreach events by facilities.

Five index testing indicators were analyzed, including: (1) number of clients offered index testing, (2) number of clients who accepted index testing, (3) number of contacts provided by the index client (contacts elicited, presented as a ratio of contacts per client), (4) number of elicited contacts who tested for HIV, and (5) number of contacts tested who were newly diagnosed as HIV-positive. The elicitation ratio was calculated as the number of contacts shared per index client. New HIV-positive diagnoses were verified using South Africa's TrakCare Lab system, an electronic laboratory results reporting system [12], to ensure the client had not previously received a positive HIV diagnosis. Newly diagnosed CLHIV < 12 years were included as index clients if their parents or legal guardians consented for them to participate in index services (the legal age of consent for HIV services in South Africa) [13]. To broadly estimate the number of children elicited for every newly diagnosed mother, the total number of children < 15 years identified as contacts were divided by the number of new HIV-positive test results among women 15–49 years. In addition, we analyzed data on the aggregate number of non-index, facility-based HIV tests and HIV-positive results from other testing modalities, which could have occurred in emergency wards, inpatient departments, pediatric clinics, antenatal and postnatal services, outpatient departments, PMTCT services, sexually transmitted infections (STI) clinics, tuberculosis (TB) clinics, VCT, mobile clinics, and voluntary medical male circumcision (VMMC) programs. Percent HIV-positivity was calculated for index and non-index modalities by dividing the number of people who tested positive by the total number of people who were tested.

All data were reported by quarter, metropolitan (metro)/non-metro area, district, sex, and age group. Metro residence was defined as residing in Ekurhuleni, Tshwane, or eThekwini metro districts, which are urban geographical areas; all other districts were defined as non–metro. This distinction was included because service delivery models vary greatly between these two geographies so it will be helpful for program implementers to see these differences. This was also done to give context for the international audience not familiar with geographies within South Africa. Data on contacts elicited were only available by aggregated age group (i.e., < 15- or ≥ 15-years). For all other indicators, age groups were stratified as: < 15-, 15–19-, 20–24-, 25–29-, 30–34-, 35–39-, 40–44-, 45–49- and ≥ 50-years. Clients missing age and sex were listed as unidentified. A chi-squared test was used to test significance

between groups. All data were analyzed using STATA, version 16.0 (https://www.stata.com/) [14].

Results

HIV Tests and HIV–Positivity by Index Testing and Other Non–index Testing Modalities

Between October 2019 and September 2021, 6,385,172 HIV tests were conducted in 371 public health facilities. Of those, 163,633 (2.6%) were tests conducted among contacts provided by HIV-positive index clients. Overall, index testing HIV-positivity was 4.3 times higher (17.8%) than HIV-positivity from other non-index modalities (4.1%) ($p < 0.001$, Table 1).

Between October and December 2019 and July and September 2021, the first and last quarters of this analysis, index testing represented 2.0%–3.3% of all tests administered and 7.0%–14.5% of all HIV-positive results per quarter (Table 1) and HIV-positivity from index testing was 3.6–5.4 times higher than other modalities. In metro and non-metro areas, index testing represented 2.3% (n = 88,271) and 3.0% (n = 75,362) of all HIV tests administered and 9.8% (n = 18,113) and 11.1% (n = 11,005) of all HIV-positive results, respectively. HIV-positivity was more than 4–times higher from index testing than other modalities in both metro (20.5%; 4.4%) and non-metro-areas (14.6%; 3.6%). By district, HIV-positivity from index testing was 3.1–6.5 times higher than other modalities. In Oliver Tambo District, index testing represented 1.7% of HIV tests administered (n = 927) and 8.0% (n = 1339) of HIV-positive results and had the highest HIV-positivity (29.4%), which was five times higher compared to other modalities (5.7%). In Bojanala District, HIV-positivity from index testing was six and a half times higher than HIV-positivity from other modalities. Among females, index testing accounted for 1.9% of all HIV tests (n = 84,264) and 8.6% (n = 15,703) of HIV-positive diagnoses. Among males, index testing accounted for 3.9% (n = 78,923) of HIV tests administered and 13.1% (n = 13,330) of HIV-positive diagnoses. HIV-positivity was approximately 4-times greater from index testing than other modalities among both males (16.9%, 4.6%) and females (18.6%, 3.9%). Among children < 15 years, index testing accounted for 7.7% of all HIV tests administered (n = 48,611) and 25.0% (n = 1349) of all HIV-positive results, with HIV-positivity 4-times higher in index testing (2.8%) compared to all other testing modalities (0.7%). The greatest differences between HIV-positivity from index testing compared to other modalities occurred among women ≥ 50 years, where HIV-positivity was more than 8-times higher with index testing (26.9%) compared to other modalities (3.3%) and among females 20–24 years, where HIV-positivity was more than 7-times greater from index testing (25.3%) compared to other modalities (3.4%).

Clients Who Were Offered Index Testing (Index Offered)

Index testing was offered to 371,018 clients attending health facilities between October 2019 and September 2021 (Table 2). The number of index tests offered increased by 94.1% from 33,634 in October–December 2019 to 65,293 in July–September 2021. More index tests were offered in metro areas (n = 214,528, 57.8%) compared to non-metro areas (n =

156,490, 42.2%). Among all districts, index offered was lowest in Ngaka Modiri Molema District (n = 4,276, 1.2%) and highest in eThekwini District (n = 101,103, 27.3%).

Nearly twice as many females (n = 243,719, 65.8%) were offered index testing than males (n = 126,531, 34.2%). The greatest number of index tests offered occurred among females and males 30–34 years (n = 50,805 and n = 23,271, respectively); the fewest occurred among females and males < 15 years (n = 4,259 and n = 3,836, respectively).

Clients Who Accepted Index Testing (Index Accepted)

Of the 371,018 clients offered index testing, 316,220 (85.2%) clients accepted (Table 2). The number of clients who accepted index testing increased by 103.7% from 27,874 in October–December 2019 to 56,790 in July–September 2021. The proportion of clients who accepted index testing was similar in non-metro (85.4%) and metro-areas (85.1%). Among all districts, the lowest acceptance was in Bojanala District (76.7%) and highest in Amathole (95.8%). Both females (n = 45,160, 88.9%) and males (n = 19,821, 85.2%) 30–34 years had the highest acceptance of index testing.

Index testing acceptance was < 80% for those ≥ 50 years (76.2%) and males 15–19 years (78.9%). Index testing acceptance was higher among females (n = 210,139, 86.2%) than males (n = 105,391, 83.3%). Index testing acceptance was higher among females in all age groups except children < 15 years (80.4% females, 83.7% males) and adult females ≥ 45 years (78.3% females, 80.8% males). Among newly diagnosed CLHIV < 15 years, 80.4%–83.7% of their parents accepted index services to provide HIV testing for their biological contacts, including mothers and siblings.

Number of Index Contacts Provided (Contacts Elicited)

Of the 316,220 clients who accepted index testing, 319,680 contacts were provided (elicitation ratio = 1.0) (Table 2). The number of index contacts increased by 82.6% from 30,972 contacts in October–December 2019 to 56,556 in July–September 2021. The elicitation ratio was similar in non-metro (1.1) and metro districts (1.0). Among all districts, the elicitation ratio was highest in Chris Hani District (1.6) and lowest in Ekurhuleni, uMgungundlovu, and Bojanala Districts (0.9).

The elicitation ratio for pediatric contacts per newly diagnosed female living with HIV of childbearing age (15–49 years) was 0.6. For index clients ≥15 years, males had a higher elicitation ratio (1.1) compared to females (0.4).

Of the 319,680 contacts provided, 62,978 (19.7%) had previously tested HIV-positive and were therefore ineligible for further testing.

Index Contacts Who Tested for HIV (Contacts Tested)

Of the 319,680 contacts elicited, approximately half (n = 163,333, 51.2%) were tested for HIV. The number of contacts tested increased by 48.9% from 17,435 in October–December 2019 to 25,961 in July–September 2021. Non-metro districts had a higher proportion of contacts tested (52.9%) compared to metro districts (49.8%). Zululand District had the

highest proportion of contacts tested (91.9%) and Dr. Kenneth Kaunda District had the lowest (11.2%).

Only 44.0% (n = 48,611) of children < 15 years who were elicited as contacts were tested. More female contacts ≥15 years (64.9%, n =59,161) were tested compared to male contacts ≥15 years (48.6%, n =55,415).

Contacts Newly Identified as HIV-Positive (Index Positive Results)

Of the 163,633 HIV tests conducted among the contacts elicited, 29,118 (17.8%) resulted in a new HIV diagnosis. The number of new diagnoses increased by 20.9% from 3334 in October–December 2019 to 4030 in July–September 2021. HIV-positive results for index contacts were higher in metro districts (n = 18,113, 20.5%) compared to non-metro districts (n = 11,005, 14.6%). Oliver Tambo District had the highest proportion of new HIV diagnoses (n = 927, 29.4%), while Amathole District had the lowest (n = 273, 9.1%).

Female contacts were more likely to test HIV-positive compared to male contacts (18.6% vs. 16.9%). The highest proportion of new diagnoses occurred among males 35–39 years (n = 2697, 28.1%) and females 30–34 years (n = 3072, 27.9%). Among children (< 15 years), HIV-positivity from index testing was 2.7%–2.8% compared to a positivity of 0.7% from other testing modalities.

Discussion

In 12 high-HIV prevalence districts in South Africa, we found that index testing was more effective at identifying new HIV diagnoses across all age, sex, and geographic categories compared to other modalities. Our analysis included disaggregated age and sex data, which is a frequently recognized limitation of index testing in the literature, and demonstrated substantial growth in index testing over a 2-year period from October 2019 to September 2021 despite interruptions from COVID-19 [7].

While index testing comprised a small proportion of the overall number of HIV tests conducted, the percent HIV-positivity was higher than non-index testing modalities, suggesting it is an efficient strategy for finding undiagnosed individuals across age and sex, including men, women, adults, and children. However, index testing has been found to be more expensive than most other testing modalities [15]. Given the increasingly limited resources of the public health sector in South Africa and reduced donor funding, it is important to target all HIV testing, including index testing services, to populations where it will be most effective.

Our findings show index testing may be particularly useful in certain districts, age groups, and sexes. Two districts in the metro-areas in Gauteng Province, and two rural districts in North West and KwaZulu-Natal Provinces had a higher number of new HIV-positive cases compared to other districts in South Africa. Further research is needed to understand reasons for this observation in order to translate best practices from these districts to other areas throughout South Africa.

Our findings also showed that 20% of contacts elicited were previously diagnosed as HIV-positive (verified using South Africa's electronic lab system, TrakCare). This indicates an opportunity to use the index testing platform to ensure diagnosed contacts are enrolled in treatment and to re-engage those who have fallen out of care back into treatment services. This strategy is important for adults and children to accelerate progress towards the 2nd 95 UNAIDS target in South Africa, and highlights the dual role of index testing as an important strategy for both case finding and returning clients to care [2].

The number of contacts elicited is quite low in this analysis, with index clients sharing on average just one contact. While we were not able to tell how many contacts were elicited from pediatric index cases, other studies have demonstrated the importance of this approach in identifying undiagnosed fathers, mothers, and siblings living with HIV [16, 17]. The ratio of pediatric contacts elicited was particularly low, given that women typically have multiple children, as demonstrated by South Africa's fertility rate in 2020 of 2.4 [18]. Overall, the ratio of contacts elicited was lowest among females ≥ 15 years, even though female clients commonly have ≥ 1 sex partner and/or ≥ 1 child.

HIV stigma remains high in South Africa and intimate partner violence (IPV) is one of the highest in the world [19]. In 2020, reported IPV-related mortality was more than seven times the global average, and an intimate partner is responsible for the death of one out of every two women killed in South Africa [19, 20]. Given the high rate of IPV in South Africa, sharing the names and contact information for partners could potentially put women or children in danger. To address this risk, South African providers who provide index testing services have been trained on LIVES (Listen, Inquire, Validate, Enhance Safety & Support), a WHO initiative that teaches providers how to identify violence and perform IPV assessments prior to offering index testing. Index testing is not offered to clients who screen positive for IPV; they are referred for appropriate IPV support services through social workers or civil society organizations. This high rate of IPV may help explain the low proportion of women sharing partner and/or pediatric contacts. In addition, in rural districts some sexual partners are migrant workers who travel to urban areas in search of work. Thus, some contacts may not be accessible for index testing because they reside in a different district than the index client. Further operational research is needed on how to safely provide index testing to women in South Africa, including anonymous partner notification approaches that do not require disclosure. Additional efforts are needed to routinize and demedicalize HIV testing and address HIV-related stigma, which negatively affects HIV testing, disclosure, and contact elicitation.

While strategies to increase elicitation are important, equally so is ensuring index testing patients are receiving high quality care from providers. It is important to have well trained counselors who have participated in significant training and role plays, who speak the local language(s), develop rapport and trust with clients, feel comfortable talking about HIV, sex and other risk factors, treat clients respectfully, ensure confidentiality, are non-judgmental, are good listeners and tailor each interaction to each client. When possible, counselors should be assigned to clients with similar demographics to improve client comfort levels. For example, men feel more comfortable speaking with men, adolescents with younger women and older clients with older counselors. Identifying and utilizing counselors with

these traits as well as implementing programmatic strategies will help to increase elicitation in index testing.

Only a little over half of all contacts elicited were tested, indicating opportunities to increase testing coverage. This is in contrast with studies in Lesotho and Kenya, where 72% and 77% of contacts elicited were tested, respectively [4, 21]. Low testing coverage could be due to high migration within South Africa. According to Stats SA, nearly 6% percent of residents changed their residence during the COVID-19 lockdown to be closer to family or friends, or to return to their home provinces, which translates to 3.6 million people [22]. In addition, it is not currently possible to trace clients electronically, and thus, tracing can only be done within facility catchment areas, which is often limited to districts. People also frequently change cell phone numbers, which makes tracing more challenging. HIV self-testing (HIVST) could be used to address the testing gap by distributing kits to clients to take home and screen their children and partners, making testing more convenient and accessible to those who do not go to facilities or who migrate for employment. A nationwide electronic medical record system (EMRS) would be helpful to address tracing challenges and has been successfully implemented in Malawi [23, 24]. However, implementation of an EMRS is hindered within South Africa due to restrictions on sharing client information outlined in the Protection of Personal Information (POPI) Act. Further advocacy will be needed to change policy and remove this structural barrier. Since Zululand District tested over 90% of their contacts, programs may benefit from learning more about the strategies that contributed to high testing coverage in that district to replicate elsewhere.

For index testing services, both HIV testing and HIV-positivity were lowest among children < 15 years. However, like other age groups, index testing HIV-positivity among children was 4-times higher than HIV-positivity from other testing modalities. A review of pediatric case finding approaches during the COVID-19 pandemic found that index testing was an effective way to identify CLHIV, accounting for 40.5% of all newly diagnosed pediatric HIV cases in PEPFAR-supported programs, with a HIV-positivity ranging from 3.6% to 4.6% in community and facility settings, respectively [25]. Studies in other countries, including Lesotho, Kenya, and Malawi, have demonstrated the effectiveness of index testing in identifying undiagnosed CLHIV [4, 26, 27]. In this analysis, index testing accounted for less than 10% of all HIV tests conducted among children, yet approximately 25% of all new HIV-diagnoses. Thus, it remains important to identify ways to scale-up pediatric index testing coverage, including offering refresher trainings for frontline healthcare workers to support quality services [28], improving cross-district referrals for children living apart from their parents [29], introducing the use of caregiver-assisted oral HIV self-screening (HIVSS) to allow parents to screen their children for HIV more conveniently and privately at home [22, 30], or referring pediatric contacts to orphans and vulnerable children programs for additional support with follow up HIV testing [28, 31] to ensure all biological children of PLHIV have a known HIV status.

In this analysis, men ≥ 35 years had higher HIV-positivity than females in the same age group, while females ≤ 34 years had higher HIV-positivity than males in the same age group. This indicates an opportunity to target testing towards younger females and older males to increase case finding through strategies specific to each demographic. HIVST presents an

opportunity to reach more men, which has been challenging because many do not routinely visit health facilities [32]. Partnering with PEPFAR's Determined, Resilient, Empowered Aids-Free, Mentored and Safe (DREAMS) program, which targets adolescent girls and young women 15–24 years, or other community-based organizations is another opportunity for reaching young women.

There are some limitations of this analysis. First, testing modality may have been reported incorrectly for some results and thus some modalities may be slightly over or under-represented. Second, we do not have costing data for conducting index testing; given limited resources, cost is an important consideration. Third, the analysis only includes data reported from public health facilities and did not include information from community or private health facilities, which also provide HIV testing. Fourth, we did not individually assess each non-index testing modality and each modality differs in its contribution to HIV positivity. Lastly, we were only able to conduct descriptive and comparative analyses since the programmatic data used in this analysis is aggregated and does not include individual-level data.

Despite these limitations, index testing was found to be a highly effective HIV case finding strategy in South Africa, with a higher HIV-positivity than other modalities. The effectiveness of index testing at identifying new positives differed by region, age, and sex, highlighting opportunities to improve coverage. In addition, challenges with elicitation and testing of contacts were observed across districts. These findings can inform quality improvement interventions to strengthen the index testing cascade in South Africa.

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References

1. "AIDSinfo | UNAIDS," Global data on HIV epidemiology and response, 2022. https://aidsinfo.unaids.org/. Accessed 24 Oct 2022
2. "WHO | Guidelines on HIV self-testing and partner notification," 2016. https://www.who.int/hiv/pub/self-testing/hiv-self-testing-guidelines/en/. Accessed 06 Mar 2020.
3. "Consolidated guidelines on HIV prevention, testing, treatment, service delivery and monitoring: recommendations for a public health approach," WHO, ISBN: 978–92-4–003159-3. https://www.who.int/publications/i/item/9789240031593. Accessed Jul 2021.

4. Jubilee M, Park FJ, Chipango K, Pule K, Machinda A, Taruberekera N. HIV index testing to improve HIV positivity rate and linkage to care and treatment of sexual partners, adolescents and children of PLHIV in Lesotho. PLoS ONE. 2019;14(3): e0212762. 10.1371/journal.pone.0212762. [PubMed: 30917167]
5. Kahabuka C, et al. Addressing the First 90: a highly effective partner notification approach reaches previously undiagnosed sexual partners in Tanzania. AIDS Behav. 2017;21(8):2551–60. 10.1007/s10461-017-1750-5. [PubMed: 28299518]
6. Williams D, et al. HIV testing and ART initiation among partners, family members, and high-risk associates of index clients participating in the CommLink linkage case management program, Eswatini, 2016–2018. PLoS ONE. 2021;16(12): e0261605. 10.1371/journal.pone.0261605. [PubMed: 34928998]
7. Mahachi N, et al. Sustained high HIV case-finding through index testing and partner notification services: experiences from three provinces in Zimbabwe. J Int AIDS Soc. 2019;22(S3): e25321. 10.1002/jia2.25321. [PubMed: 31321918]
8. UNAIDS, "Fast-Track - Ending the AIDS epidemic by 2030." https://www.unaids.org/en/resources/documents/2014/JC2686_WAD2014report. Accessed 08 Nov 2023.
9. "Standard operating procedures for HIV index testing services," National Department of Health, South Africa, South Africa, SOP number SOP000108/2020. https://www.knowledgehub.org.za/system/fles/elibdownloads/2021-02/NDoH%20Index%20Testing%20SOP-11-12-2020.pdf. Accessed 30 Jan 2023.
10. Lasry A, et al. Scaling up testing for human immunodeficiency virus infection among contacts of index patients—20 Countries, 2016–2018. Morb Mortal Wkly Rep. 2019;68(21):474–7. 10.15585/mmwr.mm6821a2.
11. Phaahla Joe, "Health Minister's speaker notes for SA satellite on 90–90-90 progress and recovery from COVID-19," South African Government, Department of Health, 2022. https://www.gov.za/speeches/health-minister%E2%80%99s-speaker-notes-sa-satellite-90-90-90-progress-and-recovery-covid-19-29-jul. Accessed 24 Oct 2022.
12. "TrakCare: EMR built for a changing healthcare world," InterSystems https://www.intersystems.com/trakcare/. Accessed 30 Jan 2023.
13. "New guidelines for counselling and testing children for HIV | HSRC," 2013. https://hsrc.ac.za/press-releases/hsc/new-guidelines-for-counselling-and-testing-children-for-hiv/. Accessed 21 Mar 2023.
14. "Stata Stistical Software: Releasae 16." StataCorp, LLC, College Station, TX, 2017.
15. Johnson LF, van Rensburg C, Govathson C, Meyer-Rath G. Optimal HIV testing strategies for South Africa: a model-based evaluation of population-level impact and cost-effectiveness. Sci Rep. 2019;9(1):12621. 10.1038/s41598-019-49109-w. [PubMed: 31477764]
16. Neary J, et al. Newly diagnosed HIV positive children: a unique index case to improve HIV diagnosis and linkage to care of parents. AIDS Care. 2020. 10.1080/09540121.2020.1719027.
17. Ochigbo SO, Torty C, Anah M. Prevalence of HIV infection among siblings of HIV positive children in Calabar, Nigeria. Pan Afr Med J. 2019. 10.11604/pamj.2019.32.179.16837.
18. The World Bank, "Fertility rate, total (births per woman)—South Africa." https://data.worldbank.org/indiator/SP.DYN.TFRT.IN?locations=ZA
19. Dos Santos MM, Kruger P, Mellors SE, Wolvaardt G, van der Ryst E. An exploratory survey measuring stigma and discrimination experienced by people living with HIV/AIDS in South Africa: the People Living with HIV Stigma Index. BMC Public Health. 2014;14:80. 10.1186/1471-2458-14-80. [PubMed: 24461042]
20. Norman R, Matzopoulos R, Groenewald P, Bradshaw D. The high burden of injuries in South Africa. Bull World Health Organ. 2007;85(9):695–702. 10.2471/blt.06.037184. [PubMed: 18026626]
21. Kariuki RM, Rithaa GK, Oyugi EO, Gachathi DM. What is the level of uptake of partner notification services in HIV testing in selected health facilities in Gatanga Sub County, Muranga County—Kenya; a retrospective study. BMC Infect Dis. 2020;20(1):432. 10.1186/s12879-020-05146-9. [PubMed: 32571230]

22. “Social impact of COVID-19 (Wave 3): mobility, migration, and education in South Africa.” 2022. http://www.statssa.gov.za/publications/Report-00-08-04/Report-00-08-04July2020.pdf. Accessed 24 Nov 2022.

23. Government of South Africa, “Protection of Personal Information Act.” 2022. https://popia.co.za/. Accessed 02 Nov 2022.

24. Centers for Disease Control & Prevention, “Innovative Electronic medical record systems expands in Malawi,” 2015. https://www.cdc.gov/globalhivtb/who-we-are/success-stories/success-storypages/innovativemalawi.html. Accessed 02 Nov 2022.

25. Traub AM. Pediatric HIV case identification across 22 PEPFAR-supported countries during the COVID-19 Pandemic, October 2019–September 2020. MMWR Morb Mortal Wkly Rep. 2022. 10.15585/mmwr.mm7128a2.

26. Wagner AD, et al. Active referral of children of HIV-positive adults reveals high prevalence of undiagnosed HIV. J Acquir Immune Defic Syndr. 2016;73(5):e83–9. 10.1097/QAI.0000000000001184. [PubMed: 27846074]

27. Ahmed S, et al. Index case finding facilitates identification and linkage to care of children and young persons living with HIV/AIDS in Malawi. Trop Med Int Health. 2017;22(8):1021–9. 10.1111/tmi.12900. [PubMed: 28544728]

28. Index testing for biological children and adolescents (< 19y/o) of PLHIV: clinical and OVC partner collaboration to expand testing services, PEPFAR Solutions Platform. https://www.pepfarsolutions.org/resourcesandtools-2/2021/10/5/index-testing-for-biological-children-and-adolescents-lt19yo-of-plhiv-clinical-and-ovc-partner-collaboration-to-expand-testing-services. 2021.

29. Neary J, et al. Male caregiver barriers to HIV index case testing of untested children. J Acquir Immune Defic Syndr. 2021;87(3):e229–31. 10.1097/QAI.0000000000002669. [PubMed: 33633034]

30. Abrahams N, Jewkes R, Martin LJ, Mathews S, Vetten L, Lombard C. Mortality of women from intimate partner violence in South Africa: a national epidemiological study. Violence Vict. 2009;24(4):546–56. 10.1891/0886-6708.24.4.546. [PubMed: 19694357]

31. Katbi M, et al. Closing the gap in pediatric HIV case finding: a review of the PASS strategy in Southern Nigeria. Int J Virol AIDS. 2020;7(2):1–6. 10.23937/2469-567X/1510068.

32. Makusha T, et al. HIV self-testing could ‘revolutionize testing in South Africa, but it has got to be done properly’: perceptions of key stakeholders. PLoS ONE. 2015;10(3): e0122783. 10.1371/journal.pone.0122783. [PubMed: 25826655]

Table 1

Number of individuals tested for and diagnosed with HIV in selected public health facilities in South Africa by index testing and non-index testing modalities, October 2019–September 2021

	Total			Index testing				Non-index modalities			
	Number of clients tested for HIV	Number of clients tested HIV-positive	HIV-positivity difference (index vs other modalities)	Number of clients tested for HIV	Number of clients who tested positive for HIV	HIV-positivity (%)	Proportion of clients tested for HIV (%)	Number of clients tested for HIV	Number of clients who tested positive for HIV	HIV-positivity (%)	Proportion of clients tested for HIV (%)
Overall	6,385,172	283,800	4.3	163,633	29,118	17.8	2.6	6,221,539	254,682	4.1	4.0
Quarter											
Oct–Dec 2019	888,370	47,492	3.7	17,435	3,334	19.1	2.0	870,935	44,158	5.1	5.0
Jan–Mar 2020	938,585	51,511	3.6	22,954	4,328	18.9	2.4	915,631	47,183	5.2	5.0
Apr–Jun 2020	593,011	30,611	3.7	19,623	3,428	17.5	3.3	573,388	27,183	4.7	4.6
Jul–Sep 2020	685,698	29,495	4.3	17,805	3,088	17.3	2.6	667,893	26,407	4.0	3.9
Oct–Dec 2021	783,821	32,573	5.0	16,564	3,125	18.9	2.1	767,257	29,448	3.8	3.8
Jan–Mar 2021	816,470	33,523	5.1	20,769	3,878	18.7	2.5	795,701	29,645	3.7	3.6
Apr–Jun 2021	862,164	30,780	5.4	22,522	3,907	17.3	2.6	839,642	26,873	3.2	3.1
Jul–Sep 2021	817,053	27,815	5.2	25,961	4,030	15.5	3.2	791,092	23,785	3.0	2.9
Residence[a]											
Metro	3,843,620	184,588	4.7	88,271	18,113	20.5	2.3	3,755,349	166,475	4.4	4.3
Non-metro	2,541,552	99,212	4.1	75,362	11,005	14.6	3.0	2,466,190	88,207	3.6	3.5
District[b]											
Amathole (EC)	176,326	4,896	3.4	2,999	273	9.1	1.7	173,327	4,623	2.7	2.6
Chris Hani (EC)	179,824	6,751	5.1	3,337	595	17.8	1.9	176,487	6,156	3.5	3.4
Oliver Tambo (EC)	189,068	11,535	5.2	3,155	927	29.4	1.7	185,913	10,608	5.7	5.6
Tshwane (GP)	646,332	37,462	4.0	13,473	2,965	22.0	2.1	632,859	34,497	5.5	5.3
Ekurhuleni (GP)	1,296,835	56,913	5.4	14,760	3,342	22.6	1.1	1,282,075	53,571	4.2	4.1
eThekwini (KZN)	1,900,453	90,213	4.6	60,038	11,806	19.7	3.2	1,840,415	78,407	4.3	4.1
uMgungundlovu (KZN)	325,380	13,154	3.1	19,242	2,127	11.1	5.9	306,138	11,027	3.6	3.4
Uthukela (KZN)	330,032	14,356	4.2	11,443	1,883	16.5	3.5	318,589	12,473	3.9	3.8

Total				Index testing				Non-index modalities			
	Number of clients tested for HIV	Number of clients tested HIV-positive	HIV-positivity difference (index vs other modalities)	Number of clients tested for HIV	Number of clients who tested positive for HIV	HIV-positivity (%)	Proportion of clients tested for HIV (%)	Number of clients tested for HIV	Number of clients who tested positive for HIV	HIV-positivity (%)	Proportion of clients tested for HIV (%)
Zululand (KZN)	396,325	18,595	3.3	25,223	3,453	13.7	6.4	371,102	15,142	4.1	3.8
Bojanala (NW)	464,985	15,653	6.5	6,694	1,339	20.0	1.4	458,291	14,314	3.1	3.1
Dr Kenneth Kaunda (NW)	321,366	10,715	4.4	1,586	232	14.6	0.5	319,780	10,483	3.3	3.3
Ngaka Modiri Molema (NW)	158,246	3,557	4.8	1,683	176	10.5	1.1	156,563	3,381	2.2	2.1
Age & Sex											
Female < 15	354,971	3,090	4.0	25,103	709	2.8	7.1	329,868	2,381	0.7	0.7
Male < 15	276,080	2,316	3.9	23,508	640	2.7	8.5	252,572	1,676	0.7	0.6
Female 15–19	517,662	12,093	6.5	6,018	869	14.4	1.2	511,644	11,224	2.2	2.2
Male 15–19	169,303	2,739	4.7	4,392	309	7.0	2.6	164,911	2,430	1.5	1.4
Female 20–24	927,195	33,936	7.4	9,870	2,502	25.3	1.1	917,325	31,434	3.4	3.4
Male 20–24	278,955	7,827	5.5	6,613	914	13.8	2.4	272,342	6,913	2.5	2.5
Female 25–29	840,530	40,177	6.3	12,158	3,371	27.7	1.4	828,372	36,806	4.4	4.4
Male 25–29	330,189	15,736	5.0	9,776	2,118	21.7	3.0	320,413	13,618	4.3	4.1
Female 30–34	635,062	34,289	5.6	11,026	3,072	27.9	1.7	624,036	31,217	5.0	4.9
Male 30–34	278,812	21,056	3.9	11,187	2,944	26.3	4.0	267,625	18,112	6.8	6.5
Female 35–39	407,886	24,426	4.8	8,720	2,309	26.5	2.1	399,166	22,117	5.5	5.4
Male 35–39	220,181	19,845	3.5	9,595	2,697	28.1	4.4	210,586	17,148	8.1	7.8
Female 40–44	242,169	14,659	4.3	5,498	1,329	24.2	2.3	236,671	13,330	5.6	5.5
Male 40–44	157,103	13,976	3.2	6,663	1,734	26.0	4.2	150,440	12,242	8.1	7.8
Female 45–49	148,893	8,984	4.6	3,233	832	25.7	2.2	145,660	8,152	5.6	5.5
Male 45–49	110,531	8,886	3.7	3,964	1,084	27.3	3.6	106,567	7,802	7.3	7.1
Female ≥ 50	289,453	10,274	8.2	2,638	710	26.9	0.9	286,797	9,564	3.3	3.3
Male ≥ 50	193,416	9,353	6.3	3,225	890	27.6	1.7	190,191	8,463	4.4	4.4
Unknown[c]	6,799	138	23.9	446	85	19.1	6.6	6,353	53	0.8	0.8

[*] All differences were statistically significant at $p < 0.001$

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[a] Residence is classified as metro (Tshwane, Ekurhuleni and eThekwini districts) and non-metro (all other districts)

[b] Districts are located in four provinces including: EC (Eastern Cape Province), GP (Gauteng Province), KZN (KwaZulu-Natal Province), and NW (North West Province)

[c] Age and/or sex was unidentified

Table 2

Cascade of index testing services in selected public health facilities in South Africa, October 2019–September 2021

	Number of clients offered index testing services (N)	Clients who accepted index testing services		Contacts elicited		Contacts tested for HIV		Contacts who tested HIV-positive	
		Number (N)	Proportion (%)	Number (N)	Ratio of contacts elicited per index client	Number (N)	Proportion (%)	Number of contacts tested for HIV who were newly diagnosed as HIV-positive (N)	Proportion of contacts tested for HIV who were newly diagnosed as HIV-positive (%)
Overall	371,018	316,220	85.2	319,680	1.0	163,633	51.2	29,118	17.8
Quarter									
Oct–Dec 2019	33,634	27,874	82.9	30,972	1.1	17,435	56.3	3,334	19.1
Jan–Mar 2020	45,237	38,708	85.6	30,972	0.8	22,954	74.1	4,328	18.9
Apr–Jun 2020	38,216	32,338	84.6	26,682	0.8	19,623	73.5	3,428	17.5
Jul–Sep 2020	36,017	30,241	84.0	35,906	1.2	17,805	49.6	3,088	17.3
Oct–Dec 2021	39,633	33,379	84.2	33,736	1.0	16,564	49.1	3,125	18.9
Jan–Mar 2021	50,450	42,141	83.5	48,801	1.2	20,769	42.6	3,878	18.7
Apr–Jun 2021	62,538	54,749	87.5	56,055	1.0	22,522	40.2	3,907	17.3
Jul–Sep 2021	65,293	56,790	87.0	56,556	1.0	25,961	45.9	4,030	15.5
Residence[a]			85.1						
Metro	214,528	182,597	85.1	177,353	1.0	88,271	49.8	18,113	20.5
Non-metro	156,490	133,623	85.4	142,327	1.1	75,362	52.9	11,005	14.6
District[b]									
Amathole	9,410	9,016	95.8	12,817	1.4	2,999	23.4	273	9.1
Chris Hani	7,056	6,622	93.8	10,563	1.6	3,337	31.6	595	17.8
Oliver Tambo	13,132	12,136	92.4	15,082	1.2	3,155	20.9	927	29.4
Tshwane	26,426	21,768	82.4	21,695	1.0	13,473	62.1	2,965	22.0
Ekurhuleni	86,999	74,838	86.0	70,410	0.9	14,760	21.0	3,342	22.6
eThekwini	101,103	85,991	85.1	85,248	1.0	60,038	70.4	11,806	19.7
uMgungundlovu	38,039	29,394	77.3	25,134	0.9	19,242	76.6	2,127	11.1
Uthukela	22,116	20,727	93.7	22,177	1.1	11,443	51.6	1,883	16.5
Zululand	31,290	25,984	83.0	27,448	1.1	25,223	91.9	3,453	13.7

	Number of clients offered index testing services (N)	Clients who accepted index testing services		Contacts elicited		Contacts tested for HIV		Contacts who tested HIV-positive	
		Number (N)	Proportion (%)	Number (N)	Ratio of contacts elicited per index client	Number (N)	Proportion (%)	Number of contacts tested for HIV who were newly diagnosed as HIV-positive (N)	Proportion of contacts tested for HIV who were newly diagnosed as HIV-positive (%)
Bojanala	17,114	13,123	76.7	11,537	0.9	6,694	58.0	1,339	20.0
Dr Kenneth Kaunda	14,057	13,104	93.2	14,107	1.1	1,586	11.2	232	14.6
Ngaka Modiri Molema	4,276	3,517	82.2	3,462	1.0	1,683	48.6	176	10.5
Age and sex									
Male and female < 15	NA	NA		110,358 (0.6)[c]	0.6	NA		NA	
Female < 15	4,259	3,424	80.4	NA		25,103	43.8	709	2.8
Male < 15	3,836	3,211	83.7	NA		23,508	44.3	640	2.7
Female ≥ 15	NA	NA		91,123	0.4	NA	64.9	NA	
Male ≥ 15	NA	NA		113,939	1.1	NA	48.6	NA	
Female 15–19	11,362	9,424	82.9	NA		6,018		869	14.4
Male 15–19	5,023	3,961	78.9	NA		4,392		309	7.0
Female 20–24	32,996	28,388	86.0	NA		9,870		2,502	25.3
Male 20–24	10,563	8,717	82.5	NA		6,613		914	13.8
Female 25–29	48,006	42,323	88.2	NA		12,158		3,371	27.7
Male 25–29	17,596	14,785	84.0	NA		9,776		2,118	21.7
Female 30–34	50,805	45,160	88.9	NA		11,026		3,072	27.9
Male 30–34	23,271	19,821	85.2	NA		11,187		2,944	26.3
Female 35–39	41,835	36,675	87.7	NA		8,720		2,309	26.5
Male 35–39	23,178	19,603	84.6	NA		9,595		2,697	28.1
Female 40–44	25,979	22,457	86.4	NA		5,498		1,329	24.2
Male 40–44	18,002	15,039	83.5	NA		6,663		1,734	26.0
Female 45–49	14,859	12,234	82.3	NA		3,233		832	25.7
Male 45–49	12,507	10,361	82.8	NA		3,964		1,084	27.3
Female ≥ 50	13,618	10,054	73.8	NA		2,638		710	26.9
Male ≥ 50	12,555	9,893	78.8	NA		3,225		890	27.6
Unidentified[d]	768	690	89.8	4,260	6.2	446	10.5	85	19.1

[a] Districts are located in four provinces including: EC (Eastern Cape Province), GP (Gauteng Province), KZN (KwaZulu-Natal Province), and NW (North West Province)

[b] Residence is classified as metro (Tshwane, Ekurhuleni and eThekwini districts) and non-metro (all other districts)

[c] Proxy of newly HIV-positive among 15–49 year old women used for denominator = 178,838

[d] Age and/or sex was unidentified