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The evolution of antenatal care HIV/syphilis sentinel surveillance in South Africa, 1990–2022, and future directions

Tendesayi Kufa[1,2*], Nosipho Shangase[1], Adrian Puren[1,3], Mireille Cheyip[4], Gillian Hunt[4], Rachel Joseph[4]

[1]Centre for HIV and STIs, National Institute for Communicable Diseases, a division of the National Health Laboratory Service, Johannesburg, South Africa
[2]School of Public Health, University of the Witwatersrand, Johannesburg, South Africa
[3]Department of Clinical Virology, School of Pathology, University of the Witwatersrand, Johannesburg, South Africa
[4]Division of Global HIV and TB, United States Centres for Diseases Control (CDC), Pretoria, South Africa

*Corresponding author: tendesayikc@nicd.ac.za

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Summary

South Africa has conducted antenatal care HIV and syphilis sentinel surveillance (ANCHSS) surveys among pregnant women attending antenatal care (ANC) services since 1990. ANCHSS surveys have been an important component of HIV surveillance in the country. The main aim of the annual–biennial surveys was to estimate HIV prevalence by age and location (province and district) over time and to generate input data for models generating national HIV prevalence and incidence estimates. To address ethical and cost considerations, there have been calls to use routine ANC and vertical transmission prevention data for HIV surveillance among pregnant women. We reviewed ANCHSS reports and relevant literature to describe objectives of past surveys and methodological changes to the surveys over the years as well as limitations and challenges in implementing the surveys. We discuss opportunities for use of routine data for HIV surveillance among pregnant women within the sentinel survey sites and beyond.

Introduction

Antenatal care (ANC) services provide convenient access to healthy women who are sexually active and can serve as a proxy for the general population with respect to HIV surveillance.[1] South Africa has conducted antenatal care HIV and syphilis sentinel surveillance (ANCHSS) surveys among pregnant women attending ANC services since 1990, which have become an important component of HIV surveillance in the country.[2–4] The surveys were developed and introduced as a tool to monitor HIV trends for the strategic response to the HIV epidemic in the country.[1,5,6] The aim of the annual surveys was to estimate HIV prevalence by age and location (province and district) over time and to generate input data for models used to generate national HIV prevalence and incidence estimates for resource allocation and planning[2–4], including the Spectrum, Thembisa (www.thembisa.org), and Naomi models (www.hivdata.org.za).[7,8]

The ANCHSS objectives, inclusion criteria, sampling procedures, and data collection methods have evolved over time to address previous survey limitations and challenges, to respond to the changes in the country's HIV surveillance needs and to changes in global HIV surveillance guidelines. The survey was designed to estimate HIV prevalence, generate data to input into epidemiological models, and estimate HIV incidence and prevalence in the general population. In 1997, the objectives were expanded to include syphilis seroprevalence among pregnant women attending ANC for the first time. Between 2011 and 2015, syphilis seroprevalence was not measured, as the data reflected that the prevalence had declined and remained low. In 2012, the survey collected data on herpes simplex type-2 (HSV-2) seroprevalence in four provinces and determined associations with HIV. In 2017, survey objectives were expanded to include assessment of the quality of routine ANC HIV data, evaluation of progress towards the global elimination of mother-to-child HIV transmission (eMTCT) targets (95-95-95 targets), and estimation of HIV incidence using the biomarker method. The 2019 edition of the survey evaluated pillar two of the vertical transmission prevention (VTP) cascade. This was done by including questions on whether or not the pregnancy was intended. This edition also estimated the syphilis care cascade using the medical records.

The 2022 edition of the survey added questions on pre-exposure prophylaxis (PrEP) use prior to and during current pregnancy as well as Dolutegravir (DTG) use in current pregnancy.

During the period 1990–1996, sampling of pregnant women was done at the regional laboratory level, with specimens collected from pregnant women being randomly selected.[2–4] From 1997,[9–23] surveys became facility-based and enrolled pregnant women aged 15–49 years attending ANC for the first time at selected sentinel sites during the designated survey period.
Facilities were eligible for selection as sentinel sites if they:
i) provided ANC;
ii) could see at least 50 (and later 40 and eventually 20) new ANC bookings per month;
iii) were capable of drawing blood samples and storing them for at least 24 hours;
iv) could transport the specimens to a local or regional laboratory within 72 hours of collecting the samples; and
v) had clinic staff who were willing and able to participate in the surveys.[9–23]

An additional blood sample was collected at the same time as a blood sample for haemoglobin, Rhesus compatibility, and syphilis screening – all of which were laboratory-based at the time. Alternatively, leftover blood samples were used for the sentinel surveillance HIV testing.[2,9–14] From 2015, women attending follow-up ANC visits were also enrolled.[21- 23]

Over the years of surveillance, the number of sentinel sites and expected sample size also increased. During 1990–1996, sample size was determined at the provincial level and was calculated such that the survey would have adequate power to estimate a given prevalence within a specified precision.[2-4] The year 1997 saw the introduction of a standardised protocol, standard operating procedures, and sampling using the probability proportional to size (PPS) sampling. The expected sample size was set at 12 000–18 000 participants across all nine of South Africa's provinces. Between 1997 and 2005, 15 300–16 850 were enrolled at 430–500 sentinel sites.[9-12] In 2006, the target sample size was increased from 16 000 to 36 000 to achieve adequate power to estimate HIV prevalence at the district level. The number of sentinel sites also increased from 430 to 1 424.[13] The year 2009 saw the introduction of stratified sampling by sentinel site location. Prior to selection, sentinel sites were stratified into rural, semi-rural/peri-urban, and urban.[16] The number of sentinel sites was adjusted to 1 595 in 2017 to address under-representation of rural sites.[21]

Enrolment typically occurred during the month of October, although in later years, this was extended to include some weeks in November to ensure the desired sample size was attained. The survey was not completed in 2021 due to COVID-19, with the 2022 edition of the survey conducted during February – April 2022. [23]

Between 1990 and 1996, the data elements collected were only those on the specimen request form. Data were collected using paper-based questionnaires and dually and manually captured into Excel

spreadsheets at the laboratory and into the ANC survey module within the District Health Information System (DHIS) at the provincial offices.[2-4] From 1997, ANC staff collected data and completed survey questionnaires as they provided routine care. Core variables included in the survey questionnaire were age, level of education, age of and relationship with the partner who fathered the current pregnancy, gravidity, parity, visit type,[9-20] and, after 2017, knowledge of HIV status, antiretroviral therapy (ART) use and timing of ART initiation, viral load completion, availability of viral load results and most recent viral load results based on record review, syphilis screening, results for those screened for syphilis, and syphilis treatment among positives, which were also based on medical record review.[21-23] Figure 1 describes the changes to the methodology of the surveys over the years, while Figure 2 and Table 1 present the sample sizes achieved and HIV and syphilis seroprevalence results over time.

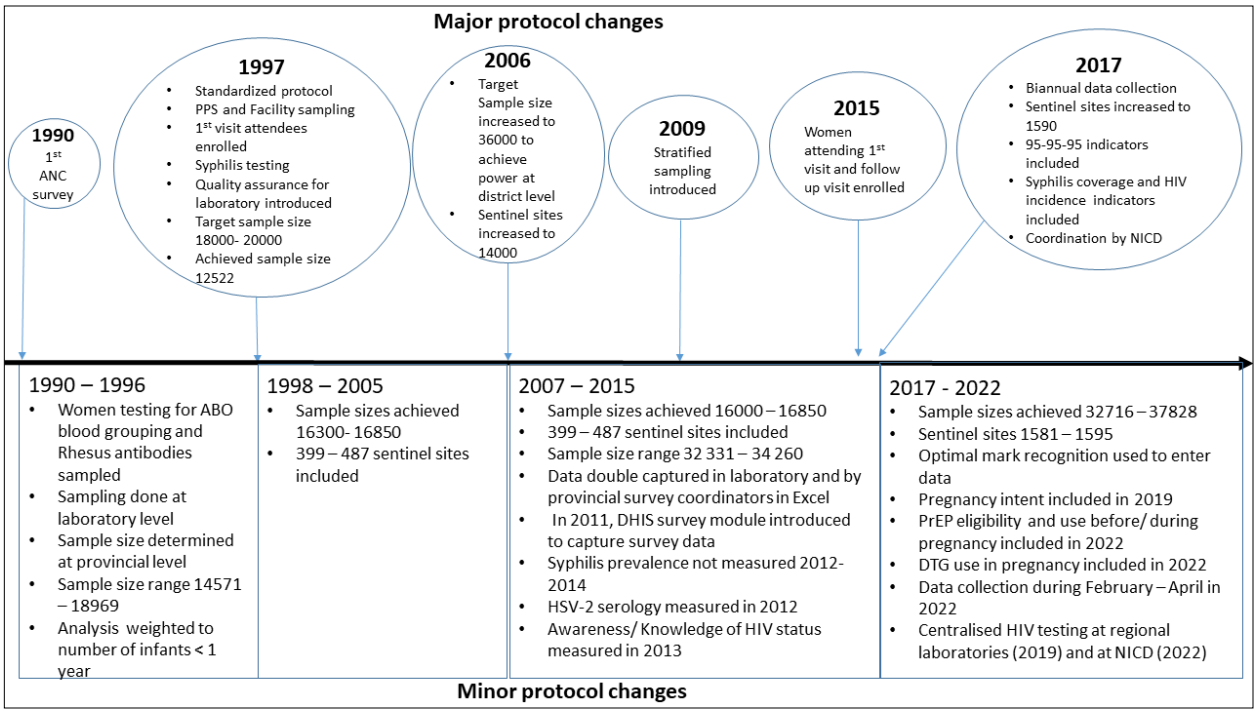

Figure 1. Evolution of the antenatal care (ANC) survey methods, South Africa, 1990–2022.

The National Department of Health (NDoH) traditionally co-ordinated the survey with inputs from a scientific committee that included the South African Medical Research Council (SAMRC), the National Institute for Communicable Diseases (NICD), a division of the National Health Laboratory Service, the World Health Organization (WHO), and the United Nations Special Programme on HIV (UNAIDS) until 2017, when the co-ordination was fully taken over by the NICD. Survey reports before 2015 included national and provincial HIV prevalence estimates in the general population (model outputs) generated from the survey data, in addition to the sample-based estimates.[2–4,9–20]

The ANCHSS surveys had limitations and challenges. These included only sampling women from the public health sector, logistical challenges such as clinic closures, sample haemolysis, data quality concerns, and difficulties in interpreting survey results and in triangulating with other data sources.[2–4,9–23] The surveys also suffered delays in disseminating results, with survey reports taking a year or longer before release.

Table 1. Changes to antenatal survey methods over time in South Africa.

Year	Key methodological considerations	Outcomes/ results
1990–92[2]	- Included women 15–49 years of age attending ANC who had blood drawn for rhesus factor (Rh) antibodies and ABO grouping. After routine antenatal screening, an anonymous sample was collected in October and November and sent to regional and reference laboratories. - Number of children <1 year of age was used as weights. - Sample sizes were 14 571, 17 318, and 18 969 in 1990, 1991, and 1992, respectively, with consecutive sampling at the laboratory level. - Data elements collected were the name of the clinic supplying the specimen, the population group, age, and place of residence.	- Estimated sample sizes were not reached in the 1990–91 surveys. - 1992 survey enrolled from 01 October – 31 December, and analysis was weighted against the number of births based on the 1991 survey. - Reports were summarised and published in in-house NDoH publications and in the South African Medical Journal (SAMJ) in 1994. - HIV prevalence was 0.76%, 1.49% and 2.69% in 1990, 1991 and 1992, respectively.
1993–95[3]	- Sample sizes were 16 206, 16 206, and 18 630 in 1993, 1994, and 1995, respectively. - Sampling was done at the laboratory level.	- Reports were summarised and published in in-house NDoH publications and in the SAMJ. - HIV prevalence was 4.0%, 7.6%, and 10.4% in 1993, 1994, and 1995, respectively.
1996[4]	- The nine provinces of South Africa as they are currently known had been introduced. - Data from previous years were recorded. - Sampling was done at the laboratory level. - 15 044 women were enrolled.	- Reports were summarised and published in the SAMJ. - HIV prevalence was 14.6%. - There was a recommendation for greater provincial involvement in the surveillance given the differing trends in the HIV epidemic by province.
1997[9,10]	- A revised nationally developed protocol and standard operating procedures were introduced with this survey and were aimed at improving on previous survey methodologies and increasing scientific rigour. The protocol was cleared by the research ethics committee at University of Natal. - PPS sampling was introduced with sentinel site-based enrolment.	- There had not been a standardised protocol in the previous seven surveys. - Provinces analysed their own data. - HIV prevalence was 17.0% and syphilis prevalence was 11.0%. - Model projections were included in the report. - HIV prevalence was presented by province and by health

	- Syphilis testing was first introduced as part of the sentinel survey with the objective of determining the prevalence of active syphilis among women attending ANC and treating it. - Sampling was done at the health facility level, and only first ANC visit attendees were included in the survey. - Site selection criteria – >50 ANC visits/month, willing to collect specimens, and able to transport specimens to the laboratory within 24 hours. - The target sample size was 18 000–20 000 women enrolled across all nine provinces, and sample size realisation was 12 522. - HIV testing used one ELISA assay, except for Western Cape laboratories, which used two assays. - NIV provided external quality assurance services to participating laboratories.	region (district).
1998[9,10]	- 15 301 women enrolled and were tested at 487 sentinel sites (each meant to enrol the first 40 first-visit attendees).	- HIV prevalence was 22.8% and syphilis prevalence was 10.8% (estimated).
1999[9,10]	- 487 sites took part (each meant to enrol the first 40 women visiting the ANC for the first time). - 16 841 women were enrolled. - Referral for VCT was included as part of the survey. - HIV-positive sera were shipped to Durban for incidence testing.	- HIV prevalence was 22.4% and syphilis prevalence was 7.3%.
2000[9,10]	- 400 sentinel sites took part in the survey, with 16 607 women enrolled and tested. - External quality assurance for syphilis testing in the laboratory was introduced.	- HIV prevalence was 24.5% and syphilis prevalence was 4.9%. - HIV model projections were included as an appendix.
2001[9]	- 16 743 women attending the 1st ANC survey visit were enrolled. - 421 sentinel sites were included in the survey.	- HIV prevalence was 24.8% while syphilis prevalence was 2.8%. - HIV model projections were included in the main text of the

	- The target sample size was 40 per site, and sites continued enrolling until 31st October. - Testing was done with one ELISA, except in settings where HIV prevalence was <10%, in which case two ELISAs were used.	report.
2002[9,10]	- Data collection was sentinel site-based with referral for voluntary. counselling and testing (VCT) and VTP services where available for those who wanted to know their HIV status. - 396 sentinel sites were included in the survey. - Data entry at the laboratory level and by the provincial co-ordinators.	- HIV prevalence was 26.5% while syphilis prevalence was 3.2%. - HIV model projections were included as an appendix.
2003[11]	- External quality assessment of samples from the survey was introduced in all participating laboratories. - A sample size of 16 643 and 430 sentinel sites were included.	- Model outputs were included in the report. - HIV prevalence was 27.9% and syphilis prevalence was 2.7%.
2004[11]	- External quality assessment of HIV testing in the survey was provided by the NICD. Panels of 20 specimens were provided to each site. - External quality assessment of syphilis testing in the survey was provided by the SAMRC. Panels of 20 specimens were provided to each site. - Sample size was 16 061.	- Model outputs were included in the report. - HIV prevalence was 29.5% and syphilis prevalence was 1.6%.
2005[12]	- 399 sentinel sites and 16 510 enrolled took part in the survey.	- HIV prevalence was 30.2% while syphilis seroprevalence was 2.7%. - Model outputs were included in the report.
2006[13]	- Target sample size increased from 16 000 to 36 000 to achieve adequate power to estimate HIV prevalence at district level. - Realised sample size was 33 034. - Number of sentinel sites was increased from 430 to 1 424.	- The increases were done to obtain adequate power to estimate HIV prevalence at district level. - HIV prevalence was 29.1% and syphilis prevalence was 1.8%.
2007[14]	- 33 684, which was 95% of the target sample size, and 1 401 sentinel sites were included. - District-level estimates were included in the survey report	- HIV prevalence was 28.0% while syphilis seroprevalence was 2.9%.

	- Use of age-based weighting.	
2008[15]	- Data captured in Excel at the laboratory and provincial level. - Regression for factors associated with prevalent HIV infection was included.	- HIV prevalence was 29.3%, while syphilis prevalence was 1.9%. - Age, race, and syphilis infection were associated with prevalent HIV infection.
2009[16]	- Stratified sampling was introduced. Sentinel sites were stratified into rural, semi-rural/peri-urban, and urban. - 1 457 sentinel sites and 32 861 women were included in the survey.	- HIV prevalence was 29.4% while syphilis prevalence was 1.9% among women 15–49 years of age.
2010[17]	- The included pregnant girls were aged 10–14 years old. - Objectives included estimating the TB burden among pregnant women and knowledge of HIV status among pregnant women enrolled. - 32 225 women enrolled and provided valid samples.	- HIV prevalence was 30.2% and syphilis prevalence was 1.5%. - 65% of 1st ANC visit attendees knew their HIV status at enrolment, and 65% of those who knew their HIV status were HIV positive.
2011[18]	- DHIS ANC survey data module was developed and introduced - 33 446 women enrolled from 1 445 sentinel sites.	- HIV prevalence was 29.5% and syphilis seroprevalence was 1.6%.
2012[19]	- Objectives of the survey were expanded to include a pilot estimate of HSV-2 seroprevalence in four provinces (Gauteng, KwaZulu-Natal, Western Cape and Northern Cape) and analysis of correlation with HIV prevalence. - 34 260 women from 1 497 sentinel sites were enrolled. - Syphilis prevalence was not measured.	- HIV prevalence was 29.5% and HSV-2 seroprevalence was 55.8%. HIV prevalence by specified socio-demographic variables was also presented – geo-location, population group, level of education, marital status, parity, age of partner, and knowledge of HIV. - HIV model estimates were included in the text of the report.
2013[20]	- Surveillance measured awareness of HIV status. - Syphilis prevalence was not measured. - 33 077 enrolled.	- HIV prevalence was 29.7%. - Recommendations included more in-depth study of biomarkers, including testing for antiretrovirals (ARVs), viral load suppression, drug resistance, and incidence testing.
2014[21]	- Syphilis prevalence was not measured. - 32 331 women were enrolled.	- Report was never officially launched or disseminated. - HIV prevalence was 30.0%.

2015[21]	- Included first-visit and follow-up-visit attendees, but follow-up attendees were not identified. - Piloted introduction of questions on ARV use as measures of ART coverage and ARV adherence. - Syphilis prevalence was measured in the laboratory. - 36 246 women were enrolled.	- Three questions around ART use were piloted in six provinces: *Do you know your HIV status? *Have you ever taken ARVs for your own health? *Have you taken ARVs in the last three days? - The Report was published in 2017. - HIV prevalence was 30.8%.
2017[21]	- Formally included first and follow-up visit attendees. - There was an increase in the number of sentinel sites. The increase was effected to increase the number of rural sites which were found to be under-represented in previous surveys. - Changed from annual to every 2–4 years. - Objectives were expanded to include HIV incidence estimates, HIV care cascade (including viral load measurement), evaluation of quality of routine HIV testing data, and syphilis screening coverage. - Linked anonymous testing was introduced with attempts to return results. - Co-ordination of the survey was moved from the NDoH to the NICD. - Centralised HIV testing was conducted at regional laboratories. - 32 716 women from 1 595 sentinel sites were enrolled.	- Return of results was challenged by batch testing and poor completion of folder numbers. - Report was published in 2019. - HIV prevalence was 30.7%.
2019[22]	- Survey objectives were expanded to look at pregnancy intent, coverage of viral load testing and syphilis sero-positivity based on record review and abstraction. - Syphilis sero-positivity was estimated based on record review and abstraction. - Optimal mark recognition (OMR) scanning of questionnaires was used for the first time in the survey. - Centralised HIV testing was conducted at regional laboratories.	- There was no official launch and dissemination of the report, although the report was made publicly available on the NICD website in 2021. - The prevalence of HIV was 30.0% nationally, while that of syphilis was 2.6%. - 97.6% of HIV-positive pregnant women knew their HIV status at enrolment, while 96% were on ART.

	- 37 116 women were enrolled from 1 589 sentinel sites.	
2022[23]	- Survey objectives were expanded to include PrEP eligibility based on the national PrEP guidelines, PrEP coverage prior to and during current pregnancy, and DTG use. - All laboratory testing was conducted at the HIV reference laboratory at the NICD. - 37 828 women were enrolled.	- HIV prevalence was 27.5% and declined in all but one province compared to the prevalence in 2019. - Syphilis prevalence was 3.1%.

ANC=antenatal care; ART=antiretroviral therapy; ARV=antiretroviral drug; DHIS=District Health Information System; NDoH= National Department of Health; DTG=Dolutegravir; ELISA=Enzyme-linked immunoassay; HIV=human immunodeficiency virus; HSV-2=herpes simplex 2 virus; SAMRC=South Africa Medical Research Council; NICD=National Institute for Communicable Diseases; OMR=optimal mark recognition; PPS=probability proportional to size; PrEP=pre-exposure prophylaxis; SAMJ=South African Medical Journal; TB=tuberculosis; VCT=voluntary counselling and testing.

Results of past ANC surveys

At the national level, HIV prevalence measured in the survey increased rapidly from 0.8% in 1990 to 22.8% in 1998. Prevalence continued to increase slowly to 30.2% in 2005. It then fluctuated around 30% until 2022, when it declined to 27.5%. Syphilis seroprevalence had decreased steadily from 11% in 1997 to 1.6% in 2004. It then fluctuated in the range 1.8%–2.9% between 2005 and 2007 before holding steady between 1.5% and 1.8% between 2008 and 2011. The measurement of syphilis was paused until 2015, when it was found to be 2.0%. The seroprevalence has been increasing to 2.6% in 2019 and 3.1% in 2022.[2–4,9–23]

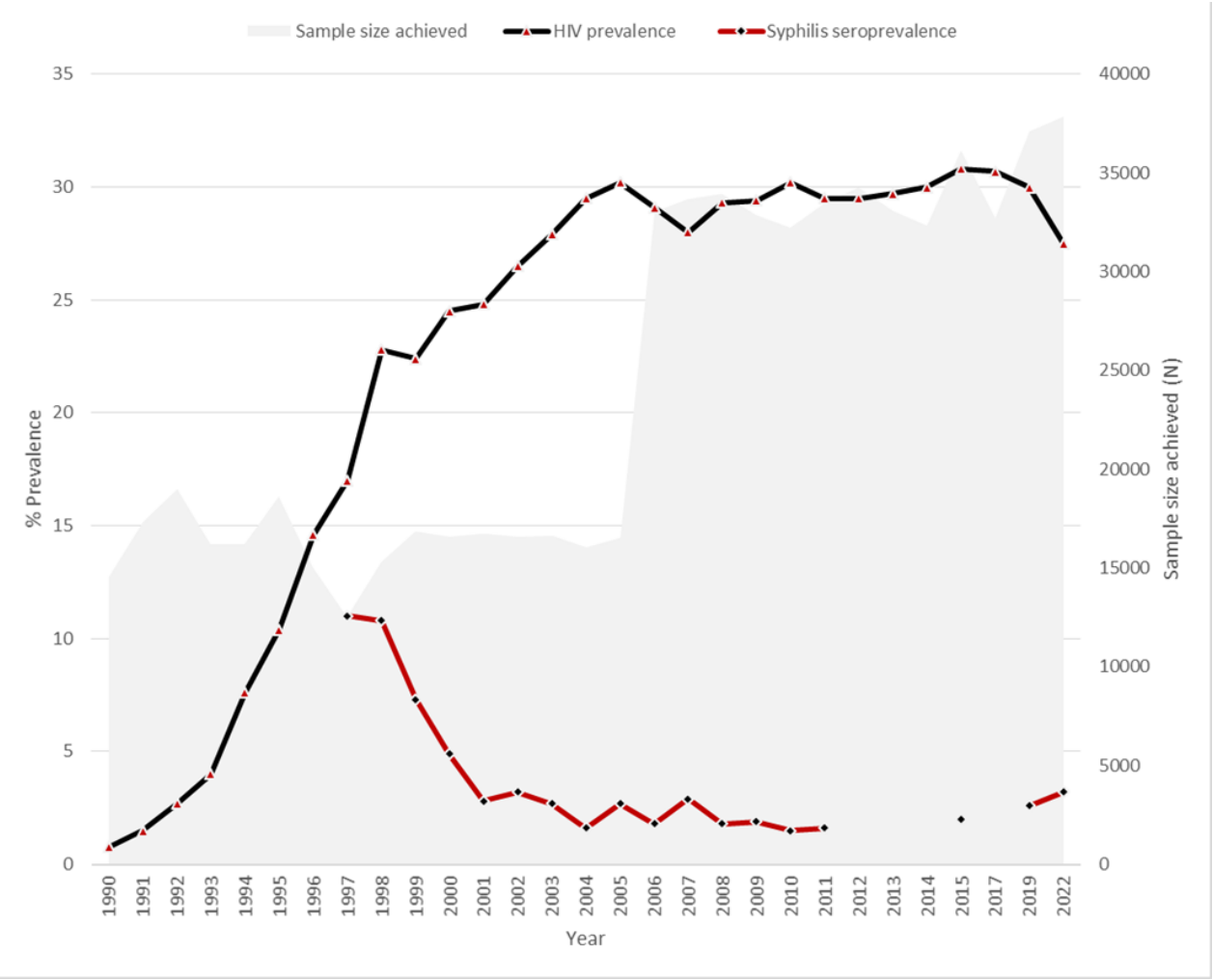

Figure 2. Antenatal care survey HIV and syphilis seroprevalence results in South Africa, 1990–2022.

Future directions

The need to transition to routine data for HIV surveillance among pregnant women

With respect to ANCHSS, from as early as the late 1990s, when antiretroviral treatment for VTP was introduced and scaled up, there were concerns about unlinked anonymous HIV testing without the return of results, duplicate HIV

testing of pregnant women, lack of written informed consent, cost of the survey, and the inability of the surveys to strengthen routine ANC and VTP data systems.[1,5,6] These limitations were not easily justifiable in the face of near-universal HIV testing and increasing HIV coverage within ANC services. From as early as 2013, there have been calls to replace ANCHSS-based surveillance with HIV surveillance based on routine data, provided these were of good quality.[5] Routine data is defined as data routinely generated through ANC and VTP service delivery and routinely recorded in standard site data tools (e.g., registers).[24]

The WHO set criteria to guide countries in transitioning from survey-based HIV surveillance within ANC to routine data.[1] The transition from HIV and syphilis sentinel surveillance (HSS) to routine data requires that the following elements be in place:

(i) agreement between ANCHSS testing and routine antenatal HIV test results;

(ii) minimal selection bias inherent in VTP-based HIV estimates, i.e., bias in HIV estimates resulting from differential offering and acceptance of HIV testing in ANC;

(iii) high coverage of HIV testing services within VTP services at the ANCHSS sites;

(iv) optimal data quality for the minimum set of surveillance variables/indicators in routinely collected programme records; and

(v) optimal quality assurance practices around HIV testing at ANC sites.[1]

Using routine ANC service data may allow the inclusion of more pregnant women, if not all, attending ANC services, as opposed to a smaller sample included in sentinel surveys, regardless of whether a census approach over a calendar year or the sampling of sentinel sites is employed.[6]

The 2017 ANC survey in South Africa demonstrated high-level positive and negative agreement between individual-level HIV testing results from the survey's laboratory testing and the HIV testing results that were documented in the medical records.[21,25] There was also minimal bias detected when comparing survey HIV test results among women not offered or who declined the HIV test according to routine ANC survey records.[21,25] ANC attendance is known to be high in South Africa; attendance of at least one visit was at 94% in the 2016 Demographic and Health Survey,[26] and the survey found that >95% of women knew their HIV status of those who had been tested in ANC at survey enrolment. In 2017, there were facility-based data quality assessments of ANC-related medical records conducted at ANCHSS sites and non-ANCHSS sites,[25] but the completeness of a pre-specified set of variables in routinely used ANC records was poor, and quality assurance practices around routine HIV testing were sub-optimal.[27,28] These 2017 data quality assessments also showed that multiple data sources for VTP data at the facility level – integrated ANC/VTP registers, laboratory specimen registers, tick registers, HIV counselling and testing registers, and patient files – were in use at facilities and that healthcare workers were using non-standardised data tools.[28] The findings demonstrated that in the absence of a large-scale data quality improvement exercise, South Africa was not ready to transition from HIV sentinel surveillance as currently implemented to using ANC HIV surveillance based on routine

data.[27] Assessing the utility of programme data is not meant to be a once-off event but rather a cycle of assessment, improvement and reassessment.[1]

Activities to improve the quality of routine VTP data have been limited since the 2017 evaluations. The COVID-19 pandemic and reduction in the President's Emergency Plan for AIDS Relief (PEPFAR) funding and their impact on the public health system could have worsened the quality of VTP data. There have not been any repeat ANC/VTP data quality assessments since the 2017 evaluations. There is a need to urgently implement another round of assessments to determine the country's readiness to use routine HIV data for HIV surveillance among pregnant women. There is also a need to systematically map out objectives, methods, processes, and procedures for ANC surveillance based on routine data before the transition can occur.[6] Other potential challenges in introducing and scaling up routine data-based HIV surveillance in ANC include a sub-optimal use of unique identifiers and a functional national-level electronic medical record (EMR), limited connectivity at health facilities, and limited quality assurance of routine data.

Opportunities for ANCHSS in the context of transitioning to routine data

The call to transition from the current ANCHSS-based HIV surveillance to HIV surveillance based on routine VTP data, as well as the uncertain funding climate, affords the NICD, as the co-ordinator of the survey, and the NDoH, as the custodian of the survey and of the data generated, opportunities to review the relevance and usefulness of the ANC survey. Beyond whether or not South Africa is ready to transition to ANC HIV surveillance using routine data, there is a need to reflect on the objectives of the survey, the design and methods of the survey, and the data collection tools used to date.

Objectives of the survey

There is overlap in the eMTCT indicators measured by the ANC survey and those reported on in the DHIS, albeit in aggregated form.[29] Similar indicators to those currently measured in the survey could be measured from analysis of individual-level data extracted from medical records if there was a national-level and functional EMR in the country. Given that data on some indicators may not be available on DHIS or may not be collected in a standardised manner in medical records, sentinel surveillance may still be useful in collecting such data. Survey objectives could be expanded to include programmatic indicators that are not available within DHIS and are not accessible in the absence of the EMR. These include:

- Pregnant women
  - Socio-demographic characteristics of enrolled pregnant women, such as income, occupation, and migrant status;
  - Contraceptive use prior to pregnancy and pregnancy intent;
  - ART interruption before and during pregnancy and reasons for it;
  - Adherence to ARV medication;

- ANC attendance and mobility during pregnancy;
- Hepatitis B virus testing, prevalence, and treatment to track progress on all goals of triple elimination;
- Prevalence of and associated factors for sexually transmitted infections such as gonorrhoea, chlamydia, and trichomoniasis; and
- Bio-behavioural drivers of new infections – condom use and multiple partners, PrEP use, and PrEP failures.

- Post-partum women
  - Adverse pregnancy outcomes related to antiretroviral drugs used as treatment or PrEP, HIV care cascade and incidence estimates among post-partum women.

Lastly, survey objectives could include evaluating the quality of routine data and validating outcomes determined by HIV surveillance using routine data.

Design of the survey

At inception, the ANCHSS sampled women at the laboratory level[2–4] – i.e., sampled women who had blood specimens collected – and then moved on to sentinel sites where women were enrolled as they attended ANC.[9- 23] With increasing efforts to use routine data for surveillance and the potential roll-out of the EMR, it will be possible for future ANC HIV surveillance to include all women attending ANC in all facilities in the whole country – the census approach. This will be possible if all facilities have access to a national-level EMR and internet connectivity. Women attending ANC could be recorded, and results of HIV, syphilis, hepatitis, and other tests done during pregnancy could be available for analysis using data extracted from the EMR and/or from the laboratory. Using all antenatal clinics would reduce selection bias by obtaining data from all ANC facilities. While preparations for this census approach are ongoing, there could be efforts to improve the data recorded at the current sentinel sites. This improvement will allow ANC HIV surveillance to be fully based on EMR and laboratory information without the need to enrol women and collect specimens. The frequency of the current ANCHSS is biennial; however, with the census approach, the frequency can be on a rolling basis with data analysed annually.[6] The census approach could be supplemented by periodic (3–5 years) data collection from sentinel sites to validate outcomes from surveillance using routine data and evaluate the quality of routine data. Table 2 compares and contrasts the ANCHSS and the census approach to using routine data for ANC HIV surveillance.

Table 2. Antenatal care HIV/syphilis sentinel (ANCHSS) vs antenatal care (ANC) routine data-based HIV and syphilis surveillance (census approach), South Africa.[6]

ANCHSS survey (sentinel approach)	**ANC routine data-based HIV and syphilis surveillance (census approach)**
Collects data on women attending ANC care at a sample of ANC sites that are chosen to represent geographical areas or populations during the surveillance period.	Collects/uses data on all women attending ANC at all public health facilities in the country during a defined surveillance period
Uses individual-level data. Because sites are selected by convenience sampling, surveillance can pre-screen or specially capacitate (or both) ANC sites so that only high-performing ANC sites participate in surveillance.	Can use aggregated or individual-level data Involves no sampling of sites or women. It is not possible to pre-screen ANC sites for readiness to participate in surveillance – underperforming sites will be included in surveillance.
Can provide estimates at national, provincial, and district levels.	Produces direct measures (not estimates) of HIV prevalence and changes in prevalence among ANC attendees at all sub-national levels.
Requires fieldwork to collect routine data from ANC sites.	Requires minimal surveillance fieldwork.
	Provides comprehensive coverage of the surveillance system. Aggregate data may limit the ability to conduct sub-analyses (e.g., by age) or monitor data quality.

Data collection methods

Since the inception of the ANCHSS, data collection has been paper-based, which was captured into the laboratory information system and then into an ANC survey-specific module in DHIS.[2 3,9,11–17,19] Since the 2019 survey, data have been collected on paper-based questionnaires but have been scanned into a database using OMR.[22,23] There is an opportunity to explore electronic data capture with the survey in the current format or with the use of routine data. If the ANC survey continues in its current format, options for electronic data capture include the use of mobile data collection tools configured for use on mobile devices, including cell phones. Buying the devices for the survey would be expensive, but the surveys could leverage resources available in the districts. Another option would be to develop a zero-rated mobile application that can be used to capture data at the sentinel sites at no cost to participating healthcare workers. With the use of the routine data, data from medical records would have been captured by NDoH-appointed data capturers and made available for analysis at the facility, district, provincial, and national levels by the NICD. This will only be possible once the national-level unique identifier is optimally rolled out.

Conclusion

In this report, we reviewed the history and evolution of the ANCHSS and opportunities presented by the call to move away from sentinel site surveillance to routine data-based HIV surveillance among pregnant women in an uncertain funding climate. Since 1990 in South Africa, ANCHSS-based surveillance has evolved greatly in response to limitations and challenges as well as to changes in global guidance. In the short term, routine antenatal and VTP programme data offer clear opportunities to strengthen HIV surveillance by providing broader coverage, more frequent reporting, and the potential for district-level analysis without the costs and delays associated with ANC sentinel surveys. Where data quality and completeness improve, these routinely collected indicators can increasingly support the monitoring of HIV prevalence, testing coverage, treatment uptake, and progress towards elimination targets. However, until a functional national EMR and unique identifier system are fully implemented, the sentinel survey remains a critical complementary platform. It can continue to generate individual-level and programme-relevant data not routinely captured – such as behavioural drivers, adherence patterns, treatment interruptions, and emerging prevention indicators – while also validating routine data and informing readiness for a full transition to routine data-based surveillance.

Recommendations

The call to move to routine data-based HIV surveillance among pregnant women presents an opportunity to use routinely collected indicators or data elements in the current ANCHSS form where they are available in medical records or to consider a census approach to HIV surveillance among pregnant women. Regardless of the direction the survey will take in South Africa, this review makes the following recommendations:

- Improve the quality of routine VTP data using a quality improvement approach based on assessment, intervention, and reassessment.
- Continue the ANC sentinel surveys as a means to validate outcomes measured in routine data-based HIV surveillance and to evaluate the quality of routine data-based HIV surveillance.
- Include outcomes in the ANCHSS that are not included as indicators in the national indicator dataset or outcomes for which data are not routinely collected. In this way, the survey will complement routine data collection.
- Improve the dissemination of survey findings; translate and package findings into data products that districts can readily use in planning, monitoring, and evaluation. Consideration should be given to a dashboard and district-level reports.
- Improve data-collection methods used in the survey and ensure the survey is more efficient and cost-effective.

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Ethical considerations

No ethical clearance was required, as the survey reviewed reports and survey documents.

Conflicts of interest

The authors declare no conflicts of interest.

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