South African National HIV Prevalence, Incidence and Behaviour Survey, 2012

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In memory of Betty Dikeledi Mashiya.
Your work during this survey was invaluable.
You will not be forgotten.

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FOREWORD

As the Minister of Science and Technology in South Africa, I am entrusted to ensure that statutory research councils that are accountable to Parliament and the Government of South Africa through my department (i.e., the Department of Science and Technology, DST), such as the Human Sciences Research Council (HSRC) undertake research that has policy impact at national, provincial, local and societal levels. This supports the DST's 10-year science strategy, particularly the Human and Social Sciences Grand Challenge. The HSRC, as one of the top-performing statutory research councils in the country, undertakes both basic and applied social sciences and public health research to help inform and implement work programmes by both government and civil society, aimed at improving decision making, monitoring and evaluation, and quality of life through research. The ground-breaking nature of some of the HSRC's research work is exemplified yet again by the release of this seminal report on HIV and AIDS, to address the priorities of the National Strategic Plan for HIV/AIDS, STI and TB (NSP), an issue that is integral to Priority 2 of Government's 12 Priority Outcomes – "A long and healthy life for all South Africans". This, in turn, also addresses Point 7 of the Department of Health's 10-Point plan, which seeks to accelerate the implementation of the HIV and AIDS strategic plan and the increased focus on TB and other diseases.

We have come a long way in our country since the 2007–2011 NSP was collectively developed by key stakeholders representing government and civil society. This research report entitled the *South African National HIV Prevalence, Incidence and Behaviour Survey, 2012* contributes significantly to assessing progress in implementing the NSP. I am delighted to present this report to you and trust that you will find it useful as you assess the state of the South African HIV epidemic.

The report covers the epidemiology of HIV from both social and biomedical points of view, providing us not only with statistical data on HIV prevalence, HIV incidence and antiretroviral treatment (ART) exposure, but also socio-behavioural and structural aspects that contribute to the spread of HIV infections in the population. This information is necessary and assists key stakeholders in the South African National AIDS Council (SANAC) in developing interventions to curb the epidemic. This is a most comprehensive report on HIV, based on laboratory results and interviews in a representative cross-section of the population, including all ages, males and females, race groups, locality types and provinces. It provides a concise synopsis of the epidemic, presented through a thoroughly researched lens.

In this research report, the authors find that this country has succeeded in rolling out treatment to people living with HIV/AIDS. It is also reported that knowledge levels have declined, accompanied by increased risky sexual behaviours. The finding that there are still high rates of new HIV infections occurring in the country is of concern and requires that we double our efforts to prevent new infections. The high incidence among young women aged 15–24 years is troubling and calls on us to address the associated social factors such as age-disparate relationships. The continued high HIV prevalence and incidence in the black African population, particularly among females aged 20–34 years and males aged 25–49 years, is a serious call for us to design and implement targeted interventions for these groups, over and above the comprehensive interventions for the population at large. The researchers also show us that people in informal areas of the country continue to be most-at-risk of HIV, with the highest HIV incidence compared to those living in other areas. This suggests that a strong multi-sectoral approach is necessary if we want to address socio-economic challenges that continue to fuel the epidemic.

The Human Sciences Research Council, together with their colleagues at the Medical Research Council, have a long history of undertaking population-based surveys on HIV, starting with the 2002 Nelson Mandela/HSRC survey on HIV/AIDS, followed by the 2005 and 2008 surveys; the 2012 is the fourth survey on HIV and they are already embarking on the 2015 survey. These researchers have been innovative when undertaking the surveys, being the first to test for antiretroviral drugs in HIV-positive survey samples in South Africa. The inclusion of novel laboratory methodologies in the survey protocol has enabled direct estimates on HIV incidence. The authors were hence very advanced in their assessment of epidemiological, social and structural factors to elucidate the drivers of HIV in this country. The data from the 2012 survey will serve as critical benchmark figures for the evaluation of the current National Strategic Plan 2012–2016. For this we are most grateful.

We appreciate the financial resources that the United States President's Emergency Plan for AIDS Relief (PEPFAR), Bill and Melinda Gates Foundation (BMGF), South African National AIDS Council (SANAC) and United Nations Children's Fund (UNICEF) have contributed to ensure that South Africa is able to monitor the HIV epidemic.

In conclusion, I encourage all those who are working on HIV in South Africa and abroad, to use this research report as a reference as they continue to find ways to prevent new infections and provide the appropriate treatment and care to those in need.

Mr Derek Hanekom, M.P.
Minister of Science and Technology

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To undertake a project of this magnitude requires the collective effort of many people who bring a range of expertise and experience at different stages. This project would not have been possible without the contribution of the many people listed below.

We wish to thank all the people of South Africa who willingly opened their doors and their hearts to give us some of the most private information about themselves, for the sake of contributing to a national effort to contain the spread of HIV. Thousands were willing to give dried blood spot (DBS) specimens for testing to enable us to estimate the HIV prevalence, incidence, viral load and the population on ARVs in South Africa. We sincerely thank them for their generosity. Without their participation we would never have been able to provide critical information necessary for planning more effective HIV prevention and treatment, care and support for HIV and AIDS patients, and mitigation of the impact of HIV and AIDS in South Africa.

We are grateful to our international partners, first to the President's Emergency Plan for AIDS Relief (PEPFAR), whose funding we received through a cooperative agreement (Grant Number 5U2GPS000570) with the USA's Centers for Disease Control and Prevention (CDC), because without their financial support the survey would not have been possible. We would also like to thank the South African National AIDS Council (SANAC) and the United Nations Children's Fund (UNICEF) for their support. The continued support of the Bill and Melinda Gates Foundation is also very much appreciated.

A special note of appreciation is due to the members of the HSRC-led consortium: thank you to Ms Rashika Maharaj of the Medical Research Council (MRC), who participated in quality control of the specimen collection and testing as well as the training of fieldworkers. Our special thanks also go to Ms Cathy Connolly, Ms Tarylee Reddy and Professor Carl Lombard from the MRC for their valuable contributions concerning data weighting and benchmarking.

We would like to thank the Global Clinical & Viral Laboratory in Durban, in particular Dr Lorna Madurai and Ms Mogi Pillay, for their excellent work in testing specimens for HIV antibodies, as well as with the training of fieldworkers.

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We also acknowledge the contribution of the CDC technical reviewers as well as the Expert Review Panel members led by Professor Helen Rees, who both advised the research team at the start of the project and also reviewed the draft report for technical soundness. Our special thanks also go to Mr Michael Cosser, Ms Meredith Evans and Dr Warren Parker for editing of the report.

A special word of thanks is due to the field staff that implemented this survey:- the supervisors, data collectors and field editors who spent months in the field, often away from their families and loved ones. Their tireless efforts on the ground ensured the success of the survey and we are grateful to them for their sterling work.

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LIST OF ACRONYMS AND ABBREVIATIONS

ART	Antiretroviral therapy
BCC	Behavioural change communication
BSS	Behavioural surveillance survey
CDC	United States Centers for Disease Control and Prevention
CEIA	Capture enzyme immunoassay
DBS	Dried blood spot
DHS	Demographic and health survey
DNA	Deoxyribonucleic acid
EAs	Census enumeration areas
EIA	Enzyme immunoassay
GIS	Geographic Information Systems
HSRC	Human Sciences Research Council
Ig G	Immunoglobulin G
MDGs	Millennium Development Goals
MIRA	Methods for Improving Reproductive Health in Africa
MMC	Medical Male Circumcision
MRC	Medical Research Council
NAAT	Nucleic acid amplification test
NDOH	National Department of Health
NICD	National Institute for Communicable Diseases
NSP	National Strategic Plan (on HIV, STIs and TB)
PEPFAR	United States President's Emergency Plan for AIDS Relief
PMTCT	Prevention of Mother-to-Child Transmission of HIV
PSU	Primary sampling unit
QA	Quality assurance
RITA	Recent Infection Testing Algorithm
SABC	South African Broadcasting Corporation
SANAC	South African National AIDS Council
SANAS	South African National Accreditation System
SSU	Secondary sampling unit
Stats SA	Statistics South Africa
UNAIDS	Joint United Nations Programme on HIV and AIDS
UNGASS	United Nations General Assembly Special Session
UNICEF	United Nations Children's Fund
USU	Ultimate sampling unit
HCT	HIV Counselling and Testing
VP	Visiting point
WHO	World Health Organisation

Introduction

The 2012 population-based survey of HIV prevalence is the fourth in the series of national HIV prevalence surveys that have investigated HIV prevalence and behaviour. In 2002, a consortium consisting of the Human Sciences Research Council (HSRC), Medical Research Council (MRC), Centre for AIDS Development, Research and Evaluation (CADRE) and *Agence Nationale de Recherche sur le Sida* (ANRS) constituted the first research team to conduct a national population-based survey of HIV prevalence in South Africa. Since 2002, the HSRC and its partners, supported by different international and local donors, have conducted several national surveys that have contributed to the country's understanding of the HIV epidemic over time (Shisana & Simbayi, 2002; Shisana, Rehle, Simbayi et al. 2005; Shisana, Rehle, Simbayi et al. 2009).

The past decade has seen South Africa make considerable progress in "turning the tide of HIV incidence" (Shisana, Rehle, Simbayi et al. 2009). By 2008, the country had begun to observe a decline in HIV incidence among the younger age groups (Rehle, Hallett, Shisana et al. 2010; Shisana, Rehle, Simbayi et al. 2009; Gouws, 2010). To date, evidence-based interventions focused on HIV prevention, treatment, care and support have been implemented with some success. Although the prevalence of HIV has remained high, it has been stable over the last decade (NDOH, 2013; SANAC, 2011a; Shisana, Rehle, Simbayi et al. 2009). The country has managed to increase the number of people on antiretroviral treatment (ART), which has led to a decrease in AIDS mortality and an increase in life expectancy (Johnson, Mossong, Dorrington et al. 2013; UNAIDS, 2012). Although challenges remain, South Africa continues to monitor the epidemic and is continually assessing, strengthening and reviewing the response to the HIV and AIDS epidemic.

These efforts have been supported in part by the previous national surveys, which have assisted the country to understand the magnitude and heterogeneity of the HIV epidemic as well as related socio-behavioural and contextual factors that drive the epidemic. Like the country's response to HIV and AIDS, the population-based surveys methodology has also evolved from the second-generation HIV surveillance approach to the third-generation HIV surveillance approach (Rehle & Shisana, 2010; Shisana, Zungu, & Simbayi, in press). This move has been informed by the changing epidemic and the imperative to align research conducted in South Africa with globally recognised best practice for HIV surveillance. The survey now incorporates new methodologies, technologies and novel laboratory methodologies that have enabled direct estimates of HIV incidence and exposure to ART. The advances in survey design and methodology have improved data triangulation and enhanced data interpretation and presentation. Improved methods of estimating HIV incidence and exposure to ART will assist the country to continue monitoring progress made since the previous National Strategic Plan (NSP) on HIV & AIDS and STI for 2007–2011 (SANAC, 2007). The 2012 data will also provide a baseline for the latest NSP on HIV, STIs and TB for 2012–2016 (SANAC, 2011a).

The aims of the survey were:

- To conduct surveillance of HIV infection and behaviour in South Africa;
- To obtain a better understanding of the factors driving the HIV epidemic;
- To collect data for monitoring the last NSP for 2007–2011); and
- To set a baseline for the current NSP (for 2012–2016).

The main objectives of the survey were:

- To determine the prevalence and incidence of HIV infection in South Africa in relation to social and behavioural determinants; and
- To determine the proportion of males in South Africa who are circumcised.

The secondary objectives were:

- To determine the proportion of PLHIV who are on ART in South Africa;
- To determine the extent to which mother-child pairs include HIV-negative mothers and HIV-positive infants; and
- To describe trends in HIV prevalence, HIV incidence, and risk behaviour in South Africa over the period 2002 to 2012.

Methodology

This section summarises the survey design, sampling methods and approaches used to collect data from households and individuals through questionnaires, collection of blood samples, preparation of data for analysis, and analysis of results.

Survey Design and Sampling

The 2012 survey design was similar to that implemented in the previous surveys (Shisana & Simbayi, 2002; Shisana, Rehle, Simbayi et al. 2005, 2009). A multi-stage stratified cluster sampling design was implemented with everyone in the sampled household invited to participate. This approach enabled analyses linking HIV results obtained from co-habiting or married sexual partners and also mother-child pairs.

Persons of all ages living in South African households and hostels were eligible to participate. A 'household member' was defined as any person who slept in the household on the night preceding the survey (including visitors who spent the night before the survey in this household). Persons resident in educational institutions, old-age homes, hospitals, correctional facilities and uniformed-service barracks as well as homeless persons were excluded from the survey.

A total of 1,000 census enumeration areas[4] (EAs) from the 2001 population census were randomly selected using probability proportional to size and stratified by province, locality type and race in urban areas from a database of 86,000 EAs that were mapped in 2007 using aerial photography to develop the 2007–2011 HSRC master sample for selecting households. The sampled EAs formed primary sampling units (PSUs). Locality types were defined as urban formal, urban informal, rural formal (including commercial farms), and rural informal (tribal authority) areas. Oversampling of Coloureds and Indians or Asians was done to meet the required minimum sample size. Aerial photographs drawn from *Google Earth* were also employed to ensure that the most up-to-date information was available for the master sample.

In each sampled EA a total of 15 visiting points (VPs) or households were used as secondary sampling units (SSUs). Within each household selected for the survey, all

4 An enumeration area (EA) is the spatial area that is used by Statistics South Africa (Stats SA) to collect census information on the South African population. An EA consists of approximately 180 households in urban areas and 80 to 120 households in deep rural areas. It is considered to be of a small enough size for one person to collect census information for Stats SA.

household members (including consenting and non-consenting household members) constituted the ultimate sampling unit (USU). A VP was defined as a stand with an address that might have one or more than one residential household in which a group of people live and eat together 'from the same pot'. If multiple households existed in a visiting point, a Kish grid[5] (Kish, 1965) was used to randomly select a responding household where all members of the selected household were eligible to participate.

Questionnaires

Four questionnaires were administered in the survey: (i) Household Questionnaire; (ii) Questionnaire for parent/guardian of children aged 0 to 11 years; (iii) Questionnaire for children aged 12 to 14 years; and (iv) Questionnaire for persons aged 15 years and older. The various modules contained in each of the household questionnaires are shown in Table 2.1 of the report, while individual questionnaires are shown in Table 2.2 of the report. Some key behavioural indicators that are presented in this report include consistency of condom use, multiple sexual partnerships, awareness of HIV status, perception of risk of HIV infection, attitudes towards people living with HIV and AIDS (PLHIV), and knowledge of HIV transmission and prevention.

Ethical considerations

The survey protocol was approved by the HSRC's Research Ethics Committee (REC: 5/17/11/10) as well as by the Associate Director of Science of the National Center for HIV and AIDS, Viral Hepatitis, STD and TB Prevention at the USA's Centers for Disease Control and Prevention (CDC) in Atlanta.

All persons who agreed to participate in the survey were required to provide either written or verbal consent for both the interview and specimen collection. CDC granted a waiver of written consent per 45CFR46 for cases where respondents were unable to provide written consent but consented verbally. Parents and guardians of children under 18 years of age were asked to give informed consent for inclusion of their children in the survey as well as for providing a blood specimen for HIV testing. Children aged 7 to 11 years were required to confirm their assent by placing a tick or cross in a demarcated box in addition to providing written consent by means of a signature (where possible).

Individual interviews were held in a private setting either inside or outside of the household. No names of respondents were recorded on the questionnaires or on the blood specimens; barcodes were placed on the questionnaires and the blood samples, thereby allowing the two components to be linked. Respondents who agreed to provide a blood sample for HIV testing were provided with an HIV Specimen Result Request Voucher referring them to a nearby HIV Counselling and Testing (HCT) centre to access their HIV test results. Special specimen results coordinators were appointed to hand-deliver a printout of all respondents' HIV test results in a particular EA to the nurse supervisor in charge of HCT at each clinic within or nearest to the particular EA.

HSRC research trainees acted as provincial survey coordinators, while supervisors, editors and nurses were recruited as fieldwork staff to undertake data collection in 2012. A training manual that had been adapted from previous surveys was utilised to train field staff. In the first phase, a total of 12 focus groups – three per race group, among males

5 A method of selection of households where there are multiple households.

and females of different age groups (teenagers, youth and adults) – were conducted to inform the survey about how best to provide feedback on HIV test results to respondents. The second phase involved a preparatory survey to pre-test all the procedures, including community entry, obtaining informed consent/assent, validating the content of the questionnaires in the field, and undertaking laboratory testing of dried blood spot (DBS) specimens.

Laboratory methods

DBS specimens collected by finger-prick (or heel-prick in infants) were tested for HIV antibodies using a testing algorithm with three different enzyme immunoassays. In addition, children under 24 months of age were also tested for HIV infection using a polymerase chain reaction (PCR) assay. The HIV incidence testing algorithm used the newly developed Limiting-Antigen Avidity Assay (LAg-Avidity EIA) in combination with additional information on antiretroviral treatment exposure and HIV viral load. As in the previous survey in 2008, the presence of antiretroviral drugs (ARVs) in HIV-positive DBS samples was confirmed by means of High Performance Liquid Chromatography (HPLC) coupled to Tandem Mass Spectrometry.

Weighting of the sample

Owing to the sampling design of the survey, some individuals have a greater or lesser probability of selection than others. To correct this potential bias due to unequal sampling probabilities, sample weights were introduced to correct for potential bias at the EA, household, and individual levels and also to adjust for non-response. The final sampling weight was thus equal to the final EA weight multiplied by the final VP sampling weight adjusted for individual non-response. The final individual weights were benchmarked to 2012 mid-year population estimates by age, race, sex, and province (Stats SA, 2013). This process produced a final sample representative of the population in South Africa for sex, age, race, locality type, and province.

Data management and analysis

Survey data from questionnaires were double entered and verified by the Data Capturing Unit (DCU) at the HSRC using Census Survey Processing (CS Pro) software Version 5.0 (U.S. Census Bureau). Taking into account the complex multi-level sampling design and adjusting for HIV testing non-response, weighted data were analysed using STATA 12/13 software (Stata Corporation, College Station, TX) and estimates of HIV prevalence, p-values and confidence intervals (95% CI) were reported with other reliability measures such as coefficient of variation, design effect, and square root of the design effect. To control for the quality of results, every table was generated independently by two different statisticians and the outputs compared to verify the results.

Results

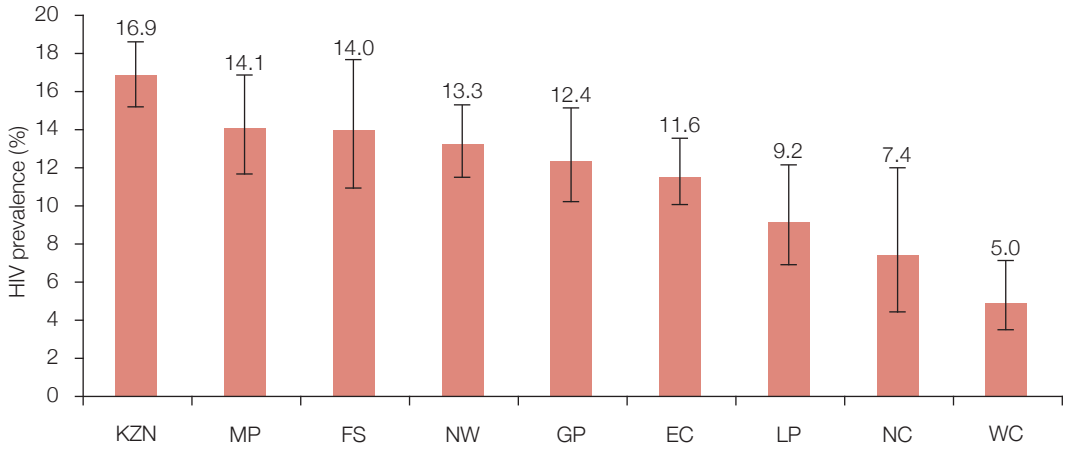
Out of 15,000 VPs that were sampled 13,083 (87.2%) were found to be valid and were therefore included in the sample. Just under 85% (11,079) of households members agreed to participate in the survey at the household level. Among the valid households, 10.3% of occupants refused to participate in the household interview and in 5% of the households no one was at home. A total of 42,950 individuals in the valid households were eligible to be interviewed and 38,431 agreed to be interviewed, resulting in a participation rate of 89.5%. In terms of HIV testing, 67.5% (28,997) of eligible individuals agreed to provide a blood specimen for HIV testing that was anonymously linked to their responses to the

questionnaires. Black Africans had, with 73.3%, the highest HIV testing response among the four race groups. Whites had the lowest response rate for HIV testing. Estimates of prevalence and incidence of HIV as well as of ART exposure arising from the testing are presented in the next sections.

HIV prevalence

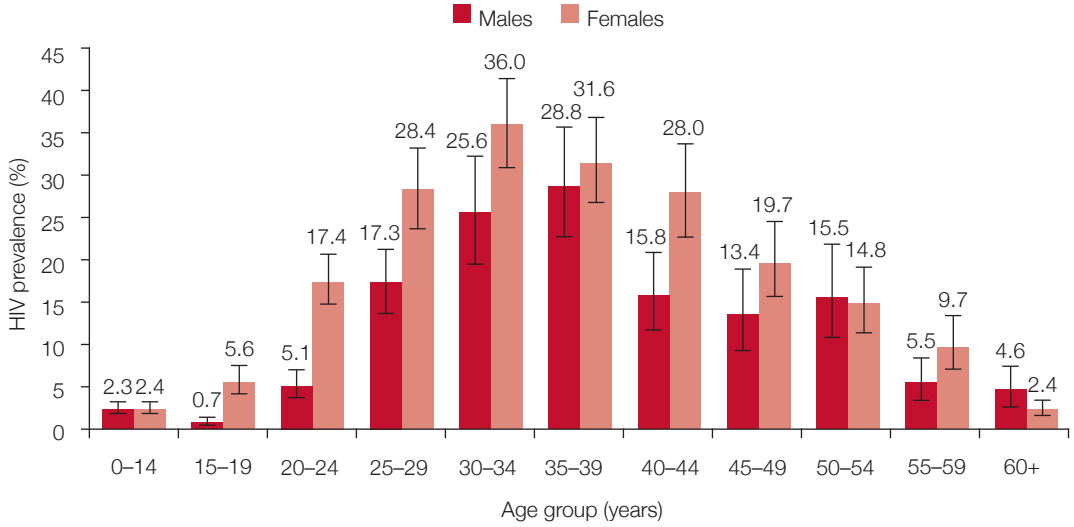
In 2012, it is estimated that 12.2% of the population (6.4 million persons) were HIV positive, which is 1.2 million more PLHIV than in 2008 (10.6%, or 5.2 million). The results of the analysis of HIV-prevalence estimates by key demographic variables suggest that the overall HIV prevalence differed substantially by province (Figure I).

Figure I: Overall HIV prevalence by province, South Africa 2012



Key: KZN – KwaZulu-Natal, MP – Mpumalanga, FS – Free State, NW – North West, GP – Gauteng, EC – Eastern Cape, LP – Limpopo, NC – Northern Cape, WC – Western Cape

Figure II: HIV prevalence by sex and age, South Africa 2012



Geographical differences were found by locality type and also by province. Rural informal area residents had a significantly higher HIV prevalence than did urban formal area residents. Provincial variation was evident, the top four high HIV-prevalence provinces being KwaZulu-Natal, Mpumalanga, Free State, and the North West, and the lowest the Western Cape. Northern Cape and Limpopo also have lower HIV prevalence than the other provinces. The relative ranking of provinces by HIV prevalence has remained the same since 2005 (Figure I).

With respect to sex, age, race, and locality type, there were statistically significant differences found (Table I). Overall, females had a significantly higher HIV prevalence than males (Figure II). The prevalence of HIV was highest among females aged 30–34 and among males aged 35–49. In the teenage population, the estimated HIV prevalence among females was 8 times that of their male counterparts, suggesting that female teenagers aged 15–19 years are more likely than their male counterparts to have sex, not with their peers, but with older sex partners.

Disaggregation of the data by race showed that black Africans had the highest HIV prevalence compared to all other race groups, followed by Coloureds. The prevalence for Indians or Asians and for whites was less than 1%. However, the figures for whites are considered unreliable because of the low response rate. In attempting to understand the possible reasons for differential racial HIV prevalence, the findings suggest that black Africans (39.1%) were less likely than all other races (>85%) to live in urban formal areas. Urban informal areas are generally under-resourced and lack some of the basic necessities

Table I: Overall HIV prevalence by sex, all age groups, race, and locality, South Africa, 2012

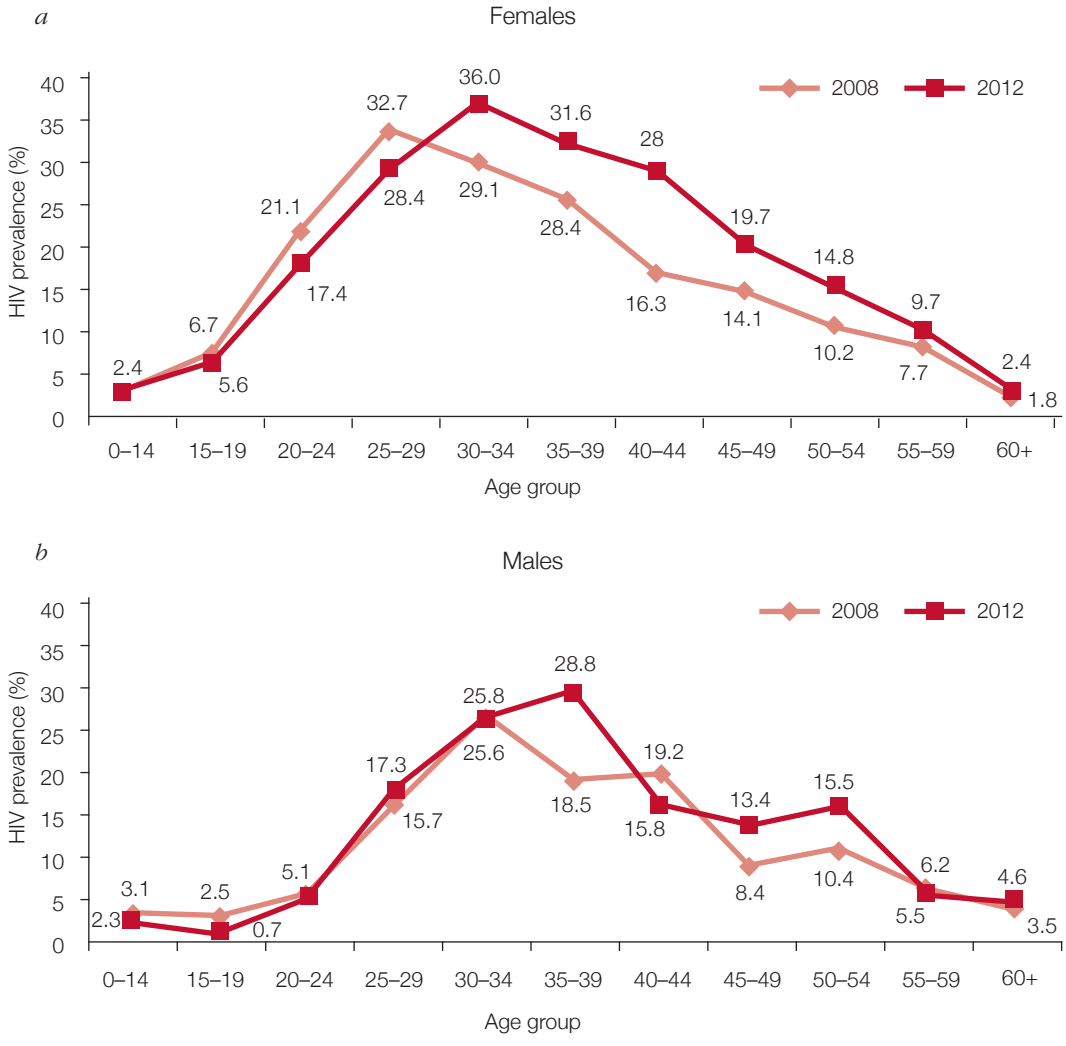
Variable	n	%	95% CI
Sex			
Male	12,896	9.9	8.9–11.0
Female	15,794	14.4	13.3–15.6
Age group (years)			
0–14	8,039	2.4	1.9–2.9
15–24	5,890	7.1	6.2–8.1
25–49	8,830	25.2	23.2–27.3
50+	5,986	7.6	6.5–8.8
15–49	14,720	18.8	17.5–20.3
Race			
Black African	18,629	15.0	14.0–15.9
White	1,733	0.3	0.1–0.8
Coloured	5,625	3.1	2.2–4.2
Indian or Asian	2,626	0.8	0.5–1.4
Locality type			
Urban formal	14,821	10.1	8.8–11.7
Urban informal	3,329	19.9	17.4–22.7
Rural informal	7,801	13.4	12.2–14.7
Rural formal	3,046	10.4	7.4–14.4
Total	**28,997**	**12.2**	**11.4–13.1**

such as formal housing, water, sanitation, and access to preventive health services. The other distinguishing factor among races is marital status. Black Africans are less likely to report being married than whites and Indians or Asians. HIV prevalence was found to be higher in the unmarried, co-habiting population than in the married population.

The epidemiological curve has shifted over the 4-year period between 2008 and 2012, presumably as a result of the effects of increased ART coverage. Peak HIV prevalence for females has shifted from the 25–29 year age group in 2008 to the 30–34 year age group in 2012, while for males it has shifted from the 30–34 year age group in 2008 to the 35–39 year age group in 2012 (Figure III a and b). With respect to children aged 2–14 years, prevalence remained the same in this age cohort between 2008 and 2012, likely the result of the effects of both reduced mother-to-child transmissions and increased survival among HIV-infected children due to improved access to ART.

The survey found significant differences in HIV prevalence between people who lived in urban informal areas and those living in the other three locality types. Rural informal area residents have a significantly higher HIV prevalence than do urban formal area residents.

Figure III: HIV prevalence in females (a) and males (b) by age, South Africa 2008 and 2012



Although the epidemic in South Africa is generalised, there are specific groups that have HIV prevalence above the national average which are classified as key populations with higher risk of HIV exposure. These groups require targeted interventions. This survey identified these groups as black African females aged 20–34 years (HIV prevalence of 31.6%), people co-habiting (30.9%), black African males aged 25–49 years (25.7%), disabled persons[6] 15 years and older (16.7%), high-risk alcohol drinkers[7] 15 years and older (14.3%), and recreational drug users (12.7%).

For the first time, this survey produced prevalence data at sub-provincial level. Figure IV shows that, as with provinces, there are variations in HIV prevalence in the metropolitan municipalities (which will be referred to as metros, from now onwards). eThekwini in KwaZulu-Natal and Ekurhuleni in Gauteng had the highest HIV prevalence, followed closely by Buffalo City, in the Eastern Cape. The City of Tshwane and the City of Johannesburg had a HIV prevalence slightly lower than the national average, but not significantly so. The three metros that had lower HIV prevalence than the rest of the provinces and the national average are Nelson Mandela Metro in the Eastern Cape, Mangaung Metro in the Free State, and the City of Cape Town, which has the lowest recorded HIV prevalence.

Table II: HIV prevalence by metropolitan municipality, 2012

Metropolitan municipality	n	%	95% CI
City of Cape Town Metro	2,250	5.2	3.4–7.8
Mangaung Metro	406	7.9	5.3–11.6
Nelson Mandela Metro	939	8.3	4.5–14.9
City of Johannesburg Metro	1,262	11.1	8.3–14.6
City of Tshwane Metro	751	11.7	8.1–16.6
Buffalo City Metro	556	13.6	10.6–17.3
Ekurhuleni Metro	822	14.3	10.3–19.5
eThekwini Metro	3,708	14.5	11.2–18.6

On the whole, the increased prevalence of HIV in 2012 is largely due to the combined effects of new infections and a successfully expanded ART programme. The latter has increased survival among HIV-infected individuals.

Antiretroviral treatment (ART) exposure

By mid-2012, out of the total estimated number of 6,422,000 PLHIV in the country, 2,002,000 (31.2%) were exposed to ART. Table III provides estimates of the total number of PLHIV, the total number of people on ART, and the proportion of people living with HIV who were on ART at the time of the survey. A significantly greater proportion of females (34.7%) than males (25.7%) had accessed treatment. HIV-infected children aged 0–14 years and adults 50 years and older were found to have the highest exposure to

6 Disabled persons included those with physical and sensory disabilities.

7 This is according to the Alcohol Abuse Disorder Identification Test (AUDIT) score. High-risk alcohol use (also referred to as hazardous or harmful drinking) was defined as a score of 8 or more on the AUDIT. "Hazardous drinking is defined as a quantity or pattern of alcohol consumption that places patients at risk for adverse health events, while harmful drinking is defined as alcohol consumption that results in adverse events (e.g., physical or psychological harm)" (see Peltzer, Davids & Njuho 2011, p. 30).

antiretroviral therapy, 45.1% and 42.7% respectively. Youth aged 15–24 years living with HIV had the lowest proportion of treatment exposure (14.3%). ART exposure in the HIV-positive population aged 15–49 years was 28.9%. Over 6 million black Africans were estimated to be living with HIV, with over 30.9% on treatment. The proportion of ART exposure among people in the other race groups was higher, at 41.3%. There was no significant difference in the proportion of treatment exposure among HIV-positive people living in formal and in informal urban settlement areas, 28.3% and 27.4% respectively. Rural informal areas showed a higher proportion of treatment exposure than rural formal areas (35.3% vs. 28.7%), but the difference is not statistically significant.

Antiretroviral treatment exposure among PLHIV had almost doubled between the last two surveys, from 16.6% in 2008 to 31.2% in 2012. The findings suggest that sex differences in health-seeking behaviour (Connell & Messerschmidt 2005; O'Brien, Hunt & Hart, 2005) together with the benefits of expanded PMTCT programmes may have facilitated women's access to treatment over the past 5 years. The increase of ART exposure is especially noticeable among HIV-infected children aged 0–14 years, which may indicate great improvements in HIV testing among children as well as the impact of the evolving national eligibility criteria for starting ART regimens in infants and children. The lower

Table III: Exposure to antiretroviral treatment among individuals living with HIV by sex, age, race and locality type, South Africa mid-2012

Variable	Estimated number of people living with HIV (n)	Estimated number of people on ART (n)	Proportion of people living with HIV on ART (%) 95% CI
Sex			
Male	2,531,000	651,000	25.7 [21.2–30.8]
Female	3,873,000	1,344,000	34.7 [31.4–38.2]
Age group (years)			
0–14	369,000	166,000	45.1 [33.9–56.9]
15–24	720,000	103,000	14.3 [10.0–20.0]
25–49	4,706,000	1,466,000	31.2 [27.4–35.2]
50 +	610,000	260,000	42.7[35.7–50.0]
15–49	5,426,000	1,569,000	28.9 [25.6–32.5]
Race			
Black African	6,232,000	1,924,000	30.9 [27.7–34.3]
Other	172,000	71,000	41.3 [30.0–53.7]
Locality type			
Urban formal	2,558,000	724,000	28.3 [22.5–39.4]
Urban informal	851,000	233,000	27.4 [23.0–32.4]
Rural informal	2,727,000	963,000	35.3 [31.3–39.5]
Rural formal	286,000	82,000	28.7 [20.1–39.2]
Total	**6,422,000**	**2,002,000**	**31.2 [28.1–34.5]**

**Numbers are rounded off to the nearest thousand.*

proportion of ART exposure among youth aged 15–24 years is expected because most HIV infections in this age group have occurred relatively recently; a much lower proportion of persons in this age group have therefore advanced to the stage of treatment eligibility compared to older adults. There is no difference in the proportion of treatment exposure among HIV-positive people living in formal and informal settlements – an indication of effective treatment access in these different socio-economic settings.

HIV incidence

HIV incidence measures are important because they provide insights into the more recent dynamics of the country's HIV epidemic. More importantly, they are the most direct means of assessing the impact of HIV-prevention programmes that the country has implemented. Our HIV-incidence analysis is based on two independent methods: (i) direct HIV incidence measures using a laboratory-based testing algorithm; and (ii) indirect HIV incidence estimates using a mathematical model.

Table IV presents HIV incidence estimates for South Africa in both relative terms (% per year) and absolute terms (number of new infections per year). Our analysis of directly measured HIV incidence indicates that 469,000 new HIV infections occurred in the population 2 years and older during 2012 in South Africa. The differential HIV transmission dynamics between males and females are reflected in the HIV-incidence profiles. Among adults aged 15–49 years, the number of new infections was 1.7 times higher in females than in males. The incidence rates among young females remain concerning. The HIV-incidence rate among female youth aged 15–24 was over four times higher than the incidence rate found in males in this age group (2.5% vs. 0.6%). Almost

Table IV: Direct, assay-based HIV incidence (%) and number of new infections by age and sex, South Africa 2012

Age groups (years)	Sex	HIV incidence % (95% CI)	Estimated number of new infections (95% CI)
2+	**Total**	**1.07 (0.87–1.27)**	**469,000 (381,000–557,000)**
	Male	0.71 (0.57–0.85)	151,000 (121,000–181,000)
	Female	1.46 (1.18–1.84)	318,000 (257,000–401,000)
2–14	**Total**	**0.25 (0.21–0.29)**	**29,000 (24,000–34,000)**
	Male	No incident cases found	
	Female	0.49 (0.39–0.59)	29,000 (23,000–35,000)
15–24	**Total**	**1.49 (1.21–1.88)**	**139,000 (113,000–175,000)**
	Male	0.55 (0.45–0.65)	26,000 (21,000–31,000)
	Female	2.54 (2.04–3.04)	113,000 (91,000–135,000)
25+	**Total**	**1.41 (1.15–1.67)**	**300,000 (245,000–355,000)**
	Male	1.29 (0.91–1.67)	125,000 (88,000–162,000)
	Female	1.62 (1.30–1.94)	175,000 (140,000–210,000)
15–49	**Total**	**1.72 (1.38–2.06)**	**396,000 (318,000–474,000)**
	Male	1.21 (0.97–1.45)	145,000 (116,000–174,000)
	Female	2.28 (1.84–2.74)	251,000 (203,000–302,000)

**Numbers are rounded off to the nearest thousand.*

a quarter (24.1%) of all new HIV infections occurred in young females aged 15–24 years. With an HIV-incidence rate of 4.5%, black African females aged 20–34 years recorded the highest incidence of HIV among the analysed population groups. The incidence results by locality type showed that half of all new HIV infections in the population 2 years and older occurred in urban formal areas. However, urban informal settlements had a higher incidence rate than urban formal areas (2.5% vs. 1.1%) among individuals 2 years and older, demonstrating the importance of place of residence as a critical epidemiological parameter for risk of HIV infection. Individuals who were married had a considerably lower HIV-incidence rate (0.6%) than did survey participants who were living together with a sexual partner (3.7%) and those who were single (3.4%). While more complex contextual measures of frequency and type of partnerships are necessary to expand on these findings, it is certainly an important topic for on-going prevention interventions.

Updated indirect HIV incidence estimates using a mathematical model were provided for the inter-survey periods 2002–2005, 2005–2008, and 2008–2012. The HIV-incidence rate among individuals aged 15–49 years was 2.2 % in the period 2002–2005. HIV incidence in this age group remained at a slightly lower level of 1.9% in the subsequent periods 2005–2008 and 2008–2012. HIV incidence among youth aged 15–24 years, however, declined steadily over the three inter-survey periods, from 2.8% in 2002–2005 to 2.3% in 2005–2008 to 1.5% in 2008–2012. The declining HIV incidence among youth was also reflected in the declining HIV-prevalence levels observed in this age group since 2005. An encouraging finding was the decline in incidence among young females aged 15–24 years, from 5.3% in 2002–2005 to 2.1% in the period 2008–2012, a statistically significant reduction of 60% in HIV incidence.

It is re-assuring that the two independent methods applied for HIV-incidence estimation for South Africa produced very similar results. However, despite this encouraging development, there is no reason to become complacent in view of the high HIV-incidence rate of over 2% among uninfected female youth aged 15–24 years.

It is conceivable that the beneficial impact of increased antiretroviral treatment coverage on HIV incidence (through viral load reduction in HIV-positive individuals) has been more than offset by the disturbing trends of increased HIV-risk behaviour in the country as presented below. The NSP for 2012–2016 states as its primary goal a reduction of new infections by at least 50%. In view of our survey findings, this will be extremely difficult to attain given the prevailing transmission dynamics in the country.

Male circumcision

Overall, this survey found that almost half (46.4%) of the male respondents aged 15 years and older reported that they were circumcised. The reported circumcision rates varied by age, race, locality type, and province, with those aged 25–49 years (48.8%), black Africans males (52.4%), those from both rural informal areas and urban informal areas (52.3% and 53.4%, respectively) and individuals from the Eastern Cape and Limpopo (74.0% and 72.6%, respectively) having the highest rates.

In terms of circumcision setting, the majority of participants reported that they had been circumcised in traditional settings on the mountain or in the bush/at initiation school (52.5%), followed by in the hospital or clinic mainly through voluntary male medical circumcision (VMMC) (40.1%). The majority of young males aged 15–24 years (51.6%) had been circumcised in medical facilities, while older males had been circumcised in traditional settings (54.6% of those aged 25–59 years and 58.6% of those 50 years and

older). The overwhelming majority of whites (90.4%), followed by Indians or Asians (71.2%) and Coloureds (66.3%), had been circumcised in medical facilities, while in contrast the majority of black Africans (59.2%) had been circumcised in traditional settings. Indians or Asians (16.7%) had the highest rates of home circumcision. A slight majority of those living in urban formal areas (53.2%) and almost half of those from rural formal areas (44.7%) had been circumcised in medical facilities, while the majority of those living in urban informal areas (69.9%) and rural informal areas (69.6%) had been circumcised in traditional facilities. The Eastern Cape (83.15%), Mpumalanga (71.3%) and Limpopo (63.5%) had higher rates of traditional circumcision than did the other provinces, while KwaZulu-Natal (67.8%), Gauteng (58.0%) and the Northern Cape (51.6%) had the highest rates of medical male circumcision.

Overall, 39.6% of male respondents aged 15 years and older who were not circumcised indicated they would like to be circumcised. A large majority of those were: aged 15–24 years (59.7%); black African (49.8%); from rural informal and urban informal areas (47.1% and 44.3%, respectively); and from the Eastern Cape (64.7%). Sizable minorities from the Free State (46.2%), North West (45.0%) and KwaZulu-Natal (44.8%) also indicated their desire for male circumcision.

Trends in adult male circumcision over the three of the four surveys (2002, 2008 and 2012) indicated that, overall, there was a significant increase in male circumcision from 2002 to 2012, with the rates of traditional circumcision being consistently higher than rates of VMMC. The pattern of changes seen in VMMC, moreover, mirrored that in the overall rate of male circumcision, with the cumulative total number of males who had undergone VMMC having increased from 1,581,574 in 2002 to 2,268,519 in 2008 to 3,301,196 in 2012. Traditional male circumcision remained relatively stable over the same period.

Behavioural determinants of HIV

Sexual debut before the age of 15 years

Overall, it was found that one tenth (10.7%) of respondents aged 15–24 years reported having had sex for the first time before the age of 15 years. Significant differences were found by sex and race, with higher percentages of males (16.7%) and black Africans (11.1%) reporting that they had done so in comparison with their counterparts. However, no significant differences were found by locality type and province.

Overall, the rates of sexual debut before the age of 15 years were stable from 2002 until 2008 at about 10%, then increased slightly in 2012 to about 11%. More importantly, there were sex differences found, with males also consistently reporting significantly higher rates of sexual debut before 15 years old compared to females in the 2002 to 2012 period.

Age differences between sexual partners among 15–19 year olds

Overall, it was found that in 2012 about one fifth of all respondents aged 15–19 years (19.9%) were involved in age-disparate relationships involving a sexual partner who was more than five years older than they were. More interestingly, there was a significant sex difference: one-third (33.7%) of all female adolescents aged 15–19 years reported having had a partner more than five years their senior, compared to only 4.1% of their male counterparts.

Trend analysis of data obtained during the three last surveys conducted in 2005, 2008 and 2012 shows that there was a steady increase in age-disparate relationships among females

aged 15–19 years, while this has hardly been a feature among their male counterparts over the period.

Multiple sexual partners

The survey found that 12.6% of the respondents aged 15 years and older reported that they had had more than one sexual partner in the last 12 months. Significant differences were found across all five reporting domains, with five times more males (20.1%) than females having had multiple partners; younger people aged 15–24 years (22.4%) having had multiple partners more than the other age groups; black Africans (14.5%) than other race groups; other locality types (range: 12.8%–13.3%) than rural formal areas (6.0%); and other provinces (range: 10.1%–14.5%) than the Northern Cape (8.7%), which might explain the low HIV prevalence in this province.

Among the key populations at higher risk of HIV exposure, recreational drug users aged 15 years and older (32.0%), high-risk (alcohol) drinkers aged 15 years and older (32.9%), black African males aged 25–49 years (21.1%), and the disabled aged 15 years and older (15.9%) reported that they had more than one sexual partner in the past 12 months than the other two high-risk groups.

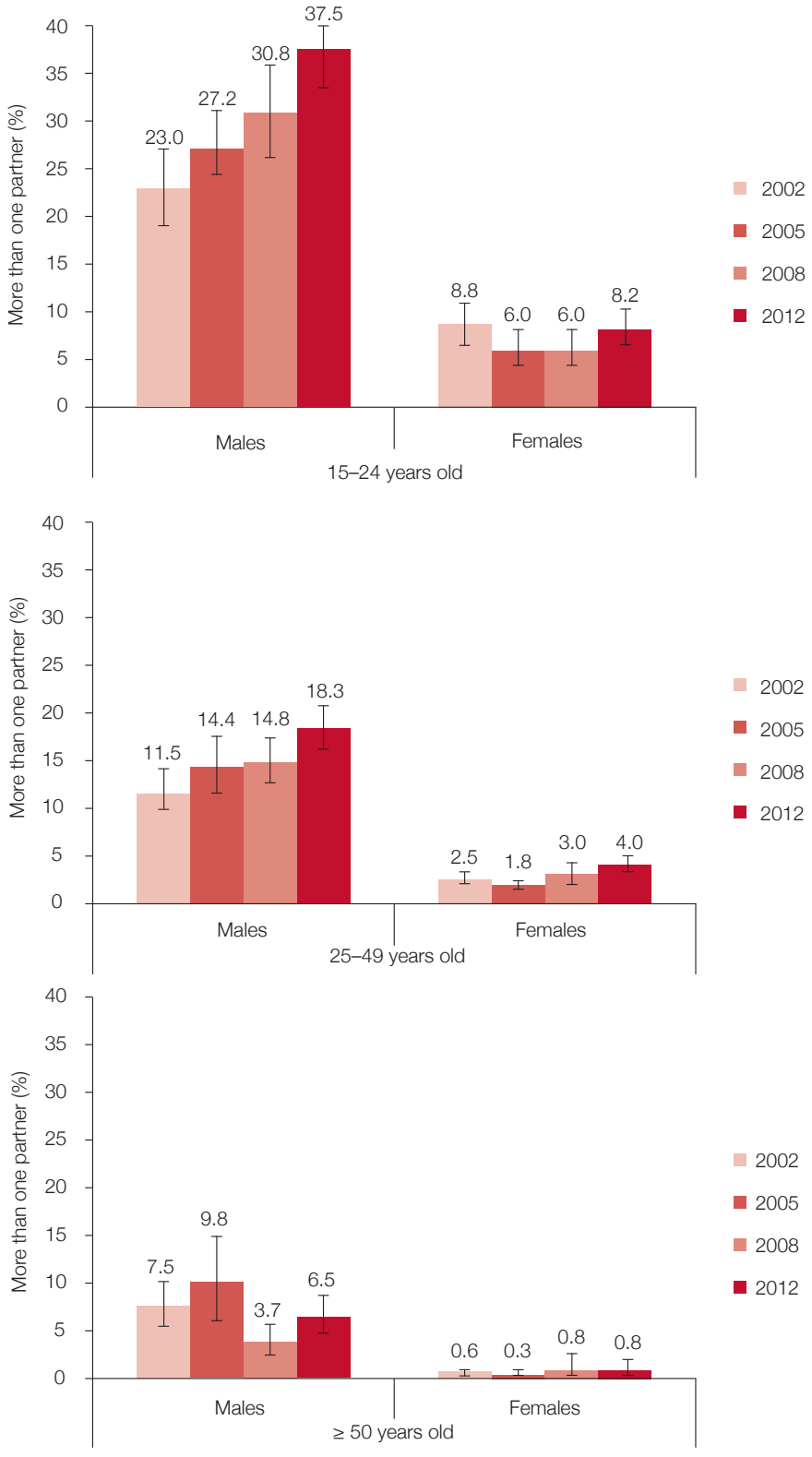
With respect to trend analyses over the four surveys conducted from 2002 to 2012, overall there was a steady increase in respondents who had had more than one sexual partner in the previous 12 months, from 11.5% in 2002 to 18.3% in 2012 (Figure IV) presumably due to decline in HIV sexual transmission knowledge coupled with reduced communication campaigns. When these data were disaggregated by sex, significantly higher percentages of males (20.1%) reported that they had had more than one sexual partner in the last 12 months than had their female counterparts (4.6%). Among respondents aged 15–24 years there was a significant increase in multiple sexual partnerships among males, from 23.0% in 2002 to 37.5% in 2012, while the percentages were both low and stable (6–8%) across the period of the four surveys among their female counterparts.

Rates of multiple sexual partnerships among the 25–49 year old group were lower (11.2%) than those among the 15–24 year old group – which was true for both males and females. Among those aged 50 years and older, the percentages of males having had multiple sexual partnerships were highest in 2005 (9.8%), decreased in 2008 (3.7%), and then increased slightly in 2012 (4.2%) – having initially been 7.5% in 2002. Corresponding percentages of females who had had multiple sexual partnerships were 8.8% in 2002 for those 15–24 years old, 4.0% for those 25–49 years old, and 0.8% for those aged 50 years and older. It is important to note that the rate for females aged 50 years and older who had multiple sexual partnerships stabilised at 0.8% over the period of the past two surveys, in 2008 and 2012.

Condom use

Overall, over one-third (36.2%) of all respondents aged 15 years and older who were sexually active during the previous 12 months indicated that they had used a condom at last sex act with the most recent sexual partner. Significant sex differences were found, with a higher percentage of males (38.6%) reporting that they had used a condom than females (33.6%). Additional analyses also revealed that: youth aged 15–24 years had a significantly higher percentage (58.4%) of condom use than the other age groups; black Africans (41.9%) than the other three race groups; those living in urban informal areas (43.7%) than those in the other three locality types; and those living in North

Figure IV: Sexually active respondents aged 15 years and older who had more than one sex partner in last 12 months, South Africa 2002, 2005, 2008, 2012



West (40.8%), the Free State (40.7%), KwaZulu-Natal (39.6%), Mpumalanga (39.4%) and Limpopo (39.3%) than those in the other provinces.

When the trends in condom use at last sex among respondents for each age group by sex over the period of the past four surveys (2002 to 2012) are considered, it emerges that overall condom use at last sex increased significantly from 2002 to 2008 and then significantly decreased in 2012 among all three age groups and for both sexes except among females aged 50 years and older. In the latter group there was a moderate increase in 2012 in comparison with the 2008 estimates (Figure V). Across the period of all surveys, condom use at last sex was highest among 15–24 year olds, followed by 25–49 year olds, and was lowest among those aged 50 years and older.

There were also significant sex differences at each age, with males having used condoms at last sex at consistently higher rates than their female counterparts since 2002. Condom use at last sex also increased significantly in all provinces from 2002 until 2008 and then decreased in 2012. The decreases in 2012 were significant in all provinces except the Northern Cape.

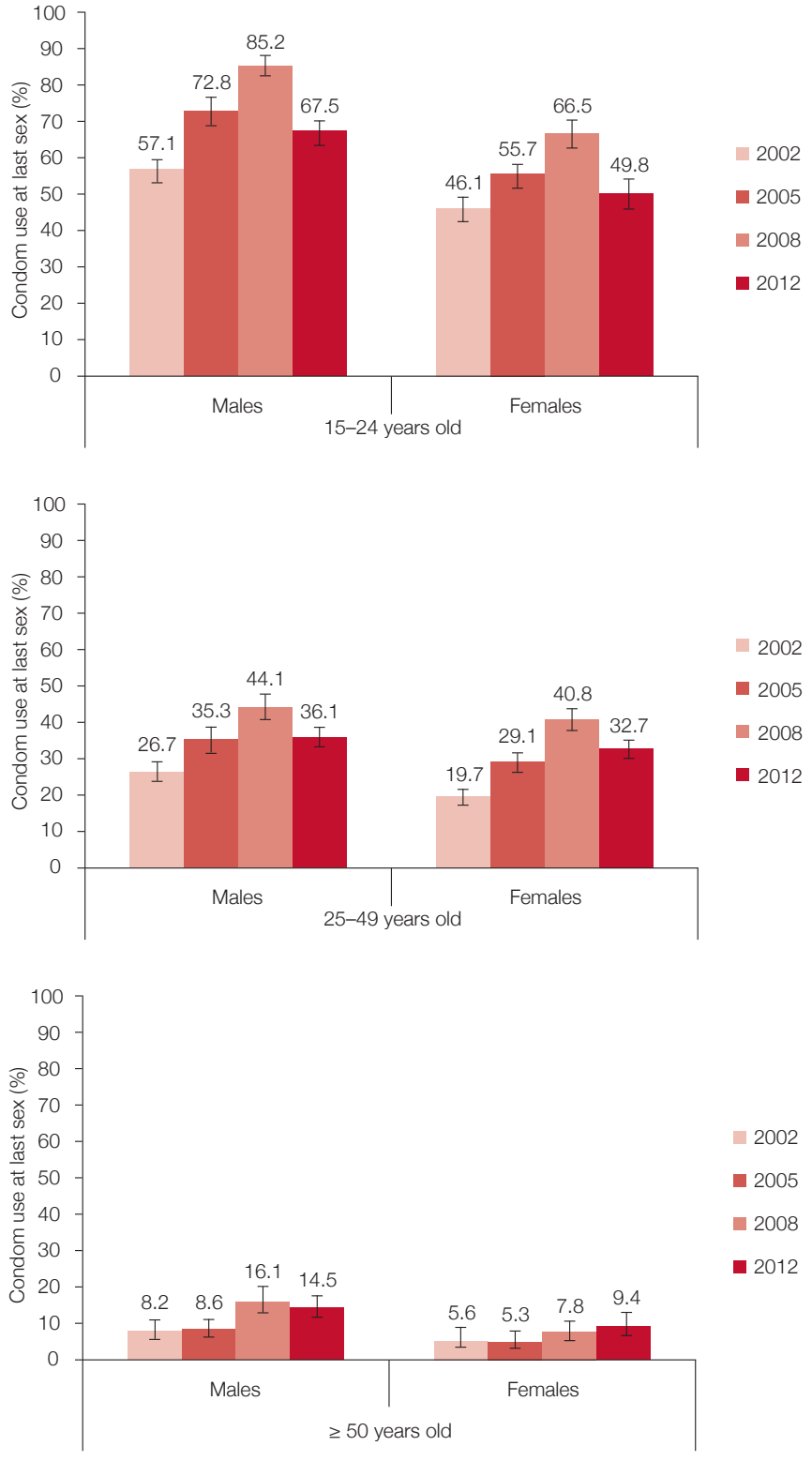
With regard to the consistent condom use during sex, 27.4% of all respondents aged 15 years and older who were sexually active during the previous 12 months indicated that they had always used a condom at last sex with the most recent sexual partner. However, the majority of respondents (52.9%) indicated that they had 'never' done so (i.e., ever used condoms). Consistency of condom use varied significantly as follows: a significantly higher percentage of males (29.5%) reported having used a condom consistently than females (25.2%); 45.7% of youth aged 15–24 years than the other two age groups; black Africans (31.6%) than the other three race groups; both occupants of urban informal and rural informal areas (32.9% and 29.6% respectively) than occupants of both urban formal and rural formal areas; and those resident in the North West (40.8%), the Free State (40.7%), KwaZulu-Natal (39.6%), Mpumalanga (39.4%), and Limpopo (39.3%) than in the other provinces.

Condom use at last sex among key populations at higher risk of HIV exposure was found to be higher than the national average (36.2%) among three of the groups: high-risk alcohol drinkers aged 15 years and older; black African females aged 20–34 years; and recreational drug users aged 15 years and older. While the disabled aged 15 years and older had the same rate as the national average, people living together who were not married aged 15–49 years of age had the lowest rate at 33.8%.

Although condom use has historically been one of the main HIV-prevention strategies used successfully in the country, especially among the youth, in 2012 condom use at last sex act by both males and females across all age groups decreased to 36.2%, returning to levels similar to those recorded in 2005 (35.4%), a peak having been observed in 2008 (45.1%). Across all four surveys, condom use at last sex act was highest among 15–24 year olds, followed by 25–49 year olds, and lowest among those aged 50 years and older. Similarly, there were also significant sex differences in each of the three age groups, with males having used condoms at last sex at higher rates than their female counterparts. The decreases in condom use in 2012 compared to 2008 were also significant in eight of the nine provinces, with the exception of the Northern Cape.

With regard to consistency of condom use by key populations at higher risk of HIV exposure, both high-risk drinkers 15 years and older (34.7%) and recreational drug users

Figure V: Condom use at last sex by age groups and sex, South Africa 2002, 2005, 2008 and 2012



15 years and older (33.1%) reported the highest percentages of consistent condom use with most recent sexual partner, while respondents 15–49 years old who were living together with a partner reported the lowest percentage of consistent condom use with most recent sexual partner, 23.6% using condoms consistently.

Sexual behaviour in the metro areas

Multiple sexual partnership rates in the last 12 months across the metros of South Africa ranged from 8.5% in the Nelson Mandela Metro to 16.4% in the Buffalo City Metro. Although the differences in rates across metros were not significant, it is still important to note that the prevalence rates of HIV in five of the metros were higher than in the remainder. This is of substantive importance: the City of Johannesburg and the City of Cape Town were among the metros that recorded large increases of ≥ 75% HIV prevalence between 2008 and 2012.

In relation to marital status distribution in the metros for participants aged 15 years and older across the eight metros (excluding the widowed and divorced because of small numbers), the results showed that the marriage rates were low: only 39.6% of metro residents were married, while 34.2% were 'living together' with their partner and the remaining 26.2% were single and had no sexual partner. The metro with the lowest marriage rate was Buffalo City (22.6%), while the metros with the highest marriage rates were Cape Town (45.5%), Ekurhuleni (45.7%), and Tshwane (46.6%).

In terms of age-disparate relationships, the prevalence for sexually active persons in the last 12 months aged 15 and older across the metros is that 18.2% of respondents reported having had partners at least five years older than themselves, with Buffalo City Metro reporting the highest rate (22.7%).

Awareness of HIV status

The overwhelming majority of participants (92.3%) knew of a place near their homes where they could be tested for HIV. Although some significant differences were found among the various levels of the five main reporting domains (that is, sex, race, age, locality type, and province), all percentages were generally very high, between 85% and 95% of respondents suggesting that HCT/VCT services were perceived as highly accessible. The exception was whites, 82.7% of whom were aware of the closest testing site venues – a high percentage nevertheless.

The majority of respondents (65.5%) indicated that they had been tested for HIV at some point. As expected, significantly higher percentages of females (71.5%) and adults aged 25–49 years (78.2%) than their respective counterparts had been tested. Among the provinces, the Western Cape (70.4%), Northern Cape (69.8%) and Gauteng (68.1%) reported the highest levels of HIV testing during the previous year than did the other provinces. It is interesting to note that no significant differences in HIV test history were found among the four race groups and among the four locality types.

Most respondents who had tested for HIV (70.0%) had their most recent test conducted in the public health sector, with exactly half of them (50.0%) having being tested in primary health care facilities. As expected, a higher percentage of females (54.9%) had been tested than males (43.5%). With 17% of respondents reporting that their most recent test had been conducted in private health facilities, this means that the remaining tests (13%) – a relatively small but equally important contribution – were conducted in other special-

purpose centres, such as youth centres, youth-friendly clinics, and HCT centres not based at clinics (including mobile clinics).

Among the 65.5% who had ever tested for HIV, two-thirds (66.2%) had done so in the 12 months preceding the interview in 2012. The proportion of respondents who were tested in 2012 (that is, 66.2%) was a large increase over the 49.1% who had been tested in 2008. Interestingly, in both survey years (2008 and 2012) there were no significant differences observed in the testing behaviour of males and females in terms of recent HIV test.

Awareness of HIV status and HIV prevalence

Overall, the survey found significantly higher rates of awareness of HIV status among females, than among males. A total of 55.0% of HIV-positive females and 45.0% of HIV-negative females were aware of their HIV status, compared to 37.8% and 35.6% respectively (HIV positive and HIV negative) of their male counterparts. Conversely, 62.2% of HIV-positive males and 45.0% of HIV-positive females were not aware of their sero-status.

Perceived susceptibility to HIV infection

The survey found that 39.6% of respondents believed that they were '*definitely not going to contract HIV*' and another 39.6% that they were '*probably not going to get HIV*' – thus suggesting that a large majority of respondents (79.2%) believed that they were not at risk of acquiring HIV. Although no significant sex differences were found on the two measures, they varied among the other four main reporting domains. Firstly, in terms of age, significantly higher percentages of those who were 50 years or older (54.3% of males and 30.9% of females) and 25–49 years (42.1% and 39.3% respectively) than of those aged 15–24 years believed they were not at risk. Secondly, in terms of race, significantly higher percentages of whites (75.6% and 23.3% respectively), Indians or Asians (75.0% and 22.3% respectively), and Coloureds (57.2% and 34.0% respectively) than black Africans believed they were not at risk. Thirdly, in terms of locality type, those in urban formal areas (47.3% and 36.1% respectively) and rural formal areas (44.2% and 36.5 respectively) believed they were less at risk of contracting HIV than those in urban informal and rural informal areas. Fourthly, and finally, in terms of provincial differences, those resident in the Western Cape (55.6% and 34.0% respectively), Northern Cape (51.1% and 32.8% respectively) and Gauteng (46.3% and 37.6% respectively) believed they were less at risk than those resident in the other six provinces.

Reasons for believing they are at low risk of contracting HIV

The most common reasons for holding the belief that one would not get infected with HIV were faithfulness to one partner (32.0%), trust in that partner (22.5%), abstaining from sex (21.3%), and using condoms (19.2%).

Reasons for believing they are at high risk of contracting HIV

The main reasons people believed they would get infected were that they were engaging in risky behaviours such as being sexually active (24.1%), not using condoms (22.4%), and not trusting the sexual behaviour of their partners (17.6%). The largest percentage, however (27.1%), did not specify the reasons for this belief.

Among the six key populations identified in this survey as being at higher risk of HIV infection, large majorities (range: 61.8%–78.2%) perceived themselves to be at low personal risk of contracting HIV. The explanations advanced for holding this belief and

those advanced by persons who believed they *would* get infected were similar to those put forward by the general population.

History of HIV testing and HIV risk perception

Those who believed they were at low risk of contracting HIV (62.3%) were less likely to have ever tested for HIV than those who believed they were at high risk (75.1%). The difference was statistically significant.

Those who believed they were at high risk of acquiring HIV were significantly more likely to be HIV positive compared to those who believed they were at low risk of HIV infection. Interestingly, 10.7% who thought they were at low risk were, in fact, HIV positive. This was more prevalent among females than males.

Knowledge of HIV transmission and prevention

The survey found that, overall, only 26.8% of South Africans had accurate knowledge about the sexual transmission and prevention of HIV.[8] The levels of HIV knowledge were found not to vary by sex but to vary significantly by age, race, locality type, and province as follows. Both youth aged 15–24 (24.3%) and adults aged 25–49 (23.4%) were more knowledgeable about sexual transmission of HIV than the elderly aged 50 years and older; more whites (43.3%) and Indians or Asians (41.4%) than black Africans and Coloureds; those in urban formal areas (31.7%) than those in the other three locality types; and those resident in the Free State (34.7%), Gauteng (31.7%), and the Western Cape (29.4%) than those in the other six provinces. Knowledge about HIV sexual transmission and prevention was significantly higher among five of the six key populations (range: 22.7%–27.6%) than among the disabled aged 15 years and older (17.7%).

There was a significant decrease in knowledge about HIV transmission and prevention between 2008 and 2012 among all three age groups of males, recreational drug users, black African males aged 25–49 years, and high-risk (alcohol) drinkers. The disabled were the least knowledgeable during both 2008 and 2012, with knowledge levels deteriorating from 23.3% in 2008 to 17.7% in 2012. It is also interesting to note that there were no sex differences in the level of knowledge among all age groups during both the 2008 and 2012 surveys.

Sources of information and perceived seriousness of HIV

The 2012 survey results indicated that television (TV) programmes were identified by about half of pre-adolescents aged 12–14 years[9], youth, and young adults as the most influential source of information that encouraged them to consider HIV as a serious condition. Radio programmes were identified by one-third of respondents across all age groups as a source of information, but coming a distant second after TV. Print media (newspapers and magazines) constituted the third most influential source of information. Other forms of communication were identified, overall, by less than one-tenth of respondents as being influential.

8 A composite measure of precise knowledge based on responses to three prompted questions and two local myths or misconceptions related to HIV transmission and prevention as recommended by UNAIDS (2013d) was used. The same items were also used in the 2008 survey, but as statements.

9 Just as with those 15 years and older, 12–14 year olds were also interviewed using age-appropriate modules.

A comparison across the three previous surveys showed that TV was the only medium which had been identified by respondents across all age groups (at about the 40%–50% rate) as having exerted a significant and consistent influence on their knowledge of HIV. Among those aged 12–14 years there was a considerable decline from 2005 to 2012 in the effectiveness of other sources of information in getting pre-adolescents to take HIV and AIDS more seriously. Similar and consistently declining trends were also observed in the three survey waves (2005, 2008, and 2012) among those aged 15–24 years, 25–49 years, and 50 years and older.

Attitudes towards PLHIV

Overall, large majorities of respondents expressed positive attitudes towards five of the six stigma questions that were broached in this survey (range: 79.0%–91.6%), with the question "*Would you be willing to care for a family member with AIDS?*" scoring the highest percentage of support. However, respondents were ambivalent toward one stigma question, namely, "*Would you want to keep the HIV-positive status of a family member a secret?*". Exactly half the respondents concurred with the statement. Overall, all the attitudes measured were mainly positive and had all changed for the better over the past three surveys.

Orphanhood

The overall level of orphanhood in 2012 among those 0–18 years of age and younger was 16.9% (maternal, 4.4%; paternal, 9.3%; double, 3.2%). This proportion is the same as that observed in the previous survey (in 2008), when the rate was 16.8%. A significantly higher proportion of orphans was found among black Africans (18.9%) than among the other race groups. Similarly, a significantly higher proportion of orphans was observed among those aged 15–18 years (30.6%) than among all the other age groups. KwaZulu-Natal had the highest proportion of orphans (23.1%) while the Western Cape had the lowest (7.5%).

Overall, the level of orphanhood has largely remained unchanged between 2008 and 2012 in the country. There was a slight increase in the number of orphans from 2008 to 2012, from 3,032,000 in 2008 to 3,132,041 in 2012. Similar increases occurred in both sexes over the two surveys, from 1,601,000 to 1,617,997 for males and 1,431,000 to 1,617,997 for females. Similar patterns were seen among maternal orphans (713,000 in 2008; 809,778 in 2012) and among double orphans (419,000 in 2008; 593,461 in 2012). However, there was a decrease among paternal orphans from 1,899,000 in 2008 to 1,730,471 in 2012.

Recommendations

There is a need to invest available resources prudently for an evidence-based, diversified and comprehensive response to the HIV and AIDS epidemic that balances the imperatives of both treatment and prevention in order to appropriately address the complex epidemic in South Africa. In particular, there is a need to accelerate the implementation of social and behavioural change communication (SBCC) campaigns which address risky behaviours such as having multiple sexual partnerships, early sexual debut, age-disparate relationships, and inconsistent condom use. In an era of increased access to ART, it is crucial to reduce the possibility of risk compensation – that is, an increase in risky behaviour in response to the wider availability of ART. In view of the false sense of security observed among some respondents in this survey whereby, based on inaccurate information, some people do not feel that they are at risk of HIV infection, there is a need to design prevention programmes that aim to help everyone understand, through the personalisation of information, the risk of acquiring HIV.

It is necessary to revive the health promotion campaign to educate the public even about the basic message of "Abstain, Be faithful, Condomise" (or simply ABC) to equip the population with basic knowledge about HIV prevention as was done during the pre-ART era.

In view of the lower HIV testing rates found among men, it is recommended that the HCT campaign be strengthened, through scaling up of testing in other settings such as mobile HCT and work-place testing as well as by traditional healers, to encourage men to be tested for HIV. Men could also benefit from the recent launch of the national VMMC campaign on World AIDS Day on 1 December 2013 by the Deputy President in his capacity as Chair of SANAC.

The finding that key populations who are at higher risk of HIV exposure do not perceive themselves to be at risk and that they continue to engage in high-risk behaviour suggests that SANAC should ensure that targeted interventions are designed and are systematically and vigorously implemented among these groups.

The survey found higher HIV prevalence and incidence among unmarried compared to married persons. The survey findings suggest that there was a strong association between marital status and multiple sexual partnerships, with unmarried persons having higher rates of multiple sexual partners. More analysis is needed to disentangle this complex relationship.

Age-disparate relationships are considered a major behavioural risk factor for HIV infection among young females; hence the urgent need to discourage this behaviour. This can be achieved through the design of targeted SBCC interventions for young females to raise awareness about the risk of such relationships. In addition, there is a need to intensify efforts to change widely held community norms that accept such practices. Since age-disparate relationships have been associated with financial gain, it is necessary to ensure that girls and young females are empowered and have access to education and employment to break the cycle of poverty. SANAC's recent appointment of a service provider to develop such an intervention is a most welcome development.

The survey found that despite the recent achievements with the VMMC programme South Africa is unlikely to meet its target for medical male circumcision – 1.6 million between 2012 and 2016 according to NSP 2012–2016, let alone 4.3 million according to experts. It is therefore recommended that SANAC and its various structures especially traditional leaders and the SANAC Men's Sector work together to increase awareness and demand for VMMC. These groups should also collaborate on finding ways of integrating VMMC into traditional rites of passage. With respect to children, there is a need to develop policy and programmatic options for the circumcision of both neonates and young adolescents before they start having sex.

In the light of the high HIV prevalence and incidence in informal settlements, it is recommended that SANAC and its partners, especially the NDOH and the Department of Social Development, design and roll out a comprehensive combination package of HIV prevention and treatment interventions that are targeted at residents of informal settlements. Together with other government departments, SANAC should seek to reduce the poor housing conditions, poverty, and unemployment that characterise informal settlement areas and create an HIV risk environment.

1. INTRODUCTION

1.1 Background

Previous national household surveys have shown that South Africa has the largest number of people living with HIV globally and that the HIV epidemic is generalised. It has also been established that the epidemic is heterogeneous with wide variations in HIV prevalence across age, race, sex, socio-economic status and geographical location (Shisana, Rehle, Simbayi et al. 2009).

Over the past decade, considerable strides have been made in managing the epidemic. Given the large population of people living with HIV (PLHIV), as well as contextual factors that continue to drive new HIV infections, South Africa has implemented an effective evidence-based response focused on HIV prevention, treatment, care and support. In relation to PLHIV, South Africa has revised its policy on treatment access to enable all HIV-positive tuberculosis (TB) patients – irrespective of their CD4 count – to access treatment. With regard to bolstering efforts to increase utilisation of antiretroviral treatment (ART) for mothers and infants, there has been a strong emphasis on providing treatment to maternal HIV cases, pregnant females and HIV–positive mothers now being provided with ART regardless of their CD4 count. This strategy has increased the number of people on treatment and has reduced AIDS mortality in the country (UNAIDS, 2012a).

Regarding HIV prevention, there has been increasing evidence of a 'turning tide' in HIV incidence, with declines in new infections occurring among various age categories (Gouws, 2010; Rehle, Hallet, Shisana et al. 2010; Shisana, Rehle, Simbayi et al. 2009). Furthermore, although HIV prevalence in South Africa is high, it has been stable over the past decade in the general population (NDOH, 2013; Shisana, Rehle, Simbayi et al. 2009; SANAC, 2011a) as well as among pregnant females attending antenatal services (NDOH, 2012, 2013; SANAC, 2011a; Shisana, Rehle, Simbayi et al. 2009).

A decline in the transmission of mother-to-child infections rate at six weeks has been observed over the past few years, indicating that policy changes in conjunction with improved implementation of the prevention of mother-to-child transmission (PMTCT) programme have been effective. Important changes include starting ART for PMTCT at 14 weeks of pregnancy or as soon as possible thereafter, instead of only during the last trimester of pregnancy (NDOH, 2010). In the first national evaluation of PMTCT impact conducted by the Medical Research Council (MRC) of South Africa and the Department of Health, it was found that HIV transmission from mother to child was reduced from 3.5% in 2010 to 2.7% in 2011 (MRC National SAPMTCT Survey, 2011; RSA Global Progress Report, 2012; also see Pillay, Dinh, Goga et al. 2012).

Another important achievement has been the increase in government spending on HIV and AIDS programmes, especially in relation to meeting costs of ART and treatment for opportunistic infections (RSA Global Progress Report, 2012; National Treasury, 2012) supported by bilateral and international donors. Such funding commitments have also contributed positively to the country's ability to implement effective HIV-prevention interventions. For example, there has been an expansion in the availability of HIV Counselling and Testing (HCT) as well as increases in the number of people who know their HIV status. It is reported that an estimated 13.4 million people reported to have been tested for HIV during an HCT campaign which was completed in June 2011 (Mbengashe, Nevhutalu, Chipimo et al. 2012).

In line with evidence indicating that voluntary medical male circumcision (VMMC) is effective in preventing HIV infections in heterosexual men (Auvert, Taljaard, Lagarde

et al. 2005; Bailey, Moses, Parker et al. 2007; Wawer, Makumbi, Kigozi et al. 2007), the South African government introduced a voluntary medical male circumcision (VMMC) campaign in 2010. The campaign has a target of completing 4.3 million circumcisions by 2015 (Njeuhmeli et al. 2011). Although challenges exist in terms of encouraging men to accept VMMC – especially among groups that practice traditional male circumcision (Sabet Sarvestani, Bufumbo, Geiger and Sienko, 2012) – there has still not been enough progress in implementing the MMC campaign so far. Traditional male circumcision is performed as part of initiatory rites of passage by many black African cultural groups such as Xhosa, South Sotho, Ndebele, Pedi and Venda (see Connolly, Simbayi, Shanmugam & Mqeketo, 2008). It is often conducted under unsterile conditions in non-medical settings such as in the mountain/in the bush/initiation school. Often steeped in secrecy, it varies between partial to full removal of the penile foreskin in different cultures and, unlike with its medical counterpart, is not recommended as a strategy for the prevention of HIV infection by the World Health Organisation (WHO). Studies indicate that the number of men who are circumcised in the country using different methods increased from 35.1% in 2002 to 42.8% in 2008 (Connolly, Simbayi, Shanmugam et al. 2008; Shisana & Simbayi, 2002; Shisana, Rehle, Simbayi et al. 2009). It has also been reported that approximately 250,000 men had been circumcised through the VMMC programme in 2011 (Third South African National HIV Communication Survey, 2012), and by the end of March 2013 it was estimated that overall numbers had increased to 910,330. Total VMMCs done between 2010 and August 2013 are estimated at 1,234,600.[10] This includes some 329,000 circumcisions that were carried out by non-governmental organisations (NGOs) supported by the United States President's Emergency Plan for AIDS Relief (PEPFAR) programme (see Malan, 2013). This is a new programme and so scale up will be slow; also this programme uses doctors and the forceps method and with the introduction of a circumcision device the numbers will increase rapidly.

To minimise the risks of sexual transmission of HIV, there has been a sustained effort to make condoms accessible through the free condom distribution programme funded by government. It is estimated that over 399 million male condoms have been distributed annually through this programme (Health System Trust, 2013).[11] High levels of condom distribution have also been correlated with increased levels of reported use of condoms at last sex in successive national surveys (Shisana & Simbayi, 2002; Shisana, Rehle, Simbayi et al. 2005, 2009).

These examples of South Africa's evidence-based treatment and prevention strategies are underpinned by ongoing political commitments made by government that are complemented by domestic and/or international partnerships as well as civil society mobilisation in response to the epidemic.

Internationally, South Africa is a signatory to both the 2001 UNGASS Declaration of Commitment and the 2006 Political Declaration on Universal Access 2011 Resolution 65/677 aimed at intensifying efforts to eliminate HIV. At a national level, SANAC is committed to providing strategic direction through the NSP on HIV and AIDS, STIs and TB for 2012–2016 (SANAC, 2011a). The NSP sets national targets and is used to monitor the country's response to the changes in the HIV epidemic. The 2012–2016 NSP sets out four key strategic objectives: 1) addressing social and structural barriers that increase

10 Personal communication, Dr Yogan Pillay, NDOH December 2013.

11 The Department of Health maintains that 530 million male condoms and 11.7 million female condoms were distributed in 2012/13 financial year, personal communication, Dr Yogan Pillay.

vulnerability to HIV, STI and TB infection; 2) preventing new HIV, TB and STI infections; 3) sustaining health and wellness; and 4) increasing the protection of human rights and improving access to justice. Further guidance is provided by various analytic reports, including the Know Your Epidemic (KYE) report (SANAC, 2011b), a situational analysis of TB in the country (Tuberculosis Strategic Plan for South Africa 2007–2011, 2011; see also Setswe & Zuma, 2013) and other epidemiological studies (Rehle, Hallet, Shisana et al. 2010).

In line with the global vision to end the HIV epidemic, SANAC has adopted the vision of the Joint United Nations Programme on HIV and AIDS (UNAIDS) that focuses on the goals of zero new HIV and TB infections; zero new infections due to vertical transmission; zero preventable deaths associated with HIV and TB; and zero discrimination associated with HIV and TB (UNAIDS Strategy 2011–2015). The data from the present national survey informs progress to date and also provides guidance towards future strategic plans.

Since 2002, the HSRC has conducted national surveys that have contributed to understanding the extent of the HIV epidemic, and that have assessed changes over time (Shisana & Simbayi, 2002; Shisana, Rehle, Simbayi et al. 2005, 2009). While these surveys have increased understanding of the extent of the HIV epidemic in South Africa as well as related socio-behavioural and contextual factors, they have also highlighted the heterogenous nature of the epidemic in the country. For example, there are marked variations in the prevalence of HIV in different geographic (or locality type) areas and the timeframes within which the virus has spread in various sub-regions or provinces of the country. Additionally, increased uptake of ART has the potential to markedly influence HIV prevalence patterns, requiring more sophisticated approaches for analysis and interpretation of data.

The inclusion of novel laboratory methodologies such as multi-assay algorithm for HIV-incidence testing and High Performance Liquid Chromatography (HPLC) coupled to Tandem Mass Spectrometry for antiretroviral drug testing in the present survey protocol has now enabled direct estimates of HIV incidence and exposure to antiretroviral treatment (ART). The advancements in survey design and methodology pioneered by the HSRC have thus added a new dimension in data triangulation and enhanced data interpretation. This 'third-generation HIV surveillance' approach aligns with globally recognised best practice for HIV surveillance (Rehle, Hallet & Shisana et al. 2010; Shisana, Zungu, & Simbayi, in press).

1.2 Key determinants of HIV transmission

The rate of new HIV infections is related to the interplay among biological vulnerabilities, socio-behavioural and contextual factors. Girls and women are physiologically more vulnerable to HIV through heterosexual transmission than boys and men, and these biological factors vary in relation to age as well co-factors including contraceptive use, among others (Quinn & Overbaugh, 2005). HIV surveys in South Africa and elsewhere have also illustrated the relationship between diverse contextual factors and vulnerability to HIV. Such understanding has contributed to the adoption of a broader strategic response that recognises the interplay between biomedical, behavioural and structural factors (UNAIDS, 2010). For example, in South Africa, among the general population, biological risk factors for HIV infection include co-infection with viral and bacterial sexually transmitted infections (STIs) and low rates of medical male circumcision (Auvert, Taljaard, Lagarde et al. 2001; Chen, Jha, Stirling et al. 2007; Mattson, Campbell, Bailer et al.

2008; Weiss, Hankins, & Dickson, 2009). Socio-behavioural factors include having multiple sexual partners, having unprotected sex, use of alcohol before sex and being exposed to sexual violence (Mattson, Campbell, Bailer et al. 2008; Morojele, Kachieng, Mokoko et al. 2006; Parry, Rehm, Poznyak, & Room, 2009). Underlying structural factors include wealth disparities and high levels of migration (SADC, 2006). Important focal areas for change include the following:

- **Condom use:** Condoms when used correctly and consistently are an effective means to prevent HIV infection. Risk, however, persists when condoms are not used correctly and consistently (Kalichman, Simbayi, Kaufman et al. 2007; Msamanga, Tchetgen, Spiegelman et al. 2009).While there are high levels of self-reported condom use at last sex, particularly among youth, condom use remains a challenge in the older age groups (Shisana, Rehle, Simbayi et al. 2009; Reddy, James, Sewpaul et al. 2013). Condom use with primary partners – either spouses or steady partners – tends to be lower than with condom use with non-regular partners as well as being lower among older persons (Dhalla & Poole, 2009; Hargreaves, Morison, Kim et al. 2009; Peltzer, Swartz, Naidoo et al. 2012; Shisana, Rehle, Simbayi et al. 2009). Although there is an increase in the distribution of female condoms, they are still not sufficient to meet the demand. Therefore, promoting both consistent use of both male and female condoms remains important focal prevention opportunities.
- **Knowledge of HIV and AIDS:** Knowledge about HIV transmission and prevention accompanied by appropriate reduction in behavioural risk practices are important in combating and reversing the spread of HIV (MDG Report, 2012). However, knowledge of HIV remain low in sub-Saharan Africa (UNAIDS, 2013a) and there is limited evidence to show that knowledge is internalised and translated into preventative practices (Sathiparsad & Taylor, 2006). In South Africa, there have been mixed findings with regards to HIV-related knowledge (van Loggerenberg et al. 2012). In contrast to the two previous national household HIV prevalence surveys (2002, 2005), the results from the 2008 survey (Shisana, Rehle, Simbayi et al. 2009) found a significant decrease in accurate knowledge about HIV transmission and prevention among all age groups when a composite UNAIDS indicator on knowledge was used. Knowledge of other HIV risk-reduction measures such as faithfulness, partner reduction and abstinence are reported to also be relatively low (Shisana, Rehle, Simbayi et al. 2009) suggesting that promoting HIV-related knowledge and awareness remains to be an area of focus.
- **HIV testing:** Maintaining awareness of one's HIV status through regular HIV testing is considered to be an important entry point to a comprehensive package of care for HIV and AIDS prevention and treatment (NDOH, 2010). Population-level HIV testing in South Africa is among the highest globally, with a large proportion of South Africans knowing their HIV status (UNAIDS, 2008; Shisana, Rehle, Simbayi et al. 2009). However, it remains necessary to maintain high levels of HIV status awareness, including understanding the stages of HIV infection necessary for ART qualification. In addition to acting as a treatment for HIV that prolongs lives, ART also reduces HIV viral load, which, in turn, decreases the likelihood of onward transmission of HIV (Donnell, Baeten, Kiarie et al. 2010).
- **Early sexual debut:** Initiating sexual activity at an early age increases lifetime risk of acquiring HIV and is associated with other HIV risk factors including alcohol use, unprotected sex, unplanned pregnancy, and multiple sexual partners (Cooper, Hoffman, Carrara et al. 2007; McGrath, Nyirenda, Hosegood et al. 2009; Kaestle, Halpern, Miller et al. 2005; Wand & Ramjee, 2012; Zuma, Setswe, Ketye et al. 2010;). Emphasis on delaying sexual debut remains an important focus for HIV prevention among adolescents.

- **VMMC and HIV:** VMMC significantly reduces the likelihood of HIV infection among heterosexual men (Byakika-Tusiime, 2008; UNAIDS, 2013c). Modelling estimates indicate that achieving high coverage of VMMC will markedly reduce new infections at among men. South Africa's VMMC roll-out remains a key component of the national HIV prevention strategy (SANAC, 2011a, 2011c), but much still needs to be done to meet the set targets.
- **Multiple sexual partnerships (MSP):** Having multiple sexual partners increases the likelihood of exposure to HIV through expanding sexual networks. During the acute phases of HIV infection the viral load is high, increasing the risk of transmission. Having concurrent sexual partners exacerbates this risk (Halperin & Epstein, 2007; Mah & Halperin, 2010; Shelton, 2009). It has been argued that concurrency does not fully explain the high HIV epidemic in Sub-Saharan Africa (Lurie & Rosenthal, 2009; Sawers & Stillwagon, 2010); Sawers 2013, as concurrent partners do not raise individual's risk of acquiring HIV any more than having a non-concurrent partner. Although the contributory effects of concurrency are diminished in high HIV prevalence settings, it remains crucial to reduce exposure to multiple sexual partnerships irrespective of concurrency (Tanser, Barnighausen, Hund et al. 2011). Reducing partner turnover, and overall numbers of sexual partners, is therefore a key component of an effective HIV prevention response.
- **Sero-discordancy among mother and child pairs:** The phenomenon of HIV sero-discordant mother-child pairs in South Africa was first identified by the University of Stellenbosch researchers who found two siblings who were HIV positive and yet their parents were HIV negative (Hiemstra, Rabie, Schaaf et al. 2002). Sero-discordant pairs were also observed among 15 children and parents in a national household survey (Shisana & Simbayi, 2002). However, that survey was unable to confirm that the parents of the 15 children identified were biological parents since it was not possible to do further DNA tests. To investigate this further, a large survey of more than 4,000 children was conducted in the Free State (Shisana, Mehtar, Mosala et al. 2005). The survey found seven sero-discordant mother-child pairs which warrants further epidemiologic investigation. Currently we do not know how these children became HIV positive.
- **Stigma and discrimination:** HIV and AIDS-related stigma and discrimination remain major barriers to effective HIV prevention as well as to the provision of treatment, care and support in many countries across the globe including South Africa (UNAIDS, 2013b). An important aspect of such stigma is the phenomenon of 'othering' whereby some people do not believe they are themselves at risk of HIV infection on account of their sex, race, creed, religion, sexual preferences or national origin (Petros, Airhihenbuwa, Simbayi, Ramlagan & Brown, 2006). These attitudes remain in spite of the excellent progress that has been achieved by many countries in the East and Southern African region, including South Africa, which have committed themselves to a rights-based response through their NSPs (UNAIDS, 2013c). The 2005 HIV household survey in South Africa reported some decline in both external stigma and discrimination directed towards PLHIV when compared to the 2002 survey (see Shisana, Rehle, Simbayi et al. 2005). It has also been suggested that scaling up HCT would help to both 'normalise' and 'destigmatize' HIV (Obemeyer, Bott, Carrieri et al. 2009). ART programmes are also noted to reduce stigma as a product of weakening the link between AIDS and death, and fostering support for PLHIV (Zuch & Lurie, 2012). It is therefore important to assess whether stigma and discrimination towards PLHIV has continued to decrease as a result of intensified HCT and ART programmes.

1.3 Aims and objectives

1.3.1 Aims

To conduct surveillance of HIV infection and behaviour in South Africa; to obtain a better understanding of factors driving the HIV epidemic; to collect data for monitoring of the last NSP for 2007–2011; and set a baseline for the current NSP for 2012–2016.

1.3.2 Main objectives

1. To determine prevalence and incidence of HIV infection in South Africa in relation to social and behavioural determinants; and
2. To determine the proportion of males in South Africa who are circumcised.

1.3.3 Secondary objectives

1. To determine the proportion of PLHIV who are on ART in South Africa;
2. To determine the extent to which mother-child pairs include HIV-negative mothers and HIV-positive infants; and
3. To describe trends in HIV prevalence, HIV incidence, and risk behaviour in South Africa over the period 2002 to 2012.

2. METHODOLOGY

2.1 Survey design

The 2012 survey design and write-up was based on the validated and reported methods used in the previous surveys carried out in 2002, 2005, and 2008 where a multi-stage stratified cluster sampling design was applied (Shisana & Simbayi, 2002; Shisana, Rehle, Simbayi et al. 2005, 2009). In previous surveys, at most three or four people in a sampled household were randomly selected to participate in the survey based on pre-determined age categories (Shisana & Simbayi, 2002; Shisana, Rehle, Simbayi et al. 2002, 2005, 2009). In 2012, a more robust and representative approach was followed whereby all household members were included. This approach enabled analyses linking HIV results obtained from co-habiting or married sexual partners and also mother-child pairs. The data on HIV sero-discordancy between co-habiting or married sexual partners are not presented in this report but will form part of a separate analysis for a peer-reviewed paper.

2.2 Survey population

The survey sample was inclusive of persons of all ages living in South African households and hostels. In selected households/hostels, all household members were invited to participate in the survey. A 'household member' was defined as any person who slept in the household on the night preceding the survey (including visitors who spent the night before the survey in this household). This is the most widely-accepted definition of 'household member' and is consistent with other surveys as well as the national population census. Persons living in educational institutions, old-age homes, hospitals, correctional facilities and uniformed-service barracks as well as homeless persons were excluded from the survey.

2.3 Sampling

As with the previous surveys, a multi-stage disproportionate, stratified cluster sampling approach was used. The steps taken to draw the sample are shown in Figure 2.1.

Figure 2.1: Steps in drawing the sample

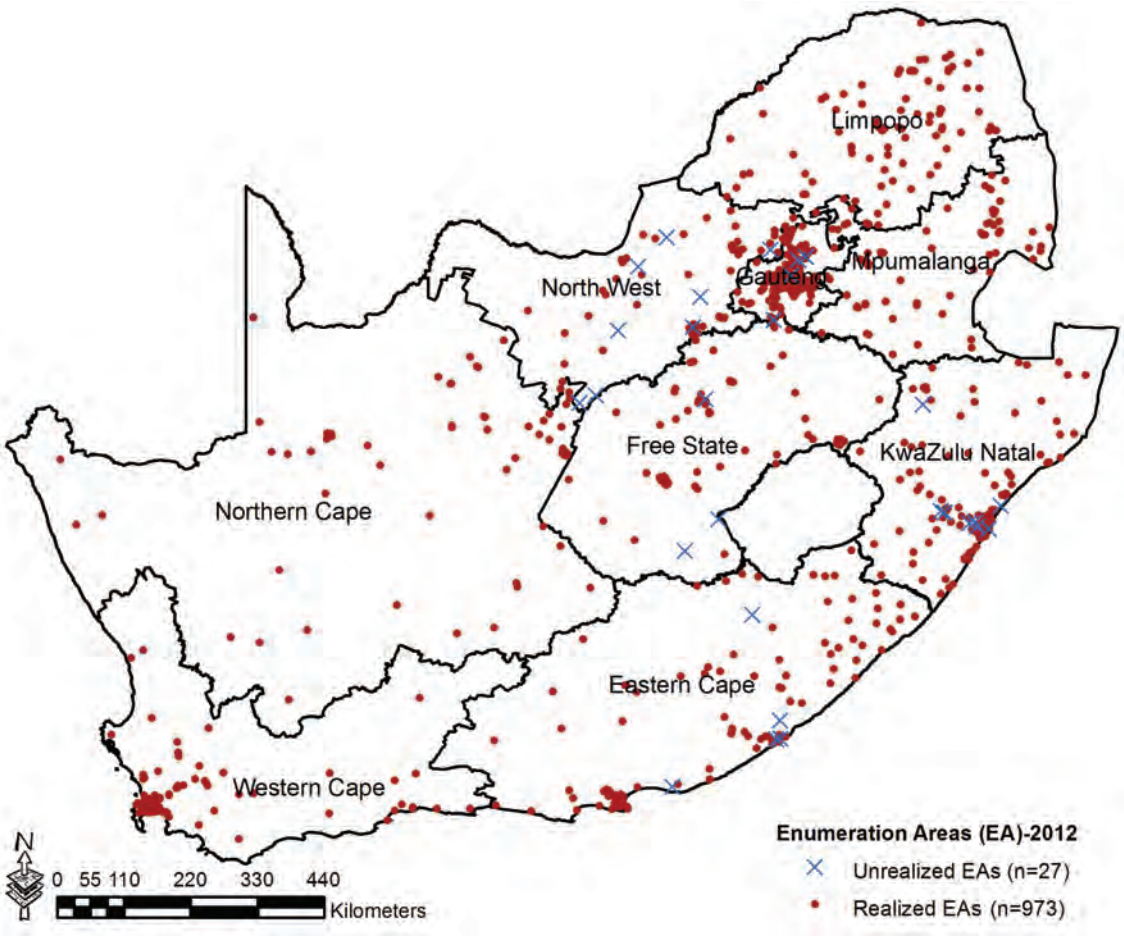
1. **Define the target population:** All people in South Africa
2. **Define the sampling frame:** 2001 national population census from which 1000 EAs were sampled
3. **Define primary sampling units (PSUs):** 1000 EAs sampled from census 2001 database of EAs
4. **Define measure of size (MOS):** 2001 estimate of visiting points (VPs), MOS was used in sampling 1000 EAs
5. **Allocation of sample:** Disproportional allocation of EAs to province, race group and locality type
6. **Define strata:** Province (n = 9) and locality type (n = 4)
7. **Define reporting domains:** Locality type (n = 4), age group (n = 4), sex (n = 2), and race group (n = 4)
8. **Define secondary sampling units (SSUs):** 15 VPs sampled from each of 1000 EAs
9. **Define ultimate sampling unit (USU):** All individuals in the household to participate in the survey.

A total of 1,000 census enumeration areas (EAs) from the 2001 population census were selected from a database of 86,000 EAs that were mapped in 2007 using aerial

photography.[12] Of the 1,000 EAs, there were 973 realised EAs, and 27 were unrealised (see map of distribution of EAs in Figure 2.2).

The EAs served as the basis for the new updated 2007–2011 HSRC master sample for selecting households. Aerial photographs drawn from *Google Earth* were also utilised to ensure that the most up-to-date information was available for the master sample. The selection of EAs was stratified by province and locality type. Locality types were defined as urban formal, urban informal, rural formal (including commercial farms), and rural informal localities. In South Africa urban informal settlements or slums are poor areas where there is a very high mobility of people. Often the residents come from either rural informal areas (i.e., villages in tribal authority areas) seeking economic opportunities in cities or are a result of an overflow from formal areas. Many of these areas were supposed to be temporary structures, while waiting for the government to provide free or subsidised housing. In most cases, these temporary shelters have become permanent structures with complex dynamics and a concentration of the poorest and the most vulnerable (see David, Mercado, Becker et al. 2007).

Figure 2.2: Realised and unrealised EAs, South Africa 2012

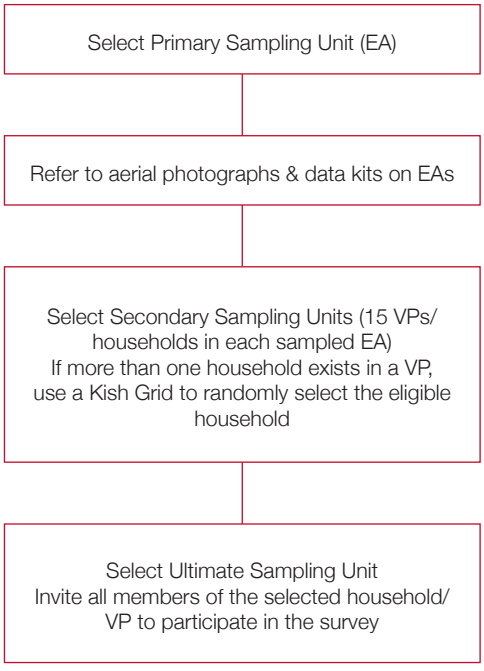


12 2011 census data were not available for updating the master sample used in this survey.

In formal urban areas, race was also used as a third stratification variable (based on the predominant race group in the selected EA at the time of the 2001 census). The allocation of EAs to different stratification categories was disproportionate, meaning that over-sampling or over-allocation of EAs occurred in areas that were predominantly populated by Indian or Asian and white race groups. This was done to increase the chances of selecting small populations of both whites and Indian or Asians to meet the required minimum sample size.

The selected 1,000 EAs formed the primary sampling units (PSUs). Visiting points (VPs) or households were used as secondary sampling units (SSUs). Within each household, all household members selected for the survey (including consenting and non-consenting household members) constituted the ultimate sampling unit (USU). To obtain an approximately self-weighted sample of visiting points (i.e., SSUs), the EAs were sampled by probability proportional to the size of the EA using the 2001 census estimate of the number of visiting points in the EA database as a measure of size (MOS). A random sample of 15 VPs was selected from each of the 1,000 EAs, yielding a total sample size of 15,000 households or VPs. A VP was defined as a stand with a physical address that might have one or more residential households. A household was defined as a group of people who live and eat together 'from the same pot'. If multiple households existed in a visiting point, a Kish grid[13] (Kish, 1965) was used to randomly select an eligible household where all members of the selected household were eligible to participate. Figure 2.3 shows the sampling approach in the field.

Figure 2.3: Steps in drawing the sample in the field



13 A method of selection of households where there are multiple households.

2.4 Sample size estimation

As in the previous surveys, the sample size estimation was guided by the following two requirements: (i) to measure change over time and to be able to detect a change in HIV prevalence of five percentage points in each of the five main reporting domains – namely, sex, age group, race, locality type, and province (5% level of significance, 80% power, two-sided test); and (ii) to have an acceptable precision of estimates per reporting domain, that is, to be able to estimate HIV prevalence in each of the main reporting domains with a precision level of less than ± 4 %, which is equivalent to the expected width of the 95% confidence interval (z – score at the 95% level for two-sided test). A design effect of 2.0 was assumed for possible clustering of HIV at household and EA level.

2.5 Measures

The following four questionnaires adapted from questions used in previous surveys were employed:

- Household Questionnaire,
- Questionnaire for parent/guardian of children aged 0 to 11 years,

Table 2.1: Household questionnaire

Section/module	Household information	Personal information
Geographic location of household	✗	
Interview details	✗	
Refusal particulars	✗	
Source, availability and distance to potable water	✗	
Type of sanitation	✗	
Energy sources	✗	
Household amenities	✗	
Number of rooms	✗	
Measures of income Qualitative assessment of household economic situation Actual income	✗	
Relationship		✗
Sex		✗
Age		✗
Population group		✗
Language		✗
Receipt of grants		✗
Parental survivorship and orphans		✗
Recent injuries		✗
Education • Highest level • Enrolment • Repetition		✗

- Questionnaire for children aged 12 to 14 years, and
- Questionnaire for persons aged 15 years and older.

Table 2.1 shows the modules contained in the Household Questionnaire. It was used to record a census of each household studied and to record household level information as well as some personal information.

The various modules contained in each of these individual questionnaires are shown in Table 2.2. In the present survey, modules added included measures of consistency of condom use, concurrency of sexual partners, community violence and mental health as well as demographic and health indicators. In addition, the demographic and health indicators for reproductive health included fertility, maternal and child mortality as well as maternal and child health from the Demographic and Health Surveys (DHS).[14] The results on these demographic and health indicators are to be published in a separate report.

Table 2.2: Questionnaires completed for each individual

Questionnaire module	Children aged 0 to 11 years (reported by parent/guardian)	Children aged 12 to 14 years (self-reported)	Youth and adults aged 15 years and older (self-reported)
Demographics: Age, sex, race, nationality, employment, marital status – employment and marital status not included in the child 0–11 and 12–14 questionnaire, etc.)	✗	✗	✗
Orphan status: Parental survivorship and residence (under 19 years) Age of child at death of parent	✗	✗	✗ (under 19 years only)
Education: School attendance Reasons for missing school	✗ (5 to 11 years)	✗	✗ (under 19 years only)
Delivery and care details: Mother's use of antenatal services, Type of delivery services and PMTCT services			✗ (Females 15 to 54)
Infant feeding practices: 24 hour feeding practices Feeding in first six months	✗ under 6 months 6 months and older		
Child health services: Vaccinations received Diarrhoea	✗		

→ *continued*

14 The relevant modules were provided by ICF Macro in 2010.

Questionnaire module	Children aged 0 to 11 years (reported by parent/guardian)	Children aged 12 to 14 years (self-reported)	Youth and adults aged 15 years and older (self-reported)
Care and protection at school: Safety and sexual harassment at school		✗	✗ (under 19 years only)
Life education Information about sex and exposure to information about sexual abuse	✗ (5 to 11 years)	✗	✗ (under 19 years only)
Fertility/Reproduction: Pregnancy and birth history Type of births (still, live, etc.) Child mortality Current pregnancy			✗ (Females 15 to 54 years)
Contraception: Knowledge of different methods Ever and current use Source of current method			✗
Maternal mortality: Number of siblings Number of sibling deaths			✗ (Females 15 to 54 years)
Media, communication and norms: Media use Sources of HIV information Participation in HIV activities	✗ (only media use-5 years and older)	✗	✗
Knowledge, attitudes, beliefs and values ;about HIV and AIDS and about HIV-related practices and behaviours		✗	✗
Sexual history: Sexual debut Partner history Sexual orientation Concurrency Age disparate sex Condom use (at last sex and consistent)		✗ (Only sexual debut)	✗
Male circumcision: Circumcision status Age and place of circumcision Reasons for circumcision Complications related to circumcision	✗	✗	✗
Condoms: Access to condoms Extent of condom use			✗

→ *continued*

Questionnaire module	Children aged 0 to 11 years (reported by parent/guardian)	Children aged 12 to 14 years (self-reported)	Youth and adults aged 15 years and older (self-reported)
HIV testing and risk perception: Testing history Source and testing reason Risk perception			✗
Drug and alcohol use: Use and impact Smoking exposure	✗ (Exposure to use within household)	✗ (Exposure to use within household)	✗
Health status including hospitalisation: history	✗	✗	✗
Mental health: Emotional wellbeing Use of services			✗
Crime: Prevalence and type of crime	✗ (Only household level)	✗	✗
Violence in relationships: Extent of intimate partner violence			✗
Health service utilisation: Access and barriers			✗

Among some of the key behavioural indicators that are presented in this report are:

- **Consistency of condom use.** This was measured by asking the following question: *How often do you use a condom with this particular partner?* The response choices were:
  Every time 1
  Almost every time..... 2
  Sometimes 3
  Never 4
- **Multiple sexual partnerships.** These were measured through indication of sex of sexual partners and total number of sexual partners in the past 12 months.
- **Concurrent multiple sexual partnerships.** These were measured through indication of whether a person had more than one sexual partner and then filtered by the two following questions:
  (i) Did any of these relationships mentioned above overlap with each other?
  (ii) Currently are you in any of these relationships that overlap with each other?
- **Knowledge of HIV and AIDS.** This survey utilised a composite measure of precise knowledge based on responses to three prompted questions related to HIV prevention, namely, "To prevent HIV infection, a condom must be used for every round of sex", "One can reduce the risk of HIV by having fewer sexual partners", and "Can a healthy-looking person have HIV in combination with rejecting two myths and misconceptions about the disease, namely, "Can AIDS be cured", and "Can a person get HIV by sharing food with someone who is infected" as recommended by UNAIDS (2013d). In addition,

we also asked the question "Can HIV be transmitted from a mother to her unborn baby". In terms of knowledge about HIV transmission and prevention, if a participant answered the first three set of questions correctly they scored 1, whereas if they answered any of the questions incorrectly they scored 0 (UNAIDS, 2013d). Concerning misconceptions about HIV transmission, if participant correctly rejected the two myths and misconceptions about the disease they scored 1, whereas if they answered any incorrectly they scored 0 (UNAIDS, 2013a). In this report, we only present to the proportions of participants who correctly answered both combinations of questions.

All questionnaires, information sheets and informed consent forms were translated into relevant local languages and pre-tested during the preparatory work.

The survey protocol including questionnaires was shared with NGOs and research agencies for the research team to obtain comments and input. Two consultative meetings were held where questionnaires measures and protocol were presented. Some adaptations were made to the initially proposed sex violence and mental health modules. Emphasis was also placed on standardising indicators to ensure effective tracking of various domains over time.

2.6 Ethical considerations

The survey protocol was approved by the HSRC's Research Ethics Committee (REC: 5/17/11/10) as well as by the Associate Director of Science of the National Centre for HIV and AIDS, Viral Hepatitis, STD and TB Prevention at the USA's Center's for Disease Control and Prevention (CDC) in Atlanta. The HSRC's REC has Federal Wide Assurance (FWA) for the Protection of Human Subjects accreditation with the USA's Department of Health and Human Services (DHHS).

2.6.1 Informed consent procedures

All persons who agreed to participate in the survey were required to provide either written or verbal consent for both the interview and dry blood spots (DBS) specimen collection. Verbal consent was applied where the respondent was illiterate. CDC granted a waiver of written consent per 45CFR46 for cases where respondents were unable to provide written consent but were able to consent verbally. Where such situations arose, field staff signed on behalf of the respondent certifying that informed consent had been given verbally by the respondent. In addition, a witness signed to certify that informed consent had been given verbally by the respondent. Parents and guardians of children under 18 years of age were asked to give informed consent for inclusion of their children in the survey as well as for providing a blood specimen for HIV testing. Children aged 7 to 11 years were required to confirm their assent by placing a tick or cross in a demarcated box in addition to providing written consent by means of a signature (where possible). Those aged 12 to 17 years were required to provide written assent by means of a signature. Data collectors gave each consenting individual a copy of the consent form.

Field staff were trained in informed consent procedures to ensure that voluntary informed consent was obtained from all respondents. The research that was undertaken on children adhered to the South African Children's Act of 2007.

2.6.2 Procedures to ensure confidentiality

Individual interviews were held in a private setting either inside or outside of the household with each respondent. Efforts were made to avoid interference from

other members of the household. No names of respondents were recorded on the questionnaires or on the blood specimens. Instead, barcodes were placed on the questionnaires and the blood samples, thereby allowing the two components to be linked. To ensure further confidentiality, data were analysed nationally, provincially, and by locality type but not by smaller geographic units.

2.6.3 Provision of HIV test results to survey respondents

A key difference from preceding surveys related to provision of HIV test results to survey respondents. A requirement of the main funder of the survey, namely, CDC on behalf of the President's Emergency Fund for AIDS Relief (PEPFAR), was that respondents be provided with an opportunity to access their HIV test results as obtained from the survey.

All respondents who agreed to provide a DBS sample for HIV testing were provided with an HIV Specimen Result Request Voucher referring them to a nearby HIV Counselling and Testing (HCT) centre[15] to access their HIV test results. This voucher had a unique respondent questionnaire number and duplicate barcode that allowed clinic staff to correctly link the HIV laboratory results to referred survey respondents. Additional information captured on the voucher included the sex and age of the respondent, date of result collection, and the name and address of the selected clinic. Special specimen results coordinators were appointed to hand deliver a printout of all respondents' HIV test results in each EA to the nurse/supervisor in charge of HCT at a clinic within or nearest to the particular EA.

Respondents were able to collect their results eight weeks after their dry blood spot (DBS) samples were collected from the field. This period allowed for sufficient time for samples to be couriered to the laboratory for HIV antibody testing, and the preparation of HIV results spreadsheets which were sent to the clinics so that respondents could access their test results. The HCT Counsellors at the clinic were expected to apply the standard NDoH's HCT protocols when survey respondents presented at the clinic. This typically involved conducting pre-test counselling, providing results, and then conducting post-test counselling.

The survey did not monitor whether individuals tested in government facilities were referred for treatment. From November 2012 until February 2013, the lists of the HIV test results were couriered to the clinics instead of being delivered by hand, in order to reduce costs. This change in protocol was approved both by the HSRC's REC and the CDC.

2.6.4 Other ethical considerations

In order to comply with mandatory reporting of child abuse (Child Care Act No 74, 1983) and the New Children's Act of 2010 (available at http://www.dsd.gov.za/index) the following steps were taken:

- No questions were asked directly about child abuse in the survey;
- Voluntary information about a child's experiences of sexual abuse was handled on an individual case-by-case basis in consultation with the supervisors and the principal investigators or project directors of the survey;
- Details of the nearest social work offices and child protection units were made available automatically to each participating household if deemed necessary or upon request.

15 HCT centres are easily accessible in primary health facilities throughout the country and offer free HIV and AIDS services including HCT, PMTCT, VMMC, and ART.

To ensure that the research was conducted according to the highest ethical standards, the following additional measures were taken:

- Each section of the questionnaires contained a short introduction stating its' focus and explaining why the questions were being asked, as well as assuring respondents of the confidentiality of their responses.
- Field staff were trained in research ethics; ethical procedures were included in the training manual. Special training was also given on the management of children and of crises that might arise in the field.
- Field staff were monitored by their supervisors to ensure that they complied with all the ethical provisions of the survey.

Vulnerable groups: This survey covered the general population and therefore also reached vulnerable groups including persons with terminal illnesses, children, adolescents, pregnant females, and people living with HIV and AIDS. The procedure required that where respondents were unable to take part in the survey because of poor health or mental incapacity, field staff made a decision to exclude them from the survey in consultation with their supervisor.

2.7 Fieldwork procedures

2.7.1 Survey fieldwork

Data collection for the survey was conducted from December 2011 to November 2012. Research trainees from the HSRC acted as provincial survey coordinators while nurses, supervisors and editors were recruited to assist with data collection. A training manual that had been adapted from previous surveys was utilised to train field staff. Topics covered included informed consent procedures, interviewing skills for questionnaire administration, blood specimen collection, quality control procedures, and ethical procedures and conduct.

2.7.2 Preparatory work

Three different activities were undertaken in preparation for the main survey. The first activity was a qualitative survey, funded by PEPFAR/CDC, to determine attitudes of the South African public concerning the giving of HIV test results to respondents. This survey involved 12 focus groups, three per each race group, among males and females of different age groups (teenagers, youths and adults).

The second activity was a preparatory survey to assess procedures including community entry, obtaining informed consent/assent, the content of the questionnaires, and laboratory testing of DBS specimens. In addition, protocols for providing HIV results to respondents were assessed. The preparatory survey survey was conducted in 20 EAs located in Gauteng, the Western Cape and KwaZulu-Natal. Fifteen households were selected in each EA, totalling 300 households. The households selected in the 28 EAs for this preparatory work were not included in the main survey.

The main emphasis of the preparatory survey was to test whether non-nurse interviewers would be able to collect blood samples using the DBS method and to test procedures for returning the HIV results to the clinics. At the time of the pilot, new regulations had been passed that allowed non-nursing staff to take certain biological samples, including DBS, for HCT. For the previous studies, the research team had hired retired nurses to conduct the interviews and collect blood specimens; however, this pool of nurses had become

small over time because of demand and shortage of nurses in the country. The survey team was concerned that the change in the type of interviewers would have an impact on the response rate for the interviews and blood specimens. The SABSSM management team therefore took a decision to test whether non-nurse interviewing staff would be able to take the DBS specimens and whether the use of non-nursing staff would affect response rates.

The preparatory survey results indicated that non-nursing staff with suitable training were able to successfully collect DBS specimens except for those of infants. Although the response rates were somewhat lower than of nurse interviewers, a decision was taken to include non-nurses; however, only professional nurses were used to collect blood specimens from infants. It was also decided that, based on performance during the preparatory survey, only the best candidates would be deployed in the main survey. The training content for the main survey was also revised to ensure that more time was spent on training non-nurses on specimen collection. Lastly, all field teams were mixed to ensure that there was a representation of both nurses and non-nurses; where possible, a professional nurse was appointed to be the supervisor of the field team.

2.7.3 Training of field staff

Formal training sessions were held to train the field staff. The training team consisted of HSRC researchers and administrative staff, as well as representatives from the laboratories, courier services and other relevant service providers. The training manual adapted from the previous surveys was used for the training. The key objectives of the training were to ensure that field staff were comfortable with asking questions – especially sensitive questions about sexual behaviour and health issues – to ensure familiarity with the fieldwork processes and to foster a positive attitude towards the survey. The first training session was conducted in Pretoria where approximately 300 field staff were trained. Subsequent training sessions were conducted in Durban, Cape Town and Pretoria. In total approximately 500 prospective field staff were trained of whom about one-fifth were found to be unsuitable and were not subsequently retained.

Training addressed ethical issues (including informed consent procedures), interviewing skills, completion of survey questionnaires, DBS specimen collection, maintaining confidentiality (field staff were required to sign a confidentiality agreement), procedures for referral of respondents to HCT centres, community entry and quality control procedures. Supervisors were also trained to identify the EAs and pre-selected households using maps, aerial photographs and GPS equipment. Those who coordinated the management of specimens were trained on how to handle HIV test results sent to them by the HSRC. The training included the transportation and handing over of results to the nurse in charge of HCT and to the HCT supervisor at each clinic within or closest to an EA as well as approaches to maintaining confidentiality.

2.7.4 Field survey

The field work for the main survey commenced in December 2011. Typically, a fieldwork team took between three and five days to cover the 15 selected households in an EA. In urban areas, fieldwork activities were conducted mostly during early evenings and over weekends, while in rural areas the timing of fieldwork activities varied depending on seasonal farming activities in the area and the times when people were available.

Fieldwork materials included aerial maps showing the locations of the 15 pre-selected households in each EA, a directional map of how to get to the EA and GPS coordinates of all 15 pre-selected households in the urban formal and rural informal areas. The pre-selected households were identified using aerial maps with the aid of GPS instruments. Where the selected VP consisted of a non-residential structure, this was noted as an invalid VP. No substitution took place at either the household or individual level. This ensured the integrity of the sampling approach. In urban informal and rural informal areas households were selected systematically on the day of the survey after taking a census of all households in the selected EA.

Up to five visits were made to each selected household in order to ensure maximum participation. A supervisor first visited the selected household to introduce the survey to the head of the household. An accompanying interviewer then explained the purpose of the survey, provided the necessary background information and clarification on any points that the head of household did not understand clearly. This was followed by obtaining informed consent after which the interviewer completed the VP questionnaire by interviewing the head of household. The completed VP questionnaire listed all members of the household. The head of the household was informed that one or more interviewers would return to conduct individual interviews of members of the household who were present at home on the day of the first visit following the completion of consent/assent procedures. After the interview, the respondent (or child's parent/guardian) was requested to provide consent to provide a DBS specimen for HIV testing.

Where possible, field staff and respondents were matched according to race group and ethnicity. The aim of this matching was to increase participation among respondents. During the fieldwork phase of the survey, weekly project management meetings were held to monitor progress.

2.7.5 Specimen collection

The DBS specimen collection strategy was chosen because it offered unique advantages for large-scale population-based surveys and because the HSRC had successfully used this strategy in previous surveys. Refrigeration of DBS samples is not necessary; samples could therefore easily be couriered from the field to the laboratory.

DBS specimens were collected from each respondent who consented/assented to provide a specimen. Whole blood, obtained by finger-prick or heel-prick, was spotted onto each of the five circles of the grade 903 card approximately 50 microlitre (µl) of blood per circle. Field staff were trained to fill in all five circles if sufficient blood could be obtained without causing discomfort to the participant. Once the blood spots were completely dry, the cards were packed in gas impermeable zip-lock bags containing desiccant packs and humidity indicator cards. Specimens were always stored in a cool place. Bags were shipped weekly by the field supervisors to the laboratory for testing.

2.7.6 Quality control of fieldwork

A range of quality control measures were taken. Before the start of the fieldwork, all maps were checked for errors and image quality. Maps and fieldwork materials were sorted in the designated offices according to province and EA. Field staff were required to meet set minimum standards to take part in the survey. Quality control measures included:

1. **Team supervisors:** It was the duty of supervisors to carry out the survey according to the agreed protocols, including finding the correct EA and identifying the selected VPs in each EA. Another important task of the supervisor was to ensure the integrity of the specimen collection and dispatch by checking barcodes on the samples against tracking sheets and questionnaires.
2. **Team editors:** The main task of editors was to check the completed questionnaire for any errors. Editors normally carried out this task while the team was in the field to allow timely correction of errors if required. Another important task of editors was to assist the supervisors in identifying the EA and the selected VPs by using the set of maps and a GPS device (using exact coordinates sourced from *Google* Maps).
3. **HSRC researchers:** A team of 13 HSRC researchers served as survey coordinators – each in charge of two to three fieldwork teams. This team ensured that teams followed the stipulated fieldwork and administrative procedures. The coordinators visited EAs together with the teams, ensured adherence to procedures and alongside supervisors, visited households, and observed interviews.
4. **Coordinators and researchers:** These teams re-visited households in selected EAs to ensure adherence to protocols using a shortened questionnaire for this purpose. During re-visits, checks were made on the correct spatial locations of VPs, the listing of respondents, the selection of individual respondents and correct completion of household and individual questionnaires during interviews.

The close involvement of coordinators, supervisors and editors in the fieldwork meant that each VP in the survey was visited by at least one of the supervisory levels in the survey. This made for a tightly controlled survey ensuring that field staff adhered to procedures and protocols. In instances where an incorrect VP was selected, data were discarded and re-collected at the correct location. For example, a case of non-adherence to survey protocols was discovered during a quality control revisit to selected EAs. This resulted in one fieldwork team being disbarred from continuing with the survey and questionnaires and specimens of five EAs completed by that team being discarded on account of unethical behaviour and non-adherence to survey protocols.

2.8 Community awareness

The advocacy and communications component of a survey of this nature is complex and multi-faceted. Given that the survey was conducted in different provinces simultaneously, country-wide and over a long period, it was important to maintain awareness of the survey within survey communities.

To ensure such awareness, a tiered multi-media implementation plan was followed. Key stakeholders were identified who could garner the support and participation of communities across the country. The strategy included:

- National awareness of the survey through a public launch that achieved mass media coverage;
- Community awareness through local media;
- Harnessing the support of well-known and respected South Africans to give voice to the importance of the survey;
- Distribution of flyers and posters;
- Information on the survey delivered through partner websites.

Other key components included:

- Provincially-focused key messages delivered through mass media that aligned with the demographics of the particular province;
- Specific strategies to reach constituencies that were not sufficiently represented in previous surveys;
- Training and regular engagement with survey teams;
- Focused 'frequently asked questions' sessions for survey teams;
- Delivery of key messages through social media.

2.9 Laboratory methods

Only laboratories that were accredited through the South African National Accreditation System (SANAS) were utilised.

2.9.1 Specimen tracking

The following procedure was followed in the specimen tracking process:

- Batches of specimens were sent to a central laboratory and were tracked through waybill procedures. Specimens and specimen tracking sheets with the DBS barcode were couriered in gas impermeable zip-lock bags containing desiccant packs and humidity indicator cards.
- Consecutively numbered laboratory barcodes were assigned to the specimens as they were received by the laboratory. The specimen barcodes were matched to the barcodes on the laboratory tracking sheets.
- The specimen barcode numbers were also scanned or typed into an Excel spreadsheet.
- The DBS cards were labelled with the laboratory barcode number.
- Laboratory managers performed a second quality control step (i.e., matching barcodes to tracking sheets and examining specimen quality) and then signed off the tracking sheets for laboratory processing.

2.9.2 HIV antibody testing

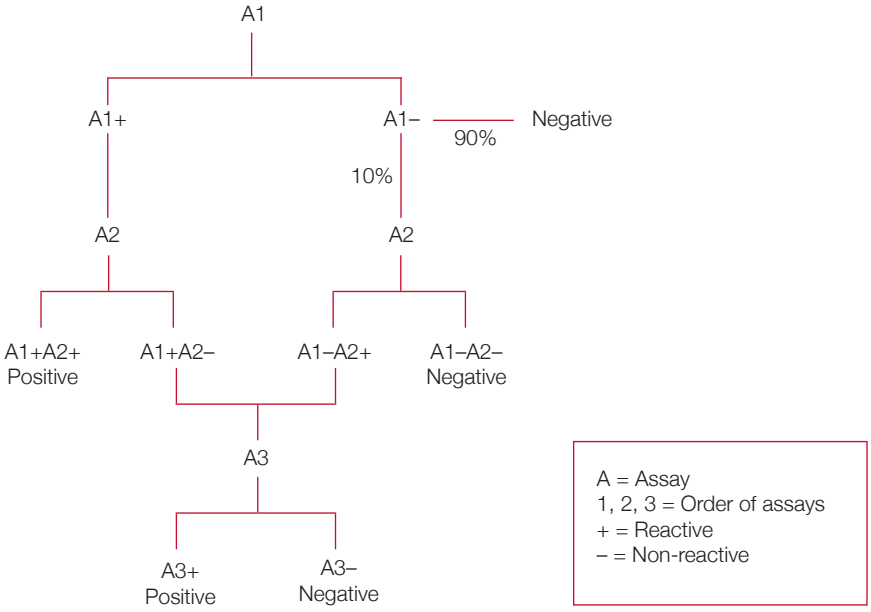
As reported in the 2008 survey (Shisana, Rehle, Simbayi et al. 2009), DBS spots were punched into a test-tube pre-labelled with the corresponding laboratory testing barcode number. The puncher was decontaminated through the punching of four blank spots after each DBS spot to ensure no carryover. Each filter paper disc was eluted overnight at 4° C with phosphate buffered saline (PBS, pH 7.3–7.4). An aliquot of the eluted sample was then used for performing the HIV testing assays, following the manufacturer's instructions. The HIV testing strategy is shown in Figure 2.4. A combination of three HIV-1 enzyme immunoassays (EIAs) was used to test for HIV-1 antibodies. All samples that tested positive in EIA 1 (Vironostika HIV Uni-Form II plus O, Biomerieux, Lyon, France) were re-tested using a second assay, EIA 2 (Advia Centaur XP, Siemens Medical Solutions Diagnostics, Tarrytown, New Jersey, USA). In addition, 10% of the samples that tested HIV-negative in the first EIA were re-tested with EIA 2. Any samples testing positive on EIA 1 and negative on EIA 2 (producing discordant results) were submitted to a third assay, EIA 3 (Roche Elecys 2010 HIV Combi, Roche Diagnostics, Mannheim, Germany) for final interpretation of discordant samples.

Children younger than 2 years of age were tested for the presence of HIV antibodies (maternal exposure) according to the methods described above. In addition, given that the HIV-antibody test does not distinguish between HIV infection and the presence of passively acquired maternal HIV antibodies in infants, children under 24 months of age

were also tested for HIV infection using a polymerase chain reaction (PCR) assay (Roche Cobas Ampliprep/Taqman, Roche Molecular Systems, South Branchburg, New Jersey, USA) to confirm HIV-1 infection. Furthermore, all sero-negative specimens of infants 0–12 months old were subjected to PCR testing in order to detect any false-negative samples (HIV-nucleic acid positive/HIV-antibody negative) in this age group.

HIV-antibody testing was performed at the Global Clinical & Viral Laboratory in Durban. In addition, external quality control of specimen handling and applied testing procedures was conducted by the Medical Research Council's (MRC) HIV Prevention Research Unit (HPRU) in Durban.

Figure 2.4: The HIV testing strategy



2.9.3 Antiretroviral testing

Widespread access to ART has increased lifespans among PLHIV. ART access thus contributes to an increase in the number of people within particular age groups who are HIV positive within the survey population, relative to previous surveys. Measuring the impact of ART on age-specific HIV prevalence is, therefore, critical for the interpretation of HIV prevalence trends. Furthermore, the detection of antiretroviral drugs in HIV-positive samples is a critical component of the HIV incidence testing algorithm (see Section 2.9.4 below) in order to reduce misclassification and improve assay-based HIV incidence estimates.

As in the 2008 survey (Shisana, Rehle, Simbayi et al. 2009), the presence of antiretroviral drugs (ARVs) in HIV-positive DBS samples was confirmed by means of High Performance Liquid Chromatography (HPLC) coupled to Tandem Mass Spectrometry. Qualitative detection of Zidovudine, Nevirapine, Efavirenz, Lopinavir, Atazanavir and Darunavir was carried out by a validated method using minor modifications of the method used by Koal et al. (2005). Drugs were extracted from a single DBS with 25% water and 75% acetonitrile containing deuterated nevirapine and deuterated lopinavir as internal standards.

Chromatographic separation was carried out on a Phenomonex Luna 5um PFP column (110A, 50 x 2mm) using acetonitrile and 0.1% formic acid to effect elution. Detection was carried out using an Applied Biosystems API 4000 tandem mass spectrometer in the Multiple Reaction Monitoring (MRM) detection mode for each drug using appropriate MRM transitions. Blank and quality control cut-off samples were included with each run. Each drug was assayed in the presence of all the others and the assay was found to be highly specific and selective with no observable interference in the detection of one drug by the others. This was anticipated given the increase in specificity expected using tandem mass spectrometry (LCMSMS) over the use of single quadruple mass spectrometry (LCMS). The limit of detection was set to 0.2 µg/ml for each of the drugs, with a signal to noise ratio of at least 5:1 for all the drugs.

The qualitative determination of antiretroviral drugs in DBS specimens was carried out at the Division of Clinical Pharmacology in the Department of Medicine at the University of Cape Town.

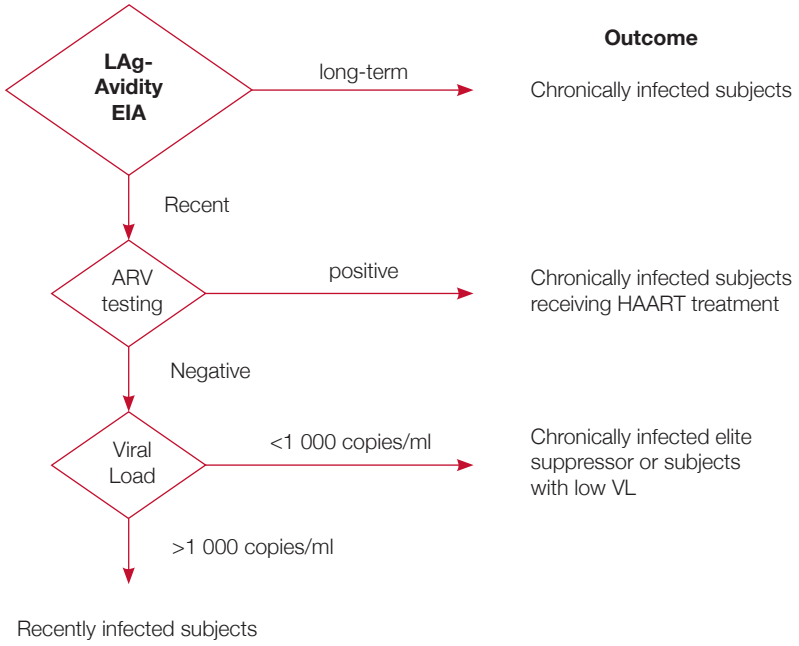
2.9.4 HIV Incidence Testing

Over the past decade, new laboratory methods have enabled the direct estimation of HIV incidence using blood specimens from cross-sectional rather than longitudinal survey designs (Busch, Pilcher, Mastro et al. 2010). Our HIV-incidence analysis is based on the most recent recommendations for HIV incidence estimation (WHO Technical Working Group on HIV Incidence Assays, 2011; also see Duong et al. manuscript in preparation, Duong, Qui, De et al. 2012; WHO/UNAIDS, 2013). On 3 March 2013, results from the evaluations of incidence assays conducted by the Consortium for the Evaluation and Performance of HIV Incidence Assays (CEPHIA) were presented to a panel of experts at a symposium held during the Conference on Retroviruses and Opportunistic Infection (CROI) in Atlanta, USA. Following CROI, on 7–8 March 2013, CDC convened an expert consultation meeting on the Limiting-Antigen Avidity EIA at which CEPHIA, CDC, and others presented results of using this test for recent infection. Based on these preliminary results, WHO/UNAIDS produced a technical update (WHO/UNAIDS, 2013). There was consensus that: (i) the newly available assay (Limiting-Antigen Avidity EIA) performs better than the previously available BED-CEIA, and (ii) incidence testing algorithms perform better than single assays.

However, it was also noted that evaluations of the assay performance on DBS specimens and the performance of multi-assay algorithms will continue even after the Limiting-Antigen Avidity assay has now been transferred to a commercial manufacturer. This was again stressed at the recent meeting of the WHO Working Group on HIV Incidence assays in Rome on 28–29 October 2013.

The detection of recent infections was performed on confirmed HIV-positive samples from survey respondents aged 2 years and older. Figure 2.5 shows the recent infection testing algorithm that was applied for the 2012 HIV incidence estimation. The HIV incidence testing algorithm used the Limiting-Antigen Avidity Assay (LAg-Avidity EIA, Maxim Biomedical Inc., Rockville, MD, USA) with a cut-off optical density (ODn) of 1.5 (Duong et al. manuscript in preparation) in combination with additional information on antiretroviral treatment exposure (see Section 2.9.3) and HIV viral load (Abbott m2000 HIV Real-Time System, Abbott Molecular Inc, Des Plaines, Illinois, USA). HIV incidence testing and viral load measures were carried out at the South African National Institute for Communicable Diseases (NICD) in Johannesburg.

Figure 2.5: Testing algorithm for recent infection



HIV incidence calculation was performed as proposed by the WHO Technical Working Group on HIV Incidence Assays WHO (2011) *When and how to use assays for recent infection to estimate HIV incidence at a population level.* Geneva: WHO using computation tools developed by the South African Centre for Epidemiological Modelling and Analysis (SACEMA) at Stellenbosch University.

The following formula was used to calculate HIV incidence as an annual instantaneous rate (I_r):

$$I_r = \frac{R - \varepsilon P}{(1-\varepsilon)\omega N}$$

The parameters were specified as follows:

N is the number of people testing HIV negative in the survey;

P is the number of people testing HIV positive in the survey;

R is the number of people classified LAg-Avidity assay recent;

ω is the mean duration of recent infection (MDRI: 130 days), specified in units of years: 0.356;

ε is the false recent rate FRR: 0.0%, i.e. no false recent rate was applied to the incidence testing algorithm which corrected for antiretroviral treatment exposure and potential elite controllers in the samples, the main sources of assay recent misclassification.

In order to provide national estimates, the HIV-incidence calculation took into account the complex sampling design and used weighted numbers in the incidence formula. Confidence intervals were computed using a delta method approximation as described in WHO (2011) and applying a design effect of 2.0.

2.9.5 HIV incidence estimates for 2002–2012 using a mathematical model

An existing method to estimate the HIV-incidence rate in the interval between two surveys (Hallett, Zaba, Todd et al. 2008; Hallett, Stover, Mishra et al. 2010) was used. A correction was applied that accounts for the effect of ART in increasing HIV prevalence through lengthening survival of HIV-infected persons (Hallett, Stover, Mishra et al. 2010; Rehle, Hallett, Shisana et al. 2010). This required assumptions about the scale-up of ART (DOH, November 2013; Johnson 2012), mortality rates on ART (Cornell, Schomaker, Garone et al. 2012) and the mean survival time without ART from the point of ART initiation. A sigmoid time-trend was assumed for the latter, with mean survival increasing from between 0.8 and 1.8 years in 2005 to between 2.0 and 5.1 years in 2012. Bootstrapping[16] was used to reflect sampling uncertainty in the prevalence measurements and parametric uncertainty in the ART correction procedure (Kirkwood & Sterne, 2003). Point estimates are the means of the generated distributions and the intervals span the 2.5th to the 97.5th percentiles. Updates in assumptions about the impact of ART in increasing prevalence and a fuller representation of uncertainties in the present method mean that estimates for the periods 2002–2005 and 2005–2008 were slightly modified from earlier presentations (Rehle, Hallet, Shisana et al. 2010).

2.10 Weighting of the sample

Owing to the sampling design of the survey, some individuals have a greater or lesser probability of selection than others. To correct this potential bias due to unequal sampling probabilities, sample weights were introduced to correct for potential bias at the EA, household, and individual levels and also adjust for non-response. Table 2.3 presents the allocation of EAs by the main reporting domains and illustrates the disproportionate allocation of EAs by stratification variables (e.g. oversampling of EAs dominated by the Indian or Asian race group in KwaZulu-Natal or all people in sparsely populated Northern Cape Province).

Table 2.3: Allocation of EAs by main reporting domains

Locality type	Province	Population group				Total
		African	Coloured	Indian/ Asian	White	
Urban formal	Western Cape	8	63	5	28	104
	Eastern Cape	17	21	2	26	66
	Northern Cape	14	22	0	21	57
	Free State	18	6	0	18	42
	KwaZulu-Natal	15	8	79	20	122

→ *continued*

16 Bootstrapping is a statistical method for assigning measures of accuracy to sample estimates. We use bootstrapping (repeating the incidence estimation with prevalence values from simulated draws of a binomial model representing the survey data) to determine how random errors in the estimates of HIV prevalence in the survey propagate to errors in the estimates of HIV incidence.

Locality type	Province	Population group				Total
		African	Coloured	Indian/ Asian	White	
	North West	15	4	0	15	34
	Gauteng	32	17	30	58	137
	Mpumalanga	13	2	2	19	36
	Limpopo	10	0	2	14	26
Subtotal		**142**	**143**	**120**	**219**	**624**
Urban informal	Western Cape	10	2	0	0	12
	Eastern Cape	12	3	0	0	15
	Northern Cape	3	2	0	0	5
	Free State	9	1	0	0	10
	KwaZulu-Natal	15	0	0	0	15
	North West	4	0	0	0	4
	Gauteng	23	2	0	0	25
	Mpumalanga	8	0	0	0	8
	Limpopo	3	0	0	0	3
Subtotal		**87**	**10**	**0**	**0**	**97**
Rural informal	Western Cape	0	0	0	0	0
	Eastern Cape	36	2	0	0	38
	Northern Cape	0	0	0	0	0
	Free State	10	0	0	0	10
	KwaZulu-Natal	33	1	0	0	34
	North West	24	1	0	0	25
	Gauteng	0	0	0	0	0
	Mpumalanga	20	0	0	0	20
	Limpopo	50	0	0	0	50
Subtotal		**173**	**4**	**0**	**0**	**177**
Rural formal	Western Cape	3	10	0	0	13
	Eastern Cape	9	3	0	0	12
	Northern Cape	6	7	0	0	13
	Free State	11	2	0	0	13
	KwaZulu-Natal	15	0	0	0	15
	North West	12	0	0	0	12
	Gauteng	3	0	0	0	3
	Mpumalanga	11	0	0	0	11
	Limpopo	10	0	0	0	10
Subtotal		**80**	**22**	**0**	**0**	**102**
Total	Western Cape	21	75	5	28	129
	Eastern Cape	74	29	2	26	131
	Northern Cape	23	31	0	21	75
	Free State	48	9	0	18	75
	KwaZulu-Natal	78	9	79	20	186

→ *continued*

Locality type	Province	Population group				Total
		African	Coloured	Indian/ Asian	White	
	North West	55	5	0	15	75
	Gauteng	58	19	30	58	165
	Mpumalanga	52	2	2	19	75
	Limpopo	73	0	2	14	89
Total		**482**	**179**	**120**	**219**	**1,000**

Weighting procedures were undertaken before analysis of the data as follows: The data file of drawn EAs contained the selection probabilities as well as the sampling weights of these EAs. These weights reflected the disproportionate allocation of EAs according to the three stratification variables, namely, race, province and locality type. The VP sampling weight was then calculated. This weight was computed as the counted number of VPs in the EA, proportionally corrected for invalid VPs and divided by the number of VPs participating in the survey. The final VP sampling weight was the product of the EA sampling weight and the VP sampling weight. Demographic and HIV testing information on all persons in all households in all responding EAs were then assembled in order to calculate individual sample weights. These individual sample weights were also adjusted for HIV testing non-response. In the final step, the information at the individual level was integrated and the final sampling weight for each data record was calculated. This weight was thus equal to the final EA weight multiplied by final VP sampling weight adjusted for individual nonresponse. The final individual weights were benchmarked to 2012 mid-year population estimates by age, race, sex and province (StatsSA, 2013). This process produced a final sample representative of the population in South Africa for sex, age, race, locality type and province. The estimates of HIV obtained did not differ significantly and only varied by less than a percent (results not shown). As a final check, two different data analyses teams independently verified the weighing programme and found similar results.

2.11 Data management and analysis

2.11.1 Data management in the field

The process of data management began at the initiation of the project. Data collection material was distributed to Provincial Coordinators who in turn distributed to the team supervisors. Data collectors received the materials from their supervisors on a daily basis. Once data were collected, quality checked and edited in the field, questionnaires were sent to the HSRC for further checking and recording before they were forwarded to the Data Capturing Unit (DCU) at the HSRC for capturing. As indicated earlier, DBS specimens were sent directly to Global Clinical & Viral Laboratory in Durban by supervisors each week for HIV-antibody testing.

Descriptive analysis was conducted and presented during the weekly meetings to monitor issues related to data quality and response rate in the field. Factors contributing to poor response rate and data quality were identified and relayed to the data collecting teams concerned.

2.11.2 Laboratory data

Laboratory managers performed second line quality control (matching barcodes to tracking sheets and examining specimen quality) and signed-off the tracking sheets for

laboratory processing. HIV-test results were sent to the HSRC in excel format with the common variable being barcodes which would be used to link the three types of HIV test results and questionnaire data. Data cleaning was done by two trained data checkers, and involved physical checks against the individual questionnaires, specimen tracking sheets and laboratory specimen tracking sheets. Expert biostatisticians were responsible for linking questionnaires and specimen data using barcodes.

2.11.3 Data entry

Data were double captured and verified by the DCU under the overall management of the Executive Director of Management Support/Executive Director of the Research Data Management Centre. The DCU includes a head of unit and five supervisors. A total of 107 data capturers were recruited and trained in data capturing using the Census and Survey Processing System (CSPro) software programme (developed by the United States Census Bureau, Macro International, and Serpro, S.A). A data flow system was used to systematically allocate questionnaires to data capturers, monitor captured questionnaires using control numbers and repack questionnaires according to EAs on a daily basis.

Data from each of the separate questionnaire types were entered into four separate databases, which were designed to be linkable by household and to be compatible with the databases from the 2002, 2005 and 2008 national household HIV surveys to allow for trend analysis. Once the database design had been completed, data from the questionnaires were entered manually using CSPro software which is often used for the entry of data from large surveys, data integrity and validation. A database was designed with range restrictions to ensure that out of range data were not captured. A verification process involved data capturers entering questionnaire data twice. This enabled the research team to identify outliers, checking for missing values, and inconsistencies in the data. The data were converted from CSPro to SPSS by the DCU prior to being sent to the research team.

Once the data were received from DCU, further data cleaning procedures were implemented. Duplicate records were identified and removed. Extensive internal consistency checks against the original questionnaires were applied to ensure that the database accurately reflected the data captured in the field. Consistency checks were carried out to ensure that no more than 15 household questionnaires for each EA were included in the database and that all individual questionnaires were linked to their respective EAs and VPs.

2.11.4 Data cleaning

To address internal data inconsistencies in terms of inappropriate sex-specific responses, responses were recoded as missing. For example, respondents coded as males who reported having had a menstrual period or other female specific characteristics were recoded as missing. In each instance an insignificant number of values (<15) were recorded as missing. In line with statistical analysis rules, other internal inconsistencies were left intact, reflecting the right of persons to refuse to answer particular questions. Individual databases were merged and managed using STATA (Version 12).

2.11.5 Weighting of the sample

Owing to the sampling design of the survey, some individuals have a greater or lesser probability of selection than others. To correct this potential bias due to unequal sampling probabilities, sample weights were introduced to correct for potential bias at the EA,

household, and individual levels and also to adjust for non-response. The final sampling weight was thus equal to the final EA weight multiplied by the final VP sampling weight adjusted for individual non-response. The final individual weights were benchmarked to 2012 mid-year population estimates by age, race, sex, and province (Stats SA, 2013). This process produced a final sample representative of the population in South Africa for sex, age, race, locality type, and province.

2.11.6 Data management and analysis

Data were double entered and verified by the Data Capturing Unit (DCU) at the HSRC using Census Survey Processing software. Taking into account the complex multi-level sampling design and adjusting for HIV testing non-response, weighted data were analysed using STATA 12/13 software (Stata Corporation, College Station, TX) and estimates of HIV prevalence, p-values and 95% Confidence Intervals (95% CIs) were reported with other reliability measures such as coefficient of variation, design effect, and square root of the design effect.

Data analysis was conducted by no fewer than eight HSRC and four MRC researchers supported by two expert biostatisticians. To control for the quality of results, every table was generated independently by at least two different statisticians and the outputs compared to verify the results.

A design-based Chi-squared test was used to test for association and comparison of proportions. A p-value of 5% or less was used to indicate statistical significance. In some cases, non-overlapping 95% CIs were used to conclude statistical significance. Other reliability measures such as coefficient of variation, design effects (DEFF) and square root of the design effect (DEFT) that took into account the complex design and individual sample weights adjusting for HIV testing non-response were computed. A chi-squared based trend test was computed to test for trend for surveys conducted in 2002, 2005, 2008 and 2012.

Tables and figures in the results section of the report present weighted percentages and unweighted counts unless otherwise specified. The sum of individual unweighted counts might not sum to the overall total because of missing data for certain demographic characteristics.

3. RESULTS

This chapter begins by assessing the reliability and validity of the survey findings. An assessment of the survey results is presented with regard to generalisability, followed by an analysis of the household and individual response rates and an assessment of the validity of the HIV sero-prevalence estimates. The epidemiology of HIV and AIDS at national, provincial and local levels is then presented drawing on the HIV prevalence, HIV incidence, extent of antiretroviral treatment exposure, and socio-behavioural results.

3.1 Assessment of 2012 survey data

The survey results were assessed in relation to generalisability and response rate, including an emphasis on coverage of HIV testing.

3.1.1 Generalisability of the survey results

The extent to which these survey results can be generalised to the South African population depends on the degree to which the sample is representative of the population. Table 3.1 compares the socio-demographic characteristics of the survey sample to the 2012 mid-year population estimates provided by Statistics South Africa

Table 3.1: Demographic characteristics of the survey sample compared to the 2012 mid-year population estimates for South Africa

Variable	Weighted Sample		Mid-Year Population 2012	
Sex	**n**	**%**	**n**	**%**
Male	25,517,043	48.7	25,453,074	48.7
Female	26,870,133	51.3	26,821,871	51.3
Age group (years)				
0–14	15,569,948	29.7	15,459,959	29.6
15–24	10,145,305	19.3	10,130,660	19.4
25–49	18,662,576	35.6	18,632,219	35.6
50+	8,064,606	15.4	8,052,107	15.4
Race				
Black African	41,656,512	79.6	41,624,670	79.6
White	4,623,857	8.8	4,622,373	8.8
Coloured	4,720,006	9.0	4,716,471	9.0
Indian/Asian	1,314,420	2.5	1,311,431	2.5
Province				
Western Cape	5,938,122	11.3	5,904,017	11.3
Eastern Cape	6,672,990	12.7	6,586,307	12.6
Northern Cape	1,155,366	2.2	1,153,090	2.2
Free State	2,764,687	5.3	2,748,506	5.3
KwaZulu-Natal	1,0421,900	19.8	10,345,539	19.8
North West	3,576,252	6.8	3,546,631	6.8
Gauteng	12,548,208	23.8	12,463,886	23.8
Mpumalanga	4,101,077	7.8	4,074,763	7.8
Limpopo	5,480,380	10.4	5,452,206	10.4
Total	**52,658,980**	**100**	**52,274,945**	**100**

(StatsSA, 2013). As shown in Table 3.1, there is less than 1% difference between the weighted survey sample and the StatsSA 2012 mid-year population estimates and therefore the 2012 survey sample is representative of the South African population. The weighted survey sample is similar to the mid-year population estimates in terms of sex, age, race group and province.

3.1.2 Response analysis

In conducting the survey, the research team prioritised achieving a high response rate through a range of strategies. These included: (i) notifying the target populations of the impending survey using a variety of means; (ii) providing comprehensive explanations to potential respondents; (iii) ensuring well-trained interviewers conducted the fieldwork; (iv) conducting up to five revisits to try to get an interview with the head of household of each sampled household in order to get consent for his/her family to participate in the survey if necessary; and (v) ensuring privacy of respondents when conducting interviews. To enhance the overall participation in the survey, both the questionnaire interviews and the collection of DBS were gathered during the same session.

Household response rate

During the fieldwork, a proportion of the selected households/VPs were found to be invalid. For example, if the household/VP had been destroyed or vacated, or the building was a business enterprise, the VP was not included in the response analysis at the household level. Such instances were not considered to be a non-response. A number of other factors also contributed to a loss of realised VPs including, for example, an absence of any households within the EA. At times, whole neighbourhoods have either disappeared altogether or changed from informal urban to formal urban areas as a result of development or formal rural to informal urban areas.

To determine the household response rate, the number of valid VPs with completed interviews was divided by the number of occupied valid VPs. Table 3.2 shows that, of the 15,000 VPs sampled, 87.2% (n = 13,083) were valid occupied households. The remaining, 1,266 VPs, were invalid VPs or clearly abandoned households. In addition, 651 VPs were not realised for other reasons as mentioned earlier. Of the 13,083 valid VPs, 11,079 (84.7%) agreed to participate in the survey at the household level. The proportions of non-response at household level were as follows:

- 1,347 (10.3%) households refused to take part in the survey; and
- 657 (5.0%) were valid VPs but the households were found to be empty after the required five repeat visits to interview the head of household or could not be considered for other reasons.

Table 3.2 also shows the household response rates by locality type and province. Urban formal residence areas had the highest levels of refusal (14.0%) compared to the other locality types. All provinces had a VP response rate of 80% and above, except the Western Cape, which achieved 78.9% and Gauteng, which achieved 78.4%.

Individual interview response rate

In the 11,079 valid VPs that agreed to participate in the survey, 42,950 individuals were eligible to be interviewed. A total of 38,431 individuals (89.5%) participated in the interviews. The proportions of non-response were as follows:

- 2,295 (5.3%) individuals refused to be interviewed; and
- 2,224 (5.2%) individuals were absent from the household or were classified as missing data.

Table 3.2: Household/Visiting point response rates by demographic characteristics, South Africa 2012

	Total VP	Valid		Interviewed		Refused		Absent/other	
Variable	n	n	%	n	%	n	%	n	%
Locality type									
Urban formal	9,280	8,254	88.9	6,632	80.3	1,156	14.0	466	5.6
Urban informal	1,449	1,296	89.4	1,195	92.2	50	3.9	51	3.9
Rural informal	2,660	2,329	87.6	2,152	92.4	77	3.3	100	4.3
Rural formal	1,530	1,204	78.7	1,100	91.4	64	5.3	40	3.3
Other/ Unknown	81	0.0	0.0						
Province									
Western Cape	1,928	1,766	91.6	1,394	78.9	283	16.0	89	5.0
Eastern Cape	1,984	1,665	83.9	1,411	84.7	156	9.4	98	5.9
Northern Cape	1,124	949	84.4	834	87.9	59	6.2	56	5.9
Free State	1,136	988	87.0	884	89.5	75	7.6	29	2.9
KwaZulu-Natal	2,757	2,428	88.1	2,172	89.5	206	8.5	50	2.1
North West	1,122	892	79.5	799	89.6	60	6.7	33	3.7
Gauteng	2,457	2,222	90.4	1,742	78.4	327	14.7	153	6.9
Mpumalanga	1,088	950	87.3	788	82.9	80	8.4	82	8.6
Limpopo	1,323	1,223	92.4	1,055	86.3	101	8.3	67	5.5
Other/ Unknown	81	0.0	0.0						
Total	**15,000**	**13,083**	**87.2**	**11,079**	**84.7**	**1,347**	**10.3**	**657**	**5.0**

HIV-testing response rate

Of the 42,950 eligible individuals, 28,997 (67.5%) agreed to provide a blood specimen for HIV testing that was anonymously linked to their responses to the questionnaires. The categories of non-response were:

- 9,434 (22.0%) of individuals were interviewed, but refused to provide a blood sample;
- 2,295 (5.3%) of individuals refused to be interviewed or to provide a blood sample;
- 2,224 (5.2%) of individuals were absent from the household or were classified as missing data.

Table 3.3 presents the 2012 HIV-testing coverage and non-response for the survey population by the main reporting domains: sex, age, race, province, and locality type. In addition to the categories for coverage (tested) and non-response (not tested), the tables break down non-response by reason for non-response, that is, refusal or absence.

The HIV-testing refusal rate was higher among males (29.2%) than among females (25.8%). The 15–24 age group was the most likely to agree to participate (71.6%), children and infants under the age of 2 years had the least number of tests done at 51.6%. Black Africans (73.3%) and Coloureds (69.6%) were more likely to agree to HIV testing, whereas only 43.0% of whites and 54.0% of Indian or Asians agreed to be tested. Rural formal and

rural informal areas had the highest testing response rates, 80.8% and 80.0% respectively. The response rate in urban formal areas was only 59.7%. Among the provinces, the Eastern Cape had the highest HIV-testing rate (75.8%) while Gauteng had the lowest participation rate (48.2%).

Table 3.3: HIV testing coverage by demographic characteristics: percentage distribution among respondents for HIV testing by testing status, South Africa 2012

	HIV-testing response rate				
	Tested %	Not tested %			
		Refused	Absent	Missing/Other	n
Sex					
Male	64.2	29.2	4.7	1.9	20,089
Female	70.3	25.8	2.6	1.2	22,457
Age group (years)					
0 – <2	51.6	45.7	1.2	1.5	1,714
2–14	70.2	27.6	1.3	1.0	10,191
15–24	71.6	21.9	4.8	1.6	8,221
25–49	64.1	28.7	5.4	1.8	13,768
50+	68.3	26.9	2.8	1.9	8,758
15–49	66.9	26.1	5.2	1.7	21,989
Race					
Black African	73.3	22.2	3.2	1.3	25,402
White	43.0	49.8	5.0	2.3	4,033
Coloured	69.6	23.6	4.9	1.9	8,079
Indian/Asian	54.0	42.5	2.0	1.5	4,859
Other	63.9	31.9	0.0	4.2	72
Locality Type					
Urban formal	59.7	34.1	4.4	1.9	24,844
Urban informal	72.7	22.5	3.6	1.2	4,582
Rural informal	80.0	16.6	2.3	1.1	9,752
Rural formal	80.8	16.1	2.2	0.9	3,771
Province					
Western Cape	64.0	29.5	4.5	2.0	5,269
Eastern Cape	75.8	19.8	3.1	1.3	5,410
Northern Cape	72.5	20.9	5.5	1.0	3,282
Free State	68.1	26.5	3.2	2.2	3,079
KwaZulu-Natal	73.1	24.8	1.1	0.9	9,648
North West	67.0	26.2	5.2	1.6	3,044
Gauteng	48.2	42.4	6.7	2.6	6,238
Mpumalanga	72.3	24.2	1.9	1.6	3,147
Limpopo	69.7	26.1	3.0	1.2	3,833
Total	**67.5**	**27.3**	**3.6**	**1.6**	**42,950**

Table 3.4 compares the HIV risk-related characteristics among survey respondents aged 15 years and older who were interviewed and tested with those who were interviewed but refused HIV testing. If respondents with risky sexual behaviours or persons who were aware of their HIV status refused to participate, the survey may over or underestimate HIV prevalence. Information on HIV risk-related characteristics was only available for those household members who were interviewed but refused to provide a blood sample and not for those who were absent or those who refused the interview as well as refused to provide a blood sample.

Of the 27.3% who refused to participate in the survey listed the following as reasons:
- Upfront refusals and/or unwillingness to participate in any survey or interview, 56.3%;
- Too busy to grant an interview, 22.6%; and
- Other reasons, 21.1%

Table 3.4: HIV risk associated characteristics among respondents aged 15 years and older who were interviewed and provided a blood sample compared with those who were interviewed but refused to provide a blood sample, South Africa 2012

Variable	Interviewed and blood sample provided		Interviewed but blood sample refused		Level of significance
	n	%	n	%	
Sex					
Male	8,757	42.3	2,846	46.7	p<0.001
Female	11,949	57.7	3,253	53.3	p<0.001
Total	**20,706**	**100**	**6,099**	**100**	
Marital status					
Married / civil union	6,740	33.1	2,650	44.8	p<0.001
Going steady / living together	6,166	30.3	1,326	22.4	p<0.001
Single	4,987	24.5	1,296	21.9	p=0.051
Divorced	693	3.4	206	3.5	p=0.945
Widowed	1,771	8.7	433	7.3	p=0.347
Total	**20,357**	**100**	**5,911**	**100**	
Perceived risk of getting HIV					
At risk	4,115	20.2	796	13.5	p<0.001
Not at risk	16,238	79.8	5,087	86.5	p<0.001
Total	**20,353**	**100**	**5,883**	**100**	
Ever had an HIV test					
No	7,547	36.9	2,215	37.5	p=0.607
Yes	12,930	63.1	3,689	62.5	p=0.506
Total	**20,477**	**100**	**5,904**	**100**	
History of HIV testing					
Never tested	7,545	36.9	2,214	37.6	p=0.549
Tested less than a year ago	8,415	41.2	2,249	38.2	p=0.013
Tested between 1 and 2 years ago	2,007	9.8	605	10.3	p=0.718
Tested between 2 and 3 years ago	980	4.8	297	5.0	p=0.888

→ *continued*

Variable	Interviewed and blood sample provided		Interviewed but blood sample refused		Level of significance
	n	%	n	%	
Tested more than 3 years ago	1,499	7.3	526	8.9	p=0.237
Total	**20,446**	**100**	**5,891**	**100**	
Aware of current HIV status					
Yes	7,950	39.2	2,109	36.2	p=0.009
No	12,323	60.8	3,725	63.8	p=0.001
Total	**20,273**	**100**	**5,834**	**100**	
Had sex in last 12 months					
No	5,109	29.5	1,253	25.7	p=0.008
Yes	12,227	70.5	3,617	74.3	p<0.001
Total	**17,336**	**100**	**4,870**	**100**	
Number of sexual partners in last 12 months					
One sexual partner	11,019	90.6	3,245	90.2	p=0.494
Two sexual partners	666	5.5	198	5.5	p=1.000
Three or more sexual partners	477	3.9	153	4.3	p=0.826
Total	**12,162**	**100**	**3,596**	**100**	
Condom use at last sex in last 12 months					
No	8,227	68.9	2,486	71.0	p=0.198
Yes	3,711	31.1	1,015	29.0	p=0.047
Total	**11,938**	**100**	**3,501**	**100**	

The proportion of female respondents interviewed who provided a blood sample was significantly higher than the proportion of females who did not provide a blood sample. For males it was the reverse. Neither HIV testing history, period elapsed since testing (except for testing less than a year ago), having more than one sexual partner and not using a condom during the last sexual act indicated apparent association with refusal to provide a blood sample. Based on this comparison of HIV risk-related characteristics among these two groups of survey respondents, we infer that overall the HIV test results were not biased due to refusal to provide a blood sample. This is further supported by the assessment of the validity of HIV-prevalence estimates (section 3.2). However, we are also planning to apply additional methods, such as the Heckman-type selection models (Heckman 1979) and advanced regression analysis techniques, to investigate more in-depth possible non-participation effects on HIV prevalence and incidence.

3.2 Validity of HIV-prevalence estimates

The survey employed a complex sampling design, namely, a multistage stratified cluster random sampling, to ensure that estimates required for specific subgroups, such as whites and Indian or Asians, and sparsely populated Northern Cape province were achieved that might have been underrepresented if a simple random sampling design had been used. The complex design allowed for oversampling of these population groups. The survey data were subsequently weighted back to the 2012 mid-year estimates to ensure that sampled subgroups that were overrepresented or underrepresented were adjusted to their respective population sizes. This allowed for validation of the population estimates of HIV prevalence. Appendix 1 displays the HIV prevalence, socio-demographic characteristics,

standard error of the simple random sample, standard error of the multistage stratified cluster random sampling, coefficient of variation and the design effect used to assess the validity of the survey results. An HIV-prevalence estimate was regarded as valid if a coefficient of variation was less than 20% using the Kish (1965) criterion. All HIV-prevalence estimates met this criterion except for the white population group, which had a low response rate of 43.0%. The coefficient of variation (CV) for the Indian or Asian population group (25.0%) and that of the Northern Cape (26.0%) were regarded as close enough to the criterion for the HIV estimates to be considered valid. A value of CV close to 20% is considered sufficiently good and tolerated (Kish 1965).

3.3 HIV prevalence

This is the fourth population-based household survey that the HSRC has conducted with its partners to assess the state of the HIV epidemic in the country. To our knowledge, South Africa is the only country to date to conduct periodic nationally representative HIV survey that not only includes HIV prevalence, incidence, and behaviour, but also assesses the extent of antiretroviral use. For this reason, we have recommended that this approach be termed the "third-generation HIV surveillance" approach (Shisana, Zungu and Simbayi, in press). This section of the report focuses on the analysis of the relationship among all four of these outcomes; HIV prevalence, incidence, behaviour, and extent of antiretroviral use.

3.3.1 Overall HIV prevalence

The national estimate for HIV prevalence among South Africans in 2012 was 12.2% (95% CI: 11.4–13.1). This estimate is statistically significantly different ($p<0.001$), from the 2008 national estimate of 10.6% (95% CI: 9.8–11.6). In absolute numbers, there has been a significant increase of almost 1.2 million more people living with HIV in South Africa, an increase from 5,253,493 PLHIV in the 2008 to 6,422,179 PLHIV in 2012. When comparing with earlier surveys, it is useful to present a 2012 national HIV-prevalence estimate that excludes children younger than 2 years (because this age group was not included previously): the 2012 prevalence is 12.6% (95% CI: 11.7–13.5) which is significantly higher ($p<0.001$) than the 2008 estimate of 10.9% (95% CI: 10.0–11.9) that also excludes young children.

Previous research, including the three previous national HIV surveys, has shown that the HIV epidemic in South Africa is disproportionally distributed by age, sex, race, locality type and province (Shisana & Simbayi, 2002, Shisana, Rehle, Simbayi et al. 2005, 2009). These socio-demographic variables are the main reporting domains for describing the patterns and spread of the HIV epidemic in the country as well as for evaluating the impact of programmatic interventions that have been implemented. For example, by tracking prevalence of HIV by age over three or more national surveys, it has been possible to show success with some age groups (i.e. children <2 years old), where a decrease in HIV prevalence was reported in 2008. Similarly, the previous surveys have identified their own key populations with higher risk of HIV exposure among whom the country needs to put more focus, namely, black African females aged 20–34 years; black African males aged 25–49 years, and those living in informal settlements. These domain variables, which have been determined in this survey, are reported on in the sections below.

Table 3.5 presents prevalence estimates in South Africa by sex, age, race, locality type and province in 2012. The samples tested were large enough to provide overall estimates of

HIV prevalence for each of the reporting domains. The findings suggest that the overall HIV prevalence differs substantially by sex, age, race, locality type, and province. Overall, females have a significantly higher HIV prevalence compared to males at all but two of the 5-year age groups.

HIV has affected all racial groups; however, black Africans had the highest HIV prevalence compared with all other race groups. Coloureds had the second highest HIV prevalence. Prevalence for Indian/Asians and whites was less than 1%. Further analyses of these differences are presented later in this report.

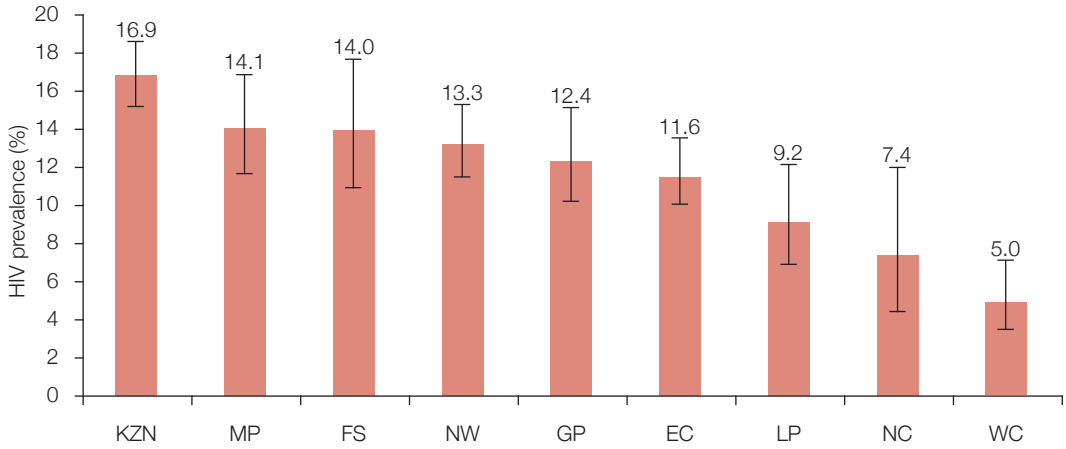
The survey found significant differences in HIV prevalence between people who lived in urban informal areas and those living in the other three locality types (Table 3.5). Residents in the rural informal areas have a significantly higher HIV prevalence when compared with urban formal area residents.

Provincial data on HIV prevalence are presented in Figure 3.1. The results show substantial variation of HIV by province. KwaZulu-Natal continued to lead South Africa in HIV prevalence (16.9%); however, HIV prevalence was not significantly different from that in Mpumalanga (14.1%), the Free State (14.0%) and North West (13.3%). The Western Cape had the lowest HIV prevalence (5.0%) followed by the Northern Cape (7.4%) and Limpopo (9.2%). The relative ranking of provinces by HIV prevalence has remained the same since 2005.

Table 3.5: Overall HIV prevalence by sex, all age groups, race and locality, South Africa 2012

Variable	n	%	95% CI
Sex			
Male	12,896	9.9	8.9–11.0
Female	15,794	14.4	13.3–15.6
Age (years)			
0–14	8,039	2.4	1.9–2.9
15–24	5,890	7.1	6.2–8.1
25–49	8,830	25.2	23.2–27.3
50+	5,986	7.6	6.5–8.8
15–49	14,720	18.8	17.5–20.3
Race			
Black African	18,629	15.0	14.0–15.9
White	1,733	0.3	0.1–0.8
Coloured	5,625	3.1	2.2–4.2
Indian/Asian	2,626	0.8	0.5–1.4
Locality type			
Urban formal	14,821	10.1	8.8–11.7
Urban informal	3,329	19.9	17.4–22.7
Rural informal	7,801	13.4	12.2–14.7
Rural formal	3,046	10.4	7.4–14.4
Total	**28,997**	**12.2**	**11.4–13.1**

Figure 3.1: HIV prevalence by province, South Africa 2012



Key: KZN – KwaZulu-Natal, MP – Mpumalanga, FS – Free State, NW – North West, GP – Gauteng, EC – Eastern Cape, LP – Limpopo, NC – Northern Cape, WC – Western Cape

3.3.2 Trend analysis of HIV by province

Detailed information is provided on HIV prevalence for 2012 in Table 3.5 and Table 3.6 provides trend analyses of HIV prevalence over the last four surveys at provincial level. The overall HIV prevalence based on a population aged 2 years and older has changed significantly ($p<0.001$) over the last four surveys from 2002 to 2012.

The provincial figures for 2002 had wider confidence intervals compared to national figures because of a smaller sample size. The figures are therefore, in some cases not comparable to the other three surveys. For this reason, provincial figures were compared starting from 2005. The comparison of HIV-prevalence estimates by province between 2005 and 2008 shows that the three highest HIV prevalence areas in order were KwaZulu-Natal, Mpumalanga and the Free State, except for 2012, when the Free State prevalence increased to the level of prevalence in Mpumalanga. The lowest HIV prevalence continues to be in the Western Cape; but the prevalence for this province increased from 1.9% in 2005 to 5.0% in 2012. HIV prevalence in the Eastern Cape, which had remained stable since 2005, increased from 9.0% in 2008 to 12.2% in 2012, moving closer to the levels of prevalence found in Gauteng and the North West. A similar increase is observed in Gauteng.

To gain a better understanding of the overall HIV prevalence, it is essential to examine the HIV prevalence distribution by age which is presented in Table 3.6. HIV prevalence was low (2.4%) for children under 15 years, but rose sharply among respondents aged 20–24 years and continued to rise until it peaked in the 30–34 years age group with a prevalence of 30.7%. Then, prevalence dropped to 30.2% for respondents aged 35–39 years, and further declined to 3.2% for persons aged 60 years and older.

The epidemiological curve for South Africa continues to show that females have a much higher HIV prevalence than males (14.4% vs. 9.9%, $p<0.001$). This trend starts from a very early age, 15–19 years old. Their male counterparts on the other hand have a HIV prevalence under 1% and yet among females the prevalence is already at 5.6% suggesting that young females are contracting HIV by having sex with older men, a finding which is

Table 3.6: HIV prevalence by sex and age, South Africa 2012

Age group (years)	Males			Females			Total		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
0–14	4,136	2.3	1.8–3.1	3,843	2.4	1.9–3.1	7,979	2.4	1.9–2.9
15–19	1,511	0.7	0.4–1.2	1,606	5.6	4.2–7.5	3,117	3.2	2.4–4.1
20–24	1,287	5.1	3.7–7.0	1,486	17.4	14.6–20.6	2,773	11.2	9.6–13.1
25–29	989	17.3	13.8–21.6	1,267	28.4	23.8–33.3	2,256	22.8	19.8–26.2
30–34	757	25.6	19.8–32.4	1,028	36.0	30.9–41.4	1,785	30.7	26.7–35.0
35–39	705	28.8	22.7–35.7	1,005	31.6	26.9–36.8	1,710	30.2	26.1–34.6
40–44	661	15.8	11.8–20.8	933	28.0	22.8–33.9	1,594	22.2	18.5–26.3
45–49	558	13.4	9.3–18.8	927	19.7	15.6–24.5	1,485	16.7	13.7–20.2
50–54	587	15.5	10.8–21.7	896	14.8	11.4–19.0	1,483	15.1	12.2–18.6
55–59	506	5.5	3.6–8.4	834	9.7	7.0–13.3	1,340	7.8	6.0–10.0
60+	1,196	4.6	2.8–7.4	1,967	2.4	1.7–3.3	3,163	3.2	2.3–4.5
Total	**12,893**	**9.9**	**8.9–11.0**	**15,792**	**14.4**	**13.3–15.6**	**28,685**	**12.2**	**11.4–13.1**

supported in Section 3.7.2 of this report. Males reach a similar level of HIV prevalence by age 20–24 years, but by then female prevalence is more than triple that of males.

Female HIV prevalence continues to increase, peaking at 30–34 years where prevalence reaches a record high of 36.0% (Figure 3.2). The HIV prevalence in males peaks in the 35–39 year age group at 28.8%. At the age of 40–44 years, prevalence for males (15.8%) is significantly lower than that of their female age peers ($p<0.001$), having dropped from the male peak prevalence of 28.8%. However, for the older age groups this trend did not persist, with males 60 years and older having significantly higher HIV prevalence than females ($p<0.019$).

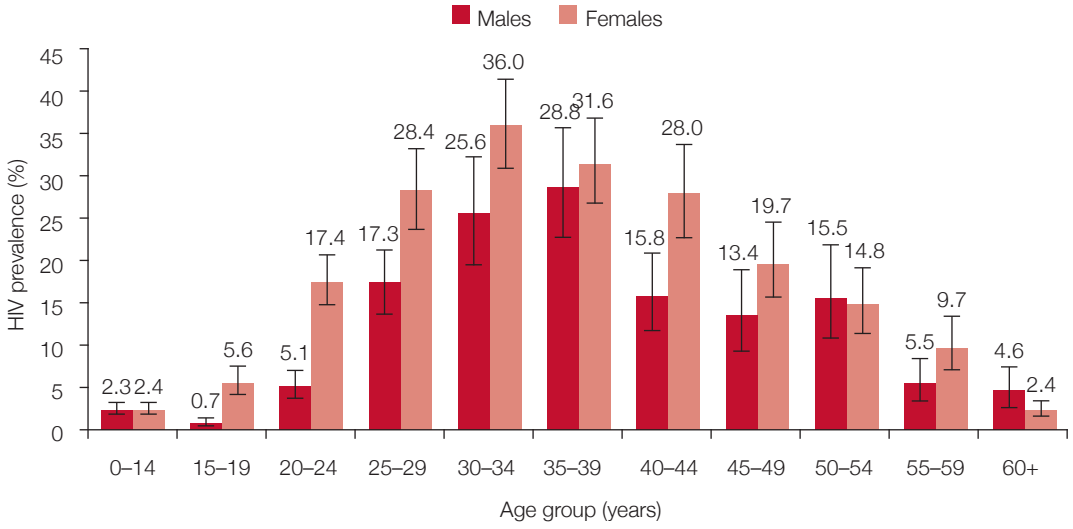
Table 3.8 presents prevalence of HIV among children by sex. These infections are transmitted from mother to child. The results show that among children 12 months and younger HIV prevalence is 1.3% (95% CI: 0.6–2.7), while that among children under 5 years is 1.7% (95% CI: 1.2–2.6), with no sex difference in 2012. Comparing 2008 and 2012, the HIV prevalence among children under 5 years has declined from 3.3% (95% CI: 2.1–5.2) in 2008 to 1.7% (95% CI: 1.2–2.6) in 2012, although this decline is not statistically significant. For children 12 months and younger, HIV prevalence has decreased from 2.0% (95% CI: 0.9–4.7) in 2008 to 1.3% (95% CI: 0.6–2.7) in 2012.

Prevalence of HIV for children aged between 5 and 14 years is 2.7% (95% CI: 2.1–3.4), with no significant difference in prevalence between males and females in this age group. For youth aged 15–24 years, sex differences are evident, with females having HIV prevalence 3.9 times higher than their male counterparts ($p<0.001$). The differences are narrower for young adults aged 25–49 years, but were large enough to be statistically significant (males: 20.9%; females: 29.4%, $p<0.001$). For older adults (50 years and older) differences between males and females are not statistically significant. However, based on Figure 3.2, it is apparent from an examination of prevalence data in 5-year age groups that there is an interaction between the sex of the participant and HIV prevalence for age.

Table 3.7: HIV prevalence by province among respondents aged 2 years and older, South Africa 2002, 2005, 2008 and 2012

Province	2002			2005			2008			2012		
	n	%	95% CI	n	%	95% CI	n	%	95% CI	n	%	95% CI
Western Cape	1,267	10.7	6.4–15.0	2,204	1.9	1.2–3.0	2,098	3.8	2.7–5.3	3,288	5.1	3.6–7.2
Eastern Cape	1,221	6.6	4.5–8.7	2,428	8.9	7.0–11.4	1,984	9.0	7.2–11.2	3,928	12.2	10.5–14.1
Northern Cape	694	8.4	5.0–11.7	1,144	5.4	4.0–7.2	1,227	5.9	4.5–7.8	2,284	7.8	4.7–12.6
Free State	540	14.9	9.5–20.3	1,066	12.6	9.5–16.7	960	12.6	10.5–15.1	1,998	14.7	11.6–18.4
KwaZulu-Natal	1,579	11.7	8.2–15.2	2,729	16.5	14.0–19.3	2,464	15.8	13.4–18.6	6,798	17.4	15.8–19.2
North West	626	10.3	6.8–13.8	1,056	10.9	8.4–14.0	1,156	11.3	9.1–14.0	1,923	13.9	12.0–16.1
Gauteng	1,272	14.7	11.3–18.1	2,430	10.8	8.9–12.9	2,093	10.3	8.3–12.7	2,899	12.8	10.5–15.5
Mpumalanga	550	14.1	9.7–18.5	1,224	15.2	12.3–18.5	988	15.4	11.9–19.7	2,180	14.5	12.0–17.3
Limpopo	679	9.8	5.9–13.7	1,570	8.0	6.0–10.6	1,252	8.8	6.5–11.9	2,562	9.4	7.0–12.4
Total	**8,428**	**11.4**	**10.0–12.7**	**15,847**	**10.8**	**9.9–11.8**	**14,222**	**10.9**	**10.0–11.9**	**27,860**	**12.6**	**11.7–13.5**

Figure 3.2: HIV prevalence by sex and age, South Africa 2012



Specifically, young males have lower HIV prevalence than their female counterparts, and older males (60 years and older) have twice the HIV prevalence of similarly aged females.

HIV prevalence by age and survey year is presented in Table 3.9. For the 15–24 year age group, there was an initial rise in prevalence from 2002 to 2005, but since then prevalence has been declining. For adults older than 25 years of age, in contrast to HIV prevalence among children, prevalence has been increasing from 15.5% in 2002 to 19.9% in 2012.

3.3.3 HIV prevalence in children aged 2–14 years by province

Provincial HIV-prevalence estimates for children 2–14 years has been on a downward trend since 2002, decreasing from 5.6% in 2002 to 2.4% in 2012 (Table 3.10). The provincial estimates for children are small, with wider confidence intervals. However, the trend analysis suggests that prevalence has declined since 2008 for all provinces, except KwaZulu-Natal, where HIV prevalence has increased, and Limpopo, where it has remained

Table 3.8: HIV prevalence by sex in selected age groups, South Africa 2012

Age groups (years)	Males			Females			Total		
	n	(%)	95% CI	n	(%)	95% CI	n	(%)	95% CI
12 months and younger	426	0.5	0.1–2.3	378	2.2	0.9–5.1	804	1.3	0.6–2.7
0–4	1,238	2.1	1.3–3.5	1,117	1.4	0.8–2.4	2,355	1.7	1.2–2.6
5–14	2,898	2.4	1.7–3.5	2,726	2.9	2.2–3.9	5,624	2.7	2.1–3.4
15–24	2,798	2.9	2.1–3.9	3,092	11.4	9.8–13.2	5,890	7.1	6.2–8.1
25–49	3,670	20.9	18.4–23.7	5,160	29.4	26.8–32.2	8,830	25.2	23.2–27.3
50+	2,289	8.2	6.3–10.5	3,697	7.1	5.9–8.6	5,986	7.6	6.5–8.8
15–49	6,468	14.5	12.8–16.3	8,252	23.2	21.3,25.1	14,720	18.8	17.5–20.3
Total	**12,893**	**9.9**	**8.9–11.0**	**15,792**	**14.4**	**13.3–15.6**	**28,685**	**12.2**	**11.4–13.1**

Table 3.9: HIV prevalence by age, South Africa 2002, 2005, 2008 and 2012

Age group (years)	2002			2005			2008			2012		
	n	%	95% CI	n	%	95% CI	n	%	95% CI	n	%	95% CI
2–14	2,348	5.6	3.7–7.4	3,815	3.3	2.3–4.8	3,414	2.5	1.9–3.5	7,154	2.4	2.0–3.0
15–24	2,099	9.3	7.3–11.2	4,120	10.3	8.7–12.0	3,617	8.7	7.2–10.4	5,890	7.1	6.2–8.1
≥ 25	3,981	15.5	13.5–17.5	7,912	15.6	14.2 -17.1	7,191	16.8	15.3–18.4	14,816	19.9	18.3–21.6
15–49	4,795	15.6	13.9–17.6	9,245	16.2	14.9–17.7	8,106	16.9	15.5–18.4	14,720	18.8	17.5–20.3
Total (≥ 2)	**8,428**	**11.4**	**10.0 -12.7**	**15,847**	**10.8**	**9.9–11.8**	**14,222**	**10.9**	**10.0–11.9**	**27,860**	**12.6**	**11.7–13.5**

Table 3.10: Prevalence of HIV by province, in the 2–14 age group, South Africa 2002, 2005, 2008 and 2012

Province	2002			2005			2008			2012		
	n	%	95% CI	n	%	95% CI	n	%	95% CI	n	%	95% CI
Western Cape	378	7.1	4.1–11.8	573	0.3	0.1–2.4	528	1.1	0.4–2.5	638	0.7	0.2–2.1
Eastern Cape	339	3.4	1.5–7.7	623	1.2	0.6–2.3	503	2.1	0.9–5.0	1,114	1.3	0.7–2.3
Northern Cape	193	3.8	1.6–8.6	283	0.6	0.2–2.1	314	2.3	0.8–6.1	571	1.2	0.5–3.0
Free State	145	4.7	1.9–11.8	264	2.3	0.9–5.6	217	4.1	1.6–10.2	520	1.7	0.9–3.2
KwaZulu-Natal	439	3.9	1.7–9.4	553	7.9	3.5–16.5	508	2.8	1.2–6.9	1,771	4.4	3.2–5.9
North West	171	4.3	1.9–9.5	259	1.4	0.4–5.1	282	3.2	1.2–8.3	539	2.2	1.1–4.1
Gauteng	312	5.0	2.7–9.2	520	2.9	1.6–5.1	478	2.2	1.2–3.8	647	2.1	1.1–4.1
Mpumalanga	165	3.7	1.9–7.1	316	5.4	3.3–8.9	258	3.8	1.7–8.1	632	1.7	0.9–3.2
Limpopo	207	4.7	2.4–8.9	424	4.7	2.8–8.0	326	2.5	1.2–5.1	722	2.8	1.7–4.6
Total	**2,348**	**5.6**	**3.7–7.4**	**3,815**	**3.3**	**2.3–4.8**	**3,414**	**2.5**	**1.9–3.5**	**7,154**	**2.4**	**2.0–3.0**

almost constant. Caution, however, is needed in interpreting these provincial estimates, mainly because of small sample sizes among children.

3.3.4 HIV prevalence among youth aged 15–24 years

Among those aged between 15–24 years, the overall HIV prevalence is 7.1%, which is lower than 8.7% found in 2008, a statistically significant difference (p<0.001). HIV prevalence also varies by sex, race, locality, and province for this age group in 2012. Because of the small number of whites and Indian or Asians in the survey, prevalence by race is compared only between black Africans and Coloureds. The results show that black Africans have a HIV prevalence 7.6 times higher than that of Coloureds (p<0.001) (Table 3.11). Furthermore, comparison by locality type shows that urban informal residents have a higher HIV prevalence, albeit not significantly higher, than that of rural informal and rural formal residents. Urban formal residents have the lowest HIV prevalence compared to other localities, a difference that is statistically significant (p=0.004). Provincial analysis also shows that KwaZulu-Natal has the highest HIV prevalence, but this is not significantly different from that in Mpumalanga (p=0.335). Limpopo has the lowest HIV prevalence among young people (3.1%).

Table 3.11: HIV prevalence among youth in the 15–24 age group by race, province and locality type, South Africa 2012

Variable	n	%	95% CI
Sex			
Male	2,798	2.9	2.1–3.9
Female	3,092	11.4	9.8–13.2
Race			
Black African	4,070	8.4	7.3–9.6
White	246	0.3	0.0–1.9
Coloured	1,115	1.1	0.6–1.9
Indian/Asian	443	0.8	0.2–4.1
Locality type			
Urban formal	2,971	5.7	4.5–7.1
Urban informal	693	11.3	8.0–15.6
Rural informal	1,687	8.0	6.4–9.8
Rural formal	539	9.1	6.8–12.1
Province			
Western Cape	677	4.4	2.6–7.5
Eastern Cape	856	6.2	4.2–9.1
Northern Cape	452	4.1	2.1–7.7
Free State	404	4.5	2.8–7.1
KwaZulu-Natal	1,438	12.0	9.8–14.7
North West	400	8.2	4.8–13.7
Gauteng	605	5.8	4.0–8.2
Mpumalanga	501	10.0	7.4–13.5
Limpopo	557	3.1	1.6–5.7
Total	**5,890**	**7.1**	**6.2–8.1**

Table 3.12 presents HIV prevalence among 15–24 year olds by province from four national surveys. The HIV prevalence has decreased significantly ($p<0.001$) from 2005 (10.3%) to 2012 (7.1%). KwaZulu-Natal, the province with the highest HIV prevalence in the 15–24 years age group, decreased from 16.1% in 2005 to 12.0% in 2012. In contrast, the Western Cape, the province with the lowest HIV prevalence among the youth, increased from 2.3% to 4.4% ($p<0.05$) in the same period. The Western Cape is the only province to have shown an increase in HIV prevalence in this age group. Gauteng and Limpopo also experienced substantial decreases.

3.3.5 HIV prevalence among the reproductive age population 15–49 years

The analysis of HIV prevalence restricted to people of reproductive age (15–49 years) is presented in Table 3.13. HIV prevalence among individuals of childbearing age follows the same pattern as the estimates among individuals 2 years and older, although at higher levels. HIV prevalence in the 15–49 year group is 18.8%. Females remain at higher risk of HIV and are 1.6 times more likely than males to be HIV positive, a difference that is statistically significant ($p<0.001$).

Racial differences in HIV prevalence are also evident: the prevalence among black Africans of reproductive age is 4.9 times higher than that among the second largest HIV prevalence group, the Coloured population ($p<0.001$). HIV prevalence among Coloureds of reproductive age is, in turn, 4.6 times higher than that among the Indian or Asian population for this age group ($p<0.001$). The figures for whites are not reliable as they do not meet the validity criterion.

Table 3.13 further presents HIV prevalence by locality type and province in the reproductive population aged 15–49 years. Respondents living in informal settlements are more likely to be HIV positive than those living in formal areas ($p<0.001$). When comparing those living in urban informal areas with those living in formal urban and formal rural areas the differences in prevalence are statistically significant ($p<0.001$). Rural informal area residents are more likely than urban formal residents to have higher HIV prevalence ($p<0.001$).

HIV prevalence among people of reproductive age is highest in KwaZulu-Natal (27.9%), 3.6 times that of their counterparts in the Western Cape, the province with the lowest prevalence ($p=0.001$). The prevalence in KwaZulu-Natal is significantly higher than that of all other provinces ($p<0.001$).

3.3.6 Trend analysis of HIV prevalence in the reproductive age population

Table 3.14 shows that the reproductive age population experienced significant increases ($p<0.001$) in HIV prevalence over the period of the four national surveys, from 15.6% in 2002 to 18.8% in 2012. Varying patterns can be observed in HIV prevalence. KwaZulu-Natal and the Western Cape experienced continued increases from 2005 to 2012, while Mpumalanga experienced a slight decrease and the Eastern Cape, Northern Cape and Gauteng appeared stable from 2005 to 2008, with increases in 2012.

3.3.7 HIV prevalence trends among respondents aged 25 years and older

Table 3.15 presents HIV prevalence among adults 25 years old and older by province from four national surveys. The HIV prevalence has significantly increased ($p<0.001$) from 2005 (15.6%) to 2012 (19.9%).

Table 3.12: HIV prevalence by province, in the 15–24 age group, South Africa 2002, 2005, 2008 and 2012

Province	2002			2005			2008			2012		
	n	%	95% CI	n	%	95% CI	n	%	95% CI	n	%	95% CI
Western Cape	311	11.2	6.0–19.9	559	2.3	1.2–4.4	553	3.0	1.5–5.8	677	4.4	2.6–7.5
Eastern Cape	320	9.2	5.4–15.2	676	11.7	7.1–18.7	495	6.6	3.8–11.0	856	6.2	4.2–9.1
Northern Cape	154	11.8	6.5–20.5	272	6.4	3.9–10.3	277	3.9	2.0–7.7	452	4.1	2.1–7.7
Free State	127	8.7	3.4–20.2	268	10.3	6.3–16.5	238	3.8	1.9–7.2	404	4.5	2.8–7.1
KwaZulu-Natal	420	7.2	3.5–14.0	727	16.1	12.5–20.4	618	15.3	11.8–19.7	1,438	12.0	9.8–14.7
North West	148	8.3	4.5–15.0	269	6.6	3.7–11.4	274	6.3	3.3–11.6	400	8.2	4.8–13.7
Gauteng	302	11.6	7.5–17.4	591	9.0	6.1–13.2	558	10.1	5.9–16.7	605	5.8	4.0–8.2
Mpumalanga	144	11.7	6.6–19.7	324	10.1	6.4–15.6	255	13.5	9.2–19.3	501	10.0	7.4–13.5
Limpopo	173	5.6	2.7–11.2	434	7.4	4.4–12.3	349	3.9	2.1–7.3	557	3.1	1.6–5.7
Total	**2,099**	**9.3**	**7.5–11.4**	**4,120**	**10.3**	**8.7–12.0**	**3,617**	**8.7**	**7.2–10.4**	**5,890**	**7.1**	**6.2–8.1**

Table 3.13: HIV prevalence among adults in the 15–49 age group by race, province and locality type, South Africa 2012

Variable	n	(%)	95% CI
Sex			
Male	6,468	14.5	12.8–16.3
Female	8,252	23.2	21.3–25.1
Race			
Black African	9,363	22.7	21.2–24.3
White	881	0.6	0.2–1.8
Coloured	3,013	4.6	3.3–6.4
Indian/Asian	1,418	1.0	0.5–2.0
Locality type			
Urban formal	7,882	14.7	12.7–17.0
Urban informal	1,815	29.9	25.9–34.2
Rural informal	3,408	22.6	20.5–24.9
Rural formal	1,615	16.1	11.7–21.8
Province			
Western Cape	1,890	7.8	5.5–10.9
Eastern Cape	1,963	19.9	17.1–23.0
Northern Cape	1,207	11.9	6.8–20.2
Free State	1,071	20.4	15.4–26.5
KwaZulu-Natal	3,536	27.9	25.2–30.8
North West	994	20.3	17.5–23.4
Gauteng	1,673	17.8	14.6–21.6
Mpumalanga	1,125	21.8	17.5–26.9
Limpopo	1,261	13.9	10.2–18.7
Total	**14,720**	**18.8**	**17.5–20.3**

The findings suggest that in 2005 Mpumalanga had the highest HIV prevalence, followed closely by KwaZulu-Natal and the Free State. These three provinces have always been among the top three provinces with the highest HIV prevalence. However, prevalence in KwaZulu-Natal has increased substantially from 20.5% in 2005 to 30.1% in 2012. The Western Cape has also experienced an increase in HIV prevalence since 2005, which has continued to 2012. Limpopo experienced a significant increase (p=0.01) in HIV prevalence in 2012 in comparison with 2005. The Northern Cape prevalence increased in 2012 to a double-digit level (12.5%) whereas in 2005 it was 8.0% and 8.6% for 2008. A similar pattern is observed for the Eastern Cape; prevalence for this province has increased to a level much closer to those of Mpumalanga, the North West and the Free State. Overall, the adult population has experienced increases in HIV prevalence across all provinces except Mpumalanga.

3.3.8 HIV prevalence among persons aged 50 years and older

The average prevalence of HIV in the elderly population aged 50 years and older is 7.1%, which is not significantly different (p=0.511) from that of the younger population of 15–24

Table 3.14: HIV prevalence by province in the 15–49 age group, South Africa 2002, 2005, 2008 and 2012

Province	2002			2005			2008			2012		
	n	%	95% CI	n	%	95% CI	n	%	95% CI	n	%	95% CI
Western Cape	380	13.2	8.4–20.2	1,250	3.2	1.9–5.3	1,240	5.3	3.7–7.5	1,890	7.8	5.5–10.9
Eastern Cape	653	10.2	7.2–14.2	1,353	15.5	12.1–19.8	1,069	15.2	11.9–19.1	1,963	19.9	17.1–23.0
Northern Cape	359	9.6	6.4–14.2	651	9.0	6.4–12.5	675	9.0	6.6–12.3	1,207	11.9	6.8–20.2
Free State	728	19.4	13.7–26.8	629	19.2	13.3–26.9	554	18.5	15.2–22.4	1,071	20.4	15.4–26.5
KwaZulu-Natal	357	15.7	11.6–21.1	1,616	21.9	18.3–25.9	1,426	25.8	22.1–29.8	3,536	27.9	25.2–30.8
North West	902	14.4	10.3–19.9	620	18.0	13.7–23.2	606	17.7	13.9–22.3	994	20.3	17.5–23.4
Gauteng	318	20.3	16.1–25.3	1,538	15.8	13.0–19.1	1,274	15.2	12.1–19.0	1,673	17.8	14.6–21.6
Mpumalanga	797	21.0	15.5–27.9	704	23.1	18.8–27.9	577	23.1	18.4–28.7	1,125	21.8	17.5–26.9
Limpopo	301	11.5	7.6–17.1	884	11.0	8.2–14.5	685	13.7	9.7–19.0	1,261	13.9	10.2–18.7
Total	**4,795**	**15.6**	**13.9–17.5**	**9,245**	**16.2**	**14.8–17.7**	**8,106**	**16.9**	**15.5–18.4**	**14,720**	**18.8**	**17.5–20.3**

Table 3.15: HIV prevalence by province among respondents aged 25 years and older age group, South Africa 2002, 2005, 2008 and 2012

Province	2002			2005			2008			2012		
	n	%	95% CI	n	%	95% CI	n	%	95% CI	n	%	95% CI
Western Cape	579	11.2	6.6–18.3	1,072	2.7	1.6–4.6	1,017	5.4	3.7–7.9	1,973	6.8	4.6–9.9
Eastern Cape	562	8.1	5.5–11.9	1,128	13.8	10.9–17.4	986	15.6	12.0–20.1	1,958	22.0	19.0–25.3
Northern Cape	347	10.6	7.0–15.6	588	8.0	5.6–11.4	636	8.6	6.2–11.9	1,261	12.5	7.3–20.8
Free State	368	22.0	14.3–32.2	534	19.7	13.2–28.4	505	20.4	17.0–24.3	1,074	23.7	18.4–30.1
KwaZulu-Natal	720	14.9	10.1–21.5	1,449	20.5	16.8–24.6	1,338	23.5	19.7–27.8	3,589	30.1	26.9–33.6
North West	307	17.8	13.4–23.3	528	18.9	14.3–24.5	600	17.7	13.9–22.2	984	21.1	18.2–24.3
Gauteng	658	18.1	13.8–28.8	1,317	14.9	11.9–18.4	1,057	14.4	11.4–18.0	1,647	18.8	15.0–23.4
Mpumalanga	241	21.0	14.8–28.8	584	24.4	19.6–30.0	475	24.5	18.4–31.9	1,047	23.6	18.8–29.2
Limpopo	299	14.0	8.8–21.8	712	11.4	8.7–14.9	577	16.7	12.2–22.4	1,283	16.3	12.1–21.6
Total	**3,981**	**15.5**	**13.6–17.6**	**7,912**	**15.6**	**14.2–17.1**	**7,191**	**16.8**	**15.3–18.4**	**14,816**	**19.9**	**18.3–21.6**

years. According to the epidemic curve presented in Figure 3.2, HIV prevalence is higher among males compared to females 50 years or older except those aged 55–59 years, a finding that warrants further investigation. Overall, for the 50 years and older age group, prevalence was 7.6% (95 % CI: 6.5–8.8) (Table 3.16). Racial differences in HIV prevalence are evident, as were differences in locality type. Black Africans had the highest prevalence compared to Coloureds and Indian or Asians (p<0.001). The response rate among whites was too low to estimate the HIV prevalence.

With respect to locality type, both residents from rural and urban informal areas had nearly twice the prevalence of HIV found among residents of formal urban and rural areas (p<0.001).

Provincial estimates of HIV prevalence among older people are based on smaller numbers, mainly because HIV is not as prevalent in older people as it is in persons of reproductive age. Provincial estimates of HIV prevalence show a different pattern. The Free State leads all the other provinces, with prevalence even higher than that of KwaZulu-Natal. However,

Table 3.16: HIV prevalence among respondents aged 50 years and older, South Africa 2012

Variable	%	95% CI	Total
Sex			
Male	8.2	6.3–10.5	2,289
Female	7.1	5.9–8.6	3,697
Race			
Black African	11.0	9.5–12.7	3,183
White	0.0*		726
Coloured	2.1	1.1–4.3	1,189
Indian/Asian	0.6	0.2–1.4	880
Locality type			
Urban formal	5.9	4.5–7.7	3,474
Urban informal	9.9	6.8–14.2	436
Rural informal	10.1	8.2–12.3	1,461
Rural formal	6.0	3.5–9.9	615
Province			
Western Cape	1.8	0.8–4.0	760
Eastern Cape	8.5	5.9–12.1	851
Northern Cape	6.1	3.3–10.8	506
Free State	13.9	9.7–19.4	407
KwaZulu-Natal	9.8	7.4–12.8	1,491
North West	9.2	5.5–14.9	390
Gauteng	6.9	4.4–10.5	579
Mpumalanga	10.1	6.9–14.6	423
Limpopo	7.3	4.7–11.2	579
Total	**7.6**	**6.5–8.8**	**5,986**

**No cases were found*

the confidence intervals are very wide, making it difficult to estimate the true population parameter for HIV prevalence in the older population in this province.

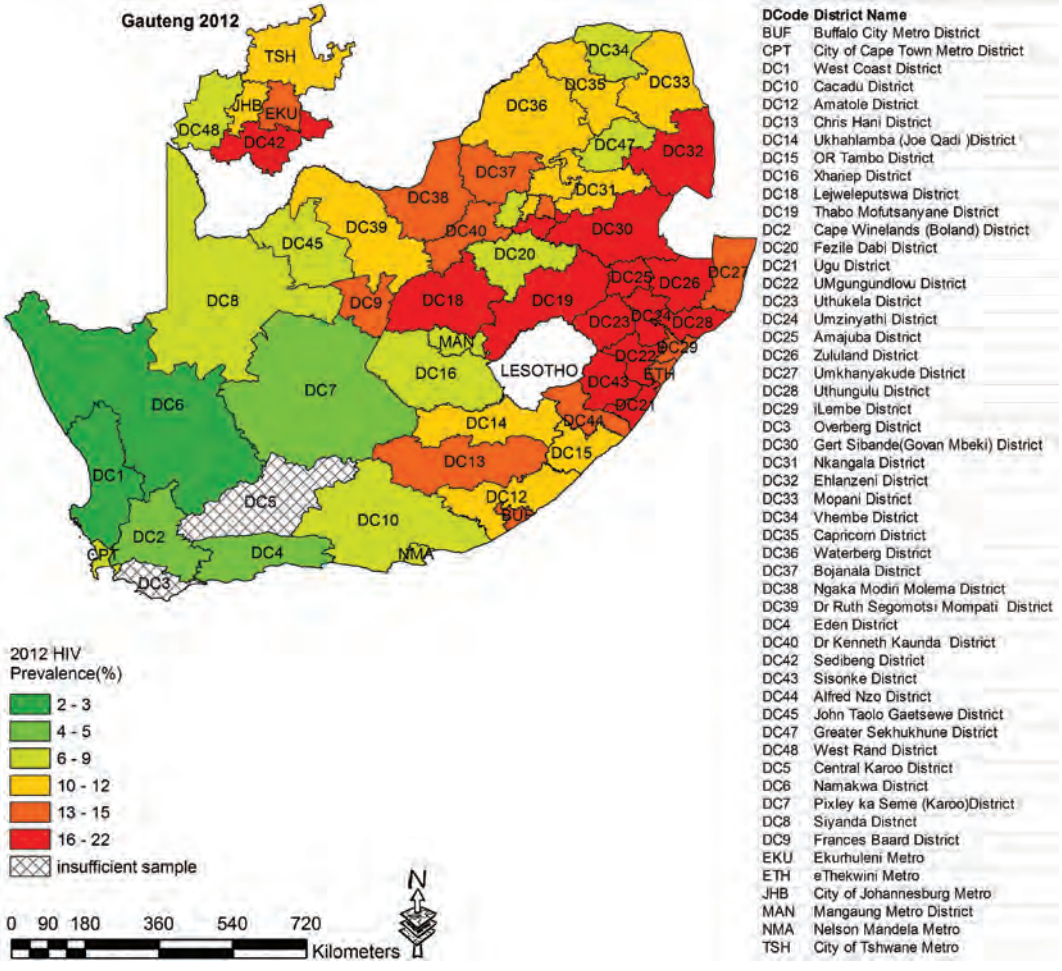
3.3.9 HIV prevalence in sub-provincial levels

Given the heterogeneity of HIV distribution in South Africa, it is essential to track the changes in HIV prevalence by district. Although the numbers are small compared to provincial data, it is still important to map the epidemiological profile of HIV by district. Figure 3.3 presents HIV-prevalence estimates by district for 2012. From this map it is evident that that the epidemic is concentrated in 13 districts. Two districts, Central Karoo and Overberg had insufficient sample number for estimation. This is reflected in Figure 3.3.

Further analysis of district level data was undertaken at the metropolitan municipality level. A metropolitan municipality is defined as a conurbation that:

- has a high population density and is characterised by an intense movement of people, goods, and services;
- has extensive development with multiple business districts and industrial areas;
- is a centre of economic activity with a complex and diverse economy; and

Figure 3.3: HIV prevalence by district, South Africa 2012



- has strong interdependent social and economic linkages among its constituent units (Act No. 117, 1998 Local Government Municipal Structures Act).

A metropolitan area (metro) is therefore highly developed and represents the economic capital of a province.

Table 3.17 shows that, as with provinces, there are variations in HIV prevalence in these metropolitan municipalities. eThekwini in KwaZulu-Natal and Ekurhuleni in Gauteng have the highest HIV prevalence, followed closely by Buffalo City, in the Eastern Cape. The City of Tshwane and the City of Johannesburg have an HIV prevalence that is slightly lower than the national average, but not significantly so. The three metropolitan municipalities that have lower HIV prevalences below the rest and the national average are Nelson Mandela Metropolitan municipality, in the Eastern Cape, Mangaung Metro municipality, in the Free State, and the City of Cape Town, which has the lowest recorded HIV prevalence.

Table 3.17: Overall HIV prevalence by metropolitan municipality, South Africa 2012

Metropolitan municipality	n	%	95% CI
City of Cape Town Metro	2,250	5.2	3.4–7.8
Mangaung Metro	406	7.9	5.3–11.6
Nelson Mandela Metro	939	8.3	4.5–14.9
City of Johannesburg Metro	1,262	11.1	8.3–14.6
City of Tshwane Metro	751	11.7	8.1–16.6
Buffalo City Metro	556	13.6	10.6–17.3
Ekurhuleni Metro	822	14.3	10.3–19.5
eThekwini Metro	3,708	14.5	11.2–18.6
Total	**28,996**	**12.2**	**11.4–13.1**

3.3.10 HIV by socio-demographic characteristics

To understand the epidemiology of HIV in South Africa requires appreciation of the relationships between social factors and HIV status.

The 2012 national survey has repeatedly shown that black Africans have the highest HIV prevalence compared with other racial groups. Further analysis of socio-economic relationship is provided to elucidate this finding. The results in Table 3.18 show that, among black Africans, HIV prevalence is highest in urban informal areas as well as rural formal areas and lowest in rural informal areas as well as urban formal areas. Among the Coloured and Indian or Asian populations, there are no significant differences in HIV prevalence based on locality type. With respect to the Indian or Asian and white populations, prevalence was under 1% in urban formal areas; there were too few observations (i.e., cell size of less than 100) in the other locality types to make a meaningful comparison.

Because the majority of residents living in urban informal and rural formal areas are black African, it is necessary to assess the living arrangements of black Africans compared to other race groups. Table 3.19 shows that there are racial differences in living arrangements. Black Africans (39.1%) are less likely than all other races (>85%) to live in urban formal areas, which is reminiscent of the apartheid era. A significant proportion of black Africans (48.0%) compared to all other groups live in rural informal areas and an

Table 3.18: HIV prevalence by race and locality type, in all age groups, South Africa 2012

Locality type	Black African			White			Coloured			Indian/Asian		
	n	%	95% CI	n	%	95% CI	n	%	95% CI	n	%	95% CI
Urban formal	6,035	15.0	13.3–16.8	1,329	0.3	0.1–0.9	4,633	3.1	2.1–4.4	2,599	0.8	0.4–1.4
Urban informal	3,070	20.4	17.8–23.3	0	0.0		207	4.9	2.7–8.8	2	0.0	
Rural informal	7,731	13.4	12.3–14.7	7	12.1	1.5–56.0	4	0.0		1	0.0	
Rural formal	1,793	20.8	17.4–24.7	397	0.0		781	2.7	1.7–4.3	24	2.3	1.0–5.0
Total	**18,629**	**15.0**	**14.0–15.9**	**1,733**	**0.3**	**0.1–0.8**	**5,625**	**3.1**	**2.2–4.2**	**2,626**	**0.8**	**0.5–1.4**

Table 3.19: Race distribution by locality type, South Africa 2012

Race	n	Urban formal		Urban informal		Rural informal		Rural formal	
		%	95% CI	%	95% CI	%	95% CI	%	95% CI
Black African	23,423	39.1	33.6–44.8	9.6	7.3–12.6	48.0	42.5–53.5	3.3	2.4–4.7
White	3,366	85.4	76.3–91.4	0.0	0.0–0.1	0.4	0.2–0.8	14.2	8.2–23.4
Coloured	6,994	86.5	79.6–91.3	2.2	1.0–5.0	0.2	0.1–0.8	11.0	6.6–17.9
Indian/Asian	4,216	98.9	96.8–99.6	0.1	0.0–0.7	0.1	0.0–1.0	0.9	0.3–3.1
Total	**38,065**	**49.0**	**44.4–53.5**	**7.9**	**6.0–10.3**	**38.2**	**33.8–42.9**	**4.9**	**3.6–6.7**

additional 9.6% live in urban informal areas; in total the majority of black South Africans (57.6%) live in the informal areas of the country (p<0.001).

These areas are under-resourced and lack some of the basic necessities, while the formal areas are well resourced in terms of basic infrastructure such as housing, water, sanitation, and access to preventive health services (ILO, 2008). This is a major distinguishing factor between high- and low-HIV population groups: the majority of black Africans live under poor conditions.

3.3.11 Marital status and HIV risk

To gain a better understanding of the relationship between marital status and HIV risk, HIV status by marital status was analysed while taking into account the sex of the participants. The results on Table 3.20 show that HIV prevalence for married participants did not differ by sex, and also that HIV prevalence for widowed participants did not differ by sex. However, for participants who were going steady there were major sex differences in HIV prevalence; females compared to males had a much higher HIV prevalence (29.5% vs 19.2%) (p<0.001).

Similar findings were observed for single persons not in a relationship; females again had a higher HIV prevalence than males (19.9% vs 9.4%) (p<0.001). Interestingly, opposite results were found among divorced participants; males were more likely than females to be HIV positive (16.1% vs 10.3%) (p=0.177) but the difference was not significant

With respect to socio-economic status, the results show that there is an inverse relationship between household economic status and HIV status, with members from lower household economic status having higher HIV prevalence (Table 3.20). Indeed, those without money are 6.7 times more likely to be HIV positive than those with excess money to spend on holidays and luxury goods (p<0.001). Even those who have money for food but are short of money for other goods are 5.7 times more likely to be HIV positive than those who have excess money to spend on holidays and luxury goods. These differences are statistically significant (p<0.001).

Although among married persons there are no differences between males and females in HIV prevalence, when data for males and females are disaggregated by household economic situation, sex differences in HIV prevalence emerge (Table 3.20). Among the poorest households with not enough money to meet basic necessities, females have significantly higher rates of HIV infection (17.5%) compared to males (11.8%) (p<0.001), but in economically endowed households, there are no significant differences in HIV prevalence by sex (females 6.8% vs males 4.8%).

3.3.12 Key populations at higher risk of HIV exposure

The second-generation surveillance guidelines on how to conduct HIV surveillance activities in low-and middle-income countries recommend that all countries conduct HIV surveillance among populations with behaviours that increase their risk for HIV, or key populations at higher risk of HIV exposure (UNAIDS/WHO, 2000; also see UNAIDS/WHO, 2013). Although the definition of key populations at higher risk of HIV exposure will vary from region to region and country to country, each region and country has its own population that tends to be at higher risk of being infected with HIV. The findings on conventional key populations with higher risk of HIV exposure such as men who have

Table 3.20: HIV prevalence by marital status, household economic situation and sex among respondents aged 15 years and older, South Africa 2012

Variable	Total			Males			Females		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Marital status									
Married/Civil union	6,741	10.0	8.5–11.8	2,983	9.3	7.4–11.6	3758	10.8	8.7–13.2
Going steady or Living together (not married)	6,168	24.3	22.3–26.5	2,737	19.2	16.7–21.9	3431	29.5	26.6–32.6
Single (not in a relationship)	4,987	14.3	12.1–16.8	2,348	9.4	6.3–13.6	2639	19.9	16.8–23.3
Widowed	1,773	13.8	11.1–17.0	288	15.0	9.6–22.8	1485	13.5	10.6–17.0
Divorced	693	12.3	8.6–17.3	232	16.1	9.1–27.1	461	10.3	6.9–15.1
Household economic situation									
Not enough money for basic things like food and clothes	11,209	14.7	13.6–15.8	5,088	11.8	10.5–13.1	6,121	17.5	16.0–19.0
Money for food and clothes, but short of many other things	8,825	12.6	11.1–14.3	3,924	10.3	8.3–12.7	4,901	14.6	12.6–16.8
Have most of the important things, but few luxury goods	4,300	5.8	4.3–7.9	1,879	4.8	3.0–7.6	2,421	6.8	5.0–9.2
Money for extra things such as holidays and luxury goods	1,006	2.2	1.3–3.8	470	1.6	0.7–3.4	5,36	2.8	1.5–5.5

sex with men (MSM) and people who use drugs were omitted from this report due too few observations to report reliably.[17]

In South Africa, although the epidemic is generalised there are sections of the population that have a higher than average HIV prevalence when compared to the general population. The HSRC over a series of national household surveys have identified specific groups to be at most risk of being infected with HIV. These key populations at higher risk of HIV exposure population groups are likely to vary over time as a result of changes in HIV prevention. These include black African females aged 20–34 years, people who are living together and are not married, black African males aged 25–49 years, disabled persons aged 15 years and older, high-risk alcohol drinkers aged 15 years and older, and recreational drugs users. It is therefore critical to monitor the HIV epidemic among key populations at higher risk of HIV exposure. UNAIDS (2011) posits that without effective surveillance and targeting with effective prevention for these groups HIV transmission is likely to continue at high rate in these special populations. However, with effective prevention, prevalence will drop in populations most-at-risk before they drop in the general population. For this reason, it is necessary to identify the most-at-risk groups in order to encourage those implementing interventions to increase the resources directed to this population.

HIV prevalence

Data shown in Table 3.21 show that in 2012 the key populations at higher risk of HIV exposure included people co-habiting, and black African females aged 20–34 years. Each one of these groups had HIV prevalence rates above 30%. The next most-at-risk groups were black African males aged 25–49 years. The third most-at-risk group comprised disabled persons, high-risk alcohol drinkers and recreational drug users.

Having focused largely on individuals, the next section concentrates on mother-child pairs. This is an attempt to understand transmission of HIV between mothers and children, as well as horizontal transmission of HIV in children.

Table 3.21: HIV prevalence in key populations at higher risk of HIV exposure, South Africa 2012

Key population	n	%	95% CI
Black African women 20–34 years	2,532	31.6	28.5–34.9
People living together, not married (15 to 49 years)	1,499	30.9	26.5–35.7
Black African men 25–49 years	2,120	25.7	22.8–28.8
Disabled (15 years and older)	1,055	16.7	12.9–21.4
High-risk drinkers (15 years and older)	1,990	14.3	11.8–17.3
Recreational drug users (15 years and older)	1,216	12.7	9.7–16.5

3.3.13 Sero-discordance between mother and child pairs

One of the objectives of this survey was to identify sero-discordance between mother and child pairs where the child was HIV positive but the mother was HIV negative. This was

17 The samples used for national population-based household surveys of the general population are not representative of key populations at higher risk of HIV exposure and separate surveys using special sampling methods such as respondent-driven sampling are recommended.

included in the survey in view of earlier findings reported by researchers at Stellenbosch University (Hiemstra, Rabie and Schaaf et al. 2002) and the HSRC (Shisana & Simbayi, 2002; Shisana, Mehtar, Mosala et al. 2008) that demonstrated that there were children who contracted HIV horizontally. Table 3.22 shows that of the 855 mother-child pairs where the child was 2 years or younger, only one HIV-positive child (0.2%) had a mother who was HIV negative. Additionally, the observation that in the HIV-positive mother-child pairs, only 10 children (4.3%) were HIV positive suggests that the HIV transmissions in these children were vertical from mother-to-child. The results indicate that the HIV status of mothers of children 2 years or younger is significantly more likely to be the same as the child's HIV status ($p<0.001$). Similar results were found for mother-child pairs with children aged 10 years or less ($p<0.001$).

Table: 3.22: HIV sero-discordance between mother-and-child pairs for children in 0–2 age group, South Africa 2012

HIV status	Mother HIV positive	Mother HIV negative	Total
Child HIV positive	4.3% (1.7–7.0) n=10	0.2% n=1	11
Child HIV negative	95.7% (93–98.3) n=220	99.8% (99.5–1) n=624	844
Total	**230**	**625**	**855**

Table 3.23 shows the results among the matched pairs of mothers and their children younger than 10 years old. Of the 2,824 pairs matched, five were sero-discordant, where the child was HIV positive but the mother was HIV negative (0.2%). The remaining 47 children (6.2%) were sero-concordant suggesting that they might have been infected through vertical transmission.

Table 3.23: HIV sero-discordancy between mother-and-child pairs in which children were younger than 10 years old, South Africa 2012

HIV status	Mother HIV positive	Mother HIV negative	Total
Child HIV positive	6.2% (4.5–7.9) n=47	0.2% n=5	52
Child HIV negative	93.8% (92.1–95.5) n=712	99.8% (99.5–100) n=2,060	2,772
Total	**759**	**2,065**	**2,824**

Having concentrated on sero-discordancy between mother-and-child pairs, the next section focuses on children who lost a parent(s) and investigates the HIV prevalence in these children.

3.3.14 Orphanhood and HIV prevalence

Orphans are considered to be at risk of HIV because of their vulnerability. They are at risk of being forced into sex, or to have sex in exchange for support or even to become sexually active earlier than their peers (Population Council 2007). For this reason, it is necessary to determine their HIV status so that HIV-prevention programmes can be established to target this vulnerable group.

Table 3.24 summarises the results of HIV prevalence by orphanhood status for children 18 years old and younger. Of the 9,892 children who tested for HIV in the survey, 2.4% were found to be HIV positive. When data were disaggregated by orphanhood status, orphans were 3.5 times more likely than non-orphans to be HIV positive; the difference was statistically significant ($p<0.001$). Double orphans (that is, children who had lost

both mother and father) were 1.7 times more likely than maternal orphans to be HIV positive; however, the difference was not statistically significant. Double orphans were 3 times more likely than paternal orphans to be HIV positive; this difference was statistically significant (p=0.004). When compared to non-orphans, the likelihood of double orphans being HIV positive increased substantially: double orphans were 6.9 times more likely than non-orphans to be HIV positive. This comparison yielded statistically significant results (p<0.001). Further disaggregation of orphans by type yielded large differences in HIV prevalence because of small sample sizes, however the estimates are uncertain (confidence intervals are very large).

Table 3.24: HIV prevalence by orphanhood status and type among children in the 0–18 age group, South Africa 2012

Orphanhood status/type	n	%	95% CI
Orphanhood status			
Orphan	1,767	6.2	4.6–8.2
Not an orphan	8,125	1.7	1.3–2.1
Orphanhood type			
Maternal	479	6.9	4.4–10.6
Paternal	961	3.9	2.5–6.2
Double	327	11.7	6.6–19.8
Total	**9,892**	**2.4**	**2.0–2.9**

Age is associated with HIV status; it is therefore necessary to stratify data on HIV status of orphans by age of respondent in an attempt to further understand the relationship between orphanhood and HIV. Table 3.25 shows HIV prevalence by orphanhood and HIV prevalence for children younger than 15 years. The results show that prevalence of HIV in this age group is 2.3% and 7.4% for orphans, compared to 1.5% for non-orphans. These differences are statistically significant (p<0.001).

Table 3.25: HIV prevalence by orphanhood status and type among children in the 0–14 age group, South Africa 2012

Orphanhood status/type	n	%	95% CI
Orphanhood status			
Orphan	1,120	7.4	5.2–10.3
Not an orphan	6,595	1.5	1.2–1.9
Orphanhood type			
Maternal	318	6.6	3.8–11.0
Paternal	613	5.0	3.0–8.2
Double	189	15.2	8.0–27.0
Not an orphan	6,595	1.5	1.2–1.9
Total	**7,715**	**2.3**	**1.9–2.9**

Table 3.26 summarises HIV prevalence for orphans among teenagers aged 15 to 18 years. The results suggest that there are no significant differences (p=0.224) in HIV prevalence between orphans and non-orphans for this age group. Further stratification by type of orphans did not yield meaningful results due to small sample sizes.

Table 3.26: HIV prevalence by orphanhood status and type among children in the 15–18 age group, South Africa 2012

Orphanhood status/type	n	%	95% CI
Orphanhood status			
Orphan	647	3.8	2.2–6.5
Not an orphan	1,530	2.5	1.6–4.0
Orphanhood type			
Maternal	161	7.5	3.3–16.3
Paternal	348	1.8	0.5–5.6
Double	138	5.3	2.3–11.9
Not an orphan	1,530	2.5	1.6–4.0
Total	**2,177**	**2.9**	**2.0–4.2**

3.4 Antiretroviral treatment exposure

The inclusion of novel laboratory methodologies in the survey protocol has enabled direct estimation of exposure ART among HIV-positive individuals. The 2008 survey was the first population-based household survey in the world to include testing for ARVs in HIV-positive samples. Increased access to ART has increased the survival time of PLHIV, with the effect that HIV prevalence is expected to increase in the age groups which are receiving ART. Hence, measuring ART exposure in the HIV-positive survey population is critical for assessing the impact of ART on HIV-prevalence levels and for the interpretation of HIV-prevalence trends. The detection of ARV drugs in HIV-positive samples is also a critical component of the HIV-incidence testing algorithm in order to reduce misclassification and improve assay-based HIV-incidence estimates.

Table 3.27 provides estimates of the total number of PLHIV, the total number of people on ART, and the proportion of people living with HIV who were on ART at the time of the survey. By mid-2012, out of the total estimated number of 6,422,179 PLHIV, 2,002,350 (31.2%) were exposed to treatment. A significantly greater proportion of females (34.7%) than males (25.7%) had accessed treatment (p=0.001). HIV-infected children aged 0–14 years and adults 50 years and older were found to have the highest exposure to antiretroviral therapy, 45.1% and 42.7% respectively. Youth aged 15–24 living with HIV had the lowest proportion of treatment exposure (14.3%). ART exposure in the HIV-positive population aged 15–49 years was 28.9%.

Over 6.2 million black Africans were estimated to be living with HIV, and over 1.9 million were exposed to treatment (30.9%). The proportion of ART exposure among people in the other race groups was higher, at 41.3%. There was no significant difference in the proportion of treatment exposure among HIV-positive people living in formal or informal urban settlement areas (p=0.893). Rural informal areas showed a higher proportion of treatment exposure than rural formal areas (35.3% vs. 28.7%), but the difference is not statistically significant (p=0.305). The number of survey participants exposed to ART at the provincial level was insufficient to generate valid ART exposure estimates by province.

Table 3.27: Exposure to antiretroviral treatment among individuals living with HIV by sex, age, race and locality type, South Africa 2012

Variable	Estimated number of people living with HIV (n)	Estimated number of people on ART (n)	Proportion of people living with HIV on ART (%) 95% CI
Sex			
Male	2,531,000	651,000	25.7 [21.2–30.8]
Female	3,873,000	1,344,000	34.7 [31.4–38.2]
Age group (years)			
0–14	369,000	166,000	45.1 [33.9–56.9]
15–24	720,000	103,000	14.3 [10.0–20.0]
25–49	4,706,000	1,466,000	31.2 [27.4–35.2]
50 +	610,000	260,000	42.7 [35.7–50.0]
15–49	5,426,000	1,569,000	28.9 [25.6–32.5]
Race			
Black African	6,232,000	1,924,000	30.9 [27.7–34.3]
Other	172,000	71,000	41.3 [30.0–53.7]
Locality type			
Urban formal	2,558,000	724,000	28.3 [22.5–39.4]
Urban informal	851,000	233,000	27.4 [23.0–32.4]
Rural informal	2,727,000	963,000	35.3 [31.3–39.5]
Rural formal	28650002	82,000	28.7 [20.1–39.2]
Total	**6,422,000**	**2,002,000**	**31.2 [28.1–34.5]**

3.5 HIV incidence

The interpretation of HIV prevalence grows increasingly complex as the epidemic matures and prevention and care efforts try to mitigate it at the same time. The estimation of HIV incidence and ART exposure (see previous section) is, therefore, crucial to disentangle the concurrent impact of prevention and treatment programmes on HIV prevalence. Incidence estimates provide critical insights into the dynamics of the HIV epidemic and are the most direct means of assessing the impact of HIV-prevention programmes. HIV incidence is also the biomarker of choice to associate with recent behaviours or recent behavioural changes.

3.5.1 HIV incidence estimates for 2012

In this section we present direct HIV incidence measures from HIV incidence testing in the cross-sectional specimens collected in the 2012 survey (see Section 2.9.4 under Methods).

The following Tables 3.28 and 3.29 present HIV incidence estimates based on assays for South Africa in both relative terms (% per year) and absolute terms (number of new infections per year). HIV incidence amongst persons aged two years and older is estimated

Table 3.28: HIV incidence (%) and number of new infections by age and sex, South Africa 2012

Age groups (years)	Sex	HIV incidence % (95% CI)	Estimated number of new infections (95% CI)
2+	**Total**	**1.07 (0.87–1.27)**	**469,000 (381,000–557,000)**
	Male	0.71 (0.57–0.85)	151,000 (121,000–181,000)
	Female	1.46 (1.18–1.84)	318,000 (257,000–401,000)
2–14	**Total**	**0.25 (0.21–0.29)**	**29,000 (24,000–34,000)**
	Male	No incident cases found	
	Female	0.49 (0.39–0.59)	29,000 (23,000–35,000)
15–24	**Total**	**1.49 (1.21–1.88)**	**139,000 (113,000–175,000)**
	Male	0.55 (0.45–0.65)	26,000 (21,000–31,000)
	Female	2.54 (2.04–3.04)	113,000 (91,000–135,000)
25+	**Total**	**1.41 (1.15–1.67)**	**300,000 (245,000–355,000)**
	Male	1.29 (0.91–1.67)	125,000 (88,000–162,000)
	Female	1.62 (1.30–1.94)	175,000 (140,000–210,000)
15–49	**Total**	**1.72 (1.38–2.06)**	**396,000 (318,000–474,000)**
	Male	1.21 (0.97–1.45)	145,000 (116,000–174,000)
	Female	2.28 (1.84–2.74)	251,000 (203,000–302,000)

**Numbers are rounded off to the nearest thousand.*

Table 3.29: HIV incidence (%) and number of new infections by race and locality type among respondents aged 2 years and older, South Africa 2012

Variables	HIV incidence % (95% CI)	Estimated number of new infections per year (95% CI)
Race		
Black African	1.34 (1.08–1.60)	448,000 (361,000–535,000)
Other	0.21 (0.17–0.25)	21,000 (17,000–25,000)
Locality type		
Urban formal	1.06 (0.84–1.28)	227,000 (180,000–274,000)
Urban informal	2.46 (1.98–2.94)	80,000 (64,000–96,000)
Rural informal	0.87 (0.69–1.05)	143,000 (113,000–173,000)
Rural formal	0.84 (0.65–1.03)	19,000 (15,000–23,000)
Total	**1.07 (0.87–1.27)**	**469,000 (381,000–557,000)**

**Numbers are rounded off to the nearest thousand.*

at 1.1%, with 469,000 new HIV infections estimated for 2012 (Table 3.28). The incidence of HIV in the population of children aged 2–14 years was 0.25% which translates to 29,000 estimated new infections in this age group. We found no HIV incident cases for males

aged 2–14 years in the survey. HIV incidence for youth aged 15–24 was 1.5% with 139,000 new infections occurring in this age group. Of special concern is the incidence rate of 2.5% among young females aged 15–24 years. An HIV incidence of 1.4% and 300,000 new infections were estimated for the adult age group 25 years and older. HIV incidence in the age group 15–49 years was 1.7% with 396,000 new infections in 2012.

Table 3.29 shows the estimated HIV incidence by race and locality type for the population 2 years and older. The number of recent infections at the provincial level was insufficient to provide reliable incidence estimates. The HIV incidence percentage per year in the black African race group was over 6 times higher than the incidence found in the other race groups, 1.3% and 0.2% respectively.

Persons living in urban informal settlements had by far the highest incidence rates (2.5%) compared to those living in urban formal areas (1.1%), rural informal areas (0.9%), and rural formal areas (0.8%).

Table 3.30 presents the relationship between HIV incidence and various socio-demographic and behavioural factors among the population aged 15–49 years old. Individuals who were married had the lowest HIV incidence at 0.6%. Participants who were living together with a sexual partner recorded a high HIV incidence of 3.1%, followed by those who were single (2.3%). Individuals who reported only one sexual partner in the past year had a lower HIV incidence (1.7%) in comparison with those who reported two or more partners (2.4%). Black African females aged 20–34 years had the highest incidence of HIV among the analysed population groups, 4.5%. Black African males aged 25–49 years recorded an HIV incidence of 1.8%.

Table 3.30: HIV incidence (%) by behavioural and socio-demographic factors in the 15–49 age group, South Africa, 2012

Variables	n	HIV incidence % (95% CI)
Marital status		
Married	3,660	0.55 (0.45–0.65)
Living together	1,499	3.08 (2.48–3.68)
Going steady	4,276	1.99 (1.61–2.37)
Single	4,432	2.28 (1.82–2.74)
Number of sexual partners		
One partner in the past 12 months	8,639	1.67 (1.33–2.01)
More than one partner in the past 12 months	1,058	2.43 (1.95–2.91)
Selected at-risk populations		
Black African females 20–34 years	2,532	4.54 (3.64–5.44)
Black African males 25–49 years	2,120	1.84 (1.48–2.20)

3.5.2 HIV incidence estimates for 2002–2012 using a mathematical model

In this section we compare the direct laboratory-based HIV incidence estimates presented in the previous section with indirect measurements of HIV incidence derived from prevalence data obtained in the national HIV surveys in 2002, 2005, 2008 and 2012. The mathematically derived estimates presented in this report are revised incidence estimates

based on an updated method to adjust for the effect of antiretroviral treatment on survival (Rehle, Hallett, Shisana et al. 2010; Rehle et al. manuscript in preparation; see also Section 2.9.5 under Methods).

Table 3.31 shows the average annual HIV-incidence rates by age and sex for the inter-survey periods 2002–2005, 2005–2008 and 2008–2012. In the period 2002–2005, the HIV-incidence rate among the population aged 15–49 years was estimated to be 2.2 %. In the period 2005–2008, incidence among males and females aged 15–49 slightly dropped to 1.9%. HIV incidence in this age group remained at this level of 1.9% in the subsequent period 2008–2012, very similar to the HIV incidence of 1.7% estimated for 2012 with the laboratory-based method. HIV incidence declined steadily over the three inter-survey periods among youth aged 15–24 years, 2.8% in 2002–2005, 2.3% in 2005–2008, and 1.5% in 2008–2012. The laboratory-based HIV incidence estimate for 15–24 year olds in 2012 was 1.5%, the same as the mathematically derived estimate for 2008–2012. The decline in incidence was more noticeable among young females aged 15–24 years, from 5.3% in 2002–2005 to 2.1% in the period 2008–2012. This change was a statistically significant at 60% reduction in HIV incidence.

Table 3.31: HIV-incidence rates by age and sex, South Africa 2002–2005, 2005–2008 and 2008–2012

	2002–2005		2005–2008		2008–2012	
Age groups (years)	(%)	95% CI	(%)	95% CI	(%)	95% CI
15–49 years	2.2	0.9–4.0	1.9	0.8–3.3	1.9	0.8–3.1
Males	1.2	0.1–3.0	1.6	0.6–3.0	1.6	0.6–2.7
Females	3.2	1.8–5.0	2.2	1.0–3.6	2.1	1.0–3.4
15–24 years	2.8	1.7–4.2	2.3	1.2–3.5	1.5	0.8–2.3
Males	0.6	0.1–1.6	1.4	0.5–2.3	1.0	0.4–1.6
Females	5.3	3.6–7.1	3.5	2.1–4.9	2.1	1.2–3.1

3.6 Male circumcision

VMMC is being scaled up in the country because it has been shown to be partially effective in reducing HIV infection among males. The South African government introduced the VMMC policy and programme in 2010 with a target of reaching 80 per cent of HIV-negative men aged 15–49 years by 2015 or 1.6 million men as recommended in the 2012–2016 NSP (SANAC, 2011). However, it has been estimated through mathematical modelling by Njeumeli et al. (2011) that 4.3 million VMMCs are needed in South Africa to achieve 80% male circumcision by 2015 which could avert more than 1 million HIV infections between 2011 and 2015. It is therefore imperative to investigate both the recent uptake and demand for VMMC during 2012. This section reports on the rates of men who were circumcised and the types of circumcisions performed.

3.6.1 Circumcision history

Table 3.32 shows the results according to demographic characteristics for adult males aged 15 years and older who self-reported that they were circumcised. Almost half of the respondents (46.4%) reported that they were circumcised. In terms of age, a significantly lower percentage of men aged 15–19 years ($p<0.001$) reported having been circumcised as compared to all other age groups. Racial differences are evident with a significantly

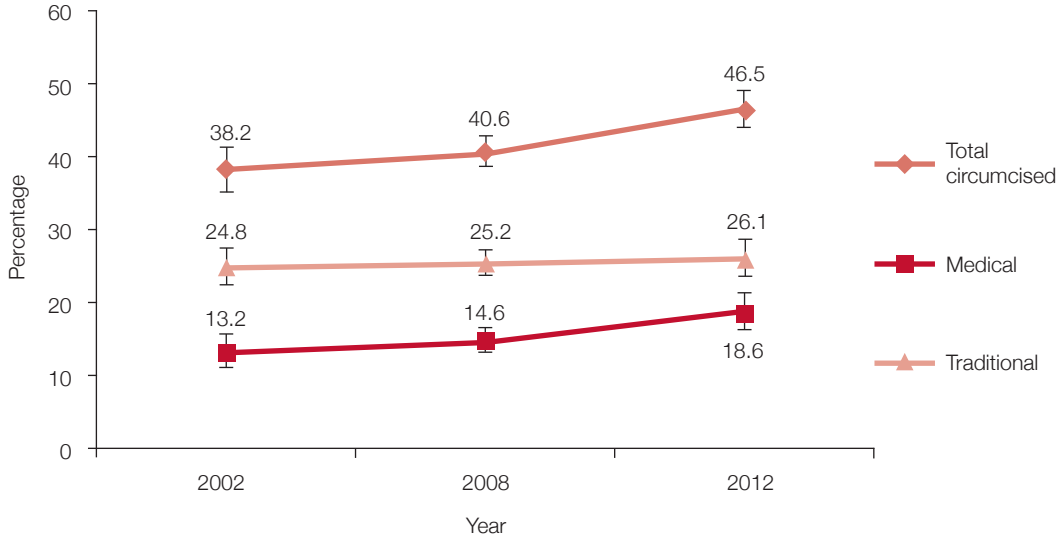
higher percentage of black Africans (52.4%) having reported that they were circumcised compared to the other three race groups. With respect to locality type, males from both rural informal areas and urban informal areas reported significantly higher rates of male circumcision than those from both urban formal and rural formal areas. Provincial figures show that males in the Eastern Cape and Limpopo have the highest rates of circumcised populations, followed by Mpumalanga and Gauteng. The Northern Cape and KwaZulu-Natal have the lowest percentages of circumcision. The rest of the provinces fall in between.

Table 3.32: Adult males (%) by demographic characteristics who self-reported being circumcised, South Africa 2012

Variable	n	%	95% CI
Age (years)			
15–19	1,846	33.3	29.3–37.5
20–24	1,640	46.9	42.8–51.1
25–49	5,024	49.8	46.7–53.0
50 +	3,093	46.8	43.3–50.4
Race			
Black African	6,510	52.4	49.5–55.2
White	1,371	23.3	18.7–28.6
Coloured	2,120	26.4	22.7–30.5
Indian/Asian	1,561	33.5	25.6–42.4
Locality type			
Urban formal	6,867	42.9	40.1–45.8
Urban informal	1,195	52.3	45.8–58.7
Rural informal	2,236	53.4	48.0–58.7
Rural formal	1,305	31.9	24.5–40.3
Province			
Western Cape	1,432	41.0	34.8–47.4
Eastern Cape	1,453	74.0	68.9–78.5
Northern Cape	929	20.3	15.4–26.2
Free State	901	36.0	30.3–42.1
KwaZulu-Natal	2,612	23.2	19.5–27.3
North West	808	36.7	31.0–42.8
Gauteng	1,594	48.2	44.2–52.2
Mpumalanga	890	49.9	39.5–60.3
Limpopo	984	72.6	66.1–78.2
Total	**11,603**	**46.4**	**44.1–48.8**

Figure 3.4 shows trends in the percentages of adult males circumcised over the period of the three surveys that were conducted in 2002, 2008 and 2012.[18] Overall, there has been a significant increase in male circumcision since 2002 (p<0.001). The graph shows that the rates of traditional circumcision have been consistently higher than the rates of medical circumcision. Furthermore, the pattern of changes in VMMC mirrors that of the overall rate of male circumcision, with the cumulative total number of men aged ≥15 years who have undergone VMMC increasing from 1,581,574 in 2002 to 2,268,519 in 2008, to 3,301,196 in 2012. Traditional male circumcision has, however, remained relatively stable over the period.

Figure 3.4: Trends in adult male self-reported circumcision by type of circumcision, South Africa 2002, 2008 and 2012



3.6.2 Circumcision settings

Circumcisions occur in many different settings which largely depend on cultural expectations and access to health facilities. For some people circumcision occurs in traditional settings or where certain cultural norms are observed and for others it is a purely medical procedure occurring in a health facility. The interviewers asked male participants to identify the places where they were circumcised. The results of the analyses are presented in Table 3.33. The majority of participants reported that they were circumcised in traditional settings, followed by medical settings and very few said the procedure was done at home or elsewhere. Analysis of data by age of the participant showed that young males were significantly more likely than all other age groups to have been circumcised in medical facilities (p<0.001). All older age groups were significantly more likely than the youth to have been circumcised in traditional settings (p<0.001). Analyses by race showed that whites were significantly more likely than any race group to be circumcised in medical facilities (p<0.001). Black Africans, in contrast, were significantly more likely to be circumcised in traditional settings (p<0.001). Indians or Asians had the highest rates of home circumcisions.

Analyses by locality types indicated that living in a formal area was associated with circumcision in medical facilities (p<0.001) whereas living in informal areas was associated

18 In 2005 population-based data on male circumcision were not collected.

Table 3.33: Settings where circumcision self-reportedly took place among male respondents aged 15 years and older, by demographic characteristics, South Africa 2012

	n	At Home		Medical		Traditional		Other	
		%	95% CI	%	95% CI	%	95% CI	%	95% CI
Age group (years)									
15–24	1,207	2.3	1.5–3.4	51.6	45.5–57.6	43.1	37.4–49.1	3.0	1.9–4.8
25–49	2,085	3.3	2.3–4.7	38.4	34.1–42.9	54.6	49.8–59.3	3.6	2.2–5.9
50+	1,220	6.3	4.2–9.2	30.5	26.0–35.4	58.6	53.3–63.6	4.7	2.7–8.1
Race									
Black African	3,239	2.9	2.2–3.9	34.8	31.0–38.9	59.2	55.0–63.2	3.0	1.9–4.7
White	264	7.0	3.6–13.2	90.4	84.5–94.3	0.6	0.2–2.2	2.0	0.7–5.0
Coloured	533	6.0	3.7–9.6	66.3	58.5–73.3	13.6	8.1–22.2	14.1	9.5–20.3
Indian/Asian	457	16.7	10.0–26.5	71.2	57.7–81.8	1.0	0.4–2.4	11.1	5.9–19.8
Locality type									
Urban formal	2,412	4.9	3.6–6.7	53.2	48.2–58.2	35.7	30.6–41.2	6.1	4.0–9.1
Urban informal	604	2.6	1.3–5.2	25.8	19.5–33.3	69.9	62.0–76.7	1.7	0.7–4.0
Rural informal	1,168	2.3	1.5–3.5	26.6	21.8–32.0	69.6	63.9–74.8	1.5	0.9–2.5
Rural formal	328	3.0	1.4–6.1	44.7	21.5–70.4	51.6	27.9–74.6	0.8	0.2–3.0
Province									
Western Cape	508	8.0	5.4–11.6	41.4	30.8–52.7	44.3	31.4–58.0	6.4	3.5–11.2
Eastern Cape	946	2.3	1.3–4.0	14.2	9.1–21.5	83.1	75.1–89.0	0.3	0.1–0.7
Northern Cape	168	4.2	1.8–9.2	51.6	36.3–66.7	42.7	26.9–60.1	1.5	0.4–5.2
Free State	299	3.1	1.4–6.6	45.0	33.5–57.0	48.7	38.2–59.4	3.2	1.4–6.9
KwaZulu-Natal	556	4.1	2.2–7.4	67.8	58.5–75.9	24.8	17.5–33.8	3.3	1.6–6.7
North West	280	5.6	2.3–13.1	44.4	35.3–53.9	46.2	34.4–58.5	3.8	1.9–7.7
Gauteng	753	3.3	1.8–5.9	58.0	51.1–64.5	31.7	25.3–38.9	7.1	3.8–12.6
Mpumalanga	385	5.3	2.7–10.4	21.8	14.7–31.1	71.3	62.5–78.8	1.5	0.7–3.2
Limpopo	617	0.9	0.2–3.7	33.5	27.6–39.9	63.5	57.4–69.2	2.1	1.2–3.8
Total	**4,512**	**3.6**	**2.9–4.6**	**40.1**	**36.7–43.7**	**52.5**	**48.7–56.3**	**3.7**	**2.6–5.2**

with circumcision in traditional facilities (p<0.001). Provincial variation was also observed in places of circumcision. Eastern Cape followed by Mpumalanga and Limpopo compared to all the other provinces had higher rates of traditional circumcisions. Western Cape had the highest rates of home circumcisions whereas KwaZulu-Natal and the Northern Cape were the two provinces with the highest rates of medical male circumcision.

3.6.3 Male circumcision among children

Almost one-tenth of the parents/guardians of children aged 5–11 years and children aged 12–14 years (9.1%, 95% CI: 7.6–10.9; n = 1,952) reported that their male children had been circumcised. When the parents/guardians of children under 5 years of age were asked to indicate whether or not their male children had been circumcised, 2.0% (95% CI: 1.2–3.2) indicated that this was the case.

3.6.4 Demand for male circumcision among those not circumcised

Table 3.34 shows, according to demographic characteristics, the numbers and percentages of male uncircumcised respondents aged 15 years and older who indicated that they

Table 3.34: Uncircumcised male respondents aged 15 years and older who indicated that they would like to be circumcised, by demographic characteristics, South Africa 2012.

Variable	n	%	95% CI
Race			
Black African	3,044	49.8	46.7–52.9
White	1,028	6.3	3.9–9.9
Coloured	1,513	30.4	26.8–34.2
Indian/Asian	1,060	15.0	11.4–19.4
Age (years)			
15–24	2,169	59.7	56.1–63.1
25–49	2,739	37.1	33.5–40.8
50+	1,751	11.7	9.0–15.1
Locality type			
Urban formal	4,199	37.3	33.7–41.1
Urban informal	548	44.3	37.2–51.6
Rural informal	1,008	47.1	42.5–51.8
Rural formal	904	24.3	17.1–33.4
Province			
Western Cape	886	27.9	22.3–34.2
Eastern Cape	446	64.7	52.8–75.1
Northern Cape	719	29.7	24.3–35.8
Free State	549	46.2	38.6–54.0
KwaZulu-Natal	1,979	44.8	39.8–50.0
North West	502	45.0	38.6–51.6
Gauteng	782	36.7	30.4–43.4
Mpumalanga	476	31.9	25.7–38.8
Limpopo	320	27.9	19.1–38.9
Total	**6,659**	**39.6**	**37.0–42.2**

would like to be circumcised. Overall, 39.6% of uncircumcised men indicated they would like to be circumcised. About half of black African respondents indicated that they would like to be circumcised – the highest rate amongst all those wanting to be circumcised – followed by under one-third of Coloured respondents.

The majority of those aged 15–24 years (59.7%) indicated that they would like to be circumcised as compared to 37.1% among those aged 25–49 years. Nearly half of those who indicated that they would like to be circumcised were from rural informal areas, followed closely by those from urban informal areas. As expected (given a strong traditional circumcision culture), nearly two-thirds of respondents from the Eastern Cape who were not circumcised indicated that they would like to be circumcised, followed by nearly half of those from the Free State, North West, and KwaZulu-Natal.

Biomedical HIV prevention alone cannot reduce new infections. When taken together with behavioural interventions known to be associated with the spread of HIV, the probability of reducing new infections increases. The next section focuses on behavioural determinants of HIV examined among various demographic groups.

3.7 Behavioural determinants of HIV

Various behaviours are believed to be important drivers of the HIV epidemic in the country. This section reports findings related to sexual debut and age-disparate relationships among young people, as well as findings related to multiple sexual partnerships and condom use among sexually active people of different age groups.

3.7.1 Sexual debut

Early sexual debut increases vulnerability to HIV infection among young people (Pettifor, O'Brien, Macphail, Miller & Rees, 2009). A major goal is to delay the age at which young people first have sex and discourage premarital sexual activity because it reduces their potential exposure to HIV. There is also evidence to suggest that having sex at a later age reduces susceptibility to infection per act of sex, at least for females (UNAIDS, 2013a). It is thus important to know the age at which sexual debut occurs in order to inform HIV prevention interventions targeted at young people. Early sexual debut was defined as having sex before reaching the age of 15 years.

Table 3.35 shows the results for sexual debut before the age of 15 years for respondents aged 15–24 years according to different demographic characteristics. Overall, one tenth of respondents reported having had sex for the first time before the age of 15 years. Three times more males than females reported having sex for the first time before the age of 15 years; this is a statistically significant difference ($p<0.001$). Analysis by race shows that early sexual debut is highest in black Africans, followed by Coloureds, then whites, and lastly Indian/Asians. Analysis by locality type showed that there are no significant differences found in early sexual debut ($p=0.453$). Respondents from both the Eastern Cape and Western Cape reported the highest rates of early sexual debut at 16.8% and 14.2% respectively, while respondents from both KwaZulu-Natal and Mpumalanga reported the lowest early sexual debut at 7.5% and 7.7% respectively. The differences between all nine provinces were not statistically significant ($p=0.060$).

Figure 3.5 shows the results for early sexual debut across the four repeated surveys in 2002, 2005, 2008, and 2012. Overall, the rates of early sexual debut were stable from 2002 until 2012, masking sex differences. There was a downward trend of early sexual debut

Table 3.35: Early sexual debut in youths in the 15–24 age group by demographic characteristics, South Africa 2012

Variable	n	Had sex before 15 years of age (%)	95% CI
Sex			
Male	1,829	16.7	14.1–19.8
Female	2,082	5.0	3.8–6.6
Race			
Black African	2,830	11.1	9.3–13.3
White	154	7.5	3.4–15.4
Coloured	698	9.3	6.9–12.5
Indian/Asian/	219	4.9	1.6–13.9
Locality type			
Urban formal	2,016	9.8	7.7–12.4
Urban informal	512	12.0	8.1–17.5
Rural informal	1,044	11.9	9.0–15.5
Rural formal	339	8.4	5.2–13.4
Province			
Western Cape	475	14.2	8.5–22.8
Eastern Cape	558	16.8	11.6–23.6
Northern Cape	286	10.1	6.3–15.6
Free State	295	10.3	7.2–14.5
KwaZulu-Natal	852	7.6	4.6–12.4
North West	303	9.8	6.6–14.5
Gauteng	480	9.5	6.7–13.1
Mpumalanga	319	7.7	4.1–14.0
Limpopo	343	11.8	7.8–17.5
Total	**3,911**	**10.7**	**9.1–12.6**

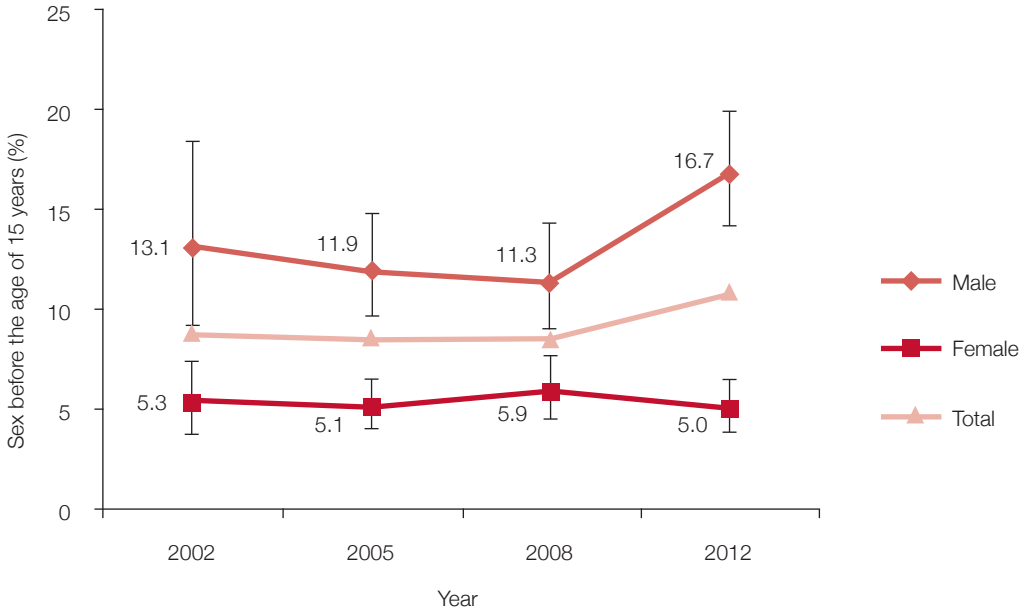
among males between 2002 and 2008 and then an increase in 2012. The rates among females in contrast to that of males have remained stable at around 5% throughout the four surveys. Males consistently reported significantly higher rates of early sexual debut compared to females in all four surveys.

Table 3.36 shows provincial rates of early sexual debut across the four repeated surveys. The results show significant variation in early sexual debut over this period, with the majority of provinces showing significant increases ($p<0.001$) in the early sexual debut.

3.7.2 Age-disparate relationships

The term 'age-disparate relationships' generally refers to relationships in which the age gap between sexual partners is five years or more (LeClerc-Madlala, 2008 and also see UNAIDS Terminology Guidelines, October 2011). Young people aged 15–24 years of age of either sex who had a sexual partner who was 5 years or older had a higher HIV prevalence than when they had a sexual partner within 5 years of their own age (Shisana,

Figure 3.5: Early sexual debut by sex of respondents in the 15–24 age group, South Africa 2002, 2005, 2008 and 2012



Rehle, Simbayi et al. 2005, although cf. Harling et al. 2014). Therefore, irrespective of one's own sex, age-disparate relationships with an older partner is generally a risk factor for HIV. In this survey we examined the age differentials, that is, the difference in the ages between sex partners among adolescents aged 15 to 19 years as the index cases.

Figure 3.6 shows the age-disparate relationship between sexual partners by sex of respondent in the 15 to 19 years age group. In 2012, 19.8% of respondents had a sexual partner who was more than 5 years older than they were. More interestingly, 33.6% of

Figure 3.6: Age-disparate sexual relationships in the 15–19 year age group by sex, South Africa 2005, 2008 and 2012

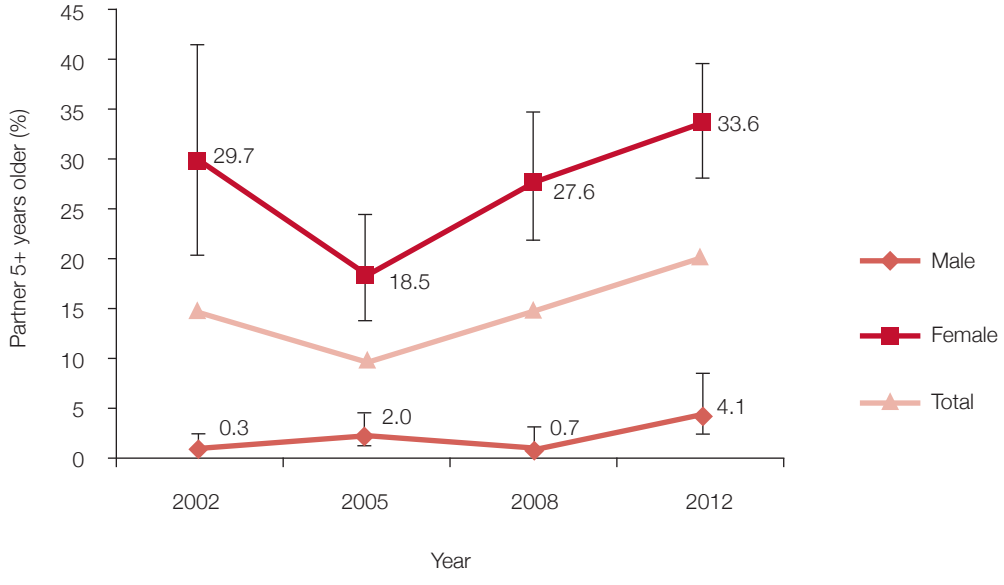


Table 3.36: Sexual debut before the age of 15 years old by respondents in the 15–24 age group, by province, South Africa 2002, 2005, 2008, 2012

Province	2002			2005			2008			2012		
	n	%	95% CI	n	%	95% CI	n	%	95% CI	n	%	95% CI
Western Cape	201	6.0	3.3–10.8	341	10.4	7.3–14.6	324	9.3	6.1–13.9	475	14.2	8.5–22.8
Eastern Cape	225	7.7	4.0–14.4	495	6.7	4.5–9.9	333	7.8	5.2–11.5	558	16.8	11.6–23.6
Northern Cape	79	3.6	1.5–8.6	156	4.6	2.4–8.9	180	7.3	4.6–11.4	286	10.1	6.3–15.6
Free State	97	0.9	0.2–3.5	200	7.8	4.5–13.0	166	9.6	4.9–17.8	295	10.3	7.2–14.5
KwaZulu-Natal	228	4.9	2.3–10.3	535	4.5	2.7–7.4	391	4.9	2.8–8.3	852	7.6	4.6–12.4
North West	104	2.5	1.3–4.8	227	12.7	8.4–18.8	197	8.5	4.8–14.7	303	9.8	6.6–14.5
Gauteng	199	6.3	3.2–12.1	411	10.2	6.8–15.1	364	7.8	4.6–12.9	480	9.5	6.7–13.1
Mpumalanga	71	4.9	2.4–9.6	232	10.1	6.5–15.4	160	15.0	9.6–22.9	319	7.7	4.1–14.0
Limpopo	123	5.5	3.1–9.7	313	10.1	6.4–15.6	233	11.2	7.3–16.9	343	11.8	7.8–17.5
Total	**1,327**	**5.0**	**3.8–6.5**	**2,910**	**8.4**	**7.2–9.9**	**2,348**	**8.5**	**7.1–10.1**	**3,911**	**10.7**	**9.1–12.6**

female adolescents aged 15 to 19 had partners who were more than 5 years older than they were compared to only 4.1% among their male counterparts (p<0.001).

Trend analyses of rates of those having a sexual partner more than 5 years older between 2002 and 2012 is shown in Figure 3.6. This figure shows that there was a decline from 2002 to 2005 followed by a steady increase to 2012. Age-disparate relationships were more common in females than males, with females being between eight to nine times more likely than males to have older sexual partners.

Table 3.37 shows the association between age-disparate relationships and HIV status in the 15 to 19 years age group. Overall, HIV prevalence was higher in age-disparate relationships compared to when sexual partners were within the same age group. Although substantive, the difference is not statistically different. Sex differences were not possible to analyse for age-disparate groups, but were possible where partners were within the same age groups. This is because there were too few males who had older sexual partners. Females were nearly 12 times as likely as males to be HIV positive in a situation where the sexual partners were within the same age group. These differences were statistically significantly (p<0.001).

Table 3.37: Age-disparate relationships by HIV status in the 15–19 age group, South Africa 2012

Age difference between sexual partners	HIV status								
	Overall			Males			Females		
	HIV positive			HIV positive			HIV positive		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
5 years and older	172	10.1	5.4–18.1	*	*	*	162	11.0	5.9–19.7
Within 5 years	654	4.8	3.0–7.7	352	0.8	0.2–2.7	302	9.3	5.6–15.0
Total	**826**	**5.9**	**4.1–8.4**	**362**	**0.8**	**0.2–2.6**	**464**	**9.9**	**6.9–14.0**

** Too few observations to report reliably.*

3.7.3 Multiple sexual partners

One of the major risk factors for HIV infection is having multiple sexual partners. In this survey, multiple sexual partnerships are measured by indicating the sex (male or female) of sexual partners and indicating the total number of sexual partners in the past 12 months.

The following results are related to multiple sexual partners in the past 12 months. Data by provinces are excluded because there were too few observations to report reliably.

Table 3.38 shows the results for respondents 15 years and older who reported having had more than one sexual partner in the past 12 months. Overall, 12.6% of respondents reported having being involved with multiple sexual partners in the last 12 months, with a percentage five times higher found among males than among females; a difference which is statistically significant (p<0.001). As expected, there is an inverse relationship between age and multiple sexual partnerships with a higher percentage of younger respondents reporting that they had had more than one sexual partner in the past 12 months compared to older respondents. Black Africans reported the highest percentage of respondents who had had more than one sexual partner in the past 12 months compared

Table 3.38: Percentage having multiple sexual partners in the past 12 months by age and sex among respondents aged 15 years and older, South Africa 2012

Variable	n	Two+ partners	
		%	95% CI
Sex			
Male	7,410	20.1	18.3–22.0
Female	8,348	4.6	3.9–5.3
Age groups (years)			
15–24	3,337	22.4	20.0–25.0
25–49	9,115	11.2	10.0–12.6
50 +	3,306	4.2	3.1–5.7
Race			
Black African	9,025	14.5	13.2–15.9
White	1,832	4.2	2.9–6.0
Coloured	2,897	8.2	6.3–10.6
Indian/Asian	1,965	4.2	3.1–5.9
Locality type			
Urban formal	9,397	12.9	11.3–14.7
Urban informal	1,752	12.8	10.4–15.6
Rural informal	2,943	13.3	11.5–15.2
Rural formal	1,666	6.0	4.5–8.0
Province			
Western Cape	2,083	10.1	7.5–13.5
Eastern Cape	1,894	14.7	12.0–17.7
Northern Cape	1,251	8.7	6.3–11.9
Free State	1,238	10.5	7.9–13.8
KwaZulu-Natal	3,593	11.1	9.0–13.6
North West	1,126	13.0	9.1–18.1
Gauteng	2,220	14.0	11.6–16.9
Mpumalanga	1,143	13.7	10.5–17.8
Limpopo	1,210	13.1	10.2–16.6
Total	**15,758**	**12.6**	**11.5–13.7**

to the other race groups, these differences were statistically significant (p<0.001). A distant second, Coloured respondents reported the second highest rate of multiple sexual partnerships, this rate was still significantly higher compared to both white and Indian or Asians respondents (p<0.001). Analysis of data by locality type showed that rural formal areas reported the lowest percentage of respondents who had had more than one sexual partner during the past 12 months compared to the other three area types. These differences were statistically significant (p<0.001). When provinces were compared, the Northern Cape reported the lowest percentage of respondents who had had more than one sexual partner during the past 12 months. The differences between the Northern Cape and the other eight provinces on this measure were all statistically significant (p=0.023).

Members of key populations at higher risk of HIV exposure find themselves in this situation because, among other reasons, they often engage in multiple sexual partnerships. Figure 3.7 shows the results obtained on this measure in this survey. It shows that large minorities of high-risk alcohol drinkers aged 15 years and older, recreational drug users aged 15 years and older, black African males aged 25–49 years, and the disabled aged 15 years and older reported that they had more than one sexual partner in the past 12 months than did the other two groups.

Figure 3.7: Proportion of key populations most at risk of HIV exposure who had more than one sexual partner in the past 12 months, South Africa 2012

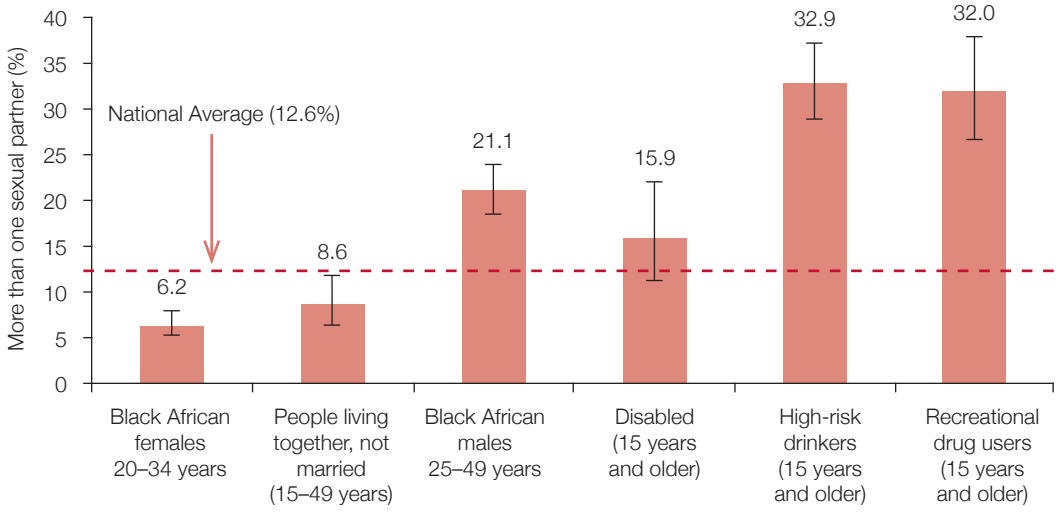


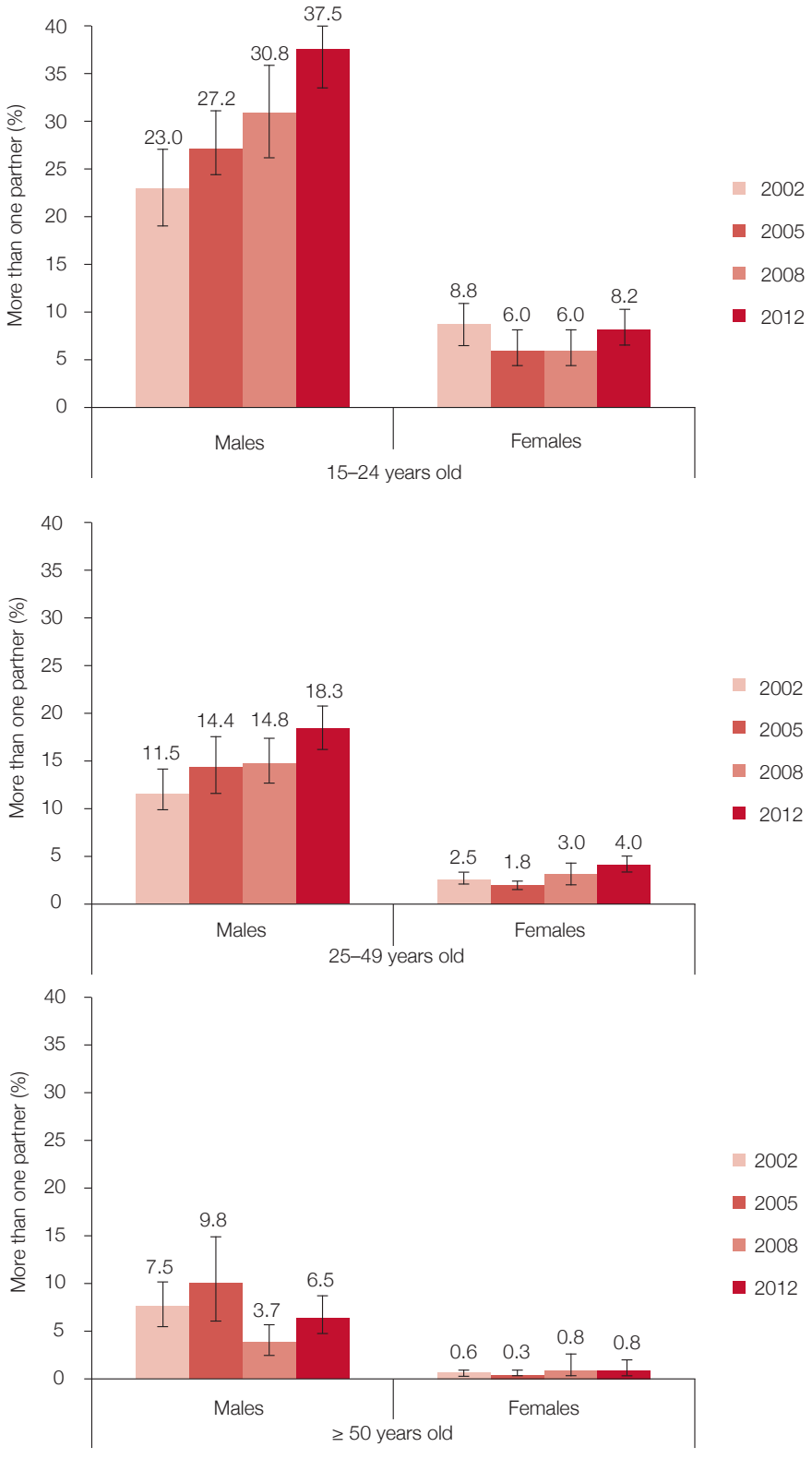
Figure 3.8 shows trends among respondents for the three age groups separately who had more than one sexual partner in last 12 months across the period of the four surveys. Overall, significantly higher percentages of males reported that they had had more than one sexual partner in the last 12 months consistently compared to females. Among respondents aged 15–24 years there was a significant increase in multiple sexual partnerships among males from 23.0% in 2002 to 37.5% in 2012 while at the same time the percentages were both low and stable across the period of the four surveys among their female counterparts ($p<0.001$). Rates of multiple sexual partnerships among the 25–49 year old group compared to those of the 15–24 year old group were lower; this was the case for both males and females.

With respect to trend analyses, there was a steady increase in the rates of multiple sexual partnerships from 11.5% to 18.3% between 2002 and 2012 respectively. Among those aged 50 years and older for males the rates peaked in 2005, decreased in 2008 and then increased slightly in 2012. Corresponding peaks for females who had multiple sexual partnerships were 8.8% in 2002 for those 15–24 years old, 4.0% for those 25–49 years old, and 0.8% for those aged 50 years and older. It is important to note that the rate for females aged 50 years and older who had had multiple sexual partnerships stabilised at 0.8% over the period of the past two surveys.

3.7.4 Condom use

Condoms, both male and female, are currently the only available and most effective technology to prevent HIV and other sexually transmitted infections (STIs), as well as

Figure 3.8: Sexually active respondents in the 15–49 age group who had more than one sex partner in last 12 months, South Africa 2002, 2005, 2008 and 2012



unintended pregnancies, among sexually active people. They are inexpensive, cost-effective, their use does not require assistance of medical or healthcare personnel, and they can be utilised by anyone who is sexually active. Correct and consistent use of condoms is an integral component of combination HIV-prevention strategies that individuals can choose at any time in their lives to reduce risks of sexual exposure to HIV and other STIs, or as a dual protective method used for also preventing pregnancy among women.

Table 3.39 shows the 2012 demographic characteristics of self-reported condom use at last sex among respondents aged 15 years and older. Overall, over 36.2% of all respondents indicated that they had used a condom at last sex with the most recent sexual partner, a significantly higher percentage of males reporting that they had used a condom at last sex than had females ($p<0.001$). As expected, condom use decreased with age, with 58.4% of

Table 3.39: Condom use at last sex by demographic characteristics, aged 15 years and older, South Africa 2012

Variable	n	%	95% CI
Sex			
Male	7,239	38.6	36.5–40.8
Female	8,200	33.6	31.6–35.7
Age group (years)			
15–24	3,263	58.4	55.3–61.4
25–49	8,929	34.4	32.4–36.6
50 +	3,247	12.4	10.3–14.9
Race			
Black African	8,850	41.9	40.0–43.8
White	1,784	14.7	11.2–19.1
Coloured	2,853	18.4	15.9–21.3
Indian/Asian	1,916	14.4	11.7–17.7
Locality type			
Urban formal	9,181	34.4	31.7–37.3
Urban informal	1,726	43.7	39.7–47.8
Rural informal	2,902	39.7	37.4–42.1
Rural formal	1,630	22.2	16.6–29.0
Province			
Western Cape	2,065	24.3	19.5–30.0
Eastern Cape	1,842	37.9	34.3–41.7
Northern Cape	1,235	26.9	21.1–33.6
Free State	1,217	40.7	33.5–48.2
KwaZulu-Natal	3,550	39.6	35.7–43.7
North West	1,085	40.8	35.6–46.3
Gauteng	2,139	35.7	31.7–40.0
Mpumalanga	1,116	39.4	35.0–44.0
Limpopo	1,190	39.3	34.9–43.9
Total	**15,439**	**36.2**	**34.5–37.9**

youth aged 15–24 years reporting that they had used a condom at last sex compared to 34.4% of adults aged 25–49 years and 12.4% of the elderly (aged 50 years and older). A significantly high percentage of black Africans reported condom use at last sex compared to the other three race groups. The differences were statistically significant (p<0.001).

In terms of locality, the percentages of condom use at last sex by respondents from both urban informal and rural informal areas were significantly higher than by respondents from both urban formal and rural formal areas (p<0.001). In addition, the percentage of condom use at last sex by respondents from urban formal areas was also significantly higher than that of respondents from rural formal areas (p<0.001). Data analysed by province show the percentages of condom use at last sex were highest in the North West, the Free State, KwaZulu-Natal, Mpumalanga, and Limpopo, followed by the Eastern Cape and Gauteng in the middle and the Western Cape and Northern Cape at the bottom. The differences between the North West, Free State, KwaZulu-Natal, Mpumalanga, Limpopo and Eastern Cape, on the one hand, and the Western Cape and Northern Cape, on the other, were all statistically significant (p<0.001). In addition, condom use at last sex for respondents in Gauteng was also significantly higher than that of Western Cape respondents (p<0.01).

With regard to key populations at higher risk of HIV exposure, condom use at last sex was found to be higher than the national average (36.2%) among four of the groups (viz., high risk drinkers aged 15 years and older, black African females aged 20–34 years, recreational drug users aged 15 years and older, and black African males aged 25–49 years. While the disabled aged 15 years and older had the same rate as the national average, people living together who are not married aged 15–49 years of age had the lowest rate at 33.8% (Figure 3.9).

Figure 3.9: Condom use at last sex by key populations most at risk of HIV exposure, South Africa 2012

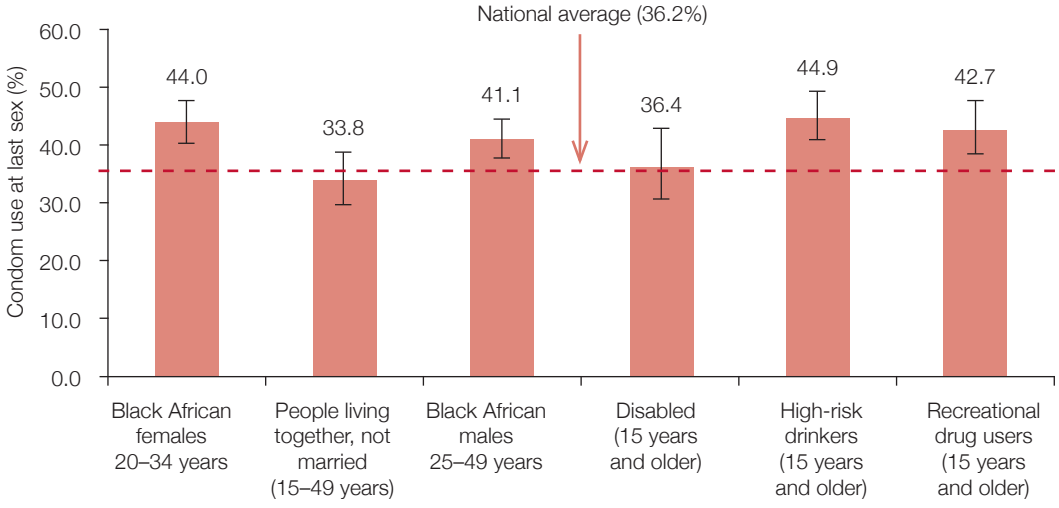
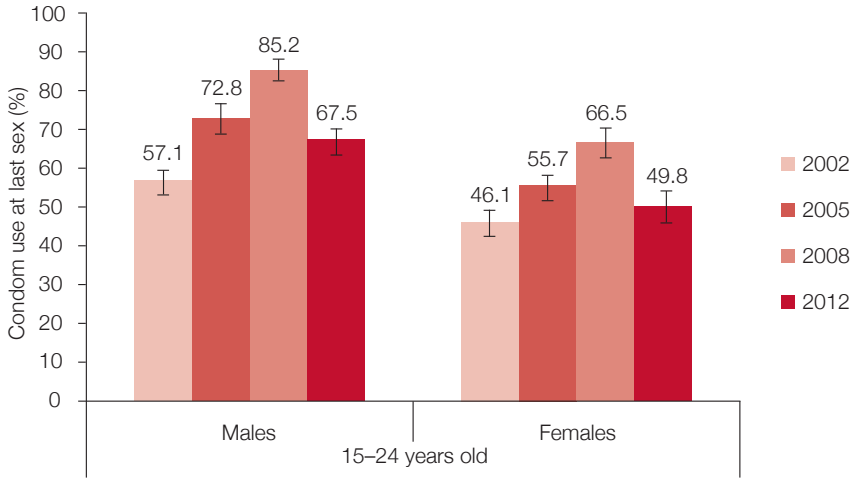
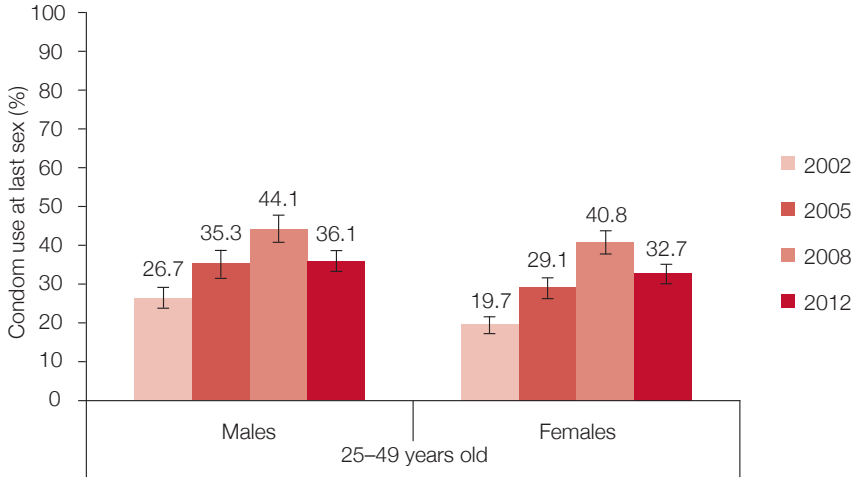
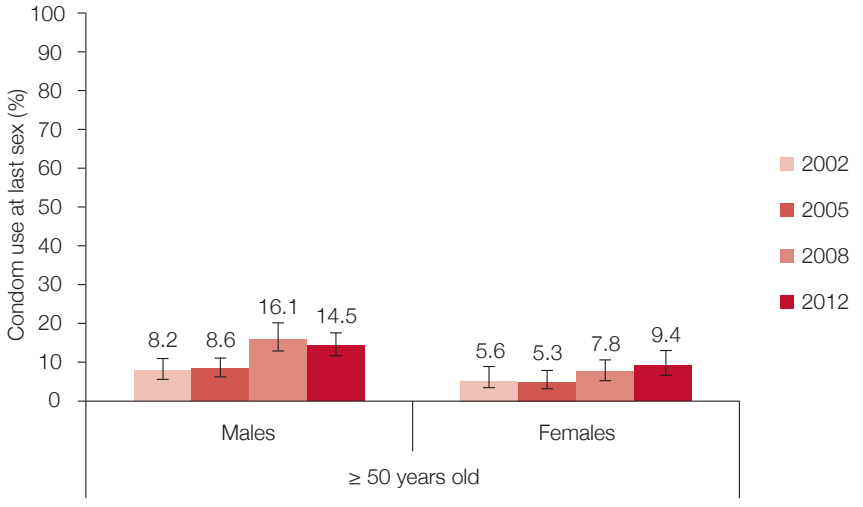


Figure 3.10 shows the trends in condom use at last sex among respondents for each age group by sex over the period of the past four surveys. The bars show that overall condom use at last sex increased significantly from 2002 to 2008 (p<0.001) and then decreased in 2012 for all three age-sex groups, except among females aged 50 years and older. In the

Figure 3.10: Condom use at last sex by age groups and sex, South Africa, 2002, 2005, 2008 and 2012







latter group there was a moderate increase in 2012 in comparison with the 2008 estimates. The bars also show that, across the period of all surveys, condom use at last sex was highest among 15–24 year olds, followed by 25–49 year olds, and was lowest among those aged 50 years and older. There were also significant sex differences at each age, with males having used condoms at last sex at higher rates than their female counterparts consistently since 2002 (all ps<0.001).

Table 3.40 shows the trend in condom use at last sex among respondents aged 15 years and older over the past four surveys both nationally and provincially. The figure shows that condom use at last sex increased significantly both at national level and in all provinces (p<0.001) from 2002 until 2008 and then decreased in 2012. The decreases in 2012 are significant nationally and for eight provinces, Western Cape (p<0.001), Eastern Cape (p<0.001), Free State (p=0.008), KwaZulu–Natal (p<0.001), North West (p<0.001), Gauteng (p<0.001), Mpumalanga (p<0.001) and Limpopo (p<0.001). The Northern Cape had a decrease in condom use at last sex, however, this difference was not significant (p=0.111).

Table 3.41 shows the results for consistency of condom use among respondents aged 15 years and older according to demographic characteristics. Overall, slightly over one-quarter of respondents (27.4%) reported having used condoms consistently (every time) with their most recent sexual partner, whereas 4.5% indicated that they had used condoms almost every time with their most recent sexual partner, 15.2% that they had used condoms sometimes with their most recent sexual partner, while the remaining 52.9%, the majority, indicated that they had never used condoms at all with their most recent sexual partner.

As expected, a significantly higher percentage of males (29.5%) than of females (25.2%) reported that they consistently used condoms (p<0.001). As also expected, reported consistency of condom use decreases with age: youth aged 15–24 years reported the highest percentage of condom use every time with their most recent sexual partner (45.7%), followed by adults aged 25–49 years (25.5%), while the elderly (aged 50 years and older) reported the lowest rate of consistent condom use (9.8%). The pairwise differences among the three age groups were all statistically significant (all ps<0.001).

Analysis of consistency of condom use by race shows a significantly higher percentage of black Africans (31.6%) reported consistent condom use with their most recent partner than did their counterparts in the other three race groups (range: 11.0% -15.0%) (p<0.001). With regard to locality type rural formal areas reported the lowest consistent condom use. In terms of provinces, the percentages for consistent condom use with most recent sexual partner were highest in the Free State, KwaZulu-Natal and North West and lowest in the Western Cape and Northern Cape. These differences were significant (p<0.001).

Consistent condom use is even more crucial for key populations at higher risk of HIV exposure because of the risk of contracting HIV. The next section presents consistency of condom use in these populations (Table 3.42).

When it came to key populations at higher risk of HIV exposure, both high risk alcohol drinkers 15 years and older (34.7%) and recreational drug users 15 years and older (33.1%) reported the highest percentages of consistent condom use with most recent sexual partner while respondents who were living together with a partner 15–49 years old reported the lowest percentage of consistent condom use with most recent sexual partner with 23.6% using condoms consistently.

Table 3.40: Condom use at last sex by respondents aged 15 years and older by province, South Africa 2002, 2005, 2008 and 2012

Province	2002			2005			2008			2012		
	n	%	95% CI	n	%	95% CI	n	%	95% CI	n	%	95% CI
Western Cape	615	21.3	18.2–24.8	1,209	22.5	17.6–28.4	1,138	34.8	29.8–40.2	2,065	24.3	19.5–30.0
Eastern Cape	571	31.5	27.7–35.5	1,267	35.8	30.1–41.9	1,114	47.9	42.4–53.4	1,842	37.9	34.3–41.7
Northern Cape	332	16.9	13.1–21.5	469	19.1	14.7–24.6	714	30.3	24.5–36.9	1,235	26.9	21.1–33.6
Free State	336	35.1	30.1–40.5	590	30.7	22.8–40.0	555	47.4	41.2–53.8	1,217	40.7	33.5–48.2
KwaZulu-Natal	898	26.7	23.9–29.8	1,805	36.3	32.2–40.7	1,508	47.4	42.7–52.1	3,550	39.6	35.7–43.7
North West	376	26.6	22.3–31.4	726	37.3	31.7–43.3	691	48.0	43.0–53.1	1,085	40.8	35.6–46.3
Gauteng	806	31.6	28.4–35.0	1,613	37.7	33.2–42.4	1,405	42.1	38.1–46.3	2,139	35.7	31.7–40.0
Mpumalanga	240	24.2	19.0–30.2	721	36.1	31.6–40.8	706	51.7	46.4–57.1	1,116	39.4	35.0–44.0
Limpopo	381	27.6	23.2–32.4	856	44.7	39.7–49.7	757	52.6	47.0–58.2	1,190	39.3	34.9–43.9
National	**4,555**	**27.3**	**26.0–28.6**	**9,256**	**35.4**	**33.4–37.3**	**8,588**	**45.1**	**43.3–47.0**	**15,439**	**36.2**	**34.5–37.9**

Table 3.41: Consistency of condom use with most recent sexual partner among respondents aged 15 years and older by demographic characteristics, South Africa 2012

Variable	Every time			Almost every time		Sometimes		Never	
	n	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Sex									
Male	7,337	29.5	27.5–31.6	4.9	4.0–5.9	13.9	12.5–15.4	51.8	49.5–54.0
Female	8,287	25.2	23.4–27.1	4.1	3.2–5.2	16.6	15.1–18.1	54.1	51.8–56.4
Age group (years)									
15–24	3,306	45.7	42.9–48.6	6.5	5.2–8.0	20.0	18.0–22.2	27.8	24.8–31.0
25–49	9,038	25.5	23.7–27.3	4.6	3.8–5.5	16.1	14.6–17.7	53.9	51.6–56.1
50 +	3,277	9.8	7.9–12.0	1.5	0.8–2.6	4.5	3.4–5.8	84.3	81.6–86.7
Race									
Black African	8,966	31.6	29.9–33.4	5.1	4.3–6.1	17.4	16.1–18.8	45.8	43.8–47.9
White	1,799	11.0	8.5–14.3	1.3	0.7–2.5	6.5	4.0–10.4	81.2	77.0–84.7
Coloured	2,878	15.0	12.9–17.5	3.1	2.1–4.5	7.5	5.9–9.5	74.4	71.0–77.5
Indian/Asian	1,944	12.0	9.6–14.9	2.8	1.1–6.7	10.2	6.8–15.0	75.1	70.3–79.3
Locality type									
Urban formal	9,295	26.6	24.4–29.0	4.9	3.9–6.2	13.0	11.5–14.6	55.5	52.5–58.4
Urban informal	1,744	32.9	30.2–35.8	5.2	3.7–7.3	18.0	15.0–21.6	43.8	39.7–48.0
Rural informal	2,932	29.6	27.2–32.0	4.1	3.2–5.3	19.0	16.9–21.4	47.3	44.4–50.2
Rural formal	1,653	15.2	11.2–20.5	1.7	1.0–3.0	10.0	6.2–15.9	73.0	66.1–78.9
Province									
Western Cape	2,077	18.4	14.7–22.8	4.8	3.2–7.3	11.0	8.2–14.8	65.7	58.4–72.3
Eastern Cape	1,868	29.8	26.7–33.2	3.3	2.1–4.9	15.9	12.9–19.5	51.0	45.8–56.1
Northern Cape	1,245	22.2	17.2–28.2	3.3	2.1–5.3	6.9	5.1–9.2	67.6	60.6–73.9
Free State	1,226	31.9	27.0–37.3	2.4	1.4–4.0	15.0	11.3–19.6	50.7	42.5–58.8
KwaZulu-Natal	3,589	30.9	27.9–34.0	5.0	3.4–7.4	13.9	11.8–16.4	50.2	45.7–54.6
North West	1,108	30.7	25.8–36.1	5.2	3.5–7.6	16.7	13.6–20.4	47.3	41.9–52.9
Gauteng	2,171	27.6	23.8–31.8	5.0	3.4–7.1	13.6	11.4–16.1	53.9	49.7–58.0
Mpumalanga	1,136	27.0	23.2–31.0	4.6	2.8–7.5	21.8	17.5–26.7	46.6	41.9–51.4
Limpopo	1,204	26.4	22.2–31.0	4.0	2.5–6.4	23.5	19.3–28.3	46.2	40.8–51.6
Total	**15,624**	**27.4**	**26.0–29.0**	**4.5**	**3.8–5.3**	**15.2**	**14.1–16.4**	**52.9**	**51.0–54.8**

Table 3.43 shows condom use at last sex among respondents aged 15 years and older by marital status and age. Higher percentages of condom use were found among both those who were single and going steady or living together compared to those who were married or in civil union in all age groups.

Table 3.43 also shows condom use at last sex by number of sexual partners in the last 12 months and age. As expected, condom use was higher among respondents who reported having had multiple sexual partners than among those who indicated that they had only one sexual partner.

Table 3.42: Condom use consistency among key populations at higher risk of HIV exposure, South Africa 2012

Variable	Every time			Almost every time		Sometimes		Never	
	n	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Black African females 20–34 years old	2,424	30.8	27.7–34.1	5.8	4.2–8.0	24.0	21.6–26.7	39.4	36.2–42.6
Black African males 25–49 years old	2,220	30.3	27.4–33.3	5.9	4.6–7.6	16.6	14.4–19.1	47.2	43.8–50.7
Living together with partner 15–49 years old	1,697	23.6	19.9–27.7	4.9	3.3–7.3	15.1	12.4–18.3	56.4	51.8–61.0
High-risk drinkers 15 years and older	1,870	34.7	31.0–38.7	5.1	3.7–7.0	15.1	13.0–17.6	45.0	41.2–48.9
Recreational drug users 15 years and older	1,008	33.1	28.6–38.0	5.2	3.2–8.3	14.9	11.6–18.9	46.8	42.0–51.6
Disabled persons 15 years and older	532	29.0	23.5–35.1	3.3	1.7–6.3	11.2	7.7–16.2	56.5	49.9–62.9

Table 3.43: Condom use at last sex by marital status and number of sex partners in last 12 months and age, South Africa 2012

Marital status	15–24 years			25–49 years			50+ years		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Married/civil union	209	20.0	11.3–33.0	4,443	16.2	14.0–18.5	2,650	7.8	5.8–10.5
Going steady/living together	2,326	58.1	55.0–61.1	3,561	45.5	42.3–48.7	349	24.8	17.7–33.6
Single	646	69.9	63.8–75.4	588	61.0	55.1–66.5	*	*	*
Divorced	*	*	*	165	62.4	50.2–73.2	*	*	*
Widower/ widow	*	*	*	*	*	*	*	*	*
No. of sexual partners in last 12 months									
One partner	2,617	56.6	53.2–59.9	8,172	32.1	30.1–34.3	3,119	11.6	9.5–14.0
Two or more partners	625	64.2	57.2–70.6	408	52.2	46.1–58.2	107	32.3	19.8–48.0

** Too few observations to report reliably.*

3.7.5 Sexual behaviour in the Metro areas

Table 3.44 summarises differences in multiple sexual partnership rates across the district metropolitan councils of South Africa. The survey found that 13.4% of residents of district metros had multiple sexual partners. This varied by metro, ranging from 8.5% in the Nelson Mandela Metro to 16.4% in the Buffalo City Metro; however, the differences were not statistically significant.

Table: 3.44: Multiple sexual partnerships among respondents aged 15 years and older who had sex in the last 12 months by the district metro council, South Africa 2012

District metro council	Sexual partnership				
	Multiple		Single		
	%	95% CI	%	95% CI	n
Buffalo City	16.4	10.8–24.2	83.6	75.8–89.2	279
City of Cape Town	11.4	8.4–15.4	88.6	84.6–91.6	1,471
Ekurhuleni	13.9	9.5–19.9	86.1	80.1–90.5	530
eThekwini	15.0	11.5–19.3	85.0	80.7–88.5	2,185
City of Johannesburg	15.5	11.3–20.8	84.5	79.2–88.7	1,025
Mangaung	9.0	4.9–15.8	91.0	84.2–95.1	318
Nelson Mandela	8.5	5.1–13.9	91.5	86.1–94.9	558
City of Tshwane	12.7	8.2–18.9	87.3	81.1–91.8	529
Total	**13.4**	**11.6–15.4**	**86.6**	**84.6–88.4**	**6,895**

In view of the finding that HIV varies by marital status, marital status distribution in the metros was explored. Table 3.45 presents marital status rates for participants aged 15 years and older across the eight metros (excluding the widowed and divorced because of smaller numbers). The results show that the marriage rates were low: only 39.6% of metro residents were married while 34.2% were co-habiting (i.e., living together with their partner); the remaining 26.2% were single and had no sexual partner. There were differences between the metros in marital status. The metro with the lowest marriage

Table 3.45: Marital status (three groups) across the district metro councils, among respondents aged 15 years and older, South Africa 2012

District metro council	Marital status						
	Single		Married		Living together		
	%	95% CI	%	95% CI	%	95% CI	n
Buffalo City	33.6	28.1–39.6	22.6	14.9–32.9	43.8	36.3–51.5	434
City of Cape Town	25.9	22.7–29.5	45.5	38.5–52.7	28.5	22.7–35.1	2,003
Ekurhuleni	25.2	20.1–31.1	45.7	39.3–52.2	29.2	24.7–34.0	764
eThekwini	27.5	23.2–32.2	29.4	23.6–35.8	43.2	38.2–48.4	3,204
City of Johannesburg	28.3	22.6–34.8	33.9	26.6–42.1	37.8	30.8–45.4	1,521
Mangaung	28.2	21.2–36.4	37.3	29.4–45.8	34.5	28.3–41.3	442
Nelson Mandela	33.3	26.9–40.3	34.1	26.3–42.8	32.6	26.3–39.7	847
City of Tshwane	20.2	16.9–23.9	46.6	37.0–56.6	33.2	25.4–42.0	717
Total	**26.2**	**24.2–28.3**	**39.6**	**36.2–43.1**	**34.2**	**31.4–37.2**	**9,932**

rate is Buffalo City and the metros with the highest marriage rates are Cape Town, Ekurhuleni and Tshwane, while the rest of the metros have rates in between. Buffalo City and Ethekwini have the highest rates of people who were living together, and these differences are significant ($p<0.001$) compared to the metros with the lowest rates of people who were living together, namely, City of Cape Town and Ekurhuleni.

Another behaviour known to be related to HIV is age-disparate relationships. Table 3.46 summarises prevalence for sexually active persons in the last 12 months aged 15 and older across the metros. The results show that the majority (64.1%) of people across the metros have peers (within five years of the index case) as their sexual partners, whereas 17.6% have partners at least five years younger and 18.2% have partners at least five years older than themselves. The Buffalo City Metro has the highest rate of age-disparate relationships with partners younger than five years or more when compared to the City of Cape Town, City of Johannesburg and Nelson Mandela Metros. There are no significant differences across the metros for age-disparate relationships with partners older than at least five years and for sex within peer age groupings (within five years of the index case).

Table 3.46: Age-disparate relationships among respondents aged 15 years and older who had sex in the last 12 months, by district metro councils, South Africa 2012

District metro council	Intergenerational sex						
	5+ years younger		Within 5+ years		5+ years older		n
	%	95% CI	%	95% CI	%	95% CI	
Buffalo City	27.3	20.4–35.5	53.0	44.4–61.4	19.7	16.8–23.0	275
City of Cape Town	15.4	12.9–18.3	67.2	63.3–70.8	17.4	15.0–20.1	1,461
Ekurhuleni	18.2	13.2–24.5	59.1	53.0–64.9	22.7	18.5–27.6	519
eThekwini	19.5	16.0–23.5	64.2	60.6–67.6	16.3	14.0–19.0	2,168
City of Johannesburg	15.4	11.8–19.9	67.8	60.5–74.3	16.8	13.2–21.0	1,006
Mangaung	16.1	10.6–23.9	64.2	54.9–72.5	19.7	14.6–26.1	314
Nelson Mandela	14.0	11.4–17.2	68.4	62.6–73.6	17.6	13.3–23.0	553
City of Tshwane	20.8	17.1–25.1	61.1	53.5–68.2	18.1	13.7–23.4	524
Total	**17.6**	**16.0–19.5**	**64.1**	**61.5–66.6**	**18.2**	**16.6–20.0**	**6,820**

3.8 Awareness of HIV status

Awareness of one's HIV status through HCT/VCT is pivotal to accessing prevention, care services, and ARV treatment which mitigates the impact of HIV. In this context it is also important to determine the success of the national HCT campaign, which commenced in April 2010 and ended in 2011. Indeed, although low-key, the campaign continued even into the period of the survey in 2012. The campaign was re-launched by SANAC by the Deputy President on behalf of SANAC on World AIDS Day, 1 December 2013.

In this section we present some of the findings on both HIV testing history and, more importantly, on HIV testing history and awareness of HIV status during the 12 months preceding the survey.

3.8.1 Awareness of HIV testing sites

Analysis of awareness of availability of a testing site closest to one's home, cross-tabulated with various demographic characteristics, is shown in Table 3.47. Participants (n=26,306)

Table 3.47: Awareness of an HIV testing site nearby among persons 15 years and older, South Africa 2012

Variable	Awareness of HIV testing site		Total
	%	95% CI	
Race			
Black African	93.7	92.9–94.4	15,108
White	82.7	78.2–86.5	2,815
Coloured	92.4	90.5–93.9	4,906
Indian/Asian	87.4	83.7–90.4	3,414
Other	95.1	73.3–99.3	43
Sex			
Male	90.9	89.7–91.9	11,377
Female	93.6	92.6–94.5	14,929
Age group (years)			
15–24	90.5	89.0–91.9	7,100
25–49	95.4	94.4–96.2	11,518
50+	87.3	85.7–88.8	7,688
Locality type			
Urban formal	91.6	90.2–92.8	15,547
Urban informal	94.1	92.3–95.4	2,673
Rural informal	93.6	92.6–94.5	5,582
Rural formal	88.2	80.3–93.2	2,504
Province			
Western Cape	92.4	90.6–93.9	3,237
Eastern Cape	92.4	90.8–93.7	3,306
Northern Cape	94.5	92.9–95.8	2,030
Free State	95.0	93.2–96.3	1,924
KwaZulu-Natal	93.8	92.1–95.2	6,161
North West	93.9	91.8–95.4	1,806
Gauteng	89.7	86.6–92.1	3,623
Mpumalanga	94.2	92.3–95.6	1,908
Limpopo	91.3	89.4–92.9	2,311
Total	**92.3**	**91.4–93.1**	**26,306**

were asked whether they knew a place near their homes where they could test for HIV. A total of 92.3% of participants responded in the affirmative, with females (93.6%) CI 95%:92.6–94.5) more likely than males (90.9%) CI 95%:89.7–91.9) being aware of the closest HIV-testing sites. Black Africans and Coloureds were more likely than whites and Indians or Asians to know the location of the closest VCT centres. Adults (aged 25–49 years) were more likely than youth and older respondents to know where these centres are located. Those living in urban informal settlements, where HIV is most prevalent, were more likely than their urban formal counterparts to know the location of the nearest testing sites. However, most respondents were aware of the location of the nearest testing site. Similar findings were obtained when the data were analysed by province. This

Table 3.48: Awareness of an HIV testing site nearby among persons aged 15 years and older, South Africa 2012

Testing site	Male (n = 6,457)		Female (n = 9,957)		Total (n = 16,414)	
	%	95% CI	%	95% CI	%	95% CI
Public hospital	19.2	17.5–21.1	20.1	18.4–21.9	19.7	18.3–21.2
Private hospital	6.3	5.0–7.9	5.3	4.5–6.2	5.7	4.9–6.6
Public clinic or doctor	43.5	40.8–46.3	54.9	52.6–57.1	50.0	47.9–52.1
Private clinic or doctor	13.3	11.6–15.1	10.0	8.9–11.3	11.4	10.3–12.6
Mine hospital	1.7	1.2–2.5	0.2	0.1–0.3	0.8	0.6–1.2
Traditional healer	0.1	0.0–0.3	0.0	0.0–0.2	0.1	0.0–0.2
loveLife clinic	0.7	0.4–1.0	0.6	0.4–0.9	0.6	0.5–0.9
Youth centre	0.5	0.2–0.9	0.3	0.2–0.6	0.4	0.3–0.6
HIV testing centre	2.4	1.9–3.1	1.7	1.4–2.2	2.0	1.7–2.4
Workplace	7.4	6.3–8.6	3.8	3.1–4.5	5.3	4.6–6.1
Other	5.0	4.0–6.3	3.0	2.5–3.7	3.9	3.3–4.6
Total	**100**		**100**		**100**	

suggests that VCT services were perceived as accessible. A follow-up question required that participants indicate the place they last had an HIV test. From this analysis, it is evident that most participants (70%) tested in the public health sector, half of these in primary care facilities. Only 17% were tested in private health facilities. Few were tested in workplaces.

Table 3.48 also summarises places of testing by sex of the respondent. From the analysis it appears that females were significantly more likely than males to have been tested in public primary health care settings ($p<0.001$). Males were more likely than their female counterparts to have been tested in work places. Special purpose centres such as youth centres, loveLife's youth-friendly clinics, and HIV-testing centres not based at clinics or mobile ones were less likely to be places where participants visited for testing.

3.8.2 History of HIV testing

The next set of questions in the survey asked whether participants had ever been tested for HIV (Table 3.49). Altogether, nearly two-thirds of respondents (65.5%) indicated that they had tested for HIV. As expected, a significantly higher percentage of females (71.5%) than of males (59%) reported that they had been tested ($p<0.001$). In addition, a significantly higher percentage of adults aged 25–49 years (78.2%) had tested than youth aged 15–24 years (50.6%) and the elderly (aged 50 years and older) (54.8%) ($p<0.001$).

Analysis of the data by race showed no significant differences in HIV testing history. The same was also true for locality type. Among the provinces, the Western Cape (70.4%), followed by Northern Cape (69.8%) and Gauteng (68.1%), reported the highest levels of HIV testing during the previous year. The differences between all provinces were statistically significant ($p<0.001$).

Respondents were also asked if they had participated in the national HCT campaign that started in 2010. The results showed that 17% (95% CI: 15.5–18.5) of the participants, or 3.7 million people, had been tested for HIV between 2010 and the end of 2012. Although

Table 3.49: Respondents aged 15 years and older, who had ever been tested for HIV, by demographic characteristics, South Africa 2012

Variable	Tested for HIV		
	n	%	95% CI
Sex			
Male	11,403	59.0	57.2–60.8
Female	14,978	71.5	70.1–72.9
Age (years)			
15–24	7,121	50.6	48.5–52.7
25–49	11,553	78.2	76.6–79.8
50 +	7,707	54.8	52.7–57.0
Race			
Black African	15,166	65.8	64.3–67.2
White	2,823	62.7	58.8–66.4
Coloured	4,911	67.8	65.4–70.1
Indian/Asian	3,419	60.6	55.7–65.3
Locality type			
Urban formal	15,580	68.0	66.3–69.8
Urban informal	2,691	67.9	64.1–71.6
Rural informal	5,602	61.6	59.6–63.5
Rural formal	2,508	63.0	57.4–68.2
Province			
Western Cape	3,245	70.4	67.8–72.8
Eastern Cape	3,311	63.3	60.5–66.1
Northern Cape	2,037	69.8	67.0–72.4
Free State	1,940	66.5	63.5–69.3
KwaZulu-Natal	6,178	65.5	62.4–68.5
North West	1,818	62.0	58.0–65.8
Gauteng	3,620	68.1	65.0–71.0
Mpumalanga	1,917	57.5	52.4–62.3
Limpopo	2,315	62.6	59.8–65.2
Total	**26,387**	**65.5**	**64.2–66.7**

only 17% of the population indicated that they had tested as part of the HCT campaign, 42.7% (15.7 million) tested for HIV in the 12 months preceding the interview.

3.8.3 Recent HIV testing

A further disaggregation of the data by testing history suggests that nearly a quarter of the participants tested in the three months preceding the 2012 survey. Nearly one in five tested in the four to six months prior to the survey. Apparently there is a tendency to regularly test for HIV. Table 3.50 summarises the testing behaviour of participants in 2008 and 2012, showing that, overall, significantly more people tested within the past year than before (49.1% in 2008 compared to 66.2% in 2012) ($p<0.001$). In 2012 a small percentage of the population had not been tested more than two years ago; most were tested in the

Table 3.50: Period of last HIV test among respondents aged 15 years and older, South Africa, 2008 and 2012

Period	2008						2012					
	Male (n = 2,202)		Female (n = 4,136)		Total (n = 6,338)		Male (n = 6,536)		Female (n = 10,042)		Total (n = 16,578)	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Less than a year ago	51.5	48.3–54.8	47.4	45.2–49.6	49.1	47.1–51.1	64.6	62.3–66.8	67.5	65.7–69.2	66.2	64.7–67.7
Between 1 and 2 years ago	25.9	23.2–28.8	27.8	25.8–29.8	27.0	25.4–28.7	17.3	15.5–19.4	14.9	13.7–16.2	15.9	14.9–17.1
Between 2 and 3 years ago	11.1	8.9–13.8	10.4	9.2–11.7	10.7	9.5–12.0	8.2	7.2–9.3	6.5	5.8–7.3	7.2	6.6–7.9
Three or more years ago	11.5	9.6–13.6	14.5	12.9–16.1	13.2	12.0–14.6	9.9	8.6–11.3	11.1	10.1–12.2	10.6	9.8–11.5

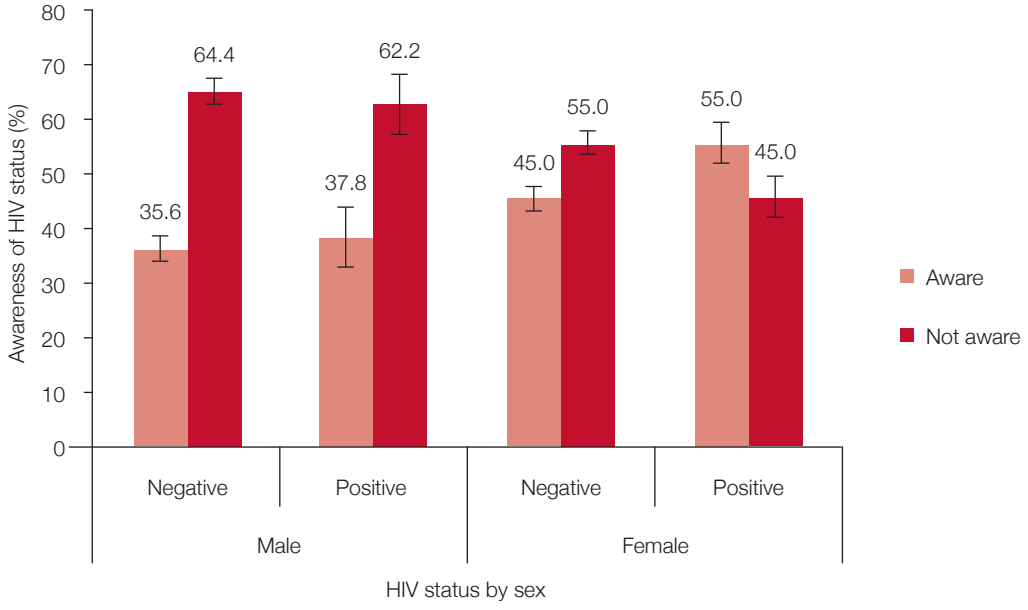
year preceding the survey or within the last two years. For both years (2008 and 2012), there were no significant differences between the testing behaviour of males and of females in terms of their having taken a recent HIV test.

3.8.4 Awareness of HIV status and HIV prevalence

In the 2012 survey males and females were asked whether they were aware of their HIV status and were also independently tested to determine their actual HIV status. These results are presented in Figure 3.12. The results show that there were no significant differences between HIV-positive males (37.8%) and HIV-negative males (35.6%) in the level of awareness of their HIV status. In contrast, HIV-positive females were more likely to be aware of their HIV status (55.0%) than their HIV-negative female counterparts (45.0%). These differences were statistically significant ($p<0.001$).

More HIV-negative females (45.0%) were aware of their HIV status than were HIV-negative males (35.6%) ($p<0.001$). A similar finding was observed between the HIV-positive females and HIV-positive males (55.0% vs.37.8% respectively) in the awareness of their HIV-positive status ($p<0.001$).

Figure 3.11: Awareness of HIV status and tested HIV status among respondents aged 15 years and older, South Africa 2012



An interesting finding was that 62.2% of HIV-positive males were not aware of their sero-status. This is in contrast to 45.0% of HIV-positive females who were not aware of their sero-status. The same figure also reveals the magnitude of the sex differences in awareness of HIV sero-status, showing that there are significantly higher rates of awareness of HIV status among females, whether negative or positive, than among males ($p<0.001$).

3.9 Perceived susceptibility to HIV infection

The association between perception of risk of HIV infection and sexual behaviour remains poorly understood, although perception of risk is considered to be the first stage towards behavioural change from risk-taking to safer behaviour. Based on the health belief model,

one's personal belief influences health behaviour (Tlou, 2005), it is expected that once individuals perceive themselves to be susceptible to a disease, they are more likely to take preventive measures. In this case, the expectation is that those who believe that they are likely to contract HIV may take precautionary measures. Since HIV is very common in South Africa, it is reasonable to expect that some will consider themselves to be at risk of HIV. However, it is also expected that this perception of risk will vary depending on what risky behaviour they are engaged in. Respondents 15 years and older were asked to rate themselves on a four-point Likert scale in terms of risk of being infected with HIV.

The results on Table 3.51 show that 39.6% believed they were definitely not going to contract HIV and another 36.9% believed that they were probably not going to get HIV, resulting in just over three quarters (77%) of the respondents believing that they are not at risk of acquiring HIV. Nearly one fifth (18.8%) believed that they would probably get infected with HIV while a small minority (4.7%) believed they will definitely get infected with HIV.

Data were also analysed by sex, race, age, province and locality type. The results show no significant differences by sex of the respondent for those who believed that they would either definitely or probably not get infected with HIV ($p=0.057$). However, more females (19.3% and 5.7%) believed that they were either probably or definitely were going to get infected with HIV than males (18.2% and 3.7% respectively) (see Table 3.51). The differences between the latter were significant ($p<0.001$).

With respect to racial differences, black Africans were less likely than all other groups to believe that they would either probably or definitely not get infected with HIV (23.2% and 5.7% respectively) than all other race groups (white: 0.9% and 0.3%; Coloured: 6.5% and 2.3%; Indian/Asian: 1.9% and 0.7%; all respectively).

Analysis of risk of getting infected with HIV was conducted by age of respondents and the results show that those 50 years or older were more likely to believe that they would either probably or definitely not get infected with HIV (54.3% and 30.9% respectively) than the other two age groups (15–24 years: 42.1% and 39.3%; 25–59 years: 31.9% and 38.2%; both respectively). Adults aged 25 to 49 years were more likely to believe that they were probably or definitely going to get infected with HIV (23.2% and 6.7% respectively) than all the other age groups (15–24 years: 16.2% and 2.5%; 50 years and older: 11.9% and 2.9%; both respectively) (also see Table 3.51).

Regarding provincial perceptions of risk, Western Cape ranked highest in proportion of people who believed that they would definitely not get infected with HIV (55.6%), closely followed by Northern Cape (51.1%). Those living in Mpumalanga (27.2%) ranked last in holding this belief. Free State had the highest proportion of people who believed they were probably going to get infected (28.9%). KwaZulu-Natal had the highest proportion of people who believed they were definitely likely to get infected (8.1%). The differences in perceived HIV risk perceptions among the provinces was significant ($p<0.001$).

Regarding locality type, urban formal areas (47.3%) and rural formal areas (44.2%) were more likely to have high proportions of the population who believed they were definitely not going to get infected with HIV compared with urban informal areas (29.8%) and rural informal areas (23.5%). The differences in perceived HIV risk among the various locality types was significant ($p<0.001$).

Table 3.51: Perceived risk of getting infected with HIV among respondents aged 15 years and older by background characteristics, South Africa 2012

Variable		I will definitely not get infected with HIV		I probably won't get infected with HIV		I am probably going to get infected with HIV		I am definitely going to get infected with HIV	
	n	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Sex									
Male	11,353	39.6	37.6–41.6	38.5	36.6–40.4	18.2	16.7–19.9	3.7	3.14.5
Female	14,883	39.6	37.6–41.7	35.4	33.7–37.1	19.3	17.9–20.8	5.7	5.0–6.4
Race									
Black African	15,057	31.5	29.8–33.2	39.5	37.8–41.3	23.2	21.8–24.8	5.7	5.1–6.4
White	2,818	75.6	71.7–79.1	23.3	19.8–27.1	0.9	0.5–1.5	0.3	0.1–0.7
Coloured	4,889	57.2	53.4–61.0	34.0	30.7–37.5	6.5	5.0–8.4	2.3	1.5–3.6
Indian/Asian	3,410	75.0	69.9–79.5	22.3	18.4–26.7	1.9	0.9–4.0	0.7	0.3–1.9
Age group (years)									
15–24	7,103	42.1	39.8–44.4	39.3	37.1–41.4	16.2	14.6–17.9	2.5	2.0–3.2
25–49	11,476	31.9	29.9–33.9	38.2	36.2–40.2	23.2	21.5–25.1	6.7	5.8–7.7
50+	7,657	54.3	51.6–57.0	30.9	28.8–33.1	11.9	10.6–13.3	2.9	2.3–3.6
Province									
Western Cape	3,234	55.6	49.7–61.3	34.0	30.1–38.2	8.2	6.0–11.3	2.2	1.5–3.3
Eastern Cape	3,276	34.3	30.5–38.4	33.4	30.7–36.2	27.1	22.9–31.8	5.1	3.8–6.9
Northern Cape	2,028	51.1	44.3–57.9	32.8	27.9–38.1	12.9	9.7–16.9	3.2	2.1–4.8
Free State	1,923	38.8	33.9–43.9	28.1	23.7–32.9	28.9	24.7–33.6	4.2	2.9–6.0
KwaZulu-Natal	6,163	31.4	28.2–34.8	39.5	35.8,43.2	21.0	18.6–23.6	8.1	6.6–9.8
North West	1,805	30.7	26.3–35.5	40.0	35.7,44.5	24.1	20.0–28.7	5.2	4.1–6.5
Gauteng	3,607	46.3	41.6–51.1	37.6	33.8,41.6	13.3	10.5–16.7	2.7	2.0–3.7

→ *continued*

Variable		I will definitely not get infected with HIV		I probably won't get infected with HIV		I am probably going to get infected with HIV		I am definitely going to get infected with HIV	
	n	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Mpumalanga	1,901	27.2	22.7–32.1	44.9	40.9,49.0	20.8	17.7–24.2	7.2	4.8–10.7
Limpopo	2,299	37.8	32.8–43.0	35.4	31.9,39.1	22.4	19.3–25.8	4.5	3.2–6.1
Locality type									
Urban formal	15,508	47.3	44.3–50.4	36.1	33.6,38.5	13.7	11.9–15.6	3.0	2.4–3.7
Urban Informal	2,663	29.8	25.2–34.9	37.7	33.5,42.0	24.7	21.0–28.8	7.8	6.3–9.8
Rural informal	5,572	29.5	27.-,31.9	38.1	35.9,40.2	25.6	23.6–27.8	6.8	5.7–7.9
Rural formal	2,493	44.2	38.4–50.1	36.5	31.8,41.6	15.5	11.1–21.1	3.8	2.36.3
Total	**26,236**	**39.6**	**37.8–41.4**	**36.9**	**35.4–38.4**	**18.8**	**17.5–20.1**	**4.7**	**4.2–5.3**

3.9.1 Reasons for believing they are at low risk of contracting HIV

Table 3.52 summarises the reasons respondents advanced for believing they would not get infected with HIV. The most common reasons were other (unspecified), followed by being faithful to one's partner, abstaining from sex, condom use, and trusting one's partner. Other reasons were knowing one's HIV status or believing that one is not at risk. Few believed in supernatural forces in preventing them from acquiring HIV.

Table 3.52: Reasons advanced among respondents aged 15 years and older for why they would not get infected by HIV

Reasons for belief one would not contract HIV	n	% of cases
I have never had sex before	21,150	11.0
I abstain from sex	21,147	21.3
I am faithful to my partner	21,144	32.0
I trust my partner	21,149	22.5
I use condoms	21,146	19.2
I know my HIV status	21,136	9.8
I know the status of my partner	21,134	4.4
I do not have sex with sex workers/prostitutes	21,112	1.7
My ancestors protect me	21,070	1.1
God protects me	21,142	2.5
I am not at risk for HIV	21,151	8.9
Other	21,142	10.4

3.9.2 Reasons for believing they are at high risk of contracting HIV

Participants who indicated that they would acquire HIV were asked to give reasons. The results are presented in Table 3.53. The most common reasons given were being sexually active, followed by non-use of protective barrier, condom use and not trusting one's sexual partner. Very few cited reasons for believing that they are at risk of acquiring HIV such as having multiple sexual partners.

Table 3.53: Reasons respondents aged 15 years and older believed they would get infected with HIV

Reasons for belief one would contract HIV	n	% of cases
I am sexually active	4,568	24.1
I have had many sexual partners	4,565	4.2
I don't use condoms	4,568	22.4
I don't always use condoms	4,568	14.3
I don't trust my partner	4,568	17.6
I am sick	4,571	7.9
My partner is sick	4,565	1.6
My partner died of AIDS	4,571	1.2
I had an accident/have cuts	4,569	11.9
Other	4,568	27.1

3.9.3 Perceived personal risk of HIV infection among key populations at higher risk of HIV exposure

Members of key populations at higher risk of HIV exposure like others find themselves in this situation because, among other reasons, they often do not perceive themselves to be at risk of HIV infection. Figure 3.12 shows the results obtained on this measure in this survey. It shows that a large majority of the disabled aged 15 years and older perceived themselves to be at low personal risk of HIV infection as much as the general population. However, slightly lower proportions of the rest of the key populations at higher risk of HIV exposure perceived themselves as being at low personal risk of HIV infection than the general population.

Figure 3.12: Perceived low personal risk of HIV infection among key populations at risk of HIV exposure, South Africa 2012

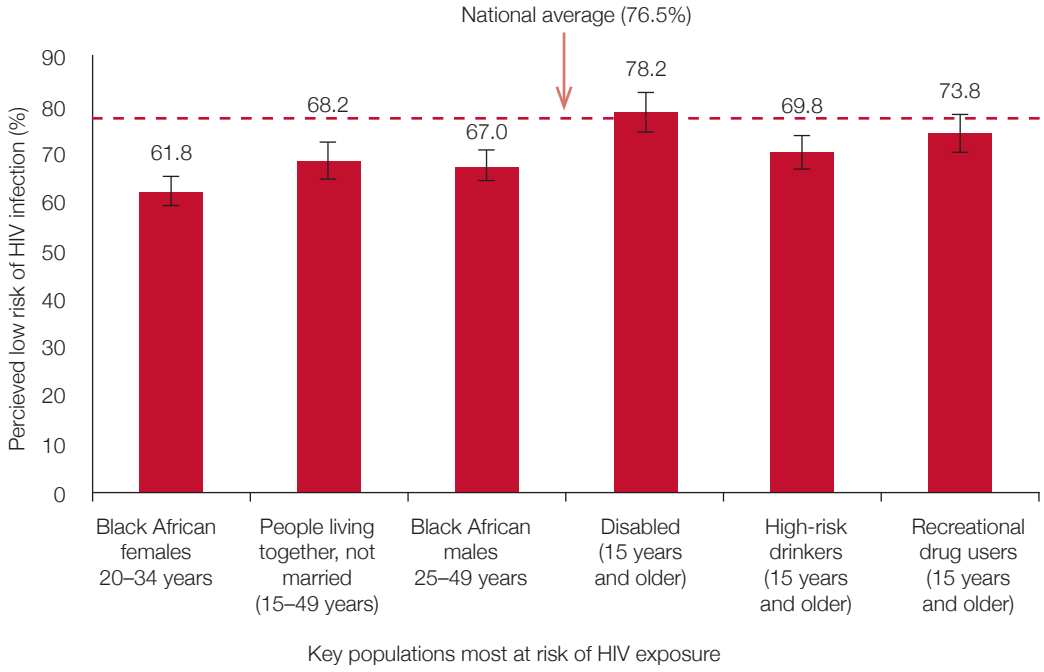


Table 3.54 shows a list of reasons provided by key populations who perceived themselves to be at low personal risk of HIV infection. The common reasons given were that they used condoms, they trusted their partners, and they abstained from sex.

Table 3.55 shows a list of reasons provided by those who believed that they would get infected by HIV. The major reasons advanced were that they were sexually active, they did not use condoms, they did not trust their partners, and they did not always use condoms.

3.9.4 History of HIV testing and HIV risk perception

A total of 26,150 participants answered a question about whether they had ever been tested for HIV; the result was cross-tabulated with risk perception. Those who believed they were at low risk of contracting HIV (62.3%; 95 CI%: 60.8, 63.8) were less likely to have ever tested for HIV than those who were at high risk (75.1%; 95 CI%: 73.1, 77.1). The difference was statistically significant ($p<0.001$).

Table 3.54: Reasons advanced by key populations at risk of HIV exposure for why they would not get infected by HIV

Reasons for belief one would not contract HIV	n	%
I have never had sex before	336	4.8
I abstain from sex	1,047	14.9
I am faithful to my partner	2,506	35.7
I trust my partner	1,791	25.2
I use condoms	1,920	27.4
I know my HIV status	842	12.0
I know the status of my partner	389	5.5
I do not have sex with sex workers/prostitutes	150	2.1
My ancestors protect me	96	1.4
God protects me	176	2.5
I am not at risk for HIV	423	6.0
Other	734	10.5

Table 3.55: Reasons given by key populations at risk of HIV exposure for believing they would get infected with HIV

Reasons for belief one would contract HIV	n	%
I am sexually active	709	25.8
I have had many sexual partners	127	4.6
I don't use condoms	618	22.5
I don't always use condoms	461	16.8
I don't trust my partner	474	17.2
I am sick	219	8.0
My partner is sick	52	1.9
My partner died of AIDS	29	1.1
I had an accident/have cuts	318	11.6
Other	686	25.0

The next level of analysis is an assessment of the relationship between level of perceived risk and actual HIV status as determined in this survey. The results are presented in Table 3.56. Those who believed they were at high risk of acquiring HIV were significantly more likely to be HIV positive compared to those who believed they were at low risk of HIV

Table 3.56: Perceived personal risk of HIV infection among respondents aged 15 years and older by sex and HIV status, South Africa 2012

Sex	Low-risk perception			High-risk perception		
	n	HIV + %	95% CI	n	HIV + %	95% CI
Male	7,072	9.2	7.6–11.0	1,547	26.4	23.2–29.9
Female	9,166	12.3	10.8–13.9	2,568	38.0	34.6–41.6
Total	**16,238**	**10.7**	**9.5–12.1**	**4,115**	**32.9**	**30.4–35.6**

infection (p<0.001). Interestingly, 10.7% who thought they were at low risk were, in fact, HIV positive. This was more prevalent among females than males.

3.10 Knowledge about HIV transmission and prevention

3.10.1 General population

Accurate knowledge about HIV transmission does not necessarily result in behavioural change and efforts to prevent HIV infection; however, it is a prerequisite for engaging in HIV prevention practices. In this survey as described in the methodology section of the report, a composite measure was created out of responses to three prompted questions related to HIV transmission and prevention and two myths and misconceptions about the transmission of the disease. This measure is used internationally by UNAIDS (2013d) to assess the extent to which the population is knowledgeable about how HIV is transmitted and prevented.

3.10.2 Knowledge about HIV transmission and prevention

We used five questions to measure knowledge levels about HIV transmission and prevention by age, sex, race, locality type and province in 2005, 2008 and 2012. Data are presented first for 2012, which are later compared with the earlier survey data from 2008 and 2005. In interpreting these data, two key points need to be considered. Firstly, the knowledge about HIV transmission and prevention indicator is index-based on correct identification of ways to prevent sexual transmission of HIV as well as on correct rejection of major misconceptions about HIV transmission. This survey addressed the areas related to correct knowledge and myths or misconceptions about HIV transmission and prevention. For comparative purposes we present the specific items included in the survey in 2012:

- Can a person reduce the risk of getting HIV by using a condom every time he/she has sex?
- Can a person reduce the risk of HIV by having fewer sexual partners?
- Can AIDS be cured?
- Can a healthy-looking person have HIV?
- Can a person get HIV by sharing food with someone who is infected?

The 2012 level of analyses presented below includes participants aged 15 years and older and shows that 26.8% were knowledgeable about sexual transmission and prevention of HIV (Table 3.57). There were no sex differences in levels of knowledge, but there were significant differences by age, race, locality and provinces. Older participants aged 50 years and older were more likely to be less knowledgeable than younger participants (p<0.001). Black Africans were more likely to be less knowledgeable about sexual transmission and prevention of HIV than all other race groups (p<0.001). Participants living in urban formal locality areas were more knowledgeable than those living in other locality types (p<0.001).

Respondents from the Free State had the highest level of knowledge of sexual transmission and prevention of HIV. They were more likely to be more knowledgeable about HIV than those living in the Eastern Cape, KwaZulu-Natal, North West, Mpumalanga and Limpopo. The province with the second highest knowledge levels was Gauteng, where the residents were more likely to be knowledgeable than those of KwaZulu-Natal, Northwest, Mpumalanga and Limpopo. The province with the lowest level of knowledge

Table 3.57: Correct knowledge about sexual transmission of HIV and rejection of major misconceptions about HIV transmission among respondents aged 15 years and older, South Africa 2012

Variable	n	%	95% CI
Sex			
Male	11,464	26.2	24.6–27.8
Female	15,080	27.3	25.8–28.9
Age group (years)			
15–24	7,154	28.6	26.8–30.4
25–49	11,634	27.7	26.0–29.4
50 +	7,756	22.4	20.5–24.4
Race			
Black African	15,231	23.6	22.1–25.2
White	2,868	43.3	39.1–47.6
Coloured	4,942	30.3	27.4–33.5
Indian/Asian	3,438	41.4	37.4–45.5
Locality type			
Urban formal	15,686	31.7	29.6–33.8
Urban informal	2,701	21.9	19.1–25.0
Rural informal	5,597	20.8	19.0–22.7
Rural formal	2,560	24.8	21.2–28.8
Province			
Western Cape	3,263	29.5	26.5–32.5
Eastern Cape	3,332	25.6	22.4–29.0
Northern Cape	2,049	28.0	22.7–33.9
Free State	1,980	34.7	30.3–39.5
KwaZulu-Natal	6,216	24.4	22.1–26.9
North West	1,826	20.8	18.1–23.9
Gauteng	3,659	31.7	28.4–35.3
Mpumalanga	1,905	21.9	18.1–26.4
Limpopo	2,314	19.3	16.0–23.2
Total	**26,544**	**26.8**	**25.5–28.1**

of sexual transmission of HIV is Limpopo. The difference in the levels of knowledge of HIV transmission and prevention among provinces was significant ($p<0.001$).

The results show that 28.6% of both young women and men aged 15–24 correctly identified ways of preventing sexual transmission and prevention of HIV and rejected major misconceptions about HIV transmission, whereas proportions varied only slightly by sex (females aged 15–24 at 29%, males aged 15–24 at 28.2%).

Analyses of data across two surveys are presented for the years 2008 and 2012. The method of measurement differed slightly in the question wording, but the substance remains the same for most items. The 2012 items were listed in a form of questions,

whereas for the 2008 survey the items were stated as statements. These changes are presented below (Table 3.58).

Table 3.58: Method of measurement of correct HIV knowledge

2008	2012
To prevent HIV infection, a condom must be used for every round of sex	Can a person reduce the risk of getting HIV by using a condom every time he/she has sex?
One can reduce the risk of HIV by having fewer sexual partners	Can a person reduce the risk of HIV by having fewer sexual partners?
There is a cure for AIDS	Can AIDS be cured?
A person with HIV can look healthy	Can a healthy-looking person have HIV?
HIV causes AIDS	Can a person get HIV by sharing food with someone who is infected?

In Table 3.59 the results are presented by age and sex across the two surveys for persons 15 years and older, as well as for the reproductive age population (i.e., those aged 15–49 years). For each survey year, there were no sex differences in the level of knowledge for all the age groups.

Table 3.59: Correct knowledge of preventing sexual transmission of HIV and rejection of major misconceptions among respondents aged 15 years and older by age-group and sex, South Africa 2008 and 2012

Age group (years)	Sex of respondent	2008			2012		
		n	%	95% CI	n	%	95% CI
15–24	Males	1,959	30.1	27.0–33.3	3,449	28.2	25.8–30.7
	Females	2,260	28.7	26.0–31.5	3,705	29.0	26.7–31.4
	Total	4,219	29.4	27.2–31.7	7,154	28.6	26.8–30.4
25–49	Males	2,090	34.6	31.6–37.9	4,962	26.5	24.5–28.7
	Females	3,518	31.2	28.9–33.5	6,672	28.7	26.8–30.8
	Total	5,608	32.8	30.8–34.9	11,634	27.7	26.0–29.4
≥50	Males	1,168	29.5	25.7–33.6	3,053	22.1	19.7–24.8
	Females	2,132	23.4	20.7–26.4	4,703	22.5	20.1–25.3
	Total	3,300	26.0	23.6–28.5	7,756	22.4	20.5–24.4
≥15	Males	5,217	32.2	30.1–34.4	11,464	26.2	24.6–27.8
	Females	7,910	28.7	27.0–30.4	15,080	27.3	25.8–28.9
	Total	13,127	30.3	28.8–31.9	26,544	26.8	25.5–28.1
15–49	Males	4,049	32.9	30.5–35.3	8,411	27.1	25.4–28.9
	Females	5,778	30.3	28.5–32.2	10,377	28.8	27.2–30.5
	Total	**9,827**	**31.5**	**29.9–33.2**	**18,788**	**28.0**	**26.6–29.4**

Between 2008 and 2012, statistically significant drops in levels of knowledge were found among males aged 25–49 years, males 50 years and older and males aged 15 years and older ($p<0.001$).

Indices take into account more than one variable at a time and tend to give a more accurate picture of knowledge levels, but are also a stringent conceptual measure. The results of single item analyses of 2012 data are presented in Table 3.60. As expected, analysis of knowledge levels for single items produce high levels of knowledge, ranging as follows: 60.6% of participants affirmed that having fewer sexual partners reduces the risk of acquiring HIV, nearly 80% believed that always using a condom prevents HIV acquisition and 83.6% of participants believed that a healthy-looking person can have HIV. Of concern is that 21% of participants believed that AIDS can be cured and another 10.2% were not sure whether HIV can be cured, resulting in only the remaining participants, a proportion of 68.8%, believing correctly that HIV cannot be cured. Another notable misconception is that 14.5% believed that it is risky to share food with someone who is HIV positive.

Table 3.60: Knowledge of HIV among respondents aged 15 years and older, South Africa 2012

Knowledge item	n	Yes		No		Don't Know	
		%	95% CI	%	95% CI	%	95% CI
Can a person reduce the risk of HIV by having fewer sexual partners?	26,476	60.6	58.8–62.3	33.2	31.5–35.0	6.2	5.7–6.8
Can a person reduce the risk of getting HIV by using a condom every time he/she has sex?	26,493	79.2	77.9–80.4	14.5	13.5–15.6	6.3	5.7–7.0
Can AIDS be cured?	26,499	21.0	19.8–22.2	68.8	67.3–70.1	10.2	9.5–11.0
Can a healthy-looking person have HIV?	26,464	83.6	82.3–84.9	11.1	10.0–12.3	5.3	4.7–5.8
Can a person get HIV by sharing food with someone who is infected?	26,512	14.5	13.4–15.7	78.7	77.4–80.0	6.8	6.1–7.5

Additional analyses were conducted to assess the relationship between ART exposure and knowledge of HIV transmission. The results show that of the 2,613 participants who were HIV positive and tested positive for ARV (28.1%; 95% CI: 23.1–33.8) had higher levels of knowledge than those who tested negative for ARV (22.3%; 95% CI: 18.6%–26.4%). However, the differences were not significant.

Further analyses were conducted to determine the level of knowledge by HCT participation status. Knowledge levels were no different for those who participated in the HCT campaign when compared to those who did not participate as shown on Table 3.61.

Table 3.61: Correct knowledge about sexual transmission of HIV and rejection of major misconceptions about HIV transmission among respondents aged 15 years and older who participated in the HCT campaign, South Africa 2012

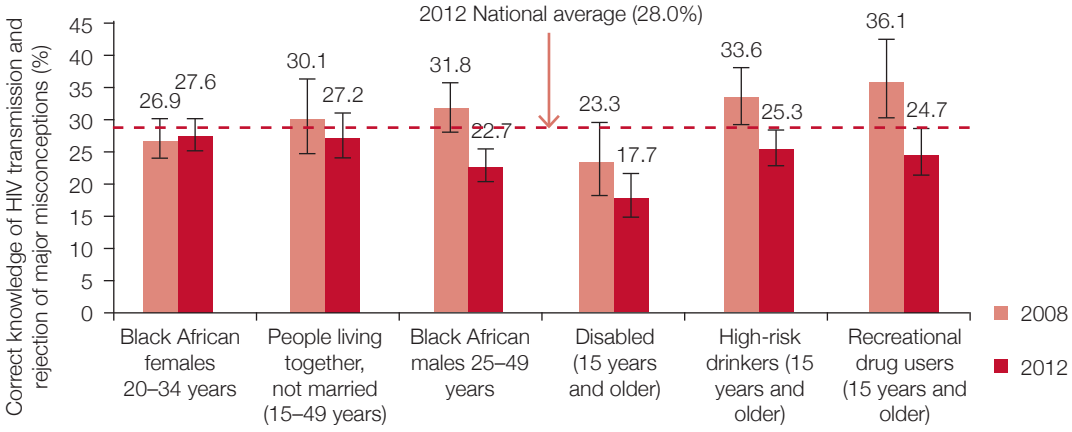
Participated in HCT campaign	n	%	95% CI
Yes	2,362	27.6	24.2–31.4
No	12,634	28.0	26.5–29.7
Don't Know	426	29.9	23.2–37.6
Total	**15,422**	**28.0**	**26.6–29.5**

3.10.3 Key populations at higher risk of HIV exposure and correct knowledge

The key populations at higher risk of HIV exposure ideally should be targets of mass education to reduce their chances of becoming infected with HIV. The HSRC-led survey has been tracking trends in knowledge levels for these populations.

Figure 3.13 shows results on the percentages of the six key populations at higher risk of HIV exposure who had correct knowledge of preventing sexual transmission and prevention of HIV and rejection of misconceptions of HIV transmission in 2008 and 2012. The figure shows that knowledge levels in these groups declined in 2012 when compared to 2008 among all key population groups except among black African women aged 20 to 34 years, and people living together. In 2012, this group (black African women 20 to 34 years) were the most knowledgeable group about sexual transmission of HIV and they rejected the myths of HIV transmission compared to other key populations at higher risk of HIV exposure, albeit the rate of knowledge at 27.6% was still low. Knowledge also decreased in 2012 compared to 2008 for both black African males aged 25–49 years and high risk alcohol drinkers. The disabled were the least knowledgeable during both 2008 and 2012, with knowledge levels deteriorating to 17.7% in 2012.

Figure 3.13: Correct knowledge of preventing sexual transmission of HIV and rejection of misconceptions of HIV transmission by key populations at higher risk of HIV exposure, South Africa 2008 and 2012



3.11 Sources of information about and perceived seriousness of HIV and AIDS

Communicating information about HIV is one of the key interventions necessary to educate the public about prevention and treatment interventions. If people are aware of the seriousness of HIV, they will be more inclined to engage in prevention and seek treatment interventions. Therefore, it is essential to assess which sources of information are useful for encouraging the population to take HIV more seriously. A number of common questions were asked in the 2005, 2008 and 2012 surveys with the aim of exploring what initiatives had caused people to take HIV and AIDS more seriously. These common sources included television (TV) programmes, radio programmes, newspapers and magazine articles, leaflets/booklets and posters, billboards, signs on taxis/buses and trains, and AIDS statistics (Table 3.64). In 2008, these questions were only asked of those aged 15 years and older, but not among 12–14 year olds as in other survey years.

The 2012 results (Table 3.62) show that TV programmes were indicated by 66.7% pre-adolescents, 50.6% of youth and 51.7% of young adults as sources of information that encouraged them to consider HIV as a serious condition. In the population aged 50 years and older only 45.7% considered television as a source of information. Radio programmes came a distant second. Print media (newspapers and magazines) came third, while leaflets and purposefully designed media with signs posted in different places seem not to have played as important a role in changing perceptions about the seriousness of HIV.

Table 3.62: Sources of information that encourage people to take HIV and AIDS more seriously, by age group, South Africa 2012

Source of information	Age group (years)			
	12–14	15–24	25–49	50+
Television programmes	66.7	50.6	51.7	45.7
Radio programmes	32.7	30.8	34.3	34.7
Newspaper/magazine articles	13.2	16.8	15.7	12.4
Leaflets/booklets/posters	12.0	8.4	7.0	4.7
Billboards	5.5	5.8	6.2	4.9
Signs on taxis/buses/trains	2.7	2.8	3.1	2.7
Plays or drama	10.2	5.6	2.1	1.1
Knowing or talking to someone with HIV and AIDS	4.4	13.4	18.2	16.6
Caring for a person with HIV and AIDS	0.8	3.0	4.5	4.3
Knowing someone who has died of AIDS	5.5	14.8	20.5	18.7
AIDS statistics	7.6	11.2	12.6	10.6
Talking to a health worker/nurse/doctor	7.5	13.2	15.6	14.6
Having an HIV test	0.8	5.0	8.3	5.5
Talking to a friend or family member	0.3	16.5	16.0	13.0
Nothing	15.2	4.0	3.3	4.5

Knowing or talking to someone with the disease plays an important role in changing perceptions of people of all ages, except for pre-adolescents, about the seriousness of HIV. Knowing someone who died from AIDS is even more significant in changing the perceptions of people of all ages except for pre-adolescents. AIDS statistics also play a role, albeit a smaller one compared to other sources of information, in encouraging youth and adults to take HIV more seriously, but certainly not common among pre-adolescents. Talking to health workers and family members also emerges as important in changing perceptions among youth and adults. Pre-adolescents are less likely to find this source of information useful, however; instead, they tend to rely more on electronic media such as TV and radio.

An examination of the data across the three surveys shows that among those between 12 to 14 years there was a decline from 2005 to 2012 in the effectiveness of these electronic sources of information in getting pre-adolescents to take HIV and AIDS more seriously. Similar and consistent declining trends were also observed in the three survey waves (2005, 2008, and 2012) among those aged 15–24, 25–49 and 50 years and above (Table 3.63).

3.12 Attitudes towards PLHIV

Stigma towards and discrimination against PLHIV remain a major barrier to effective HIV prevention, as well as to the provision of treatment, care and support. This section of the report addresses aspects of externalised or general stigma towards PLHIV.

Table 3.64 shows the attitudes of respondents aged 15 years and older towards PLHIV by age. Overall, large majorities of the respondents expressed positive attitudes in response to five of the six stigma questions that were investigated (range: 79.0%–91.6%) with the question "*Would you be willing to care for a family member with AIDS?*" with the highest proportion responding affirmatively. However, respondents were ambivalent toward one stigma question, namely, "*Would you want to keep the HIV-positive status of a family member a secret?*" as exactly half of them responded affirmatively to it. Only one sixth of the respondents responded affirmatively toward the question "*Is it a waste of money to train or give a promotion to someone with HIV/AIDS?*". This suggests that the large majority of respondents actually disagreed with it (i.e., when the responses of those who disagreed with the question are considered instead).

A comparison of the responses of people in different age groups to the first three of the six stigma questions in Table 3.64 (viz., "*If you knew that a shopkeeper or food seller had HIV, would you buy food from them?*", "*Would you be willing to care for a family member with AIDS?*" and "*If a teacher has HIV but is not sick, he or she should be allowed to continue to teach?*") showed that equally high percentages of the youth aged 15–24 years (Range: 81.9% – 92.1%) and adults 25–49 years (Range: 81.8%–92.6%) held positive attitudes about people living with HIV and AIDS and the for elderly (Range: 69.0%–88.5%). However, on the question "*Are you comfortable talking to at least one member of your family about HIV/AIDS?*" equally high percentages of youth aged 15–24 years and the elderly (aged 50 years and older) held similar positive views with both rates significantly lower compared to the corresponding attitudes held by adults aged 25–49 years ($p<0.001$). Furthermore, significantly lower percentages of respondents (i.e., around 50%) endorsed the question "*Would you want to keep the HIV-positive status of a family member a secret?*" when compared to the other five of the six items with equal percentages of majorities of both youth aged 15–24 years and adults 25–49 years doing so while less than half (45.3%) of the elderly (aged 50 years and older) endorsed the statement.

There were no age differences between the very low percentages of respondents (range 16.0%–18.3%) who agreed with the item "*Is it a waste of money to train or give a promotion to someone with HIV/AIDS?*"

Table 3.65 shows results for respondents aged 15 years and older, by province, who responded affirmatively to individual questions about people living with HIV and AIDS. In response to Question 1 in the table ("*If you knew that a shopkeeper or food seller had HIV, would you buy food from them?*"), the Free State and Mpumalanga had the highest percentages (84.6% and 83.3% respectively) of respondents who were favourable, while Limpopo and the Western Cape had the lowest (74.3% and 74.9% respectively). All the other provinces had concurrence rates of over 75.0%. In terms of Question 2 ("*Would you be willing to care for a family member with AIDS?*"), all provinces had concurrence rates of over 90% with the highest ones being Mpumalanga, Western Cape and Northern Cape except for Limpopo which was the lowest at 87.6%. On Question 3 ("*If a teacher has HIV but is not sick, he or she should be allowed to continue to teach?*"), seven of the

Table 3.63: Sources of information that encourage people to take HIV and AIDS more seriously, by age group, South Africa. 2005, 2008 and 2012

Source of information	Age group											
	12–14			15–24			25–49			50+		
	2005	2008	2012	2005	2008	2012	2005	2008	2012	2005	2008	2012
Television programmes	54.8	NA	66.7	50.8	41.0	50.6	45.6	36.9	51.7	40.6	32.9	45.7
Radio programmes	51.1	NA	32.7	51.8	27.1	30.8	46.9	26.8	34.3	44.5	29.1	34.7
Newspaper/magazine articles	16.1	NA	13.2	22.2	16.0	16.8	20.3	14.7	15.7	13.9	8.1	12.4
Leaflets/booklets/posters	16.7	NA	12.0	19.6	117	8.4	13.4	10.3	7.0	8.3	5.9	4.7
Billboards	13.5	NA	5.5	14.4	9.2	5.8	12.4	8.9	6.2	8.4	5.7	4.9
Signs on taxis/buses/trains	13.3	NA	2.7	14.7	6.8	2.8	12.1	6.5	3.1	10.5	3.8	2.7
AIDS statistics	12.9	NA	7.6	19.2	22.7	11.2	22.2	23.8	12.6	20.9	22.0	10.6

Table 3.64: Perception of stigma by age group, South Africa 2012

Stigma questions	Age (years)							Total	
	15–24			25–49		50 +			
	n	%	95% CI	%	95% CI	%	95% CI	%	95% CI
If you knew that a shopkeeper or food seller had HIV, would you buy food from them?	26,528	81.9	80.0–83.6	81.8	80.2–83.3	69.0	66.7–71.2	79.0	77.7–80.3
Would you be willing to care for a family member with AIDS?	26,505	92.1	90.9–93.1	92.6	91.3–93.7	88.5	86.9–90.0	91.6	90.6–92.5
If a teacher has HIV but is not sick, he or she should be allowed to continue to teach?	26,508	84.9	83.3–86.4	84.7	83.1–86.2	76.8	74.7–78.8	83.0	81.8–84.2
Is it a waste of money to train or give a promotion to someone with HIV/AIDS?	26,496	16.0	14.5–17.7	16.1	14.8–17.6	18.3	16.8–19.9	16.6	15.5–17.7
Would you want to keep the HIV-positive status of a family member a secret?	26,431	53.8	51.3–56.3	50.2	48.2–52.3	45.3	43.0–47.6	50.1	48.4–51.8
Are you comfortable talking to at least one member of your family about HIV/AIDS?	26,507	83.9	82.4–85.2	88.5	87.3–89.6	83.2	81.4–84.8	86.0	85.1–87.0

nine provinces had rates of above 80% agreement, with North West and Mpumalanga being the highest and both Eastern Cape and Limpopo were the lowest. On Question 4 ("*Is it a waste of money to train or give a promotion to someone with HIV/AIDS?*"), many respondents disagreed with Free State and KwaZulu-Natal having relatively higher rates of agreement and the Eastern Cape, Gauteng and Limpopo having the lowest (i.e., the majority actually agreed with the opposite). On Question 5 ("*Would you want to keep the HIV-positive status of a family member a secret?*"), respondents from KwaZulu-Natal and Mpumalanga had the highest negative responses and the Western Cape the lowest. Lastly, on Question 6 ("*Are you comfortable talking to at least one member of your family about HIV/AIDS?*"), all provinces, except for Limpopo which was the lowest, had agreement rates above 80%, with both the Western Cape and Mpumalanga having the highest rates.

Table 3.66 shows results from respondents aged 15 years and older by age group who agreed with four statements about PLHIV asked in the past three surveys as well as an additional two statements asked in the 2008 and 2012 surveys only. As is seen from the totals for each survey, there has been a significant increase in the percentages of respondents in all three groups across the three surveys from 2005 to 2012 who responded affirmatively with the first question ("*If you knew that a shopkeeper or food seller had HIV, would you buy food from them?*") ($p<0.001$). With regards to the second question, ("*Would you be willing to care for a family member with AIDS?*"), the percentages agreeing have also increased significantly both in the total and also among the three age groups across the period of the three surveys ($p<0.001$). On the third question, ("*If a teacher has HIV but is not sick, he or she should be allowed to continue to teach?*"), the percentages remained stable in the 2008 and 2012 surveys). On Question 4, ("*Is it a waste of money to train or give a promotion to someone with HIV/AIDS?*"), the percentages agreeing were very low but have remained stable both in terms of the total and also among the three age groups for the 2005, 2008 and 2012 surveys. In response to Question 5 ("*Would you want to keep the HIV-positive status of a family member a secret?"),* there was a significant increase in the percentages of respondents who agreed with the statement from fewer than one-third of respondents in 2005 to half the respondents in 2012 ($p<0.001$). This pattern is observable both at the level of the total and also among the three age groups between 2005 and 2012. On Question 6, ("*Are you comfortable talking to at least one member of your family about HIV/AIDS?*"), there was a significant decline in the percentages who agreed both in the total and also among the three age groups between 2008 and 2012 ($p<0.001$).

3.13 Orphanhood status

One of the major impacts of HIV and AIDS is the premature deaths of parents of young children, resulting in orphanhood. The survey was not able to distinguish between children who became orphaned because their parents died from HIV and AIDS-related diseases and children who became orphaned for other reasons. Instead, we simply counted how many children had lost a mother, father or both before reaching the age of 18 years. This section reports on the findings about the current state of orphanhood in South Africa including the relative distribution of paternal and maternal orphans.

Table 3.67 shows the status of orphanhood in South Africa in 2012 for children 18 years and younger. Overall, prevalence of orphanhood is 16.9%. The highest percentage of orphans were paternal orphans, followed by maternal orphans and then double orphans. There were no sex differences in the percentages of the different types of orphans. There

Table 3.65: Percentage of respondents aged 15 years and older who agreed with individual statements about people living with HIV/AIDS by province, South Africa 2012

Stigma question	WC			EC		NC		FS		KZN	
	n	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
If you knew that a shopkeeper or food seller had HIV, would you buy food from them?	20,019	74.9	71.5–78.1	79.5	76.8–82.0	78.3	72.8–82.9	84.6	81.5–87.2	76.3	72.4–79.9
Would you be willing to care for a family member with AIDS?	24,043	93.2	91.6–94.6	92.0	89.7–93.8	93.1	90.5–95.0	92.1	89.6–94.1	90.8	88.7–92.5
If a teacher has HIV but is not sick, he or she should be allowed to continue to teach?	21,505	84.0	81.4–86.4	75.0	71.2–78.5	84.0	79.6–87.6	84.9	82.4–87.1	82.6	79.2–85.5
Is it a waste of money to train or give a promotion to someone with HIV/AIDS?	4,685	15.6	13.2–18.3	10.6	8.8–12.6	19.9	17.3–22.8	27.9	23.5–32.8	23.8	20.6–27.4
Would you want to keep the HIV-positive status of a family member a secret?	12,378	37.5	33.5–41.8	50.5	45.7–55.3	43.6	38.7–48.7	44.2	40.8–47.6	62.3	58.7–65.8
Are you comfortable talking to at least one member of your family about HIV/AIDS?	22,838	91.3	90.0–92.5	81.9	79.6–83.9	83.8	81.2–86.1	88.7	86.4–90.7	85.2	83.1–87.1
	n	NW		GP		MP		LP		Total	
If you knew that a shopkeeper or food seller had HIV, would you buy food from them?	20,019	79.7	75.8–83.1	81.9	78.7–84.7	83.3	79.5–86.5	74.3	71.0–77.3	79.0	77.7–80.3
Would you be willing to care for a family member with AIDS?	24,043	91.6	89.6–93.2	91.4	88.3–93.7	95.0	93.5–96.2	87.6	83.0–91.1	91.6	90.6–92.5
If a teacher has HIV but is not sick, he or she should be allowed to continue to teach?	21,505	87.5	84.7–89.8	85.9	82.9–88.5	87.3	84.9–89.3	77.5	73.5–81.1	83.0	81.8–84.2
Is it a waste of money to train or give a promotion to someone with HIV/AIDS?	4,685	14.8	12.4–17.4	13.4	11.3–15.8	16.8	14.9–18.8	13.8	11.4–16.5	16.6	15.5–17.7
Would you want to keep the HIV-positive status of a family member a secret?	12,378	54.9	49.4–60.4	46.8	43.2–50.3	62.0	55.9–67.7	43.4	39.6–47.2	50.1	48.4–51.8
Are you comfortable talking to at least one member of your family about HIV/AIDS?	22,838	88.8	86.7–90.7	87.8	85.7–89.6	89.3	87.3–91.0	76.1	70.6–80.9	86.0	85.1–87.0

Key: WC = Western Cape; NC = Northern Cape; EC = Eastern Cape; FS = Free State; KZN = KwaZulu-Natal; NW = North West; GP = Gauteng; MP = Mpumalanga; LP = Limpopo.

Table 3.66: Respondents aged 15 years and older who agreed with individual statements about people living with HIV and AIDS by age group, South Africa 2005, 2008 and 2012

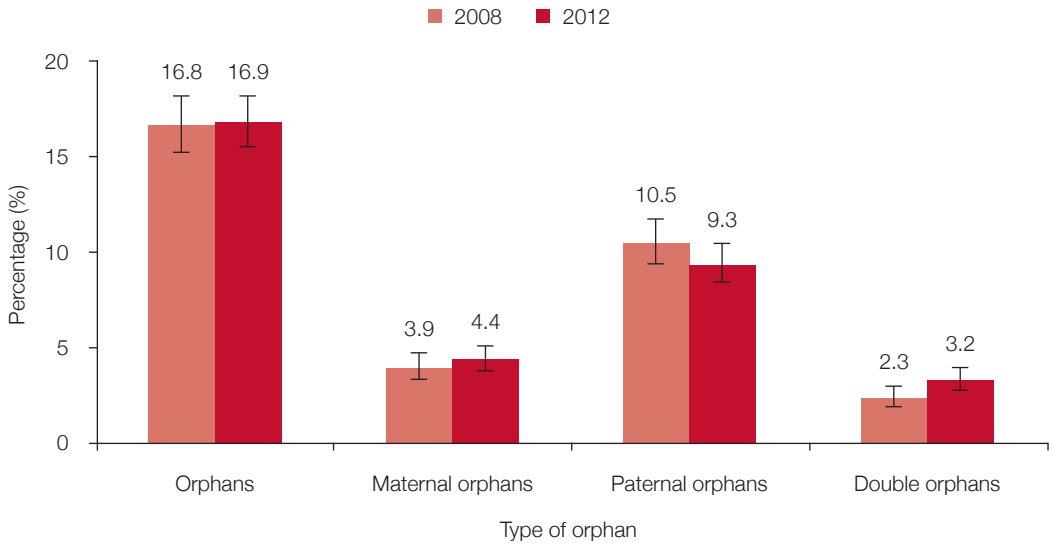
Statement	2005 Age (years)			Total	2008 Age (years)			Total	2012 Age (years)			Total
	15–24	25–49	50 +		15–24	25–49	50 +		15–24	25–49	50 +	
	%	%	%	%	%	%	%	%	%	%	%	%
If you knew that a shopkeeper or food seller had HIV, would you buy food from them?	74.5	73.5	60.9	71.1	76.6	75.3	60.3	72.5	81.9	81.8	69.0	79.0
Would you be willing to care for a family member with AIDS?	91.0	92.6	86.0	90.7	92.7	93.2	88.9	92.1	92.1	92.6	88.5	91.6
If a teacher has HIV but is not sick, he or she should be allowed to continue to teach?	NA	NA	NA	NA	85.8	85.1	73.6	82.8	84.9	84.7	76.8	83.0
Is it a waste of money to train or give a promotion to someone with HIV/AIDS?	13.3	14.8	17.4	14.9	14.4	15.3	18.5	15.8	16.0	16.1	18.3	16.6
Would you want to keep the HIV-positive status of a family member a secret?	31.6	30.0	29.9	30.5	42.2	40.2	36.3	39.9	53.8	50.2	45.3	50.1
Are you comfortable talking to at least one member of your family about HIV/AIDS?	NA	NA	NA	NA	86.5	91.5	86.1	88.9	83.9	88.5	83.2	86.0

was, however, a significantly higher percentage of orphans among black Africans (18.9%) than among the other three race groups ($p<0.001$).

As expected, the percentage of orphans also increased with age, rising from 3.9% among children aged 0–4 years old to 30.6% among those aged 15–18 years. The 15–18 years age group also recorded the highest percentage of paternal orphans at 16.6%. The percentage of orphans across the different locality types does not differ significantly. From a provincial perspective, KwaZulu-Natal had the highest percentage of orphans (23.1%), followed by the Free State (22.8%) while the lowest percentage of orphans was recorded in the Western Cape (7.5%) followed by Limpopo (13.0%) and Gauteng (13.5%).

Figure 3.14 shows a comparison of orphanhood rates between 2008 and 2012. Overall, there was a slight increase from 2008 to 2012, with 3,032,000 orphans in 2008 and 3,132,041 in 2012). Similar increases occurred in both sexes over the two surveys, from 1,601,000 to 1,617,997 for males and 1,431,000 to 1,617,997 for females. A similar pattern was seen among maternal orphans (713,000 in 2008 and 809,778 in 2012) and among double orphans (419,000 in 2008 and 593,461 in 2012). However, there has been a decrease in the number of paternal orphans from 1,899,000 in 2008 to 1,730,471 in 2012.

Figure 3.14: Comparison of orphanhood, South Africa 2008 and 2012



From a provincial perspective (Table 3.68), two different patterns are found. While the rates of orphanhood dropped from 2008 to 2012 in the Western Cape, Eastern Cape, Gauteng and Limpopo, they increased over the same period in the Northern Cape, Free State, KwaZulu-Natal, North West, and Mpumalanga.

This report provides a detailed account of the epidemiology of HIV in South Africa in order to advance knowledge and inform policy and programme development. To achieve the objectives set, the report integrates data on biomarkers and behaviour together with social determinants of HIV resulting in a more comprehensive description of the epidemic.

Table 3:67: Status of orphanhood of among children in the 0–18 years age group, South Africa 2012

	n	Orphan		Maternal		Paternal		Both		Not orphan	
		%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Sex											
Male	6,943	17.4	15.5–19.4	4.7	4.0–5.6	9.4	8.2–10.7	3.3	2.6–4.1	82.6	80.6–84.5
Female	6,604	16.4	14.8–18.2	4.0	3.3–4.8	9.3	8.0–10.6	3.1	2.5–3.9	83.6	81.8–85.2
Race											
Black African	9,439	18.9	17.4–20.6	4.9	4.2–5.6	10.3	9.2–11.5	3.7	3.2–4.4	81.1	79.4–82.6
White	618	5.7	2.4–12.7	0.8	0.4–1.9	4.8	1.8–12.3	0.1	0.0–0.7	94.3	87.3–97.6
Coloured	2,461	7.3	5.9–9.1	2.3	1.5–3.4	4.4	3.3–5.8	0.7	0.4–1.1	92.7	90.9–94.1
Indian/Asian	999	4.1	2.6–6.2	2.0	0.8–5.1	2.1	1.2–3.5	0.0		95.9	93.8–97.4
Age group (years)											
0–4	3,811	3.9	3.1–5.0	1.1	0.7–1.7	2.7	2.1–3.5	0.2	0.1–0.5	96.1	95.0–96.9
5–9	3,708	13.1	11.3–15.2	3.1	2.4–4.1	8.2	6.7–10.0	1.8	1.3–2.5	86.9	84.8–88.7
10–14	3,402	24.3	21.9–26.9	6.6	5.5–7.8	12.2	10.6–14.0	5.6	4.3–7.2	75.7	73.1–78.1
15–18	2,633	30.6	27.7–33.6	7.9	6.4–9.6	16.6	14.5–18.9	6.2	5.0–7.6	69.4	66.4–72.3
Province											
Western Cape	1,380	7.5	5.8–9.6	1.7	1.0–2.9	4.8	3.5–6.6	0.9	0.4–2.0	92.5	90.4–94.2
Eastern Cape	1,907	17.3	14.6–20.3	5.3	3.8–7.5	9.0	6.9–11.7	3.0	2.0–4.5	82.7	79.7–85.4
Northern Cape	1,068	14.6	11.0–19.0	4.8	3.4–6.7	7.9	5.4–11.4	1.9	1.1–3.2	85.4	81.0–89.0
Free State	932	22.8	19.3–26.6	6.4	4.1–9.7	13.9	10.5–18.1	2.5	1.6–3.7	77.2	73.4–80.7
KwaZulu-Natal	3,183	23.1	19.4–27.2	5.1	3.9–6.7	13.1	10.6–15.9	4.9	3.6–6.7	76.9	72.8–80.6
North West	1,001	16.3	12.8–20.6	4.9	3.2–7.5	8.7	6.4–11.8	2.6	1.7–4.1	83.7	79.4–87.2
Gauteng	1,605	13.5	10.8–16.7	4.3	3.1–5.9	6.9	5.0–9.5	2.3	1.5–3.5	86.5	83.3–89.2
Mpumalanga	1,132	21.3	17.8–25.2	4.4	3.0–6.2	10.6	8.1–13.7	6.3	4.5–8.8	78.7	74.8–82.2
Limpopo	1,346	13.0	10.2–16.4	2.8	1.8–4.3	8.1	5.9–11.1	2.1	1.2–3.6	87.0	83.6–89.8
Locality type											
Urban formal	6,684	14.3	12.4–16.3	3.8	3.1–4.7	8.2	6.8–9.9	2.3	1.7–3.0	85.7	83.7–87.6
Urban informal	1,665	17.1	14.8–19.7	4.9	3.7–6.5	9.2	7.5–11.2	3.0	2.0–4.5	82.9	80.3–85.2
Rural informal	4,101	19.7	17.5–22.2	4.9	4.0–6.0	10.7	9.2–12.4	4.0	3.2–5.1	80.3	77.8–82.5
Rural formal	1,104	11.9	8.9–15.8	2.9	1.8–4.5	5.2	3.6–7.5	3.8	2.5–5.7	88.1	84.2–91.1
Total	**13,554**	**16.9**	**15.6–18.3**	**4.4**	**3.8–5.0**	**9.3**	**8.4–10.4**	**3.2**	**2.7–3.8**	**83.1**	**81.7–84.4**

Table 3.68: Estimates of orphanhood in children in the 0–18 years age group by province, South Africa 2008 and 2012

Province	2008			2012		
	n	%	95% CI	n	%	95% CI
Western Cape	1,098	11.0	8.2–14.6	1,380	7.5	5.8–9.6
Eastern Cape	1,157	23.2	18.9–28.1	1,907	17.3	14.6–20.3
Northern Cape	559	10.5	7.3–14.7	1,068	14.6	11.0–19.0
Free State	522	18.2	14.4–22.7	932	22.8	19.3–26.6
KwaZulu-Natal	1,563	19.4	16.2–23.2	3,183	23.1	19.4–27.2
North West	678	13.2	10.0–17.1	1,001	16.3	12.8–20.6
Gauteng	1,199	14.2	10.9–18.3	1,605	13.5	10.8–16.7
Mpumalanga	661	15.3	11.4–20.3	1,132	21.3	17.8–25.2
Limpopo	766	16.0	12.1–20.9	1,346	13.0	10.2–16.4
Total	**8,203**	**16.8**	**15.3–18.3**	**13,554**	**16.9**	**15.6–18.3**

4. DISCUSSION

As alluded to earlier, this report is the fourth in a series of household surveys and it presents trends in HIV and its determinants between 2002 and 2012 allowing the country to monitor its response to the HIV epidemic over time.

In some instances the results have confirmed what is already known about the HIV epidemic while, in other cases, they have pointed to areas where the country is facing challenges, for example, in lower condom use and lower levels of knowledge of HIV. These findings also illustrate that the focus of the country's HIV response has shifted more towards ART and implementation of biomedical prevention strategies such as prevention of mother-to-child transmission, medical male circumcision and HCT campaign. In addition, wide scale implementation of ART is expected to reduce new infections as shown in the land mark HPTN 052 survey (see Cohen, Chen, McCauley et al. 2011). However, social and behavioural interventions have fallen largely by the wayside. South Africa does not have a national communication campaign after Khomanani was disbanded. Social scientists working on HIV research were asked to contribute to an evidence-based prevention communication strategy, but this was not implemented. More recently a funder cut funding to HIV communications programmes like Soul City by more than 75%.[19] All these contributed to reduction in communication campaigns which may have resulted in a decrease in knowledge and an increase in risky sexual behaviour.

It is likely that the roll-out of ART may have been seen as an effective medical solution to the reduction of new HIV infections as well as an effective means to treat the disease. Those managing HIV programmes may believe that adequate work has been done to curb the spread of HIV and to provide treatment to those living with the disease and therefore they may see no need to intensify design and implementation of social and behavioural interventions. The public may also believe that HIV is no longer a "death sentence" and therefore, behavioural, structural and social changes may no longer be necessary since biomedical solutions are at hand. Therefore, the implementation of social and behavioural interventions might have been a victim of a successful biomedical response to the epidemic.

The survey has also exposed new challenges that are associated with an epidemic that is maturing and very complex as seen in the changing risk profiles of the population and new key populations at higher risk of HIV exposure that were identified. Below we discuss the data drawing on the different components presented in the report, namely, HIV prevalence, ART exposure, HIV incidence and behavioural determinants of HIV.

4.1 HIV prevalence

4.1.1 HIV prevalence among adults, youth and children

The 2012 HIV prevalence of 12.2% is an increase over the 2008 estimate. This was partly expected as South Africa is expanding its ART programme coverage. The estimated prevalence increase of about 1.2 million between 2008 and 2012 is likely a result of new HIV infections that occurred over the past four years and reduced mortality among those living with HIV and AIDS due to the large-scale roll-out of ARVs (see Bor, Herbst, Newell & Bärnighausen, 2013). Consequently, the epidemiological curve has shifted over the five-year period between 2008 and 2012. The peak HIV prevalence for females has moved from the 25–29 year age group to the 30–34 year age group, while for males it has shifted

19 Personal communication, Dr Sue Goldstein, December 2013.

from the 30–34 years age group to 35–39 years. The 2012 peaks are at higher levels than in 2008.

The current survey confirmed that we still have a generalised and heterogeneous HIV and AIDS epidemic that is complex and differs by different provinces, districts, locality types, and among different age groups, sex and race groups. The good news is that nationally the gains reported in 2008 (Shisana, Rehle, Simbayi et al. 2009) with regards to the reduction of HIV prevalence among children have been maintained.

HIV prevalence in children under 14 has declined over the past decade from 2002 to 2012, however, there was little change between 2008 and 2012. The prevalence in children aged 2–14 years has declined, even though not significantly, suggesting that PMTCT programmes have been successful. The prevalence in infants 12 months and younger has decreased slightly but not statistically significant. The observed reduction of HIV prevalence among children under five years has been attributed to the PMTCT programme. This intervention is said to have successfully reduced vertical transmissions in the country (Pillay, Dihn, Goga and Jackson et al. for the SAPMTCTE Survey, 2012; UNICEF, 2013). The ART programme in general has had a positive impact on mortality with evidence showing that deaths of children and adults have declined by 43% and 20% respectively and life expectancy is up by six years (Mayosi et al. 2012).

There seem to be different behavioural dynamics operating in each age group combined with the effects of the scale-up of the ART programme, particularly in older populations. HIV prevalence has increased in the population aged 25 years and older, the group that would be more eligible for ART. Nationally, females aged 30–34 years (36%) and males aged 35–39 years (28.8%) have been found to have the highest HIV prevalence, which is probably a function of both treatment and new infections in this group. As was found in the previous surveys, high levels of HIV prevalence are observed among female black African adults aged 20–34 years. The probable reasons for the high prevalence of HIV in this group, above and beyond the implementation of ART, are both biological susceptibility and the socio-economic conditions in which these women live which may give rise to risky sexual behaviour.

In the youth population aged 15–24 years, HIV prevalence decreased slightly between 2005 and 2012. Overall HIV prevalence for youth has declined slightly in the majority of provinces.

4.1.2 HIV prevalence by province, district, and metros

The rankings of HIV prevalence by province remained the same between 2005 and 2012. However, some provinces, which had previously shown a stable prevalence in the 2005 survey, such as the Eastern Cape and Gauteng, are now showing sharp increases in prevalence. This is probably due to increased number of people receiving ART, which would lead to reduced mortality and increased longevity. The Western Cape has continued to have the lowest HIV prevalence overall. What is often not highlighted is that although the Western Cape has a low provincial prevalence, it has a high HIV prevalence in the City of Cape Town as well as in some of the districts. Hence, there is a need for the Western Cape to intensify its efforts at combatting the disease through focusing on the districts with the highest HIV prevalence.

Big cities are associated with anonymity and have been linked to increases in HIV risk and vulnerability, especially among those who are attracted by promises of employment

and a better life (Hunter, 2007). This report includes, for the first time, HIV prevalence and behaviour data disaggregated by metros. A comparison of the eight metros shows that eThekwini and Ekurhuleni have a HIV prevalence higher than that of South Africa as a whole. The prevalence in eThekwini is not surprising as KwaZulu-Natal has the highest HIV prevalence in the country; and as was found in the three previous surveys, the province, continues to lead all nine provinces in terms of HIV prevalence. At a district level, HIV prevalence is clustered in specific districts located mostly in KwaZulu-Natal, Mpumalanga, and the Free State, as well as some districts in the North West.

4.1.3 HIV prevalence in different race groups

The survey confirmed what has been reported previously, that HIV prevalence continues to vary by race. Black Africans, especially females, continue to be disproportionately affected by HIV and AIDS, followed by Coloureds. The high prevalence observed among black Africans made it necessary to interrogate the results further. It was found that the high HIV prevalence in the black African population is associated with low prevalence of marriage, low socio-economic status, and other behavioural and social factors that affect this group.

4.1.4 HIV and marital status

As was found previously and has been reported in the literature, HIV infection varies considerably by marital status (see Shisana, Zungu-Dirwayi, Toefy et al. 2004). Married people are less likely to be HIV positive compared to any other reported marital status group in the survey. HIV prevalence among those who are going steady (have a consistent sexual partner and are living together with that partner) is higher than among persons of any other marital status group, followed by those who are living together but are not married (that is, they are co-habiting). The likelihood of HIV infection is considerably worse for those co-habiting who are of reproductive age.

The finding that HIV prevalence is highest among unmarried individuals who are co-habiting is a worrying finding in a country where evidence suggests that marriage levels are low among black Africans (Setswe & Zuma, 2013; Shisana, Zungu & Simbayi, in press) and co-habiting has become common – a practice driven by the costs associated with *lobola* and marriage (Hunter, 2006). These findings suggest a need to revisit social norms and values that used to protect people.

4.1.5 HIV prevalence differences by locality

With respect to locality type, HIV prevalence continues to be higher in informal urban areas than in all other areas. This was found to be related to the poor socio-economic status of those living in informal urban areas. The corollary is that HIV prevalence is lowest in high socio-economic areas. The association of poverty and HIV also emerges when the analysis is expanded to include participants of reproductive age and focuses on key socio-demographic variables such race, locality type, and socio-economic status. Poverty and race remain associated with the spread of HIV in South Africa.

In line with the finding that females are disproportionately affected by HIV infection, there is a need to ensure that poverty and its impact on females in general and young girls in particular is addressed. A recent survey conducted in South Africa suggests that by providing young girls with a source of income such as a small grant, it is possible to reduce their risk of HIV as they are not forced to be involved in intergenerational and transactional sexual relationships with older men for financial gain (Cluver, Boyes, Orkin, Pantelic, Molwena & Sherr, 2013).

High HIV prevalence in informal settlements remains a glaring issue that has been highlighted in all four of the surveys (2002, 2005, 2008, and 2012). Even though scholars have interrogated this phenomenon (Hunter, 2006, 2007), no targeted HIV interventions have been designed or implemented to reduce HIV infection in the high-risk setting of the informal settlement. In 2004 the South African government set itself a target to eradicate informal settlements by 2014 (Department of Housing, 2004). However, high levels of poverty, unemployment, and external and internal migration that is economically motivated render this a moving target that will be difficult to achieve.

4.1.6 HIV among the key populations at higher risk of HIV exposure

Tracking of key populations at higher risk of HIV exposure has become an important part of monitoring the epidemic in the country. The findings of the 2012 confirmed that there are sections of the population who continue to have a higher risk of infection and have a higher average HIV prevalence when compared to the general population. Of great concern is that in 2012 some new groups had to be added to the category of key populations at higher risk of HIV exposure in South Africa. A slight increase in HIV prevalence was observed among key populations at higher risk of HIV exposure when compared to the 2008 survey (Shisana, Rehle, Simbayi et al. 2009) suggesting that HIV interventions that are directed at the general population may not be reaching this group. This became clear when key behavioural determinants of HIV (e.g. multiple partnerships, knowledge of HIV, condom use, etc.) were investigated in this group. Compared to other groups they were the most lacking in HIV-preventive behaviours necessary for reduction of HIV infections. They also lack basic HIV transmission and prevention knowledge, and were more likely to report lower condom use (all other key populations except high-risk drinkers and recreational drug use), and had higher levels of multiple sexual partners (except black African females and those living together but not married). The findings confirm that key populations at higher risk of HIV exposure are likely to vary over time (UNAIDS, 2011) as a result of changes in HIV prevention and group risk profiles.

The 2012 results showed that HIV prevalence is higher than the general population among: African females aged 20–34 years, people who are living together and are not married (or co-habiting), African males aged 25–49 years, disabled persons aged 15 years and older, high-risk alcohol drinkers aged 15 years and older; and recreational drugs users. It is therefore important for the country to customise HIV/STI prevention, care and treatment programmes for key populations at higher risk of HIV exposure in order to reduce new infections not only for the general population but also among key populations at higher risk of HIV exposure. As shown above with regards to behaviour, this group has a highest risk of transmitting and acquiring HIV/STI due to increased frequency of high-risk behaviours (UNAIDS, 2013c). It is important to continue researching this area; indeed there is growing evidence suggesting that some key populations at higher risk of HIV exposure have overlapping risks (e.g., MSM also involved in recreational drug use or a high-risk drinker) explaining in part the high prevalence found in this group (Kai, 2010).

4.2 Antiretroviral exposure

Over the past few years, South Africa has embarked on the largest ART roll-out programme in the world. The immediate benefits of ART provision are already evident in the large reductions of AIDS deaths among people living with HIV. The scale-up of ART has also the potential to reduce HIV incidence, since effective treatment reduces viral loads and, as a consequence, the infectiousness of infected individuals. A recent survey conducted in KwaZulu-Natal confirmed that high coverage of ART is associated with a decline in the risk of HIV acquisition at the community level (Tanser, Barnighausen, Grapsa et al. 2013).

We conducted ARV testing in all HIV-positive samples from individuals of all ages, including infants, children and adults. Our estimates of the total number of people on treatment match the figures given for mid-2012 by the National Department of Health (DOH, November 2013), 2,002,350 versus 1,929,637, respectively. Currently, not every HIV-infected person is eligible for treatment. Therefore, the proportions of treatment exposure among all HIV-positive people should not be confused with estimates for ART coverage, which include only HIV-positive people who meet the national ART eligibility criteria. Such estimates are at present only derived by a mathematical model (Johnson, 2012). To investigate treatment coverage among eligible individuals according to current eligibility criteria would have required CD4 counts in our survey participants – which are not possible on DBS samples. However, our survey was able to provide a direct estimate of the proportion of the total HIV-positive population on ART. A further advantage is that those estimates are independent of the changing eligibility criteria and allow comparisons of directly measured proportions over time.

Antiretroviral treatment exposure among people living with HIV has almost doubled from 16.6% in 2008 to 31.2% in 2012. There was a significant difference in ART exposure observed between males and females in 2012 (25.7% vs 34.7%). The findings suggest that sex differences in health-seeking behaviour together with the benefits of expanded PMTCT programmes may have facilitated women's access to treatment over the past four years. The increase of ART exposure was especially noticeable among HIV-infected children aged 0–14 years, which may indicate great improvements in HIV testing among children as well as the impact of the evolving national eligibility criteria for starting ART regimens in infants and children (NDOH, 2013). Youth aged 15–24 living with HIV had the lowest proportion of treatment exposure (14.3%). ART exposure in the HIV-positive population aged 15–49 years was 28.9%. The lower proportion of ART exposure among youth aged 15–24 is expected because most HIV infections in this age group occurred relatively recently and, therefore, a much lower proportion advanced to the stage of treatment eligibility compared to older adults. There was no significant difference in the proportion of treatment exposure among HIV-positive people living in formal and those living in informal settlement areas, an indication of effective treatment access in these different socio-economic settings.

While South Africa's efforts to further expand antiretroviral treatment programmes should be commended, the high rates of new infections and the trends of increased HIV risk behaviour in the country suggest an evolving complacency among people at risk for HIV infection. Interventions to counter potential behavioural risk compensation (i.e., an increase in risky behaviour) in the era of a successful ART roll-out programme are urgently required.

4.3 HIV incidence

As indicated above, incidence estimates are important because they provide insights into the more recent dynamics of the HIV epidemic. More importantly, they are the most direct means of assessing the impact of HIV-prevention programmes that the country has implemented. HIV incidence is therefore the biomarker of choice to associate with recent behaviours or recent behavioural changes. Our HIV-incidence analysis is based on two independent methods: (i) direct HIV-incidence measures using a laboratory-based testing algorithm, and (ii) indirect HIV-incidence estimates using a mathematical model.

Our analysis of directly measured HIV incidence indicates that 469,000 new HIV infections occurred in the population 2 years and older during 2012 in South Africa. The differential HIV-transmission dynamics between males and females are reflected in the HIV incidence profiles. Among adults aged 15–49 years, the number of new infections was 1.7 times higher in females than in males. The incidence rates among young females remain concerning. The HIV-incidence rate among female youth aged 15–24 was over four times higher than the incidence rate found in males in this age group (2.5% vs 0.6%). Almost a quarter (24.1%) of all new HIV infections occurred in young females aged 15–24 years. With an HIV-incidence rate of 4.5%, black African females aged 20–34 years recorded the highest incidence of HIV among the analysed population groups. The incidence results by locality type showed that half of all new HIV infections in the population 2 years and older occurred in urban formal areas. However, urban informal settlements had a considerably higher incidence rate (2.5% vs 1.1%) among individuals 2 years and older, demonstrating the importance of place of residence as a critical epidemiological parameter for risk of HIV infection. Individuals who were married had considerably lower HIV incidence (0.6%) compared to survey participants who were living together with a sexual partner (3.1%) and those who were single (2.3%). While more complex contextual measures of frequency and type of partnerships are necessary to expand on these findings, it is certainly an important topic for on-going prevention interventions.

Updated indirect HIV-incidence estimates using a mathematical model were provided for the inter-survey periods 2002–2005, 2005–2008 and 2008–2012. The HIV-incidence rate among individuals aged 15–49 years was 2.2 % in the period 2002–2005. HIV incidence in this age group remained at a slightly lower level of 1.9% in the subsequent periods 2005–2008 and 2008–2012. HIV incidence among youth aged 15–24 years, however, declined steadily over the three inter-survey periods, from 2.8% in 2002–2005, 2.3% in 2005–2008, to 1.5% in 2008–2012. The declining HIV incidence among youth was also reflected in the declining HIV-prevalence levels observed in this age group since 2005. The decline in incidence among young females aged 15–24 years from 5.3% in 2002–2005 to 2.1% in the period 2008–2012 was a statistically significant reduction of 60% in HIV incidence. However, despite this encouraging development, there is no reason to become complacent in view of the high HIV-incidence rate of over 2% among female youth aged 15–24 years.

It is assuring that the two independent methods applied for HIV incidence estimation produced very similar results for South Africa. The incidence analysis suggests that there is no evidence that incidence among adults aged 15–49 years has changed between 2008 and 2012. The NSP 2012–2016 states as its primary goal a reduction of new infections by at least 50%. This will be a challenge given the transmission dynamics that still prevail in the country.

4.4 Sero-discordance among mother and child pairs

The results from this survey of mother-child pairs, found only 10 instances (4.3%) where both mother and child were HIV positive and only one child (0.2%) who was positive with a negative mother confirming that vertical transmission remains the dominant mode of transmission among children. These results are similar to those observed by Cotton, Marias, Andersson et al. (2012) and Shisana, Connolly, Rehle et al. (2008).

4.5 Male circumcision

Although the increased rates in male circumcision spell good news, voluntary medical circumcision (VMMC) rates remain low compared to traditional circumcision. Men are at highest risk for acquiring HIV when they are in their twenties and thirties, therefore, it is particularly encouraging that increased rates of VMMC occurred in this group. While VMMC confers a clear HIV-prevention benefit to young men and should be continued, it has less immediate impact on new HIV infections than circumcision of older men. Reaching men aged 25–29 years would be more likely to result in immediate HIV-prevention benefits.

VMMC is currently being implemented and is being scaled up as part of the country's HIV-prevention strategy (SANAC, 2011a). Although it was observed that male circumcision has increased among men 15 years and older, nevertheless rates of males who are medically circumcised have remained low with only about one million men having been medically circumcised between 2008 and 2012. The percentage of older men who report to have been traditionally circumcised remains high especially among ethnic groups where circumcision is a rite of passage for men. It is, however, also important to note that most youth are now being mostly circumcised in hospital or clinic settings suggesting that VMMC is the dominant method in this age group. This is to be commended as the impact of VMMC at population level is likely to be substantial when led by this dynamic group of males. The relatively low uptake of VMMC overall is likely to have been due to a lack of an aggressive national VMMC campaign hitherto. The recent launch of the national VMMC campaign on World AIDS Day on 1 December 2013 by the Deputy President of South Africa in his capacity as Chair of SANAC is therefore timely.

In provinces such as Eastern Cape, Mpumalanga and Limpopo where traditional circumcision is commonly practiced VMMC rates were low. Overall, there appears to have been no change in the rates of traditional circumcision reported relative to VMMC in the three surveys that we have carried out in 2002, 2008 and 2012 (see Connolly, Simbayi, Shanmugam et al. 2008; Shisana, Rehle, Simbayi et al. 2009). This means that unless there is a preponderance of VMMC going forward the country may not be able to meet its target of reaching 80 per cent of HIV-negative men aged 15–49 by 2015, unless the demand for VMMC increases and more is done to increase acceptability of VMMC among groups that practice traditional circumcision.

4.6 Behavioural determinants of HIV

In terms of risk behaviour, the present survey found certain disturbing results which suggest a regression in some aspects of preventive behaviour. These are discussed below.

4.6.1 Risk perception and risk of HIV infection

The findings from the current survey indicate that females are more likely than males to believe they are at risk of being infected with HIV. Similar findings have been reported previously (Kibombo, Neema, Ahmed et al. 2007; Pettifor, Rees, Steffenson et al. 2004). This is in line with the observation that HIV prevalence among females is indeed significantly higher than among males. The findings also show that adults aged 25–49 years (both male and female) tend to believe they are at risk of acquiring HIV. The HIV prevalence results support this risk perception. Just as people tend to believe others, and not themselves, are at risk of contracting HIV (Joffe, 1999), the current survey shows that a large proportion of the population believe they are not likely to become infected with HIV. Surprisingly this includes members of all six of the key populations at higher risk of HIV exposure that were identified in this survey. This belief is based on inaccurate information about the transmission of HIV and suggests therefore that many people believe that they are not at risk of acquiring HIV on the basis of false information. Perceiving oneself to be at a lower risk of HIV infection is associated with lower HIV-testing rates. What is even more surprising is that a substantial percentage of those who believed they were at low risk of HIV infection were, in fact, found to be HIV positive, both females and males. A similar finding was made in 2008 (Shisana, Rehle, Simbayi et al. 2009) – reinforcing the point that perceiving oneself to be at a lower risk of HIV infection creates a false sense of security.

4.6.2 Sexual debut before the age of 15

Early sexual debut increases the risk of HIV infection at a very early age. Delaying sexual debut remains an important focal area for reducing HIV infections among adolescents. A higher proportion of youth (10.7%) reported age of sexual debut before 15 years than in the previous two surveys, in 2005 and 2008 (Shisana, Rehle, Simbayi et al. 2005; 2009). As was observed in previous surveys (Shisana & Simbayi, 2002, Shisana, Rehle, Simbayi et al. 2005, 2009), significantly more males reported having had their sexual debut before the age of 15 than their female counterparts. This finding regarding males debuting early is consistent with the findings obtained from other studies (Harrison, Cleland, Gouws et al. 2005; Reddy, James, Sewpaul et al. 2013; Zuma, Setswe, Ketye et al. 2010). These findings suggest that whereas females appear to have heeded the prevention message to delay the onset of sex, males continue to engage in early sexual debut.

Possible explanations for young people engaging in early sex include peer pressure, low self-esteem, pessimism, sexual coercion and transactional sex (loveLife, 2012; also see Shisana, Rehle, Simbayi et al. 2009). Others include exposure to television programmes with plots around love, sex and money (Ankomah, Mamman-Daura, Omoregie et al. 2011). The increasing trend towards an earlier age of sexual debut among boys is extremely worrisome in light of the fact that early sexual debut has been associated with higher HIV exposure because it is linked to more frequent sexual intercourse, more lifetime sexually transmitted infections, and more sexual partners (Donenberg, Brynat, Emerson et al. 2003), less consistent contraceptive use (Geary, Maumgartner, Tucker et al. 2008) and unplanned pregnancies (Baumgartner, Geary, Tucker et al. 2009). Interventions to reduce early sexual debut are needed. Research has found that reasons for delaying early sex among young females tend to include religious injunction against premarital sex, prevention of HIV infection, fear of pregnancy, and linked to this, the fear of dropping out of school (Ankomah, Mamman-Daura, Omoregie et al. 2011). Some of these factors should be explored as part of the schools life skills programme as well as community-based social and structural interventions targeting especially male youth aged 15–24 years.

4.6.3 Age-disparate relationships

Age-disparate relationships increase the risk of HIV infection especially among young girls. The percentages of young females who have had sex with partners who are 5 years and older than them has increased over the period of the four surveys, reaching a high rate of one-third (33.6%) of young females aged 15–19 years in 2012. At the same time low percentages of young males (4.1%) engaged in similar behaviour. Similar findings were reported in 2005 and 2008 surveys (Shisana, Rehle, Simbayi et al. 2005, 2009) and the 2003 Reproductive Health Research Unit's survey (Petiffor, Rees, Steffeson et al. 2004). Similarly, the 2012 survey results also demonstrate a high HIV prevalence among adolescents with partners who are five or more years older than themselves.

Age-disparate relationships are mainly driven by poverty where young girls are attracted by material things they gain from the older partner (Beauclaire & Delva, 2013; LeClerc-Madlala, 2008; loveLife, 2012; Ott, Barnighausen, Tanser et al. 2011). The promise of gifts and other financial and social benefits, including the potential for upward social mobility, can affect early sexual debut and motivate girls to engage in age-disparate sexual relationships, transactional sex or marriage at a young age (UNICEF, 2013). Where HIV prevalence is high these factors combine with increased biological vulnerability, limited knowledge about HIV and low risk perception to enhance the risks and limit the choices girls and their families make.

These findings are a major concern as youth who have partners five or more years older than themselves are more exposed to HIV by virtue of having sexual contact with persons in the higher prevalence age group (Shisana, Rehle, Simbayi et al. 2005). By having sex with partners older than themselves, young people are at increased risk of engaging in risky sexual activity, contracting an STI, not using contraception, and becoming pregnant (Kirby, 2007); hence the need to design and implement evidence-based interventions including social and behavioural change communication messages that discourage age mixing between older men and younger girls.

In addition to the above, one structural HIV-prevention intervention that is available in South Africa and appears to work is the social grants system (Cluver, Boyes, Orkin et al. 2013; also see UNICEF, 2013). As alluded to earlier, providing young girls with a source of income such as a small grant has been shown to reduce their risk of HIV as they are not forced to be involved in intergenerational and transactional sexual relationships with older men for financial gain (Cluver, Boyes, Orkin et al. 2013). This suggests the need to both strengthen and extend coverage of the social grants system.

Another structural HIV-prevention intervention that is also widely available is education especially for OVC (see UNICEF, 2013). Fortunately school attendance is universal even for OVC irrespective of sex as shown in Appendix 2. This achievement too should be maintained steadfastly.

4.6.4 Awareness of HIV status and HIV testing

The percentage of people who tested for HIV in the 12 months preceding the survey in 2012 had increased compared to 2008. However, sex differences are apparent. Most promisingly, the increase in HIV testing occurred equally as a doubling of numbers for both sexes was observed (from 19.9% in 2008 to 37.5% in 2012 among males and from 28.7% in 2008 to 52.6% in 2012 for females). The observation that more females than males are aware of their HIV status may be due to the additional effect of the PMTCT

programme. Clearly, the significant increase in HIV testing can be partly attributed to the HCT national campaign roll-out undertaken by SANAC from April 2010 (UNAIDS, 2013b). Evidence from this survey shows that 17% (about 3.5 million people) of the respondents in the 2012 survey indicated that they participated in the HCT campaign.

South Africa is among the few countries in the world that has achieved such success with HCT during the past few years. South Africa's neighbour, Botswana, started implementing routine provider-initiated HCT way back in 2004, and by 2008 had achieved near parity between the two sexes (with 61.5% for females and 59.0% for males) in terms of testing for HIV and having received the results of such testing in the last 12 months. Although South Africa started provider-initiated HCT four years later and had very low rates of testing in 2008, it is now showing some progress on this indicator: 37.5% among males and 52.6% among females in 2012. Indeed, the national HCT campaign in South Africa has been largely credited for the success in getting over two million people onto ARV treatment to date (UNAIDS, 2013b).

4.6.5 Knowledge of HIV prevention and risk perception

The picture emerging from this survey is that the country has slid backwards in the important work of communicating messages on HIV prevention. The population knowledge of the basics of HIV prevention has declined from 2008 to 2012. Lowest knowledge levels were found amongst older people aged 50 years and older, black Africans and individuals residing in the urban informal areas as well as among four key populations at higher risk of HIV exposure as were identified by this survey. The population is now generally less knowledgeable about sexual transmission and prevention of HIV and a large percentage was unable to reject myths about HIV. This observation, along with the decrease in condom use, increase in multiple sexual partnerships, and increase in age-disparate relationships is indicative that a coordinated HIV-prevention programme is urgently needed.

Traditional approaches for communicating HIV-prevention messages such as posters, bill boards, AIDS statistics, newspapers and magazine articles, leaflets and booklets and signs on taxis or buses of trains were all rated much lower in 2012 compared to 2005 as sources of information that made people take HIV more seriously. All of these methods as effective forms of communicating the seriousness of HIV and AIDS declined by close to 10% each in 2012. Television remains the most popular mode of communication for information on HIV and AIDS. However, HIV and AIDS-related content is not as high in the country as it was a decade ago. There has been a relegation of HIV and AIDS messaging to the days leading up to or on World AIDS Day, which may be contributing to the observed low levels of knowledge about and complacency around prevention. At the height of the epidemic HIV messages tended to flood the airwaves; the focus was on the basics of HIV prevention together with encouraging open discussion about the disease.

The decline in accurate HIV-prevention knowledge has implications for efforts to reduce new HIV infections in the country. There is no longer a strong HIV-prevention programme to encourage the population to take HIV more seriously. The focus has primarily been on biomedical interventions such as ARV treatment, VMMC, HCT, PMTCT and less so on social and behavioural interventions. The results from the 2012 survey when compared to those obtained in 2008 demonstrate a serious need to revamp efforts aimed at addressing the HIV epidemic beyond the current focus of biomedical approach only. To successfully combat HIV in South Africa, treatment and evidence-based social and behavioural prevention programmes must go hand in hand.

4.6.6 Condom use

It is not having sex, but rather having unprotected sex with a partner whose status is not known or who is HIV positive, that places people at serious risk of HIV infection. Although South Africa has done well with regard to the distribution of condoms and the rates of condom use increased between 2005 and 2008, especially among the youth, in 2012 condom use at last sex for both males and females of all age groups decreased back to levels similar to those found in 2005. This is despite the peak that was reported in 2008 (Shisana, Rehle, Simbayi et al. 2009).

In order for condoms to be protective, they must be used both correctly and consistently. Therefore, although condom use remains relatively high at last sex especially among the youth, there is a problem with both incorrect and inconsistent condom use. Of concern is that, among those who reported using condoms, consistency was shown to be very poor (27%), suggesting that the country needs to focus on this aspect in the promotion of condoms.

Similar declines in condom use have also been reported in other African countries such as Cote d'Ivoire, Niger, Senegal, and Uganda (UNAIDS, 2013c). One possible explanation for decline of condom use in South Africa is that prevention efforts targeting condom use are no longer receiving as much attention as they did a decade ago.

Some researchers have suggested that reporting condom use is now more accurate as people are now open to discussing condoms and that self-reporting was therefore overestimated in the past (Johnson et al. 2012). Another possible explanation is that the drop in condom use may reflect the impact of risk compensation (also known as behavioural disinhibition or treatment optimism) which leads to increased sexual risk behaviour such as decreased condom use and increasing multiple partnerships) because of the wide availability of and access to ARV treatment (see Cassell, Halperin, Shelton & Stanton, 2006; Obermeyer, Bott, Carrieri et al. 2009). However, all other sexual risk factors have increased, suggesting that condom use rates may not have been overestimated. The issue of behavioural disinhibition has to be researched and closely monitored further.

4.6.7 Multiple sexual partners

Having multiple sexual partners increases one's chances of contracting as well as transmitting an STI, including HIV. The percentages of males of all age groups who had multiple sexual partners continued to increase for the year 2012, especially among those aged 15–24 years. The observed upward trend in multiple sexual partnerships among males aged 15–24 years and 25–49 years is of great concern. Although sexual activity is seen by some members of society as acceptable for males (Leclerc-Madlala, 2008), it is nonetheless concerning. For the first time, females have also shown an increase in the self-reported numbers of multiple sexual partnerships in comparison with previous surveys. However, the increases are not as dramatic as those observed among men. Multiple sexual partnerships increase the likelihood of exposure to HIV as a result of individuals being linked through sexual networks and of the possibility of exposure to the high viral loads that occur in the early phases of new HIV infection when people are unaware that they are infected (Kirby, Dayton, L'Engle & Prickett, 2012).

UNAIDS (2013a) suggests that despite the improved reach of awareness campaigns, accurate knowledge about HIV and AIDS is still poor. Interestingly, in 2008 there was a drop in knowledge about the HIV risk of multiple sexual partnerships. People's

reasons for having multiple sexual partners may include sexual exploration, peer pressure, acquiring the status of being sexually desirable, seeking sexual pleasure, and a de-emphasis on the importance of long-term relationships (Shisana, Rehle, Simbayi et al. 2009). Reducing partner turnover and overall numbers of sexual partners is therefore a key component of an effective HIV-prevention response. It is also imperative that both females and males be targeted for risk reduction interventions before the situation worsens.

4.6.8 Attitudes towards PLHIV

Stigma towards and discrimination against PLHIV remains a major barrier to effective HIV prevention and to the provision of treatment, care and support (UNAIDS, 2013b). This survey has found that, in terms of stigma, there were some significant improvements on some of the positive attitudes held towards PLHIV between the results of the last three surveys (2005, 2008 and 2012). This suggests that the increase in ARV treatment uptake which has partly been the result of the recent national HCT campaign, which has increased the number of people tested, has impacted positively on attitudes towards PLHIV, which in the main remain highly favourable. Given the magnitude of the epidemic in South Africa, the proximity towards PLHIV, and the visibility of the disease in most communities as well as the successful ART roll-out programme which has resulted in PLHIV on treatment living longer, it is not at all surprising that attitudes towards PLHIV as measured by individual responses in this survey are generally very favourable. However, it is of concern that respondents were still ambivalent about disclosure of the HIV status of relatives to other people. This shows that a high level of stigma still remains concerning this issue. This has implications for increasing the visibility of HIV and AIDS as only a few people including celebrities have publicly disclosed about their own HIV status or of their close relatives. Usually this has happened after the death of the relatives rather than when they are still alive.

4.7 Orphanhood

The HIV and AIDS epidemic is recognised as one of the major challenges that threatens the development of children and the realisation of children's rights in South Africa (DSD, 2013). Orphanhood has been tracked since 2002; and in 2012 it was found that the overall level of orphanhood found for those 0–18 years of age is 16.9%. This proportion appears to be similar to the previous survey in 2008, when the rate was 16.8% suggesting that orphanhood has remained stable in the country. The 2008 survey estimated that there were close to three million orphans in South Africa (Shisana, Rehle, Simbayi et al. 2008). The stable figures observed in levels of orphanhood could be due to the availability of ART that has prolonged the lives of HIV-positive parents. Indeed there is evidence of a decline in mortality in South Africa (see Bor, Herbst, Newell & Bärnighausen, 2013).

In line with the observed high level of HIV prevalence by province, KwaZulu-Natal had the highest proportion of orphans, while the Western Cape with the lowest HIV prevalence also had the lowest number of orphans. Variations were found when type of orphan and race were analysed. With regards to the types of orphans, a significantly higher proportion of paternal orphans than maternal orphans were found. In line with the high prevalence of HIV and AIDS among black Africans it was observed that a significantly higher proportion of orphans are found in this group compared to other race groups. This can be explained by the high AIDS-related mortality that was observed among black Africans before the ART programme was rolled-out in the country (Chigwedere, Seage, Gruskin, & Lee, 2008).

Similarly, as was observed in 2008, when different age groups were compared it was found that a significantly higher proportion of teenagers (15–18 year olds) are likely to be orphaned compared to other age groups. The adolescent age is a critical stage in the development of a child, hence targeting young female orphans with structural interventions is important in reducing HIV infections among them.

This survey shows a higher HIV prevalence among orphans compared to those who are not orphans. The disparities between HIV-prevalence rates for orphans compared to non-orphans remains a concern. This finding suggests that HIV infection is likely to be a direct result of vulnerability and the risk associated with being an orphan. Moreover, double and paternal orphans had a higher HIV prevalence than maternal orphans. This finding contradicts what is known about paternal orphans. Indeed, there is evidence to suggest that female-headed households tend to be poorer and more likely to be HIV positive when compared to the male-headed households (Shisana, Rice, Zungu & Zuma, 2010). The vulnerability associated with being a paternal orphan can also be related to the absence of the male figure in the family. Research has shown that the father has a role in reducing early sexual debut (Hutchenson, 2002; Mendle, Paige Harden, Turkheimer et al. 2009). Girls growing up without a father maybe more at risk of being pushed into transactional sex with older partners for survival of the family as a whole. Findings from several qualitative studies conducted by the HSRC have shown that at times some mothers turn a blind eye to sugar-daddies or actively encourage their daughters to go out "bayophanda" (seek rich partners and exchange sex for survival) (HSRC 2005, 2008 – unpublished qualitative data). This higher prevalence of HIV among orphans in general requires attention as well as evidence-based-interventions that work to ensure fewer parental deaths and where deaths have occurred it is important for safety nets to be provided for orphaned and vulnerable young people.

4.8 Comparisons between the 2012 HSRC Survey and other national HIV and AIDS surveys conducted in South Africa in 2012

Two other national HIV and AIDS surveys were carried out in 2012, namely, the 2012 antenatal clinic-based survey of pregnant women and the 2012 National HIV Communication Survey (NCS) (see Johnson, Kincaid, Figueroa et al. 2013). Unfortunately, the 2012 antenatal survey report was not yet available when this report was being finalised. Similar findings were obtained from the NCS for only 5 of the 12 common behavioural indicators that were measured by the two studies, namely, a) ever tested for HIV, b) multiple sex partners, c) age-disparate relationships/intergenerational sex, d) ever circumcised, and e) type of circumcision (medical vs. traditional). However, the rest of findings differed markedly. This could be attributed to methodological differences between the two surveys which include, among others, a) how weighting and benchmarking was done (e.g., 2007 Stats SA Community Survey for NCS vs. StatsSA 2012 mid-year population estimates in this survey), b) participant selection (one vs. all per household), c) sample sizes used (10,000 aged 16 to 55 years in NCS vs. 21,989 aged 15 to 49 years in this survey), and d) measurement of knowledge (individual items only vs. also using a composite UNAIDS indicator in this survey). Finally, there was also a difference in how HIV prevalence and ARV use was determined (i.e., self-report in NCS vs. laboratory tests in this survey).

4.9 Strengths and limitations of the survey

Both the strengths and limitations of the survey are the same as in the previous surveys as illustrated below.

4.9.1 Strengths

There were several strengths associated with this survey. The sample sizes are large enough to allow for meaningful analyses of data to enable generalisation of the results to the whole South African population (Shisana, Rehle, Simbayi et al. 2009). Out of 42,950 eligible individuals (take all approach) in this survey, 38,431 individuals (89.5%) completed the interviews while 28,997 individuals (67.5%) agreed to provide DBS specimens for HIV testing. This makes the survey nearly double the size of the 2008 survey which identified 23,369 eligible individuals (no more than four per household, including infants under 2 years) of which 20,826 (89.5%) agreed to be interviewed and 15,031 (67.0%) provided DBS specimens for HIV testing.

As was the case with all the three previous surveys, the survey is based on a sampling approach that ensures representativeness of the South African population. The survey used a multi-stage, stratified, cluster sampling approach to draw the census enumerator areas (EAs). For this reason, the results obtained are generalisable to the whole nation, provinces, locality types, age groups, race groups, and sexes. For the fourth time, South African policy-makers, planners, NGOs and the public will have information on HIV prevalence for people of different races and for those living in urban areas, whether in formal or informal dwellings, rural formal and rural informal areas (Shisana, Rehle, Simbayi et al. 2009).

As was the case with all the three previous surveys, the survey used a Master Sample that allows for repeated surveys to track changes in population behaviour, exposure to information for HIV prevention, and HIV status (Shisana, Rehle, Simbayi et al. 2009).

This is the second national population-based HIV survey to include HIV-incidence measures obtained directly through laboratory testing. This clearly adds to the critical scientific evidence required by the government and NGOs as well as donors to determine the levels of new HIV infections using state of the art methods. This is the first national survey to use a new assay that has been developed by CDC for use on DBS specimens. This information will be crucial to assessing the effectiveness of the national response in reducing new HIV infections (Shisana, Rehle, Simbayi et al. 2009).

Finally, this is the fifth national South African survey on the general population that we have conducted including the recent South African National Health and Nutrition Examination Survey or SANHANES-1 (see Shisana, Labadarios, Rehle et al. 2013) and we have also conducted several other large-scale surveys since the 2002 survey among South African health workers (e.g., Shisana, Hall, Maluleke et al. 2003) and also among educators (e.g., Shisana, Peltzer, Zungu-Dirwayi & Louw, 2005; also see Shisana, Rehle, Simbayi et al. 2009).

Apart from the experience gained and confidence in the methodology applied, the fact that this is the fourth follow-up survey is also important in its own right. In particular, having data collected in 2012 allows us to investigate the trends in changes in both HIV-prevalence rates and behavioural risks as well as the impact of communication

compared to the data that was obtained in the three previous surveys (Shisana, Rehle, Simbayi et al. 2009). This is indeed a major strength of these repeated household surveys.

4.9.2 Limitations

As was the case with the three previous surveys conducted in 2002, 2005 and 2008, there are two types of limitations, those that are inherent in cross-sectional socio-behavioural studies and those specific to this survey, as discussed below.

In all cross-sectional studies, exposures and outcomes are measured at the same time and hence there can be difficulties in determining causality (Shisana, Rehle, Simbayi et al. 2009). The difficulties in determining the temporal sequence of HIV infection and potential risk factors are exacerbated when using prevalent rather than incident cases of HIV because some of the infections may have occurred up to 30 years previously whereas questionnaires enquire about current risk behaviours. Individuals may well have changed their behaviour since becoming infected for a variety of reasons that may or may not be due to their HIV status (Shisana, Rehle, Simbayi et al. 2009). However, inclusion of HIV incidence and correlating it with sexual behaviour has addressed this bias and contributed to the understanding of the relationship between behaviour and HIV acquisition.

Another limitation, common to nearly all surveys about knowledge, attitudes, beliefs, and behaviours related to HIV and AIDS, is that they are based on respondents' self-declarations (Shisana, Rehle, Simbayi et al. 2009). Self-declarations may be affected by recall biases and, when it comes to behaviours in the sphere of individual private lives (such as sexual or addictive behaviours), respondents' answers may also be affected by a social desirability bias, that is, respondents tend to provide the answers they think are socially acceptable. It must, however, be pointed out that questions used for self-declaration of intimate or socially stigmatised behaviours were questions that have been validated in other scientific surveys dealing with similar issues (see Shisana, Rehle, Simbayi et al. 2009).

A further limitation of the survey, which is also common to most surveys in general populations using a household survey type of design, relates to exclusion of people not living in homes (Shisana, Rehle, Simbayi et al. 2009). The survey sample excludes people who live in homes and some hostels. The survey also excluded homeless people, those who live on the streets or in shelters or hotels. The design of the sample purposely excluded people confined to institutions, such as soldiers, prisoners, and students living in hostels at boarding schools, colleges and universities (Shisana, Rehle, Simbayi et al. 2009). Some of these groups may have higher HIV prevalence than the general community (Shisana, Rehle, Simbayi et al. 2009). For this reason, the survey results are generalisable to people who regularly live in homes.

Finally, the design of this household survey has been conceived in order to allow for detailed analysis of the major sub-populations in South Africa, including oversampling when necessary to guarantee meaningful comparisons (e.g. between the different races in the South African population). However, this design and the goal of ensuring national representativeness implies that some groups that may be of particular interest for understanding the epidemic could not be captured in sufficient numbers in this survey (e.g. individuals with homosexual and bisexual practices, injecting drug users, sex workers, etc.) (Shisana, Rehle, Simbayi et al. 2009). It must,

however, be acknowledged that similar limitations are encountered by all surveys about sexual and HIV-related risk behaviours based on general population samples in other countries (Shisana, Rehle, Simbayi et al. 2009).

Other limitations specific to this survey are presented below:

Although researchers and fieldworkers made every attempt to encourage participation, as was the case with the three previous surveys in 2002, 2005 and 2008, the low HIV test participation rates of specific groups may have biased HIV-prevalence estimates in some sub-populations (Shisana, Rehle, Simbayi et al. 2009). Although the overall participation rates were good in the survey, the participation among Indian or Asians and whites still remained a major issue. The overall response rate for HIV testing in this survey was 67.5% which matches the 67.0% which was achieved in the 2008 survey. However, when data on response rates was disagregated by race, it was found that black Africans (73.3%) and coloureds (69.6%) were more likely to agree to be tested and that Indian or Asians (54.0%) and whites (43.0%) were less likely to agree to be tested in the survey. This is despite a communication mobilisation campaign half way through the survey to reach these two groups.

The unwillingness of Indian or Asian and white groups to participate in surveys has been observed in previous studies in South Africa, including all the three previous HIV surveys (see Shisana, Rehle, Simbayi et al. 2009). When it comes to participation in HIV surveys, it was found that the perception that HIV was not a problem in their communities played a major role in refusal to participate in both groups (Shisana, Rehle, Simbayi et al. 2009). The groups believed that they are not vulnerable to HIV and that HIV is not a problem in their community and thus were not interested in taking part in such surveys. Another issue of concern seems to be that the two groups did not open their doors to our fieldworkers because of security concerns. The same challenge was also experienced in all affluent areas. They often have homes with high walls or live in security complexes which do not allow access to fieldworkers (Shisana, Rehle, Simbayi et al. 2009).

As was reported in the 2008 survey report, respondents from both groups were also more likely to look at incentives or benefits to themselves as motivation for HIV testing (see Shisana, Rehle, Simbayi et al. 2009). Another reason for refusing HIV testing in surveys among both groups is that many of them already knew their status as they have easy access to private medical practitioners (see Shisana, Rehle, Simbayi et al. 2009). More needs to be done to increase interest and participation in these groups in future studies as data gathered from them on HIV testing cannot be accepted with confidence (Shisana, Rehle, Simbayi et al. 2009). Indeed, the lack of participation of this group may also increase the perception that the two groups are not affected by HIV and AIDS and therefore not needing interventions to be directed to them. This false sense of security, while realistic at present, might indeed be dangerous as the communities concerned could also soon find themselves having a major burden of HIV and AIDS in the near future, as was the case back in the early 1990s for the black African majority (Shisana, Rehle, Simbayi et al. 2009).

Finally, it would have been useful to compare the results of this survey to the 2012 antenatal clinic-based survey of pregnant women as was done in the two previous surveys. However, the 2012 antenatal survey report was not available when this report was completed.

5.1 Conclusions

This 2012 survey design produces reliable and valid HIV estimates for all the reporting domains of sex, age, race, locality type and province. However, the HIV estimates for the white population are considered uncertain because of low response rates in this group.

5.1.1 HIV prevalence has increased substantially

The overall conclusion reached is that the HIV prevalence has increased from the previous survey in 2008 to the current 2012 survey by 1.2 million PLHIV. The increase in numbers can be partially explained by the massive expansion of the ARV programme that has saved many lives.

The epidemiological curve has shifted over the five-year period between 2008 and 2012 as the result of the effects of increased treatment coverage. The peak HIV prevalence for females has shifted from the 25–29 year age group in 2008 to the 30–34 year age group in 2012, and for males the peak HIV prevalence has shifted from the 30–34 year age group in 2008 to the 35–39 year age group in 2012. The 2012 peaks are at higher levels than they were previously in 2008. HIV prevalence for children under 14 has declined from 2002 to 2012, however, there was little change between 2008 and 2012. Prevalence for children aged 2–14 years has declined substantially, even though not significantly, suggesting that PMTCT programmes and interventions have been successful. This is also reflected in a further decline in HIV infections among children 12 months and younger between 2008 and 2012.

The provincial rankings of HIV prevalence have remained the same over the seven-year period from 2005 to 2012. HIV prevalence increased for the population aged 25 years and older. In the young population HIV prevalence has decreased slightly among young females and has declined significantly among young males. HIV prevalence for youth has declined in all provinces except the Western Cape where youth HIV prevalence has increased two-fold, albeit from a low base.

The current survey also finds that HIV prevalence continues to vary by race, with black Africans having the highest HIV prevalence. Coloureds came second. The high HIV prevalence in the black African population is found to be related to low rates of marriage and low socio-economic status in this group.

With respect to locality type, HIV prevalence continues to be high in informal urban areas compared to all other areas; this is found to be related to the poor socio-economic status of residents living in informal urban areas. In contrast, HIV prevalence is lowest in localities where residents have a high socio-economic status.

This report produces for the first time HIV prevalence and behaviour data for districts including metros. Among metros, HIV prevalence is highest in eThekwini in KwaZulu-Natal and in Ekurhuleni in Gauteng in comparison with the other six metropolitan municipalities in the country.

According to HIV-prevalence estimates at a district level, this report concludes that HIV is clustered in specific districts located mostly in KwaZulu-Natal, Mpumalanga, and the Free State as well as some districts located in the North West.

5.1.2 Different key populations at higher risk of HIV exposure present a major source of concern

The 2012 results show a shifting risk profile among some groups. Based on the criterion of having HIV prevalence that exceeds the national HIV estimate, key populations at higher risk of HIV exposure were identified as black African females aged 20 to 34 years, black African males aged 25 to 49 years, high risk alcohol drinkers, recreational drug users and those aged 15 to 49 years old that are cohabitating with their partners.

5.1.3 Living together but not married (that is, co-habiting) is associated with high HIV prevalence

HIV infection varies considerably by marital status. Those that are married are considerably less likely to be HIV positive compared to any other reported marital status. HIV prevalence among those that are going steady (have a consistent sexual partner) is higher than any other marital status group followed by those that are living together but not married (co-habiting). The likelihood of HIV infection is considerably worse for those cohabitating who are of reproductive age.

5.1.4 Antiretroviral treatment (ART) exposure

South Africa has the largest ART roll-out programme in the world. Our survey confirmed that by mid-2012 over two million PLHIV were on ARV treatment. We found that more females were exposed to ART compared to males, which suggests that sex differences in health-seeking behaviour together with the benefits of expanded PMTCT programmes may have facilitated women's access to treatment over the past four years. The increased ART exposure among HIV-infected children is a particularly encouraging sign and is a further indication of improved HIV testing among children and the evolving impact of the new national guidelines for starting ART regimens in infants and children.

While South Africa's effort to expand ART programmes should be praised, the incidence analysis points to persisting high rates of new infections in the country. To succeed the country will have to overcome the growing tendency to focus mainly on treatment. The findings suggest a need to balance treatment and prevention.

5.1.5 HIV-incidence rates remain at high levels

Our analysis of directly measured HIV incidence indicated that 469,000 new HIV infections occurred in the population 2 years and older during the year 2012 in South Africa. Among adults aged 15–49 years the HIV-incidence rate was 1.7%. However, the incidence rate in females was almost twice the incidence rate found in males. The rates of new infections among young females are still of concern. The HIV-incidence rate among female youth aged 15–24 years was over four times higher than the incidence rate found in males in this age group. Almost a quarter of all new HIV infections occurred in young females aged 15–24 years. The HIV-incidence rate in black African females aged 20–34 years was 4.5%, the highest incidence of HIV among the analysed population groups.

Our HIV-incidence analysis was based on two independent methods which produced similar results for the population groups youth aged 15–24 years and adults aged 15–49 years. On the whole, there is a strong indication that HIV incidence has declined between 2002 and 2012 among young females aged 15–24 years. There is also indication that incidence among youth has continued to decline between 2008 and 2012. However, there

is no indication that incidence among adults aged 15–49 years has changed between 2008 and 2012.

It is conceivable that the beneficial impact of increased antiretroviral treatment coverage on HIV incidence (through viral load reduction in HIV-positive individuals) may have been offset by the disturbing trends of increased HIV-risk behaviour in the country. Furthermore, it may take a few more years of ART roll-out before the effects are realised as has been shown in Hlabisa sub-district in northern KwaZulu-Natal.

5.1.6 Some people believe that they are not at risk of HIV infection

Overall, it was found that there was a large proportion of the general population as well as all the six key populations at higher risk of HIV exposure identified by this survey that believed they were personally at low risk of HIV infection. As expected, females were relatively more likely than males to believe they are at risk of acquiring HIV. This perception was supported by the findings that prevalence for females is indeed significantly higher than that of males. Adults aged 25–49 years (both males and females) were also more likely to believe they were at risk of acquiring HIV. Again, the HIV-prevalence results support this risk perception. It is critical to note that this general belief of personal invincibility to HIV infection is based on inaccurate information about transmission and prevention of HIV and therefore creates a false sense of security.

Perceiving oneself to be at a lower risk of HIV infection is associated with lower HIV testing rates. Perceiving oneself to be at a lower risk does not guarantee infection avoidance; in this survey substantial percentages of those who believed they were at low risk of HIV infection were, in fact, found to be HIV positive, both females (12.3%) and males (9.2%). This further supports the conclusion that perceiving oneself to be at lower risk of HIV infection creates a false sense of security.

5.1.7 HCT programmes increased testing for HIV status

The survey found that nearly two-thirds of respondents (65.5%) indicated that they had ever been tested for HIV. Two thirds (66.2%) reported that they were tested in the previous 12 months before the survey. Both findings show that the country has among the highest levels of HIV testing in any country at a national level. This has resulted in an increase in the number of PLHIV who are initiated on ARV treatment. This is most commendable.

5.1.8 Risk behaviour has increased

In terms of risk behaviour, the results of this survey suggested that risky behaviour is on the rise. The survey found:

a) **Sexual debut before the age of 15 years continues to increase**
   There was an increase in the percentage of young people who had their sexual debut before the age of 15 years, and this was especially true for young males. Early sexual debut increases the risk of HIV infection at any early age.
b) **One third of young females aged 15–19 years had sexual partners who were five years and older**
   The percentages of young females who had sex with partners who were five years and older than them has increased over the four surveys, with nearly one third of young females aged 15–19 years in 2012 having older sexual partners. At the same time, only low percentages of young males engaged in similar behaviour.

c) **Multiple sexual partners has increased in males**
The percentages of males for all age groups who have multiple sexual partners have continued to increase for the year 2012 when compared to previous surveys, especially among those aged 15–24 years. Similar increases were also noted among high-risk alcohol drinkers aged 15 years and older, recreational drug users aged 15 years and older, black African males aged 25–49 years, and the disabled aged 15 years and older. There were also small increases among both young and adult females.

d) **Condom use has decreased**
Although condom use is one of the main HIV-prevention strategies and one that has been previously promoted successfully in the country, especially among youth, condom use at last sex by both males and females among all age groups decreased in 2012 back to levels similar to those in 2005 after having peaked in 2008. Importantly, there were also relatively low percentages of consistent condom use by both males and females among all age groups, and prevalence of consistent condom use for both males and females decreased with age. Therefore, although condom use remained relatively high at last sex, there is a problem with both correct and inconsistent condom use which was found to be relatively low.

5.1.9 Knowledge about sexual transmission of HIV is low

Survey participants were found to have very low levels of accurate knowledge about the sexual transmission and prevention of HIV as well as very low levels of accurate knowledge to inform appropriate rejection of major misconceptions about HIV transmission. Lowest knowledge levels were found amongst older people aged 50 years and older, black Africans, individuals residing in the urban informal areas and in both North West and Limpopo provinces as well as among all the six key populations at higher risk of HIV exposure that were identified by this survey.

More importantly, the population's knowledge of the basics of HIV transmission and prevention has declined from 2008 to 2012. Such a decline in correct HIV-prevention knowledge has implications for the prevention of new HIV infections in the country. The protective behaviours that were not correctly identified are effective for preventing the spread of HIV. Low levels of HIV-prevention knowledge found in this survey have been accompanied by a significant drop in protective sexual behaviours, including lower rates of condom use at last sex and more sexual partners during the previous 12 months preceding the survey.

5.1.10 VMMC is slowly increasing

Male circumcision has increased overall in 2012 among men 15 years and older, however, the rates of VMMC still remains low overall compared to traditional circumcision. The percentage of males who report having been traditionally circumcised remains highest, especially among ethnic groups where circumcision is a traditional rite of passage for males. However, the tide has begun to turn among youth aged 15–24 years as the majority of them were medically circumcised. Although this is most promising, the fact that the majority of males are still undergoing traditional circumcision means that the country may not be able to meet the target set by SANAC, namely, having 80% of HIV-negative men medically circumcised within the 15–49 age bracket by 2015, unless the demand for VMMC increases.

5.1.11 HIV prevalence remains high for residents of informal settlements

HIV prevalence continues to be high in both informal urban settlements and rural informal areas throughout the country. This suggests that approaching the problem generically may not be working and instead there is a need to design interventions that target residents of informal settlements specifically. In particular, the high rates of HIV among residents of informal settlements importantly point to structural drivers of the epidemic, especially poverty, as important contributing factors in the spread of HIV.

5.1.12 Attitudes towards PLHIV have remained stable

Overall, attitudes towards PLHIV were mostly favourable in 2012 as they had been in 2008. However, on one question "*Would you want to keep the HIV-positive status of a family member a secret?*" the attitude has remained ambivalent. This suggests that the respondents' attitudes towards PLHIV have remained fairly stable between 2008 and 2012, while one which was mostly negative have improved slightly over the course of the past three surveys to ambivalence. This has occurred because of the wider availability of ART that have prolonged the lives of PLHIV and may have resulted in a more positive shift in attitudes from the perception of HIV and AIDS as a fatal disease due to the fact that HIV and AIDS is now both a chronic and manageable illness.

5.1.13 Orphanhood is stable

Overall, the level of orphanhood in 2012 has remained stable at 16.9% since the previous survey conducted in 2008. This could be partly explained by the availability of ART which has prolonged the lives of HIV-positive parents as well as other reasons as the causes of parental death was not discerned. However, there were variations found among the different types of orphans, with a significantly higher proportion of paternal orphans than maternal orphans as expected. Moreover, a significantly higher proportion of orphans are found among black Africans than among the other race groups. Similarly, this is seen among the different age groups which is also as expected as 15–18 year olds are found to have a significantly higher proportion of orphanhood in comparison with younger age groups. Lastly, KwaZulu-Natal had the highest proportion of orphans while the Western Cape had the lowest level of orphans, which is expected given the sizes of the HIV epidemic in these provinces.

The disparity between HIV-prevalence rates for orphans and those for non-orphans remains important. This survey shows a higher HIV prevalence among orphans than among non-orphans. Moreover, maternal orphans had a higher HIV prevalence than paternal orphans suggesting possible vertical transmission. This higher prevalence of HIV among orphans requires attention as does evidence-based-interventions that work to reduce parental deaths.

5.2 Recommendations

From the 13 conclusions drawn above, we would like to make the following eight recommendations.

5.2.1 There is a need for an evidence-based, diversified and comprehensive multi-sectoral response to the HIV and AIDS epidemic.

In line with the four main strategic objectives of the 2012–2016 NSP (SANAC, 2011a) and also recommended by the UNAIDS Investment Framework approach (see Schwartlander et

al. 2011; UNAIDS, 2011), there is a need to invest the available resources prudently for an evidence-based, diversified and comprehensive response to the HIV and AIDS epidemic that balances the imperatives of both treatment and prevention in order to appropriately address the complex epidemic in our country. Both prevention and treatment must be equally promoted if we are to be successful. This means in the era of "roll-out" of ART, prevention initiatives should be accelerated. We must financially resource prevention programmes and vigorously implement evidenced-based prevention strategies that combine both biomedical and social and behavioural interventions and also scale-up treatment in order to prevent new infections as well as reduce mortality, and thus increase life expectancy. This is crucial because judging by the levels of knowledge and social and behavioural indicators the NSP-prevention programme implementation does not seem to be focusing on behaviour change communication and social change associated with undesirability of risky behaviours such as having multiple sexual partnerships, early sexual debut, age-disparate relationships and inconsistent condom use. In addition, structural issues such as gender inequality also need to be addressed with a clear and implementable plan of action. This would address, among other concerns, age-disparate relationships that were observed in this survey.

This survey has demonstrated that many people do not understand their risk of HIV infection, and there is a need to design prevention programmes that aim to help them to do so. The low levels of accurate knowledge of the sexual transmission of HIV prevent people from understanding or personalising the risk of infection. Therefore, it is recommended that intensive SBCC campaigns for South Africans that encourage literacy on the sexual transmission and prevention of HIV and the identification of myths associated with HIV transmission. This is urgently needed and should form part of the HCT campaign. Indeed, health care workers must also be empowered to convey key HIV-prevention messages to clients that make use of health facilities as was the case in the past before the ART era began in the country.

5.2.2 Further strengthen and encourage HCT

HCT is a critical entry point into services for HIV-positive and negative people, as it is not known if HCT does impact on HIV prevention directly. The recent re-launch of the HCT campaign by the Deputy President of South Africa on behalf of SANAC further strengthens the need for more people to test as well as those who have previously tested to repeat testing annually. An issue of major concern is the gender disparity whereby females dominate both in terms of the proportions who undergo HCT and know their HIV status as well as subsequently accessing ARV treatment compared to their male counterparts. There is therefore a need to find ways to encourage more men to test for HIV and also access ARV treatment as much as their female counterparts do. Among other approaches considered to improve the uptake of HCT by men should be the use of mobile services as was shown by Project Accept (van Rooyen, McGrath, Chirowodza et al. 2011). Indeed, other non-traditional settings for HIV testing especially those that are most accessible to males are under-utilised such as in the workplace and also using traditional healers must be promoted. Other options include developing male-friendly community centres where males can gather and interact with each other as well as discuss important social issues that affect them and also access some health services as they eschew going to normal PHC clinics. The refining of the re-launched HCT campaign is essential if we are to ultimately get as many ART-eligible PLHIV initiated into care. Hopefully this will ultimately enable us to benefit as a country at a population level from the fact that ART can also be seen as HIV prevention (see Cohen, Chen, McCauley et al. 2011; also see Tanser, Barnighauser, Hund et al. 2013).

5.2.3 Encourage consistent condom use and faithfulness

An evidence-based, diversified and comprehensive response to the HIV and AIDS epidemic must include developing appropriate combination prevention packages to encourage fidelity and condom use. This could include reviving the basic "abstinence, be faithful and condomise" (or simply ABC) prevention intervention to equip the population with basic knowledge about HIV prevention.

Lower condom use rates among females compared to males and high multiple sexual partnership rates among males point to the structural issue of gender inequality in our country that continues to drive the HIV and AIDS epidemic. This issue will also need to be addressed.

5.2.4 Key populations at higher risk of HIV exposure need to be targeted with evidence-based interventions

SANAC is called upon to introduce targeted HIV-prevention programmes for key populations at higher risk of HIV exposure (including the conventional ones like MSM and sex workers not covered in this report) in order to reduce the risk of HIV infections among these populations. These programmes should include basic HIV knowledge of sexual transmission, the importance of condom use, and the promotion of monogamous relationships. Programmes aimed at reducing risky alcohol consumption and curbing the use of recreational drugs should also be scaled up and coupled with HIV-prevention messages.

All females aged 15–24 years, black African females especially those that are aged 20–34 years, as well as black African males aged 25 to 49 years require specialised interventions aimed at raising awareness about the impact of HIV, promoting condom use, and reducing multiple sexual partnerships. Both scaling-up of the use of female condoms and the development of other female-controlled prevention methods such as microbicides needs to be accelerated to ensure that females are able to protect themselves from infection.

5.2.5 Encourage monogamy

South Africans need to be encouraged to be monogamous. Several studies, including this one have repeatedly shown that married people have lower prevalence of HIV and that the rates of multiple sexual partnerships are lower in married people than in unmarried people. The association between being married and a low HIV prevalence requires further investigation. The authors acknowledge that marriage may not be a panacea to prevent HIV infections. Most countries with high marriage rates also have low HIV prevalence (Shisana, Zungu and Simbayi, in press) making a case for further investigation of this within the South African context.

Co-habitation or going steady in a relationship outside of marriage has been found in this survey to be associated with higher HIVprevalence. The behavioural indicators studied show that co-habiting or going steady is associated with higher rates of having multiple sexual partners. It is imperative that social mores that construct multiple sexual partnerships as a norm should be changed. Monogamy and faithfulness should continue to be promoted for both married and unmarried couples.

5.2.6 Encourage the social unacceptability of age-disparate relationships

There is evidence from this survey and others that young girls engage in sexual relationships with older male partners for several reasons, including material gains. Age-disparate relationships are considered a major behavioural risk factor for HIV infection among young females; hence the urgent need to discourage this behaviour. This can be achieved through the design of targeted communication interventions for young females to raise awareness about the risk of such relationships. Additionally there is a need to intensify efforts to change widely held community norms that accept such practices. Since age-disparate relationships has been associated with financial gain, it is necessary to ensure that girls and young females are empowered and have access to education and employment to break the cycle of poverty.

It is gratifying to note that SANAC recently successfully obtained some funding from the Global Fund to Fight AIDS, TB and Malaria to support such an initiative and appointed a highly experienced local NGO with an international reputation for effective SBCC campaigns to implement it.

5.2.7 Increase the demand for VMMC

As was alluded to earlier, the recent launch of the VMMC on World AIDS Day on 1 December 2013 by the Deputy President of South Africa in his capacity as Chair of SANAC is timely. It is also recommended that SANAC and its various, components especially the traditional leaders and men's sectors work together to increase awareness and demand for VMMC. The above-mentioned groups should also collaborate on finding ways of integrating VMMC into traditional rites of passage. These stakeholders need to work together to craft messages on the importance of VMMC in a context of dynamic African cultures that are evolving and changing in response to different challenges including the HIV and AIDS epidemic. Above all, there is a need for a multi-faceted national advocacy campaign both to create demand for VMMC and also explain clearly its benefits and highlight the need for continued use of condoms due to the partial efficacy of the intervention. In addition, policy and programmatic options involving circumcision of both neonates and young adolescents before they start having sex should be considered.

5.2.8 Promote HIV prevention in urban informal settlements

SANAC and its partners, especially the NDOH and the Department of Social Development, should design and roll-out a comprehensive combination package of HIV prevention and treatment interventions that are targeted to residents of informal settlements. At the same time, interventions must be developed to address the conditions that are prevalent in these areas, such as poverty, poor education and unemployment. In the long-term the government led by the Ministry of Human Settlements has to work collaboratively with communities, banks and the private sector to accelerate the provision of formal housing and the eradication of informal settlements in South Africa. The association between informal settlements and HIV infection has been established (Shisana & Simbayi, 2002; Shisana, Rehle, Simbayi et al. 2005, 2009) and research has shown that "informal settlement residents experience multiple overlapping vulnerabilities, which can increase risk of acquiring HIV and TB, and increase vulnerability to the effects of living with HIV and TB" (Mahlangu, Vearey, & Thomas, 2011, p. 4; also see David et al. 2007). It is known that informal settlements tend to have a concentration of the most mobile, poor and vulnerable population and have limited or no access to basic services such as water, sanitation, roads, transport and health services. It therefore inevitable that the existing poor living conditions

become a fertile environment for the spread of infectious diseases (David et al. 2007) hence it is critical to eradicate informal settlements in the long run.

6. REFERENCES

Auvert, B., Taljaard, D., Lagarde, E., Sobngwi-Tambekou, J., Sitta, R. and Puren, A. (2005). Randomised, controlled intervention trial of male circumcision for reduction of HIV infection risk: The ANRS 1265 trial. *PLOS Medicine*, 2 (11), e298: 1112–1122.

Ankomah, A., Mamman-Daura, F., Omoregie, G., Anyanti, J. (2011). Reasons for delaying or engaging in early sexual initiation among adolescents in Nigeria HIV prevalence. *Adolescent Health, Medicine and Therapeutics,* 2: 75–84.

Bailey, R.C., Moses, S., Parker, C.C., Agot, K., Maclean, I., John N Krieger, J.A., Williams, C.F.M., Campbell, R.T. and Ndinya-Achola, J.O. (2007). Male circumcision for HIV prevention in young men in Kisumu, Kenya: a randomised controlled trial. *Lancet,* 369: 643–656.

Baumgartner, J.L., Geary Waszak, C., Tucker, H., and Wedderburn, M. (2009). The influence of early sexual debut and sexual violence on adolescent pregnancy: a matched case-control survey in Jamaica. *International Perspectives on Sexual and Reproductive Health*, 35 (1): 21–28.

Beauclaire, R., Delva, W. (2013). Is younger really safe? A qualitative study of perceived risks and benefits of age-disparate relationships among women in Cape Town, South Africa. *PLoS ONE* 8(11): e81748.

Bor, J., Herbst, A.J., Newell, M.L. and Bärnighausen, T. (2013). Increases in adult life expectancy in rural South Africa: valuing the scale-up of HIV treatment. *Science.* 339(6122): 961–965.

Busch, M.P., Pilcher, C.D., Mastro, T., Kaldor, J., Vercauteren, G., Rodriguez, B., Rousseau, C., Rehle, T., Welte, A., Averill, M.D., Garcia Calleja, J.M., for the WHO Working Group on HIV Incidence Assays. (2010). Beyond detuning: 10 years of progress and new challenges in the development and application of assays for HIV incidence estimation (Editorial Review). *AIDS,* 24: 2763–2771.

Byakika-Tusiime, J. (2008). Circumcision and HIV infection: assessment of causality. *AIDS and Behaviour*, 12(6): 835–841.

Cassell, MM., Halperin. D.T., Shelton. J.D. and Stanton., D. (2006). Risk compensation: the Achilles' heel of innovations in HIV prevention? *British Medical Journal.* 332: 605–607.

Chen, L., Jha, P., Stirling, B., Sgaier, S. K., Daid, T., Kaul, R. et al. (2007). Sexual risk factors for HIV infection in early and advanced HIV epidemics in sub-Saharan Africa: Systematic overview of 68 epidemiological studies. *PLoS ONE*, 2(10), e1001.

Chigwedere, P., Seage, G.R. III, Lee, T.H., and Essex, M. (2008). Efficacy of Antiretroviral Drugs in Reducing Mother to Child Transmission of HIV in Africa: A Meta-Analysis of Published Clinical Trials. AIDS Res. Hum. Retroviruses. 24(6): 827–37.

Cluver, L., Boyes, M., Orkin, M., Pantelic, M., Molwena, T. and, Sherr, L. (2013). Child-focused state cash transfers and adolescent risk of HIV infection in South Africa: a propensity-score-matched case-control survey. *Lancet Global Health,* 1: 362–70.

Cohen, M.S., Chen, Y.Q., McCauley, M., Gamble, T., Hosseinipour, M.C., Kumarasamy, N., Hakim, J., Kumwenda, J., Grinsztejn, B., Pilotto, J.H., Godbole, S.V., Mehendale, S., Chariyalertsak, S., Santos, B.R., Mayer, K.H., Hoffman, I.F., Eshleman, S.H., Piwowar-Manning, E., Wang, L., Makhema, J. et al. (2011). Prevention of HIV-1 infection with early antiretroviral therapy. NEJM. 365: 493–505 PMCID: 3200068.

Connell, R. W., & Messerschmidt, J. W. (2005). Hegemonic masculinity rethinking the concept. *Gender & society*, *19*(6): 829–859.

Connolly. C., Simbayi. L.C., Shanmugam. R. and Mqeketo. A. (2008). Male circumcision and its relationship to HIV infection in South Africa: Results from a national survey in 2002. *South African Medical Journal*. 98(10): 789–794.

Cornell M, Schomaker M, Garone DB, Giddy J, Hoffmann CJ, Lessells R, Maskew M, Prozesky H, Wood R, Johnson LF, Egger M, Boulle A and Myer L for the International Epidemiologic Databases to Evaluate AIDS Southern Africa (IeDEA-SA) Collaboration (2012) Gender Differences in Survival among Adult Patients Starting Antiretroviral Therapy in South Africa: A Multicentre Cohort Survey. PLoS Medicine, 9 (9). e1001304.

Cotton. M.F., Marais. B.J., Andersson. M.I., Eley. B., Rabie. H., Slogrove. A.L., Dramowski. A., Schaaf. H.S., and Mehtar. S. (2012). Minimizing the risk of non-vertical. non-sexual HIV infection in children – beyond mother to child transmission. *Journal of the International AIDS Society* 15: 17377.

Cooper, D., Hoffman, M., Carrara, H., Rosenberg, L., Kelly, J., Stander, I. et al. (2007). Determinants of sexual activity and its relation to cervical cancer risk among South African women. *BMC Public Health*, 7: 341.

Department of Social Development (DSD, 2013). *Comprehensive HIV and AIDS, TB and STI strategy 2013– 2016.* Pretoria: DSD.

Dhalla, S. and Poole, G. (2009). Determinants of condom use: results of the Canadian community health survey. *Canadian Journal of Public Health,* 100, (4): 299–303.

Donenberg, G.R., Brynat, F.B., Emerson, M.A., Wilson, B.A., and Pasch, B.A. (2003). Tracing the roots of early sexual debut among adolescents in psychiatric care. Journal of the American Academy of Child and Adolescent Psychiatry, 42 (5): 594–608.

Donnell. D., Baeten. J.M., Kiarie. J., Thomas. K.K., Stevens. W., Cohen. C.R., McIntyre. J., Lingappa. J.R., Celum. C. for Partners in Prevention HSV/HIV Transmission Survey Team. (2010). Heterosexual HIV-1 transmission after initiation of antiretroviral therapy: a prospective cohort analysis. *Lancet,* 12.375(9731): 2092–2098.

Duong, Y.T., Qiu, M., De A.K., Jackson, K., Dobbs, T., Kim, A.A., Nkengasong, J.N., Parekh, B.S. (2012). Detection of recent HIV-1 infection using a new limiting-antigen avidity assay: potential for HIV-1 incidence estimates and avidity maturation studies. *PloS ONE* 7(3): e33328.

Duong, Y.T. et al. Recalibration of LAg-avidity EIA to determine mean duration of recent infection in divergent HIV-1 subtypes. Manuscript in preparation.

Geary Waszak, C., Baumgartner, J.L., Tucker, H., Johnson, L., Wedderburn, M., and Wagman, J. (2008). *Early sexual debut, sexual violence, and sexual risk-taking among pregnant adolescents and their peers in Jamaica and Uganda*. FHI Working Paper Series, USA.

Gouws, E. (2010). *Trends in HIV prevalence and sexual behaviour among young people aged 15 to 24 years in countries most affected by HIV.* The International Group on Analysis of trends in HIV Prevalence and Behaviours in Young People in Countries most Affected by HIV. Geneva: Switzerland.

Hallett, T. B., Zaba, B., Todd, J., Lopman, B., Mwita, W., Biraro, S. et al. (2008). Estimating incidence from prevalence in generalised HIV epidemics: methods and validation. PLoS Medicine, 5(4), e80.

Hallett, T. B., Stover, J., Mishra, V., Ghys, P. D., Gregson, S., and Boerma, T. (2010). Estimates of HIV incidence from household-based prevalence surveys. AIDS 24(1): 147–152.

Halperin, D.T., and Epstein, H. (2007). Why is HIV prevalence so severe in southern Africa? The role of multiple concurrent partnerships and lack of male circumcision. Southern African Journal of HIV Medicine, 26: 19–25.

Hargreaves, J.R., Morison, L.A., Kim, J.C., Busza, J., Phetla, G., Porter, J.D., Watts, C., and Pronyk, P.M. (2009). Characteristics of sexual partnerships, not just of individuals, are associated with condom use and recent HIV infection in rural South Africa. AIDS Care, 21(8): 1058–1070.

Harling, G. et al. (2014). Age-disparate relationships and HIV incidence amongst rural South African Women. 21st Conference on Retroviruses and Opportunistic Infections, 3–6 March. Oral abstract 145.

Harrison, A., Cleland, J., Gouws, E. and Frohlich, J. (2005). Early sexual debut among young men in rural South Africa: Heightened vulnerability to sexual risk? Sex. Trasm. Infect. 81: 259–61.

Health Systems Trust. (2013). District Health Barometer 2012/2013. Durban: Health Systems Trust.

Heckman J (1979) Sample selection bias as a specification error. *Econometrica* 47: 153–161.

Hiemstra, R., Rabie, H., Schaaf, H.S., Eley, B., Cameron, N., Mehtar, S., Janse van Rensburg, A., Cotton, M.F. (2004). Unexplained HIV-1 infection in children--documenting cases and assessing for possible risk factors. *S Afr Med J*, 94(3): 188–93.

Hunter, M. (2006) "Fathers without *amandla*: Zulu-speaking me fatherhood", in L. Richter and R. Morrell (eds), *Baba: Men anFatherhood in South Africa*. Cape Town: HSRC Press.

Hunter, M. (2007). The changing political economy of sex in South Africa: The significance of unemployment and inequalities to the scale of the AIDS pandemic. *Social Science and Medicine*, *64*: 689–700.

Hutchenson, K. M. (2002). The influence of sexual risk communication between parents and daughters on sexual risk behaviors. *Family Relations*. *51*(3): 238–248.

ILO. (2008). Promotion of rural employment. International Labour Conference: Geneva.

Joffe, H. (1999). Risk and 'the other'. Cambridge: Cambridge University Press.

Johnson, S., Kincaid, L., Figueroa, M., Delate, R., Mahlasela, L., and Magni, S. (2013). The Third National HIV Communication Survey, 2012. South Africa: Pretoria.

Johnson, L. F. (2012). Access to antiretroviral treatment in South Africa, 2004–2011. Southern African Journal of HIV Medicine (3): 22–27.

Johnson, L.F., Hallett. T.B., Rehle, T.M., and Dorrington, R.E. (2012). The effect of changes in condom usage and antiretroviral treatment on human immunodeficiency virus incidence in South Africa: A model-based analysis. *Journal of the Royal Society/ Interface/the Royal Society*. 9(72): 1544–1554.

Johnson LF, Mossong J, Dorrington RE, Schomaker M, Hoffmann CJ, Keiser O, Fox MP, Wood R, Prozesky H, Giddy J, Belen Garone D, Cornell M, Egger M, Boulle A: Life

expectancies of South African adults starting antiretroviral treatment: collaborative analysis of cohort studies. *PLoS Med,* 10: 1001418.

Kaestle. C.E., Halpern. C.Y., Miller. W.C. and Ford. C.A. (2005). Young age at first sexual intercourse and sexually transmitted infections in adolescents and young adults. *American Journal of Epidemiology*, 161 (8): 774–780.

Kai, S. (2010). *Technical Brief: Integrating Gender into Programs with Most-at-Risk Populations*. Arlington, VA: USAID's AIDS Support and Technical Assistance Resources, AIDSTAR-One, Task Order 1.

Kalichman, S.C., Simbayi, L.C., Kaufman, M., Cain, D. and Jooste, S. (2007). Alcohol use and sexual risks for HIV/AIDS in sub-Saharan Africa: Systematic review of empirical findings. *Prevention Science,* 8: 141–151.

Kibombo, R., Neema, S., and Ahmed, F. (2007). Adolescents and their perceptions of HIV/AIDS. Afri. J. Productive Health 11(3): 168–181.

Kirby, D., Dayton, R., L'Engle, K., and Prickett, A. (2012). Promoting partner reduction: Helping Young People Understand and Avoid HIV Risks from Multiple Partnerships. Durham: FHI360.

Kirby, D. (2007). *Emerging Answers 2007: Research Findings on Programs to Reduce Teen Pregnancy and Sexually Transmitted Diseases*. Washington. DC: The National Campaign to Prevent Unplanned Pregnancy.

Kirkwood, B. and Sterne, J.A.C. (2003). Essential Medical Statistics (Second Edition): Blackwell Science.

Kish. L. (1965). *Survey sampling*. New York: Wiley.

Leclerc-Madlala, S. (2008). Age-disparate and intergenerational sex in southern Africa: the dynamics of hypervulnerability. Suppl 4: 17–25.

loveLife. (2012). *Talking Points: A survey on HIV, sexual risk behaviour, and access to opportunity among young people in South Africa*. Johannesburg: loveLife.

Lurie, M.N and Rosenthal, S. (2009). Concurrent partnerships as a driver of the HIV Epidemic in sub-Saharan Africa? The evidence is limited. *AIDS and Behaviour,* 14(1): 17–24.

Malan, M. (2013). *PrePex will save many lives in SA-with traditional leaders' help*. Retrieved from: Van Wyk, C. South Africa: *Zuma expresses outrage at circumcision related deaths*. Retrieved from: http://www.theafricareport.com/Health/south-africa-zuma-expresses-outrage-at-circumcision-related-deaths.html.

Mah, T. and Halperin, D.T. (2010). Concurrent sexual partnerships and the HIV epidemic in Africa: The evidence to move forward. *AIDS and Behavior,* 14(1): 11–6.

Mattson, C., Campbell, R., Bailer, R., Agot, K., Ndinya-Achola, J. O. and Moses, S. (2008). Risk compensation is not associated with male circumcision in Kisumu, KenyA multi-faceted assessment of men enrolled in a randomized controlled trial. *PLoS ONE*, 3(6), e2443. DOI: 10.1371/journal.pone.0002443.

Mayosi, B.M, Lawn, J.E., van Niekerk, A., Bradshaw, D., Abdool Karim, S.S., Coovadia H.M. for The Lancet South Africa team (2012). Health in South Africa: changes and challenges since 2009. *Lancet*, 380 (9858): 2029–2043.

McGrath, N., Nyirenda, M., Hosegood, V and Newell, M.L. (2009). Age at first sex in rural South Africa. *Sexually Transmitted Infections*. 85: i49-i55.

Medical Research Council (MRC) (2011). *Effectiveness of the National Prevention of Mother-to- Child Transmission (PMTCT) Programme in South Africa 2011*. Cape Town: MRC of South Africa.

Mendle, J., Paige Harden, K., Turkheimer, E., Van Hulle, C.A., D'Onofrio, B.M, Brooks-Gunn, J., Rodgers, J.L., Emery, R.E., and Lahey, B.B. (2009). Associations between father absence and age of First Sexual Intercourse. *Child Development*. 80(5): 1463–1480.

Mbengashe, T., Nevhutalu, Z., Chipimo, M., Chidarikire, T. and Diseko, L. (2012). *The national HIV counselling and testing campaign and treatment expansion in South Africa: a return on investments in combination* prevention. Oral Poster Discussion during the XIX International AIDS Conference held in Washington DC, USA 22–27 July, 2012.

Morojele, N.K., Kachieng'a, M.A., Mokoko, E., Nkoko, M.A., Parry, C.D.H., and Nkowane, A.M. (2006). Alcohol use and sexual behaviour among risky drinkers and bar and shebeen patrons in Gauteng province, South Africa. *Social Science and Medicine*, 62: 217–227.

Msamanga, G., Tchetgen, E., Spiegelman, D., Fawzi, M.K., Kaaya, S., Urassa, W., Hunter, D., Kapinga, S., and Fawzi, W. (2009). Determinants of condom use among antenatal clinic attendees in Dar es Salaam, Tanzania. *East African Journal of Public Health*, 6(2): 175–83.

National Department of Health (NDOH) (2010). *Antiretroviral drugs for treating pregnant* women and *preventing HIV infection in infants Recommendations for a public health approach*. Pretoria: NDOH.

National Department of Health. (2013a). *District Health Information System*,Pretoria: NDOH. Received November 2013.

National Department of Health. (2013b). *The South African antiretroviral treatment guidelines*, March 2013. Pretoria: NDOH.

National Department of Health. (2013c). District Health Information System, November 2013. Pretoria: NDOH.

National Department of Health. (2012). *The National antenatal sentinel HIV and syphilis prevalence survey, South Africa, 2011*. Pretoria: NDOH.

Njeuhmeli, E., Forsythe, s., Reed, J., Opuni, M., Bollinger, L., Heard, N., Castor, D., Stover, J., Farley, T., Menon, V., Hankins, C. (2011). Voluntary medical male circumcision for HIV prevention in Eastern and Southern Africa. *PloS Med*, 8: e1001132.

Obermeyer. C.M., Bott. S., Carrieri. P., Parsons. M., Pulerwitz. J., Rutenberg. N. and Sarna. A. (2009). *HIV testing. treatment and prevention: generic tools for operational research*. Geneva: WHO.

O'Brien, R., Hunt, K., & Hart, G. (2005). 'It's caveman stuff, but that is to a certain extent how guys still operate': men's accounts of masculinity and help seeking. *Social Science & Medicine*, *61*(3): 503–516.

Ott, M. Q., Barnighausen, T., Tanser, F., Lurie, M.N. and Newell, M.L. (2011). Age-gaps in sexual partnerships: seeing beyond 'sugar daddies'. *AIDS, 25(6)*: 861–863.

Parry, C., Rehm, J., Poznyak, V., and Room, R. (2009). Alcohol and infectious diseases: an overlooked causal linkage? *Addiction*. 104: 331–332.

Peltzer, K., Davids, A. and Njuho, P. (2011). Alcohol use and problem drinking in South Africa: findings from a national population-based survey. *African Journal of Psychiatry*, 14: 30–37.

Peltzer, K., Swartz, S., Naidoo, P., Ramlagan, S., Mlambo, M., Sanger, N. et al. (2012). *Evaluating the value that young people attach to loveLife and investigating factors impacting the life choices and risk tolerance of youth.* Unpublished Research report.

Petros, G., Airhihenbuwa, C.O., Simbayi, L., Ramlagan, S. and Brown, B. (2006). HIV/AIDS and 'othering' in South Africa: the blame goes on! *Culture, Health and Sexuality,* 8(1): 67–77.

Pettifor A, O'Brien K, Macphail C, Miller WC, Rees H. (2009). Early coital debut and associated HIV risk factors among young women and men in South Africa. International Perspectives on Sexual Reproductive Health, 35(2):82–90. doi: 10.1363/ifpp.35.082.09.

Pettifor, A. E., Rees, H. V., Steffenson, A., Hlongwa-Madikizela, L., MacPhail, C., Vermaak, K. et al. (2004). *HIV and sexual behaviour among young South Africans.* Johannesburg: Reproductive Health Research Unit, University of Witwatersrand.

Population Council. (2007). Situation Analysis of the Sexual and Reproductive Health and HIV Risks and Prevention Needs of Older Orphaned and Vulnerable Children in Nyanza Province, Kenya. Government of Kenya.

Pillay, Y., Dinh, T., Goga, A. and Jackson, D. (2012). *Impact and Effectiveness of South Africa's PMTCT Programs on Perinatal HIV Transmission, 2010–2011: Using data to improve program implementation, and policy.* Oral presentation during the XIX International AIDS Conference held in Washington DC, USA 22–27 July, 2012.

Quinn. T.C., and Overbaugh. J. (2005). HIV/AIDS in females: An expanding epidemic. S. 308(5728): 1582–1583.

Reddy, S.P., James, S., Sewpaul, R., Sifunda, S., Ellahebokus, A., Kambaran, N.S. and Omardien, R.G. (2013). Umthente uhlaba usamila: The South African youth risk behaviour survey 2011. Cape Town: South African Medical Research Council.

Rehle, T.M., Hallett, T.B., Shisana, O., Pillay-van Wyk, V., Zuma, K., Carrara, H,. and Jooste, S. (2010). A decline in new HIV infections in South Africa: Estimating HIV incidence from three national HIV surveys in 2002, 2005 and 2008. *PLoS ONE* 5(6): e11094. doi: 10.1371/journal.pone.0011094.

Sabet Sarvestani, A., Bufumbo, L., Geiger, J.D., Sienko, K.H. (2012). Traditional Male Circumcision in Uganda: A Qualitative Focus Group Discussion. Analysis. *PLoS ONE,* 7(10): 45316.

SADC. (2006). *Expert Think Tank Meeting on HIV Prevention in High-prevalence Countries in Southern Africa Report.* Maseru: SADC.

SANAC. (2011a). *National strategic plan on HIV, STIs and TB 2012–2016.* Pretoria: SANAC.

SANAC. (2011b). *End of term review of the NSP 2007–2011: Final report.* Pretoria: SANAC.

Sawers, L. (2013). Measuring and modeling concurrency. *Journal of the International AIDS Society.* 16: 17431.

Sawers, L., and Stillwagon, E. (2010). Concurrent sexual partnerships do not explain the HIV epidemics in Africa: a systematic review of the evidence. *Journal of the International AIDS Society.* 14.34. doi: 10.1186/1758-2652-13-34.

Sathiparsad, R. and Taylor, M. (2006). "Diseases come from girls": Perspectives of male learners in rural KwaZulu-Natal on HIV infection and AIDS. *Journal of Education,* 38: 117–137.

Setswe, G and Zuma, K. (2013). "HIV, AIDS and tuberculosis epidemics in South Africa: Overview and responses," in Udesh Pillay et al. editors, *State of the Nation: South Africa* 2012–2013. Cape Town: HSRC Press: 485–516.

Shelton, J. D. (2009) Why multiple sex partners? *Lancet,* 374: 367–3690.

Shisana, O., Hall, E., Maluleke, K.R., Stoker, D.J., Schwabe, C., Colvin, M., Chauveau, J., Gumede, T., Fomundam, H., Rehle, T. and Gisselquist, D. (2003). *Survey of Health Personnel, Ambulatory and Hospitalised Patients and Health Facilities, 2002*. Pretoria: National Department of Health.

Shisana, O., Labadarios, D., Rehle, T., Simbayi, L., Zuma, K., Dhansay, A., Reddy, P., Parker, W., Hoosain, E., Naidoo, P., Hongoro, C., Mchiza, Z., Steyn, N.P., Dwane, N., Makoae, M., Maluleke, T., Ramlagan, S., Zungu, N., Evans, M.G., Jacobs, L., Faber, M., and SANHANES-1 Team (2013) *South African National Health and Nutrition Examination Survey (SANHANES-1)*. Cape Town: HSRC Press.

Shisana, O., Mehtar, S., Mosala, T., Zungu-Dirwayi, M., Rehle, T., Dana, P., Colvin, M., Parker, W., Connolly, C., Dunbar, R. and Gxamza, F. (2005). *HIV Risk exposure in children: A survey of 2–9 year-olds served by public health facilities in the Free State, South Africa*. Cape Town: HSRC Press.

Shisana, O., Peltzer, K., Zungu-Dirwayi, N., and Louw, J. (Eds.). (2005). *The health of our educators: A focus on HIV/AIDS in South African public schools*. Cape Town: HSRC Press.

Shisana, O., Rice, K., Zungu, N. and Zuma, K. (2010).Gender and Poverty in South Africa in the Era of HIV/AIDS: A Quantitative Survey. *Journal of Females's Health*. 19 (1): 39–46.

Shisana, O., Rehle, T., Simbayi, L.C., Zuma, K., Jooste, S., Pillay-van Wyk, V., Mbelle. N., Van Zyl, J., Parker, W., Zungu, N.P., Pezi, S. and the SABSSM III Implementation Team (2009). *South African national HIV prevalence. incidence and communication survey 2008: A turning tide among teenagers?* Cape Town: HSRC Press.

Shisana, O., Rehle, T., Simbayi, L.C., Parker, W., Zuma, K., Bhana, A., Connolly, C., Jooste, S. and Pillay, V. (2005). *South African national HIV prevalence, incidence, behaviour and communication survey*. Cape Town: HSRC Press.

Shisana, O. Zungu-Dirwayi, N., Toefy, Y., Simbayi, L.C., Malik, S. and Zuma, K. (2004). Marital status and the risk of HIV infection in South Africa. *South African Medical Journal*, 94(7): 537–543.

Shisana. O. and Simbayi. L. (2002). Nelson Mandela/HSRC Survey of HIV/AIDS: *South African National HIV Prevalence. Behavioural Risks and Mass Media Household Survey 2002*. Cape Town: Human Sciences Research Council (HSRC) Press.

Statistics South Africa. (2013). *Mid-year population estimates* http://beta2.statssa.gov.za/publications/P0302/P03022013.pdf

Schwartländer, B., Stover, J., Hallett,T., Atun, R., Avila, C., Gouws, E., Bartos, M., Ghys, P.D., Opuni, M., Barr, D., Alsallaq, R., Bollinger, L., de Freitas, M., Garnett, G., Holmes, C., Legins, K., Pillay,Y., Stanciole, A.E., McClure, C., Hirnschall, G., Laga, M., Padian, N., on behalf of the Investment Framework Survey Group (2011). Towards an improved investment approach for an effective response to HIV/AIDS. *Lancet,* 377: 2031–2041.

Tanser, F., Bärnighausen, T., Grapsa, E., Zaidi, J., and Newell, M. L. (2013). High coverage of ART associated with decline in risk of HIV acquisition in rural KwaZulu-Natal, South Africa. *Science*, 339: 966–971.

Tanser, F., Bärnighausen, T., Hund, L., Garnett, G.P., McGrath, N. and Newell, M.L.(2011). Effect of concurrent sexual partnerships on rate of new HIV infections in a high-prevalence, rural South African population: a cohort survey. *Lancet,* 378(9787): 247–55.

Tlou, E.R. (2005). *The effectiveness of a HIV/AIDS health promotion approach derived from the Health Belief Model*. Stellenbosch University: South Africa http://scholar.sun.ac.za

UNAIDS. (2008). *Report on the global AIDS epidemic*. Geneva. UNAIDS.

UNAIDS. (2010). Combination *HIV Prevention: Tailoring and Coordinating Biomedical, Behavioural and Structural Strategies to Reduce New HIV Infections, A UNAIDS Discussion Paper*. Geneva: UNAIDS).

UNAIDS (2011). Issues Brief. UNAIDS: Geneva.

UNAIDS. (2012a). *UNAIDS Report on the global AIDS epidemic 2012*. Geneva: UNAIDS.

UNAIDS. (2012b). *Millenium Development goals*. Geneva: Switzerland.

UNAIDS. (2013a). *UNAIDS Report on the global AIDS epidemic 2013*. Geneva: UNAIDS.

UNAIDS. (2013b). *2013 Regional Report – Getting to zero: HIV in Eastern and Southern Africa*. UNAIDS: Geneva.

UNAIDS (2013c). *Combination Prevention in Eastern and Southern Africa*. Retrieved 2013. from www.unaidsrstesa.org/thematic areas-HIV prevention.

UNAIDS. (2013d). *Global AIDS response progress reporting 2013: construction of core indicators for monitoring the 2011 UN Political Declaration of HIV/AIDS*. Geneva: UNAIDS.

UNAIDS/WHO Working Group on Global HIV/AIDS and STI Surveillance. (2000). *Guidelines for second generation HIV surveillance: the next decade*. Geneva: WHO/ UNAIDS.

UNAIDS/WHO Working Group on Global HIV/AIDS and STI Surveillance. (2013). *Surveillance of the HIV/AIDS epidemic: a comprehensive package*. Geneva: WHO/ UNAIDS.

United Nations Children's Fund (UNICEF). (2013). *Towards an AIDS-Free Generation – Children and AIDS: Sixth Stocktaking Report. 2013*. New York: UNICEF.

Van Loggerenberg, F. et al. (2012. HIV) prevention in high-risk women in South Africa: condom use and the need for change. *PLoS ONE*. 7(2). e30669. doi:10.1371/journal. pone.0030669.

Van Rooyen, H., McGrath, N., Chirowodza, A., Joseph, P., Fiamma, A., Gray, G., Richter. L. and Coates. T. (2013). Mobile VCT: Reaching Men and Young People in Urban and Rural South African Pilot Studies (NIMH Project Accept, HPTN 043). *AIDS and Behavior*. 17(9): 2946–2953.

Weiss, H.A., Hankins, C.A,. and Dickson, K. (2009). Male circumcision and risk of HIV infection in females: A systematic review and meta-analysis. *The Lancet Infectious Diseases*. 9: 669–677.

Wand, H. and Ramjee, G. (2012). The relationship between age of coital debut and HIV seroprevalence among women in Durban, South Africa: a cohort survey. *BMJ Open*, 2:e000285. Doi:10.1136/bmjopen-2011–000285.

Wawer, M.J, Makumbi, F., Kigozi, G., Serwadda. D., Watya. S., Nalugoda. F., Buwembo. D., Ssempijja. V., Kiwanuka. N., Moulton. L.H., Sewankambo. N.K., Reynolds. S.J., Quinn. T.C., Opendi. P., Iga. B., Ridzon. R., Laeyendecker. O. and Gray. R.H. (2007). Circumcision in HIV-infected men and its effect on HIV transmission to female partners in Rakai, Uganda: a randomised controlled trial. *The Lancet*, 374: 229–237.

WHO/UNAIDS. (2013). *Technical Update on HIV incidence assays for surveillance and epidemic monitoring*. Geneva: WHO/UNAIDS.

WHO Technical Working Group on HIV Incidence Assays. (2011). *When and how to use assays for recent infection to estimate HIV incidence at a population level.* Geneva: WHO/UNAIDS.

Zuch, M., and Lurie, M. (2012). 'A virus and nothing else': the effect of ART on HIV-related stigma in rural South Africa. *AIDS and Behaviour,*16(3): 564–570.

Zuma, K., Setswe, G., Ketye, T., Mzolo, T., Rehle, T., and Mbelle, N. (2010). Age at sexual debut: a determinant of multiple partnership among South African youth. *African Journal of Reproductive Health,* 14(2): 47–54.

Appendix 1: Assessment of the validity of HIV-prevalence estimates, South Africa 2012

The estimation of the HIV prevalence takes into account the complexity of the complex design of the sample by using the Stata survey command and produces statistics on standard error, coefficient of relative variation, design effect and standard error of complex sampling.

These are defined by Rosier, 2000 as follows:

$$\textbf{deff} = \frac{\textbf{(standard error of sampling for complex sample)}^2}{\textbf{(standard error of sampling for srs)}^2}$$

where srs is simple random sampling

$$\textbf{deft} = \frac{\textbf{(standard error of sampling for complex sample)}}{\textbf{(standard error of sampling for srs)}}$$

HIV prevalence among participants age 0 years and older. Socio-demographic characteristics. coefficient of variation,and the design effect based on StatsSA 2012 Mid-year estimates

	Eligible	Tested	HIV response	HIV+ (%)	Standard Error		CV	DEFT	DEFF
					SRS	COMPLEX			
Age group (Years) Variable									
0–14	10,191	7,154	70.2%	2.5	0.2	0.3	0.12	1.5	2.3
15–24	8,221	5,890	71.6%	7.1	0.3	0.5	0.07	1.7	2.8
25–49	13,768	8,830	64.1%	25.2	0.4	1	0.04	2.5	6.3
50+	8,758	5,986	68.3%	7.6	0.3	0.6	0.08	2.0	4.0
age25	22,526	14,816	65.8%	19.9	0.3	0.8	0.04	2.7	7.1
age49	21,989	14,720	66.9%	18.8	0.3	0.7	0.04	2.3	5.4
Sex									
Male	20,089	12,896	64.2%	9.9	0.2	0.5	0.05	2.5	6.3
Female	22,457	15,794	70.3%	14.4	0.3	0.6	0.04	2.0	4.0
Race									
Black African	25,402	18,629	73.3%	15	0.3	0.5	0.03	1.7	2.8
White	4,033	1,733	43.0%	0.3	0.2	0.2	0.67	1.0	1.0
Coloured	8,079	5,625	69.6%	3.1	0.2	0.5	0.16	2.5	6.3
Indian/Asian	4,859	2,626	54.0%	0.8	0.2	0.2	0.25	1.0	1.0
Other	72	46	63.9%	11.8	5	6.9	0.58	1.4	1.9
Locality type									
Urban formal	24,844	14,821	59.7%	10.1	0.2	0.7	0.07	3.5	12.3
Urban informal	4,582	3,329	72.7%	19.9	0.6	1.4	0.07	2.3	5.4
Rural informal	9,752	7,801	80.0%	13.4	0.4	0.6	0.04	1.5	2.3
Rural formal	3,771	3,046	80.8%	10.4	0.6	1.8	0.17	3.0	9.0

	Eligible	Tested	HIV response	HIV+ (%)	Standard Error		CV	DEFT	DEFF
					SRS	COMPLEX			
Province									
Western Cape	5,269	3,372	64.0%	5	0.4	0.9	0.18	2.3	5.1
Eastern Cape	5,410	4,102	75.8%	11.6	0.4	0.9	0.08	2.3	5.1
Northern Cape	3,282	2,381	72.5%	7.4	0.5	1.9	0.26	3.8	14.4
Free State	3,079	2,098	68.1%	14	0.7	1.7	0.12	2.4	5.9
KwaZulu-Natal	9,648	7,052	73.1%	16.9	0.4	0.9	0.05	2.3	5.1
North West	3,044	2,038	67.0%	13.3	0.7	1	0.08	1.4	2.0
Gauteng	6,238	3,007	48.2%	12.4	0.6	1.2	0.10	2.0	4.0
Mpumalanga	3,147	2,274	72.3%	14.1	0.7	1.3	0.09	1.9	3.4
Limpopo	3,833	2,673	69.7%	9.2	0.5	1.3	0.14	2.6	6.8
Total	**42,950**	**28,997**	**67.5%**	**12.2**	**0.2**	**0.4**	**0.032787**	**2.0**	**4.0**

Appendix 2: Performance on UNGASS Indicators

The table below presents the core UNGASS indicators. The shaded rows represent indicators which could be calculated in the 2012 survey. The results and the methods of measurement used for the calculations are listed below the table.

CORE Indicators for the Implementation of the Declaration of Commitment on HIV and AIDS

Indicators	
General population	
1.1	Percentage of young women and men aged 15–24 who correctly identify ways of preventing the sexual transmission of HIV and who reject major misconceptions about HIV transmission
1.2	Percentage of young women and men aged 15–24 who have had sexual intercourse before the age of 15
1.3	Percentage of adults aged 15–49 who have had sexual intercourse with more than one partner in the past 12 months
1.4	Percentage of adults aged 15–49 who had more than one sexual partner in the past 12 months who report the use of a condom during their last intercourse
1.5	Percentage of women and men aged 15–49 who received an HIV test in the past 12 months and know their results
1.6	Percentage of young people aged 15–24 who are living with HIV
Sex workers	
1.7	Percentage of sex workers reached with HIV-prevention programmes
1.8	Percentage of sex workers reporting the use of a condom with their most recent client
1.9	Percentage of sex workers who have received an HIV test in the past 12 months and know their results
1.10	Percentage of sex workers who are living with HIV
Men who have sex with men	
1.11	Percentage of men who have sex with men reached with HIV-prevention programmes
1.12	Percentage of men reporting the use of a condom the last time they had anal sex with a male partner
1.13	Percentage of men who have sex with men that have received an HIV test in the past 12 months and know their results
1.14	Percentage of men who have sex with men who are living with HIV
Injection drug users	
2.1	Number of syringes distributed per person who injects drugs per year by needle and syringe programmes
2.2	Percentage of people who inject drugs who report the use of a condom at last sexual intercourse
2.3	Percentage of people who inject drugs who reported using sterile injecting equipment the last time they injected
2.4	Percentage of people who inject drugs that have received an HIV test in the past 12 months and know their results
2.5	Percentage of people who inject drugs who are living with HIV

Indicators	
HIV infections among children	
3.1	Percentage of HIV-positive pregnant women who receive antiretrovirals to reduce the risk of mother-to-child transmission
3.2	Percentage of infants born to HIV-positive women receiving a virological test for HIV within 2 months of birth
3.3	Mother-to-child transmission of HIV (modelled)
Antiretroviral	
4.1	Percentage of eligible adults and children currently receiving antiretroviral therapy
4.2	Percentage of adults and children with HIV known to be on treatment 12 months after initiation of antiretroviral therapy
Tuberculosis	
5.1	Percentage of estimated HIV-positive incident TB cases that received treatment for both TB and HIV
AIDS spending	
6.1	Domestic and international AIDS spending by categories and financing sources
Sex inequalities	
7.1	Proportion of ever-married or partnered women aged 15–49 who experienced physical or sexual violence from a male intimate partner in the past 12 months. *(All indicators with sex-disaggregated data can be used to measure progress towards target 7)*
Orphans	
10.1	Current school attendance among orphans and non-orphans aged 10–14
10.2	Proportion of the poorest households who received external economic support in the last 3 months

Indicator 1.1: Percentage of young women and men aged 15–24 who both correctly identify ways of preventing the sexual transmission of HIV and who reject major misconceptions about HIV transmission

Although the HSRC's 2012 national household survey did not ask verbatim the same questions as the UNGASS indicator for all three questions, however, the survey did also address the areas related to correct knowledge and/or misconceptions about HIV transmission.

Method of measurement:

- Can a person reduce the risk of getting HIV by using a condom every time he/she has sex?
- Can a person reduce the risk of HIV by having fewer sexual partners?
- Can a healthy-looking person have HIV?
- Can AIDS be cured?
- Can a person get HIV by sharing food with someone who is infected?
- Can HIV be transmitted from a mother to her unborn baby? (Not included in the analysis)

Numerator:

Number of respondents aged 15–24 who gave the correct answer to all six questions

Denominator:

Number of respondents aged 15–24 who gave answers to all six questions

Percentage of young women and men aged 15–24 who both correctly identify ways of preventing the sexual transmission of HIV and who reject major misconceptions about HIV transmission

All 15–24	Females	Males	15–19 years	20–24 years
24.2	25.3	23.2	23.7	24.7

Indicator 1.2: Percentage of women and men aged 15–24 who have had sexual intercourse before the age of 15

Method of measurement:

- Sexual behaviour: virgins, abstainers or sexually activity in the last 12 months.
- How old were you when you had sex for the first time?

Numerator:

Number of respondents aged 15–24 who report the age which they first have sexual intercourse as under 15 years.

Denominator:

Number of all respondents aged 15–24 years who reported ever having sex

Percentage of women and men aged 15–24 who have had sexual intercourse before the age of 15, South Africa 2012

All 15–24 years	Females	Males
10.7	5.0	16.7

Indicator 1.3: Percentage women and men aged 15–49 who have had sexual intercourse with more than one partner in the last 12 months

Method of measurement:

How many sexual partners did you have for the past 12 months?

Numerator:

Number of respondents (aged 15–49) who report having had more than one sexual partner in the past 12 months

Denominator:

Number of all respondents aged 15–49 years who reported sexual activity in the past 12 months

Percentage women and men aged 15–49 who have had sexual intercourse with more than one partner in the last 12 months, South Africa 2012

All 15–49 years	Females	Males	15–19 years	20–24 years	25–49 years
14.1	5.1	23.1	22.4	22.4	11.2

Indicator 1.4: Percentage women and men aged 15–49 who had more than one partner in the last 12 months reporting the use of a condom during their last sexual intercourse

Method of measurement:

- How many sexual partners did you have for the past 12 months?
- Did you use a condom the last time you had sex?

Numerator:

Number of respondents (aged 15–49) who report having had more than one sexual partner in the past 12 months who also report that a condom was used the last time they had sex.

Denominator:

Number of respondents (aged 15–49) who report having had more than one sexual partner in the last 12 months

Percentage women and men aged 15–49 who had more than one partner in the last 12 months reporting the use of a condom during their last sexual intercourse, South Africa 2012

All 15–49 years	Females	Males	15–19 years	20–24 years	25–49 years
57.1	49.7	58.7	69.8	62	52.2

Indicator 1.5: Percentage of females and men aged 15–49 who received an HIV test in the last 12 months and who know their results

Method of measurement

- Have you ever had an HIV test?
- How long ago did you have your most recent HIV test?
- Have you been told/informed of the result of your most recent test?

Numerator:

Number of respondents aged 15–49 who have been tested for HIV during the last 12 months and who know their status

Denominator:

All respondents aged 15–49

Percentage of women and men aged 15–49 who received an HIV test in the last 12 months and who know their results, South Africa 2012

Total	Females	Males	15–19 years	20–24 years	25–49 years
45.0	52.6	37.4	26.7	48.4	49.2

Indicator 1.6: Percentage of young people who are HIV infected

The 2012 HSRC household survey did not collect information on whether women were currently attending antenatal clinics. Our survey does, however, report HIV prevalence for women and men 15–24 years.

Numerator:

All respondents 15–24 years who tested HIV positive

Denominator:

All respondents 15–24 years were tested for HIV

HIV prevalence among youth aged 15–24 years. South Africa 2008

All 15 -24 years	Females	Males	15–19 years	20–24 years
7.1	11.4	2.9	3.2	11.2

1.13 Percentage of men who have sex with men that have received an HIV test in the past 12 months and know their results

Numerator

Number of men who have sex with men who have been tested for HIV during the last 12 months and who know their results

Denominator

Number of men who have sex with men responding to these questions

Disaggregation: Age (<25/25+)

All MSM	15–24	25+
31.7	52.4	46.8

1.14 Percentage of men who have sex with men who are living with HIV

Numerator

Number of MSM who test positive for HIV

Denominator

Number of MSM tested for HIV

Calculation: $\frac{\text{Numerator}}{\text{Denominator}}$

Disaggregation: Age (<25/25+)

All MSM	15–24	25+
8.6	6.4	9.4

Indicator 2.2: Percentage of people who inject drugs who report the use of a condom at last sexual intercourse

Method of Measurement:

Behavioural surveillance or other special surveys people who inject drugs are asked the following sequence of questions:

1. Have you injected drugs at any time in the last month?
2. If yes: Have you had sexual intercourse in the last month?
3. If yes in answer to both 1 and 2: Did you use a condom when you last had sexual intercourse?

Numerator

Number of people who inject drugs who reported that a condom was used the last time they had sex

Denominator

Number of people who inject drugs who report having injected drugs and having had sexual intercourse in the last month

Disaggregation: Sex

- Age (<25/25+)

All IDU	15–24	25+
38.9	56.6	32.2

Indicator 2.4: Percentage of people who inject drugs that have received an HIV test in the past 12 months and know their results

Numerator

Number of people who inject drugs respondents who have been tested for HIV during the last 12 months and who know their results

Denominator

Number of people who inject drugs responding to these questions

Disaggregation: Sex

- Age (<25/25+)

All IDU	15–24	25+
34.6	47.2	29.7

Indicator 2.5: Percentage of people who inject drugs who are living with HIV

Numerator

Number of people who inject drugs who test positive for HIV

Denominator

Number of people who inject drugs tested for HIV

Disaggregation: Sex

- Age (<25/25+)

All IDU	15–24	25+
16.2	1.9	22.9

Indicator 7.1: Proportion of ever-married or partnered females aged 15–49 who experienced physical or sexual violence from a male intimate partner in the past 12 months

Numerator

Females aged 15–49 who currently have or ever had an intimate partner who report experiencing physical or sexual violence by at least one of these partners in the past 12 months

Denominator

Total women surveyed aged 15–49 who currently have or had an intimate partner

Disaggregation: Age (15–19, 20–24 and 25–49)

All women 15–49	15–19	20–24	25–49
5.1	7.7	7.3	4.4

Indicator 10.1: Current school attendance among orphans and among non-orphans aged 10–14

Method of measurement

For selected respondents aged 10 -14 living in the household the following questions were answered:

- Is your mother alive?
- Is your father alive?
- Do you currently attend school?

Numerator:

Number of respondents aged 10–14 who have lost both parents or their father or mother and who attend school.

Denominator:

All respondents aged 10–14 who have lost both parents or their father or mother.

Current school attendance among orphans, by type of orphan and among non-orphans aged 10–14

	All 10–14 years	Males	Females
Maternal	98.3	99.8	96.8
Paternal	99.3	98.8	99.8
Double orphan	99.5	100.0	99.0

Current school attendance among orphans and among non-orphans aged 10–14

	All 10–14 years	Males	Females
Orphans	99.1	99.3	98.8
Non-orphans	99.3	98.9	99.7

Appendix 3: PMTCT programme impact indicators

WHO and UNICEF have recently proposed the following four indicators to measure the impact of PMTCT programmes (WHO & UNICEF 2013) *Considerations for measuring the impact of PMTCT programmes using population-based surveys in selected high HIV prevalence countries*. Geneva: WHO):

Indicator 1: HIV prevalence among children 1–23 months (by age groups 1–11 months and 12–23 months)

Numerator

HIV-positive (PCR confirmed) children 1–23 months (and by age group)

Denominator

All children 1–23 months (and by age group)

-11 months	2.4	1.1–5.2
12–23 months	1.4	0.5–3.8

Indicator 2: HIV prevalence among HIV-exposed children 1–23 months (born to HIV-positive mothers)

Numerator

HIV-positive (PCR confirmed) children 1–23 months

Denominator

Living children born in the last two years to women who are currently HIV positive

HIV prevalence	6.1 (3.2–11.3)

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Research consortium

South African National HIV Prevalence, Incidence and Behaviour Survey, 2012

Currently 6.4 million people in South Africa live with HIV, this figure represents a quarter of the burden of HIV infections in sub-Saharan Africa and 18 per cent of the global burden. With this view, the South African National HIV Prevalence, Incidence and Behaviour Survey, 2012 is a crucial report for government, policy makers and other stakeholders as they work towards reducing the HIV epidemic in South Africa.

This 2012 HIV survey is the fourth in the series of national population-based surveys. The survey was conducted from December 2011 to November 2012. As with previous surveys, it was designed to investigate the overall HIV prevalence, incidence and behaviour as well as social determinants that drive the epidemic. It also served to collect data to help monitor the National Strategic Plan 2007–2011 and set the baseline for the 2012–2016 NSP. This report is a must-read and essential for researchers who want to understand the HIV dynamics in South Africa.

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