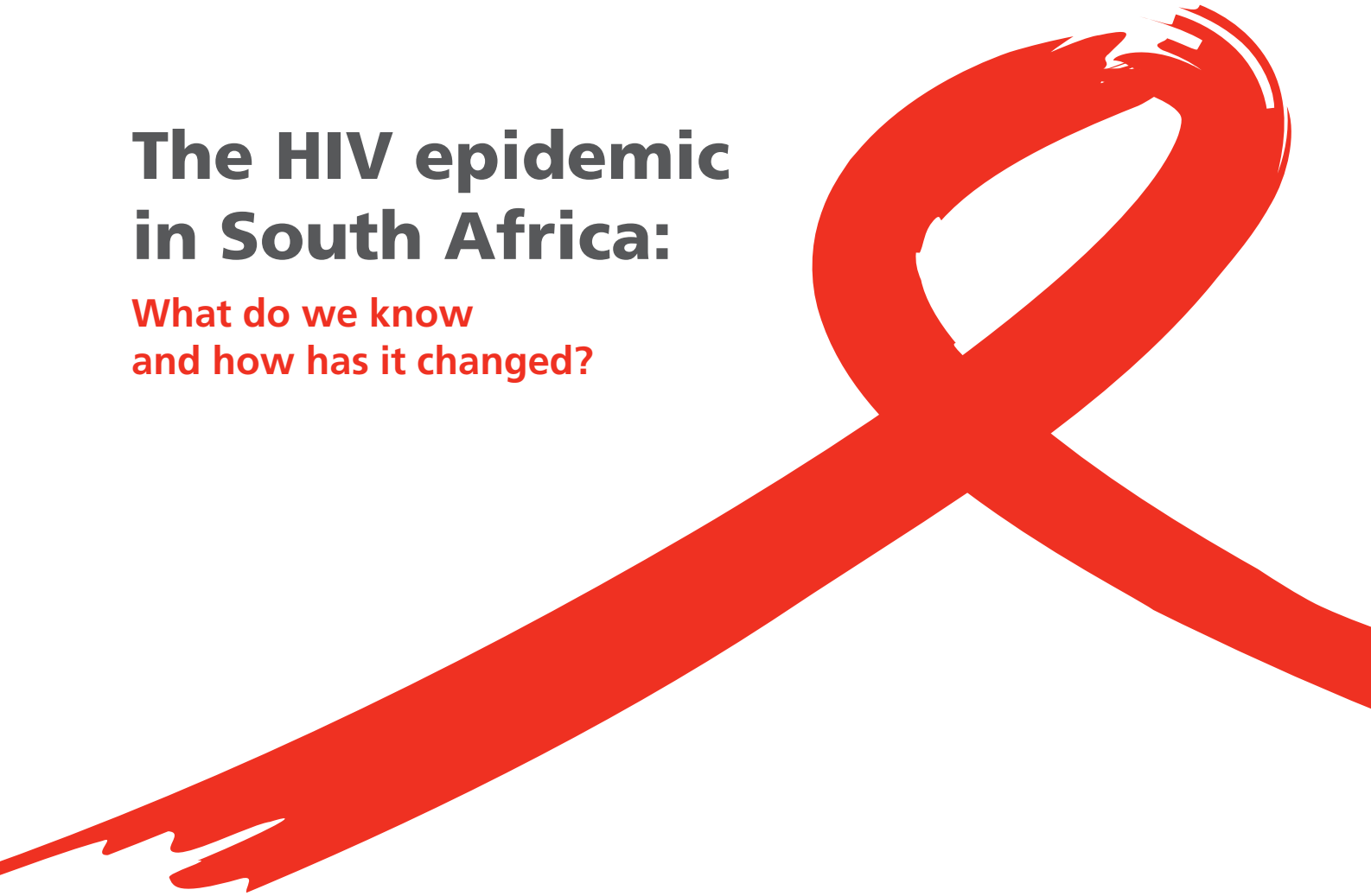
The HIV epidemic in South Africa:

What do we know and how has it changed?



South African National AIDS Council

Our Actions Count

The HIV epidemic in South Africa:

What do we know and how has it changed?

April 2011

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Table of Contents

References

Annexes

List of Figures

List of Tables

Acknowledgements

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Acronyms

ACDIS	Africa Centre Demographic Information System
AFM	Age at First Marriage
AFS	Age at First Sex
AIDS	Acquired Immunodeficiency Syndrome
ANC	Antenatal care
aOR	Adjusted Odds Ratio
ART	Antiretroviral Therapy
ARV	Antiretroviral
ASSA	Actuarial Society of South Africa
BCC	Behavioural Change Communication
CAPS	Cape Area Panel Study
CBO	Community Based Organisation
95%CI	95% Confidence Interval
CSP	Concurrent Sexual Partnership
CT	Counselling and Testing
DHS	Demographic and Health Survey
DOH	Department of Health
EC	Eastern Cape (province)
EPP	Estimation and Projection Package
ERPS	Epidemic, Response and Policy Synthesis
FP	Family Planning
FS	Free State (province)
FSW	Female Sex Worker
GFATM	Global Fund to Fight AIDS, Tuberculosis and Malaria
GHAP	Global HIV and AIDS Program of the World Bank
GoSA	Government of the Republic of South Africa
GP	Gauteng Province
HAART	Highly Active Antiretroviral therapy
HDA	Health & Development Africa
HEAIDS	Higher Education HIV/AIDS Programme
HEI	Higher Education Institution
HIV	Human Immunodeficiency Virus
HSRC	Human Sciences Research Council
HR	Hazard Ratio
IDU	Injecting Drug Use/User
IMAGE	Intervention with Microfinance for AIDS & Gender Equity
IPV	Intimate Partner Violence
JEMS	Johannesburg/ eThekwini Men's Study
JHHESA	Johns Hopkins Health and Education in South Africa
KYE	Know Your Epidemic
KYR	Know Your Response
KZN	KwaZulu-Natal (province)
LP	Limpopo Province
M&E	Monitoring & Evaluation
MARP	Most-at-risk Population
MC	Male Circumcision
MCP	Multiple or Concurrent Partner
MOE	Ministry of Education
MP	Mpumalanga Province
MSM	Men having Sex with Men
MSP	Multiple Sexual Partnership
MTCT	Mother-to-Child Transmission
MTR	Mid-Term Review
NC	Northern Cape (province)
NCS	National Communication Survey
NGO	Non-Government Organisation
NSP	National HIV and AIDS Strategic Plan
NW	North-West (province)
OR	Odds Ratio
PAR	Partner Acquisition Rate
PEP	Post Exposure Prophylaxis
PLHIV	Persons Living with HIV
PMTCT	Prevention of Mother to Child Transmission
PSA	Prostate Specific Antigen
PwP	Prevention with Positives
RST-ESA	UNAIDS Regional Support Team for East and Southern Africa
SANAC	South Africa National AIDS Council
SANBS	South African National Blood Service
SCC	Social Change Communication
SES	Socio-Economic Status
SSA	Statistics South Africa
STD	Sexually Transmitted Disease
STI	Sexually Transmitted Infection
SW	Sex worker
TB	Tuberculosis
UAI	Unprotected Anal Intercourse
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNGASS	United Nations General Assembly Special Session on HIV/AIDS
VCT	Voluntary Counselling and Testing
WB	World Bank
WC	Western Cape (province)
WHO	World Health Organization
WPTBS	Western Province Blood Transfusion Service

Executive Summary

This review of the HIV epidemic in South Africa is one of four component reports of an assessment of the HIV epidemic and prevention response in South Africa. The assessment was commissioned by the Government of South Africa and realized jointly by several partners and contractors, under the coordination of the UNAIDS secretariat in South Africa, with technical support from the World Bank and others. The primary objective of this component, the review of the HIV epidemic, is **to contribute to ongoing efforts to better understand the HIV epidemic and help develop the best-possible approach to HIV prevention**.

Specifically, the HIV epidemic review aims to:

1) Describe the level of heterogeneity of the South African HIV epidemic and comment on any sub-epidemics that can be delineated within the national epidemic
2) Identify the populations at greatest risk of HIV infection based on analysis of the distribution of new infections
3) Establish the factors driving the HIV epidemic through an analysis of national and provincial behavioural, biological, socio-economic and demographic data
4) Provide an epidemiologic evidence base for formulating evidence-informed, better targeted, more effective prevention strategies and actions.

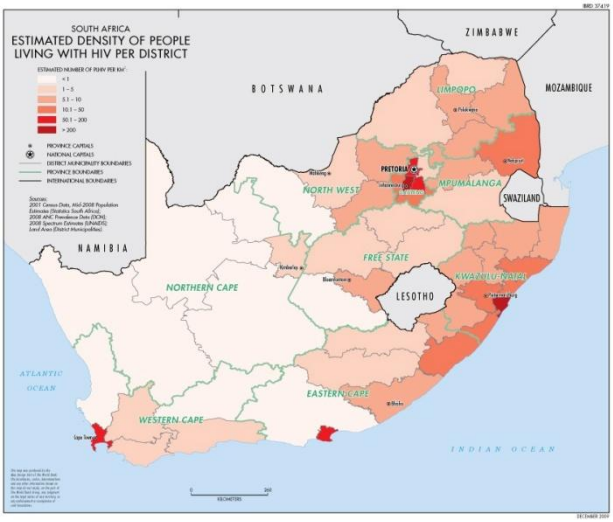
The assessment was conducted through a desk review of existing published and unpublished literature. Secondary bivariate and multivariate data analysis was carried out on all recent population-based HIV and sexual behaviour data – the three national bio-behavioural surveys of 2002, 2005 and 2008 by the Human Sciences Research Council (HSRC), and the two national communication surveys (NCS) of 2006 and 2009 by Health & Development Africa and Johns Hopkins Health and Education in South Africa. Over 700 relevant reports and publications were reviewed, catalogued, and data extracted on South Africa's HIV epidemic.

Levels and trends in HIV prevalence

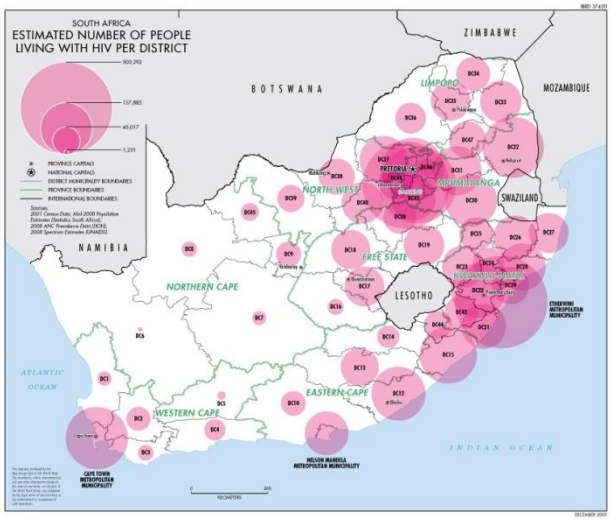
Data from both population-based sero-surveys and sentinel surveillance of pregnant women suggest that the HIV epidemic has plateaued in South Africa. In adults aged 15-49 years, the three HSRC surveys estimated HIV prevalence at 15.6% (2002), 16.2% (2005) and 16.9% (2008, increase not statistically significant). In antenatal care (ANC) clients, HIV prevalence has gradually levelled off just below 30%, after steeply increasing for more than 10 years from 7.6% in 1994 to 29.5% in 2004. The ANC prevalence estimates for 2006, 2007, 2008 and 2009 are very similar with 29 of 100 sampled ANC clients HIV-positive (the 2009 result was 29.4% with a 95% confidence interval of 28.7% - 30.2%). Although **the percentage of HIV-positive people - HIV prevalence - has plateaued, the *absolute number* of people living with HIV (PLHIV) is on a steep increase** of approximately 100,000 additional PLHIV each year. The estimated number of PLHIV in 2009 was 5.63 million (Spectrum, in line with the ASSA2008 model estimate of 5.5 million for 2010, ASSA 2011). There is a **substantial downturn in AIDS related mortality** in recent years, with annual number of AIDS deaths reduced from about 257,000 in 2005 to about 194,000 in 2010 (ASSA, 2011). This is **largely due to the expansion of the ART programme**.

There is tremendous heterogeneity in provincial HIV prevalence levels, ranging from 3.8% in Western Cape to 15.8% in KwaZulu-Natal in 2008. Compared to men in Western Cape, men in KwaZulu-Natal, Mpumalanga and North West were significantly more likely to be HIV-positive (2008, multivariate analysis). Women in Mpumalanga and KwaZulu-Natal were also significantly more likely to be HIV-positive. Provincial HIV prevalence levels appear to have stabilised in recent years, which is in line with the trends in national HIV prevalence. **There are even larger differences** in HIV prevalence data from ANC sentinel surveillance **across health districts.** They range from a low of 0% (0/68) in Namakwa/Northern Cape to a high of 46.4% in Uthukela/ KwaZulu-Natal. There is evidence of localised high HIV transmission in areas such as close to national roads.

Maps of South Africa showing estimated density (left) and clustering (right) of people living with HIV



Sources: 2001 census data, mid-2008 population estimates (Statistics SA), 2008 ANC HIV prevalence data (DOH), and 2008 Spectrum estimates (UNAIDS), Land area (District Municipalities)



Sources: 2001 census data, mid-2008 population estimates (Statistics SA), 2008 ANC HIV prevalence data (DOH), 2008 Spectrum estimates (UNAIDS)

Women aged 15 years and above are significantly more likely to be HIV-positive than men. This holds true in all provinces except Northern Cape and North West. HIV prevalence in women showed a significant increase between the 2005 and the 2008 survey from 15.1% to 17.4%, while men's HIV prevalence stayed at 10%. This increase in women is attributed to the effect of antiretrovirals (ARVs). The majority of adult PLHIV (54%) live in just two provinces, KwaZulu-Natal and Gauteng (more than their 44% share of the South African population).

HIV prevalence in young women is much higher than in young men, especially in the 20-24 age group. In 2008, HIV prevalence was over four times higher in women aged 20-24 (21.1% HIV-positive) than in men aged 20-24 years (5.1%). There is **evidence of a downturn in HIV prevalence in youth aged 15-19 years and 20-24 years between 2005 and 2008**. In youth aged 15-24 years, the prevalence drop between the two surveys is 3% for females and 0.8% for males (differences not statistically significant). This downturn is encouraging, and it is corroborated by mathematically derived HIV incidence data for this age group. Overall, ANC-based and female population-based data tell the same story: in young women below 30 years of age, HIV prevalence levels show a downward

trend, whereas in older women, HIV prevalence is increasing.

Race is an important epidemiological variable because it reflects socio-economic contexts that influence risk of HIV infection. The African (black) population of South Africa has the highest level of HIV infection. Coloured people are 3.4 times less likely to be HIV-positive than Africans, Indians 16.2 times and whites 7.8 times, based on the available data from the 2008 survey. HIV prevalence levels in the African population show a small, non-significant upward trend over the three surveys, and ARV use is again thought to contribute to this. The Cape Area Panel Survey provides evidence that differences in sexual partnership patterns, especially sexual concurrency of both partners at the same time, explain some of the racial differences in HIV/STI transmission.

There is a **trend of increasing age at first marriage** in South Africa, especially in women, leading to long periods of time spent single and sexually active. Secondary data analysis revealed associations between marital status and HIV status. In 2008, married women had lower odds of HIV infection than unmarried women. While married women in their 20s, 30s and 40s had the odds of HIV infection of unmarried teenage girls, unmarried women in these older age groups had significantly higher odds of HIV infection. For men, marriage was not important for their likelihood of being HIV infected.

Similar to marriage, **higher education appeared to have a protective effect against HIV**. Based on HSRC survey data, men and women with tertiary education were significantly less likely to be HIV-positive than those with no school education. Students, as opposed to the unemployed, were also significantly less likely to be HIV-positive. In 2008 in Eastern Cape and KwaZulu-Natal, men with matriculation (graduated from high school) or tertiary education were significantly less likely to be HIV-positive than those with less education.

Low economic status was identified as a risk factor for HIV infection. Deprivation was linked to significantly higher HIV prevalence especially in Africans. Respondents working in the informal sector had overall the highest HIV prevalence among the different employment groups, with almost one third of African informal workers HIV-positive. In women, the greater the lack of money, the more likely they were HIV-positive.

The type of residence area is also associated with the likelihood of being HIV infected. Several studies have found that **urban informal areas are linked to highest HIV prevalence** levels, compared to urban formal, rural informal and rural formal areas. In 2008, women living in urban informal areas were 57% more likely to be HIV infected than those in urban formal areas. In urban formal areas, HIV prevalence has fallen since 2002 by about 3% (not statistically significant). In contrast, in rural areas HIV prevalence increased by over 5% between 2002 and 2008 (increase statistically significant for rural informal areas).

Male circumcision (MC) **has been shown** in the South African MC efficacy trial at Orange Farm near Johannesburg **to reduce men's risk of getting HIV infected by 61%.** In the 2005 HSRC survey, men who reported having been circumcised before first sex were significantly less likely to be HIV-positive. In South Africa, MC is mainly performed on young people as part of initiation rites of passage into manhood, primarily among the Venda, Pedi, Ndebele and Tsonga, as well as the Xhosa and South Sotho. The procedure often takes place after sexual debut. Neonatal MC is mainly a custom among Jewish and Muslim populations. The prevalence of reported MC varies by province with highest levels in Free State and Western Cape (71% and 68%, respectively), and lowest levels in Gauteng (25%)

and KwaZulu-Natal (27%). Recent data show that a large proportion of South African men would consider undergoing the procedure and men and women are supportive of MC.

Estimations of HIV incidence

South Africa has considerable experience in the use of a variety of methods to estimate HIV incidence (new HIV infections). HIV incidence is a key prevention impact indicator in the national HIV response. The NSP 2007-2011's main prevention goal is to reduce the rate of new HIV infections by 50% by 2011 (this would mean that the HIV incidence – the percent of the population who become newly infected each year -- would have fallen from 1.3% in 2007 to 0.65% in 2011).

Incidence estimation in young people aged 15-20 suggest that although youth in their teens prevented infections more effectively in 2008 than in 2002, they still acquire new HIV infections rapidly as they get into their twenties. One incidence estimation method suggested that HIV incidence may have declined by 60% in young women aged 15-24 between the inter-survey periods 2002/05 and 2005/08. However, **the country seems far off track from achieving the NSP prevention goal**. In summary, the different methods to estimate HIV incidence suggest **annual incidence of 2.0%-2.4% in the first half of the 2000s and about 1.2%-1.7% in the second half of the 2000s**.

There is important local and regional evidence from Uganda, Malawi and Zimbabwe that HIV **incidence is particularly high in pregnancy and post-partum**. Recent evidence from sero-discordant couples in the Partners in Prevention HSV/HIV Transmission Study, in which South Africa participates, suggests that the risk of men being infected by HIV doubles when their partners are pregnant.

From the Africa Centre HIV cohort in KwaZulu-Natal, very high life-time risks of HIV infection have been reported: life time risk at age 55 is estimated at 78% for males, and 75% for females. Compared to other HIV monitoring sites in sub-Saharan Africa, HIV incidence in the Africa Centre research area is exceptionally high. This is corroborated by recent results from the tonofovir trial which reported an HIV incidence rate in sexually active women in KwaZulu Natal of 9.1/100 person-years (placebo group).

Modes of HIV transmission

The South African HIV epidemic is clearly **driven by heterosexual transmission**, which is typical for generalized and hyperendemic epidemics. Research is ongoing on the transmission probability of HIV between heterosexual partners. Two estimations both reported very high estimated per-partnership probability of HIV transmission, nearing 1.0 for young women.

Same-sex transmission between men having sex with men (MSM) has been addressed in research studies in several South African cities. Serological data confirm MSM as a high risk population. In a survey among young men in the Eastern Cape, men with same-sex experience were 3.6 times more likely to be HIV-positive. There is a high frequency of self-reported unprotected anal intercourse and other risk behaviours among MSM, and there is evidence of some sero-sorting when partners are acquired i.e. selection of sexual partners with the same HIV status. Overall, there is evidence that MSM-related HIV transmission contributes to current HIV incidence.

While it seems that South Africa does not have a major **injecting drug use** (IDU) problem at present, it has a large and growing problem with crack cocaine, especially among sex workers (who in turn inject and smoke heroin as a come-down drug for crack cocaine). According to the 2005 HSRC survey 1.6% of adults said they had injected drugs in the last 3 months. Only 0.1% of respondents indicated that they had shared injecting needles. In the 2008 International Rapid Assessment and Response Evaluation, HIV prevalence in a small sample of 35 IDUs was 20%, and HIV prevalence was highest among drug-using sex workers and MSM. Therefore, IDU seems a minor contributor to current HIV transmission and is interlinked with other risk contexts, i.e. commercial sex and MSM.

Data on the role of **medical injections and infection control** in health care settings are limited. The 2005 HIV exposure study among children found that children who had received a medical injection in the past 12 months were slightly more likely to be HIV-positive than those who had not had an injection (difference not significant). Some data are available for single, accidental percutaneous injuries with needles or other sharp objects, commonly involving health care workers and laboratory workers. Studies in several hospitals reported that unsafe practices are widespread and the methods of reporting blood exposures inadequate. The 2002 health worker study implemented in several provinces highlighted the need for rigorous infection control practices to protect both health care workers and patients from HIV transmission in health care settings.

Prevention of HIV transmission through **blood and blood products** is under the control of the South African National Blood Service and the Western Province Blood Transfusion Service. Both services have rigorous internal quality assurance measures, and are inspected by the South African Quality Assurance Systems and subjected to other external quality assurance procedures. All (100%) of donated blood units are screened for HIV-1, HIV-2, hepatitis B and C, and syphilis. Since 2005, all donations are screened for HIV-1, hepatitis B and C using nucleic acid amplification technology. HIV transmission through blood transfusions is probably close to zero, unless there are frequent blood transfusions outside the control of the blood services.

There is a body of evidence from biomedical and sociological research and estimation work on **vertical transmission of HIV** from mother to baby, and the effects of prevention of mother-to-child transmission (PMTCT) interventions. It was estimated that in 2009, about 42,700 new infections will happen in children aged 0-14 years, mostly through vertical transmission (this represents 11% of all new infections estimated for South Africa in 2009). In the same year, about 214,000 HIV-positive mothers needed PMTCT services, and about 159,000 children aged 0-14 years needed antiretroviral treatment (ART). A recent study found that MTCT rates were significantly lower in women who became pregnant on ART than in those initiating ART during pregnancy (0.7% versus 5.7%), and that each additional week on ART reduced odds of MTCT by 8%. Vertical transmission can also be reduced by preventing unwanted pregnancies in HIV-positive women. In the 2003 Demographic and Health Survey, 23% of the births in the last five years in South Africa were not wanted at the time they were conceived. The international literature states that preventing unintended pregnancies among HIV-positive women could produce equivalent reductions in infant HIV incidence as ARV prophylaxis during pregnancy.

South African research has also demonstrated the importance of exclusive breastfeeding or safe replacement feeding to reduce the risks of MTCT in infants up to 6 months of age. However, the proportion of infants exclusively breastfed was low in both the 1998 and the 2003 SADHS (only 8% of infants under 6 months were reported to have been exclusively

breastfed). The 2005 HIV exposure study among children found that wet-nursing was risky for the infant – children who had been breastfed by a non-biological mother were 17 times more likely to be HIV infected than children without wet-nursing experience.

Factors in the sexual transmission of HIV

Sexual debut: There is a trend towards earlier sexual debut amongst youth - median age at first sex was 20 years for men and women born before 1950 and 18 years for those born in the 1980s. Sex before 15 years of age increased significantly in Free State, North West and Mpumalanga between 2002 and 2008. Young Africans report higher levels of sexual experience than coloured, Indian and white youth. The Cape Area Panel Study found that girls in lower income households tended to have earlier sexual debut, and that community poverty rates were associated with early sexual debut and higher rates of unprotected sex. In the Africa Centre study area, the most important and highly significant factor protecting females against first sex before the 17th birthday was school attendance.

Secondary abstinence (no sex in last 12 months among those who had ever had sex): Nearly one third of adults reported secondary abstinence, and more than one-fifth of youth aged 15-24 years reported secondary abstinence. The average period of abstinence after child birth was 8.2 months for African women, 3.3 months for coloured women, and 1.9 months for Indian and white women in 2003.

Multiple sexual partners (MSPs): The frequency of reported multiple partners varies by race and is highest in African men. In the 2009 NCS, 16.7% of men and 2.3% of women aged 16-55 years reported two or more partners (among those who had ever had sex). Multiple partner frequency peaks in people in their twenties, but there may be underreporting in older age groups where marriage is more common. Comparing multiple partner data across the five national surveys, there some indication of an increase over time in the proportion of 16-55 year old men who reported MSPs in the past 12 months. HIV prevalence was higher in respondents reporting more sexual partners. Women reporting more than one partner at the time of survey in 2005 were 4.3 times more likely to be HIV-positive ($p=0.0001$). The sexual concurrency analysis of the NCS 2009 data confirmed the relatively higher concurrency prevalence for African men compared to coloured, Indian and white men. Sexual relationships are seen as a path to a number of distinct benefits by both females and males.

Acquisition of new partners: Overall, the rate of partner acquisition was three times higher in men than in women, and highest in men aged 20-24 years (NCS 2009). The rate was highest among those who have no partner, and those who are in their early twenties. African men and women seemed more likely to acquire a new partner than non-Africans. Men and women living in tribal areas were the least likely to acquire a new partner. People who had an HIV test in the 12 months before the survey had higher acquisition rates in the same period. This is because people who get a new partner might be getting tested as they enter the new relationship; alternatively, people who are aware that new partners present an HIV risk may get tested in response to their exposure.

Condom use: Young singles (who are not married or cohabiting) and young people reporting multiple sexual partners are most likely to report using condoms. People above 50 and married people are least likely to report condom use. Young females reporting once-off partners also report low condom use. Regarding short-term trends, overall reported condom use significantly increased between 2002 and 2008, but not among people reporting multiple

sexual partners. PLHIV who knew that they were HIV-positive were significantly more likely to use a condom than PLHIV who did not know their HIV status. Available data indicated that condoms were least likely to be used consistently in partnerships characterised by long term concurrency. In provinces with higher HIV levels, sexually active women are more likely to choose condoms as contraceptives than in provinces with less HIV.

Increased condom use among the youth may have contributed to the recent decline in HIV incidence in this age group (note that this is self-reported condom use data with known problems of validity).

Prevention knowledge and risk perception: Correct knowledge on the prevention of sexual transmission of HIV was lower in 2008 than in 2005 in all age and sex strata except in males aged 50 or above. Correct knowledge on prevention and the rejection of misconceptions about HIV transmission has overall decreased, especially in Limpopo, KwaZulu-Natal, Mpumalanga, and Eastern Cape. A relatively small proportion of the population regard themselves to be at any significant risk for HIV, but significantly more HIV-positive respondents perceived themselves to be at high risk of HIV compared to HIV-negative respondents.

HIV testing behaviour: Testing behaviour varies by province**,** and the three high prevalence provinces KwaZulu-Natal, Mpumalanga and Free State have comparatively fewer people recently tested for HIV. Among adults, a quarter have had an HIV test and received their results.

Age-disparate sexual relationships: An analysis of the reported age gaps between sexual partners suggests that as men get older, the age gap with their partners gets bigger. The HSRC data show that sexual relationships between young girls aged 15-19 years and older men are risky – girls reporting an age-disparate relationship were 72% more likely to be HIV infected than girls with similar-aged partners (HIV prevalence 29.5% vs. 17.2%). In summary, men and women who have partners much younger/older than themselves are more likely to be HIV-positive than people who reported partners of similar age only.

Transactional sex: The exchange of cash, gifts or services for sexual intercourse is closely linked with age-disparate sex. In South African surveys, reported frequencies of transactional sex vary widely; 2 - 52% of females and 4 - 30% of males have reported transactional sex experiences. Research in a number of sub-Saharan African contexts has conclusively demonstrated that exchange of sex for material resources is common practice, and that the vast majority of women who engage in such transactions do not see themselves as sex workers. Transactional sex is part of a cluster of closely related violent and controlling practices by men, and may often be motivated by ideas of sexual conquest as much as sexual desire.

Commercial sex work: About 2% of men reported ever having paid for sex in HSRC's 2005 survey. Having had sex with a sex worker almost tripled men's odds for HIV infection. Three recent bio-surveys in sex workers reported HIV prevalence levels of around 60%, but infection levels in white and coloured SW were reported to be much lower, just below 20%. Sex work, alcohol use and consumption of drugs overlap, and sex workers work in unsafe and dangerous conditions. They suffer violence from clients, their partners and the police, and have difficulties accessing health, social, police, legal and financial services.

Alcohol use: South African data demonstrate that alcohol consumption is associated with

risky sexual behaviour, a higher likelihood of being HIV infected, and poor HIV prevention behaviours. Findings from the South African Community Epidemiology Network on Drug Use demonstrate that acute alcohol intoxication is associated with increased mortality and morbidity in South Africa due to accidents, violence, unsafe sexual practices, and the damaging effects of alcohol to the unborn baby.

Gender roles and norms: Traditionally, in many parts of sub-Saharan Africa, women have played a subordinate role in reproductive and sexual decision making, and culturally-based gender norms have rendered women subservient to male partners. In South Africa, the gender hierarchy and dominant constructions of South African masculinities legitimate the control of women. However, gender norms and roles are undergoing change in South Africa, and it has been reported that the gender gap is closing. One consequence of this is that there is 'gender role confusion' and couples have to renegotiate gender roles and relations. Ironically, women who break out of the traditional sexual and gender roles can incur increased HIV risks – for instance, women who seek secondary sexual partners as revenge for their primary partner's infidelity.

Violence and rape: South African data suggest a direct link between violence and HIV infection – HIV-positive women are more likely than HIV-negative women to have experienced partner physical abuse. In Soweto, women with violent or controlling male partners were more likely to be HIV-positive, and abusive men were more likely to have HIV and impose risky sexual practices on their partners. In an HIV-negative cohort of young women in Eastern Cape, relationship power inequity and intimate partner violence significantly increased the risk of incident HIV infection (population attributable fractions were 13·9% for relationship power equity and 11·9% for intimate partner violence).

Mobility and migration: In South Africa, the risk of HIV infection has been found to be higher among individuals who either have personal migration experience or have sexual partners who are migrants. Since the early stages of the epidemic, infections in rural areas have been traced to those who had been in urban areas, and truckers have been found to be at higher risk because of their greater mobility. In the Africa Centre research area, HIV prevalence levels have been higher along major roads. It has been stated that oscillating migration – with spouses living apart for extended periods of time - is an essential component for an epidemic as severe as the one witnessed in South Africa.

Social cohesion and social capital: Evidence of a possible link between levels of social cohesion or social capital and HIV prevalence comes from two South African studies: the Intervention with Microfinance for AIDS & Gender Equity (IMAGE) study in rural Limpopo, and a study in the Summertown mining community near Johannesburg. The interface between HIV infection and social capital is clearly complex and defies easy generalization. Membership in some types of organisations may be associated with lowered HIV risk (such as sports groups, church organizations, women's organizations).

Recommendations[1]

Getting more from the data

1. **Promote data analysis across datasets whenever possible, in order to understand changes over time and obtain better estimates around less frequently reported behaviours through data pooling.** This will require more collaboration among research institutions to ensure the same measures can be tracked across surveys and that the survey protocols are harmonized to the greatest extent possible. People involved in the analysis must be involved in questionnaire and survey design from the start. The sharing of databases would encourage better data management and permit some useful analysis.

2. **Strengthen programming, data management and analysis capacity in the main research and survey institutions to be able to address the increasingly complex data analysis and modelling challenges.** The goal of such capacity strengthening would be to have a core group of programmers and statisticians with the skills needed for complex data analyses and modelling as well as technical exchange. There is already specialist analytical capacity and skill in a few institutions in South Africa, but this is not sufficient for the amount of population level data collected. Datasets are frequently not fully analysed due to limited human resource and capacity. This KYE analysis calculated for the first time sexual concurrency rates and partner acquisition rates for South Africa from available national survey data.

3. **Establish a knowledge hub which centralises, stores and archives HIV survey and research study protocols, the actual databases and reports and publications.** The aim is to make HIV research and survey data and information accessible in one central repository. This study showed that data are scattered and although some institutions have searchable lists of their own publications (e.g. Medical Research Council, HSRC, Africa Centre), survey protocols, grey literature and data bases often are not accessible or shared, and there is no centralisation in one hub.

Improving data quality

4. **Reinforce communication campaigns prior to surveys with the aim of high participation rates in all race groups.** The cited reasons among whites, Indians and coloureds for non-participation in the surveys must be taken seriously and specific solutions found which increase the trust of sampled individuals and the perception that HIV concerns all South Africans. Even if sophisticated data analysis methods are used to allow for non-participation, as done in this KYE study, biases arising through systematic differences in participation cannot be ruled out.

5. **Further strengthen the methodological work on the measurement and estimation of HIV incidence.** The aim is to improve the understanding of each method of incidence measurement and its relative performance compared to other methods, and to agree on the best method to track national HIV incidence. This KYE process with its HIV incidence workshop showed that South Africa is already leading in this methodological work but that there is still no consensus on how to track the main indicator in the NSP on HIV prevention – national HIV incidence.

[1] Based on these HIV epidemic review findings - more programmatic and policy recommendations are made in the full KYE/KYR national synthesis report

6. **Support research into the methodologies of behavioural surveys in order to broaden the spectrum of available measuring tools and to deepen the understanding of the validity of responses obtained from survey/study participants.** The overall aim would be to improve the research tools – both quantitative and qualitative - for behavioural surveys and studies. This KYE analysis demonstrated that unless data with better validity can be obtained, it is difficult to understand people's behaviours and practices in their sexual lives. Any research results need to be communicated effectively to other research institutions working in the country in order to impact the quality and validity of behavioural research results in South Africa.

Acting on the data

7. **Aim to better understand the prevention behaviours of different categories of PLHIV** (those on ART, those in the pre-ART cohort, those who know they are positive but are well, those who are unaware that they are positive, as well as children living with HIV). This KYE analysis summarized the available evidence, and findings like the one on significantly higher condom use by PLHIV if they know that they are positive are crucially important and supportive of HIV testing campaigns. Findings of high rates of unprotected sex in pre-ART patients is alarming and points to a lack of communication and counseling activities with these patients. In order to make 'Prevention for Positives' activities work in a context of fast-growing PLHIV numbers, prevention behaviours in the different categories of PLHIV must be better understood.

8. **Strengthen research on vertical transmission and monitoring & evaluation of PMTCT interventions.** The overall aim would be to understand better the factors leading to HIV transmission in pregnancy and how the PMTCT programme impacts HIV transmission. Specific areas of focus would be the use and non-use of family planning services by positive couples (many pregnancies in positive couples are unwanted), the prevention and sexual behaviours of positive couples during pregnancy (pregnant women and their partners have an increased chance of HIV acquisition during pregnancy), the use of PMTCT services (testing as a couple, re-testing in late pregnancy, etc.). Apart from such research studies, routine PMTCT monitoring also needs improvements.

9. **Strengthen the legal and policy context for interventions for female and male commercial sex workers**. The overall aim would be to decriminalise sex work and move towards the protection of male and female sex workers. The KYE study showed the deficiencies in addressing sex work in South Africa, and the problems with violence, discrimination and stigma of commercial sex workers, who are sometimes even attacked by police officers instead of protected. Making sex work safer requires policy provision and may entail medical follow-up and issuing permits for sex workers. In addition, a concerted programme focus is required on sex work in urban hotspots.

10. **Explore possibilities of interventions to promote earlier marriage.** The objective would be to stop and reverse the trend of late marriage in South Africa, which undoubtedly contributes to the HIV epidemic. This analysis summarised the evidence on the extended periods of sexual activity with different partners where there is no marital commitment and where people compete for partnering with those few who have a good income. The *lobola* payment for marriage is a major contributor to late marriage. Possible structural interventions could be policy provisions on preferential access to housing and work programmes for married people.

CHAPTER 1. BACKGROUND AND OBJECTIVES

"The long term commitment that each new HIV infection calls for is a reminder of the importance of prevention. The cost of treating someone with HIV for life means it makes financial as well as ethical sense to minimise new infections"
(All Part Parliamentary Group on AIDS, 2009, p9).

1.1 Background

South Africa continues to be home to the world's largest population of people living with HIV (PLHIV) - approximately 5.63 million in 2009 (Spectrum, 2010), which means that **one of every six people with HIV in the world lives in South Africa**. The ASSA2008 model estimates 5.5 million for 2010 (ASSA, 2011).

Systematic monitoring of the HIV epidemic dates back to 1990 and South Africa has nineteen years of consistent HIV prevalence monitoring data through annual antenatal HIV and syphilis surveillance. Although the South African HIV epidemic has stabilised over the last 8-10 years, prevention efforts are failing to keep pace with the HIV epidemic -- **the total number of people living with HIV continues to grow,** because there are more new infections than AIDS-related deaths each year. There is thus an urgent need to better focus the national response on preventing new HIV infections. There are urgent reasons why countries heavily affected by HIV need to make prevention work better:

1. The global financial crisis has wide-ranging impacts – widespread **falls in budgetary revenues from taxes are exacerbated in most developing countries by likely reductions in donor assistance** (UNAIDS/World Bank, 2009, p5). There is increasing evidence that future international support to HIV programmes will be stable or decrease.
2. To offset the resulting worsening fiscal deficit, the natural reaction of governments is to cut prevention services – in 2009, almost 60% of surveyed ESA countries expected the global crisis to **adversely affect prevention programmes** (UNAIDS/World Bank, 2009, p10). In nearly all seven regions of the world surveyed, more respondents expected an adverse impact on prevention than on treatment (p11).
3. With countries scaling up ARV provision, **expenditure for treatment has been increasing in absolute and/or relative terms**, to the detriment of prevention resources, especially in Southern Africa where the burden of AIDS is large. Countries are "locked in" regarding their spending on AIDS treatment – once patients are started on ART, it needs to continue, and ambitious ART access targets need to be met.
4. There is a risk that when faced with potential funding reductions, uniform cuts are applied across all programmes rather than attempting to maximize the impact of the remaining funding available. While most countries' national strategic frameworks recognize **the need to invest in interventions likely to have the greatest impact**, translating this principle into a prioritized set of interventions based on evidence of impact has proved difficult.
5. Underpinning the shortcoming in the prevention response in many countries is **the**

inadequate systematic use of evidence to inform the responses to an evolving and multifaceted HIV epidemic. The end result has been largely ineffective targeting of prevention interventions, misapplication of limited available resources and the loss of early opportunities to address the unique factors driving infection in the populations most at risk.

The South African National Strategic Plan for HIV and AIDS and STIs (NSP) covers the period 2007 to 2011. The primary prevention goal of the NSP is to reduce the national HIV incidence rate by 50% by 2011. A mid-term review (MTR) was conducted in late 2009 to assess performance in the implementation of the NSP. It concluded that **South Africa has made significant progress in scaling up some key interventions** with the following main achievements (MTR report, SANAC 2010):

- A number of large scale national AIDS awareness campaigns were rolled out in the first two years of the NSP.
- Condom use is growing according to self-reported condom use data, with highest use reported amongst younger age groups,
- The coverage of voluntary counseling and testing (VCT) has increased, with 96% of public health facilities offering VCT and 25% of adults reporting that they had a test and received their results in the past 12 months (2008/2009 data).
- Anti-retroviral therapy (ART) has been rolled out with 250% or greater increase in adults and approximately 150% increase in children on ART compared to 2006.
- Services to prevent mother-to-child transmission (PMTCT) also have been rolled out -- 95% of public health facilities now provide PMTCT services, 80% of pregnant women attending antenatal care have received HIV testing and 76% of HIV-positive pregnant women receive PMTCT prophylaxis.
- Work place programmes have been well developed at national and provincial levels in the public sector with a focus on reducing stigma and discrimination.
- An increasing number of families are receiving support from both Department of Health and Department of Social Development services, as well as through numerous Non-government and Non-profit organisations.

Despite these programmatic achievements, the MTR identified shortfalls in South Africa's response to HIV, including a lack of systematic measurement; poor understanding of programme effectiveness and impact; inadequate knowledge of both service needs and provision; and the lack of an annual national planning process. The following statements of the MTR team are particularly pertinent to this synthesis (SANAC, 2010):

"Although epidemiological data is available, showing a high prevalence rate in the province, the response does not seem to take the epidemiological status into account" (p325)

"Monitoring, evaluation and research tends to be an under-capacitated and under-appreciated area. Thus, data quality suffers and use of data for programme improvement is not a priority" (p60)

"There is no unifying prevention strategy to guide multi-sectoral contributions to prevention, which has hindered progress in this area" (p11)

In order to update and consolidate South Africa's evidence base for HIV prevention interventions, it was decided by the Government of South Africa to commission a synthesis of the available data on the epidemiology of prevalent and incident HIV infections, and the wider epidemic context of these infections. This **"Know Your Epidemic"** (KYE) approach has been successfully implemented in a number of Sub-Saharan African countries[2]. The process involves a desk review and secondary analysis of existing biological, behavioural and socio-demographic data in order to determine the epidemiology of new HIV infections. KYE reports present key findings and policy and programme recommendations which are grounded in local evidence and aim to support decision-making and improve HIV prevention results. In 2010, South Africa also conducted a **"Know your response"** (KYR) review, which critically assessed HIV prevention policies, programmes and resource allocations. The overall results of this HIV epidemic review and the KYR review will be published in a separate, national KYE/KYR synthesis report.

The initial reading of the epidemiological literature led to the following **working hypothesis** ('storyline'):

> *A review of the epidemiology of HIV in South Africa shows that the epidemic is in a hyperendemic phase with one of the highest adult HIV prevalence rates in the world at about 17%. HIV in South Africa is dynamic and extremely heterogeneous affecting different populations differently. There is a great imbalance in HIV burden across the races and across different areas of the country – HIV infection is strongly associated with location of residence and race in South Africa. An assessment of the trends of the epidemic suggests that HIV prevalence is rising in some age groups above 30 years of age, and falling in younger people. HIV prevalence is also on the increase among the rural population although declining in formal urban areas. It is believed that the risk factors and drivers fuelling the epidemic in South Africa include a high level of multiple concurrent partners, inconsistent condom use, a low level of male circumcision, high population mobility, gender-based violence and deprivation, as well as unfavourable social and cultural factors.*

> *Despite the heavy burden of HIV, South Africa has shown remarkable achievements in scaling up access to ART and PMTCT over recent years. However, there is an urgent need to scale up effective prevention measures in the context of this accelerated access to treatment and the long-term commitment brought about by every new person on ART.*

This working hypothesis was developed so as to drive the analysis of the key factors related to the South African HIV epidemic.

1.2 Objectives of the HIV Epidemic Review

The primary objective of the HIV Epidemic Review Report is **to contribute to ongoing efforts to understand the HIV epidemic better and therefore help develop the**

[2] UNAIDS: http://www.unaidsrstesa.org/hiv-prevention-modes-of-transmission, Global HIV/AIDS Program/World Bank: http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTHEALTHNUTRITIONANDPOPULATION/EXTHIVAIDS/0,,contentMDK:21735886~menuPK:376477~pagePK:148956~piPK:216618~theSitePK:376471,00.html

best-possible approach to HIV prevention.

Specifically, the Report aims to:

1) Describe the **level of heterogeneity** of the South African HIV epidemic and comment on any sub-epidemics which can be delineated within the national epidemic
2) Identify the **populations at greatest risk of HIV infection** based on analysis of the distribution of new infections
3) Through an analysis of national and provincial behavioural, biological, socio-economic and demographic data, establish the **factors driving the HIV epidemic**
4) Provide an **epidemiologic evidence base** for the formulation of evidence-informed, better targeted and more effective prevention strategies and actions.

1.3 Structure of the Epidemic Review Report

This introductory section has provided the background to the analysis, the rationale, the hypothesis driving the analysis, and the study objectives.

Chapter 2 details the methodology used for this analysis. It also describes the organisational and coordination aspects of the study and the approval mechanisms.

Chapter 3 summarizes the findings of the HIV epidemic review. It presents the outcomes of the review of the epidemiologic data and the findings of several secondary analyses of major recent data sets.

Chapter 4 interprets the findings presented in chapter 3 and presents some conclusions. These conclusions are based on the South African evidence, but also take into account data, evidence and lessons learnt from the sub-region, especially from other countries confronted with a hyperendemic situation.

Chapter 5 presents recommendations for policies, programmes, and for monitoring & evaluation.

Annexes 1-4 present detailed results of bivariate and multivariate analyses of HIV prevalence, socio-demographic and behaviour data collected within the three HSRC surveys (National HIV prevalence, Behavioural Risks and Mass Media Household Survey 2002, and the National HIV prevalence, HIV incidence, Behaviour and Communication Surveys of 2005 and 2008) and the two HDA/JHHESA surveys (National Communication Surveys on HIV/AIDS of 2006 and 2009). They also provide analyses of trends in HIV prevalence in three surveys, age at first sex and reported multiple partner frequencies across five surveys, and specific analyses of the NCS 2009 data on sexual concurrency and partner acquisition rates.

CHAPTER 2. METHODOLOGY

2.1 Partners and Coordination

- The overall coordination of the study was assumed by the **SANAC Prevention Task Team Chair**, who also ensured liaison with all relevant SANAC committees, the national technical team and other structures.
- The **SANAC Prevention Task Team**, in conjunction with the National Technical Team, facilitated access to necessary data sources and was tasked with the validation of the report.
- The **National Technical Team Coordinator** (the UNAIDS Country Office M&E Advisor) was responsible for liaison with the SANAC Prevention Task Team, organising National Technical Task Team meetings, and providing progress updates to the SANAC Prevention Task Team, the National Technical Team, SANAC committees and other stakeholders. Another important responsibility was organising dissemination meetings for the report, in conjunction with the SANAC Prevention Task Team.
- The members of the **National Technical Team** played an oversight role and carried out the technical review of the final draft report before submission to SANAC.
- At provincial level, the **Provincial Focal Point** coordinated activities linked to the study, such as identifying grey literature, local reports and data; setting up a validation committee and organising validation meetings; and disseminating the findings.
- The UNAIDS country office coordinated the overall effort and RST/ESA provided technical support and funding.
- The **study team** itself consisted of the technical leader from the Global HIV and AIDS Program of the World Bank (N.F.) responsible for writing the HIV epidemic review report, biostatisticians from the Human Sciences Research Council South Africa (K.Z., P.N.) and Health & Development Africa (F.C.) for additional bivariate analysis of survey data and providing support and input into the KYE report, and two consultant biostatisticians (E.S., V.H.) for the multivariate data analysis. They all worked under the supervision and coordination of the World Bank team leader (M.G.), who also had a key communication and liaison role between these technical personnel and the main partners SANAC and UNAIDS, and other stakeholders.

2.2 Study Methodology

The analysis entailed a desk study and secondary data analysis of existing population-based data and subsequent synthesis of all available data.

Analytical framework

All types of data were included, i.e. directly measured, estimated, projected or modelled. All HIV transmission pathways were considered - heterosexual sex, same-sex, medical injections, blood transfusion, mother-to-child transmission, accidental exposure through needles, sharps and blades, and injecting drug use. In general, preference was given to recent data (last two years) and to measures indicating recent risk behaviours rather than lifetime exposures, since this analysis is particularly interested in current transmission and

incident (new) HIV infections. However, older data were also considered, particularly when assessing trends over time. The analysis did not include tuberculosis or any other opportunistic infection, and did not focus on other STIs. Risk factors and drivers were retained as presented in the original literature.

In the multivariate regression analyses, a conceptual framework for the factors associated with HIV infection was used to guide analysis (see **Annex 1 section 1A**). This was based on the proximate determinants framework by Boerma & Weir (2005) and separates factors into three levels, the background (most distal) factors, those that determine exposure to an infected partner and those that affect transmission directly (most proximate).

The **desk study** included published and unpublished documents about HIV in South Africa, and any other relevant documentation from other countries in Sub-Saharan Africa. Peer reviewed journal articles were sourced electronically using search engines (such as Google, Google Scholar, Journal Storage, PubMed and Medline) as well as other internet-based databases while websites of major South African organizations were browsed for literature relevant to the epidemic in South Africa[3]. The searches looked for publications over the last 15 years, using a collection of search words[4]. The Provincial Focal Points helped identify local grey literature and local study reports. A large literature list was compiled with 722 documents classified, and made available to SANAC and stakeholders.

Data analyses were sometimes limited by the suitability of the data to answer certain questions. For instance, the relationship between women's hormonal contraceptive use and HIV status could not be assessed due to non-availability of the appropriate data.
The **secondary data analysis** included data from five representative household surveys (three bio-behavioural surveys by HSRC[5] and two behavioural surveys by HDA/JHHESA[6]). Both bivariate and multivariate analysis was carried out based on an analytical plan.

i) Bivariate analysis
The additional bivariate analysis of HSRC survey data focused on the 2008 dataset for which only limited results had been published. The bivariate analysis of the data from the NCS (HDA/JHHESA) surveys were extensive and included both the 2006 and the 2009 data.

ii) Multivariate analysis
Methodological details for this analysis are presented in **Annex 1 section 1B**. The multivariate regression analysis had the following aims:

[3] Websites of the following institutions were consulted: South Africa National AIDS Council (SANAC), Department of Health (DoH), Statistics South Africa (SSA), South African Medical Research Council (MRC), South African Institute of Race Relations (SAIRR), the Centre for Actuarial Research Cape Town (CARe), the South African Centre of Excellence for Epidemiological Modelling and Analysis in Stellenbosch (SACEMA), Institute for Security Studies in Pretoria (ISS), the South African National Blood Service (SANBS), Western Province Blood Transfusion Service, Sonke Gender Justice Network, Soul City Institute in Johannesburg, Targeted AIDS Interventions in Pietermaritzburg (TAI), the South African Police Service (SAPS)

[4] The following search terms were used alone and in combination: South Africa, Southern Africa, Sub-Saharan Africa, HIV, AIDS, prevalence, incidence, modelling, systematic review, meta analysis, HIV prevention, HIV infection, mobility, migration, sexual behaviour, behaviour change, behaviour adaptation, sexual network, surveillance, DHS, reproductive health, STD/STI, violence, substance use/abuse, heroin, cannabis, alcohol, sex work, anal sex, MSM, homosexual, prison, iatrogenic, medical injection, blood transfusion, social capital, gender, inequality, poverty.

[5] "National HIV prevalence, behavioural risks and mass media household survey 2002"; "National HIV Prevalence, Incidence, Behaviour and Communication Survey 2005" and "National HIV Prevalence, Incidence, Behaviour and Communication Survey 2008", referred to here as HSRC 2002, HSRC 2005 and HSRC 2008

[6] "National Communications Survey 2006" and "National Communications Survey 2009", referred to here as NCS 2006 and NCS 2009

- To identify and characterise HIV-positive individuals, including any current behaviours which might facilitate onwards transmission
- To describe factors associated with any risky sexual behaviours that were found to be associated with HIV status at survey
- To compare the proportion reporting multiple partners in the five different surveys
- To compare the proportion HIV-positive in the five different surveys
- To describe acquisition rates for new partners, and associated factors

In the conceptual framework used (see **Annex 1 section 1A**), the socio-demographic factors include "time and place" variables for each individual that relate to the HIV prevalence among their likely potential sexual partners – and hence their HIV exposure. Individual factors such as mobility, education, socio-economic status, religion and marital status can influence HIV risk by modifying opportunity, motivation and choice of sexual partners and can also influence transmission risk via condom use and STI prevention and treatment. These datasets contained information on prevalent, rather than incident HIV cases. Analysis of HIV status therefore focussed on describing who was infected, and their current behaviour, rather than trying to understand what factors led to their infection. Logistic regression models were fitted separately for men and women to identify the factors associated with HIV status at survey. All variables identified as important in the univariate analysis were put into a fixed effects logistic regression model adjusted for survey design. Variables with a p-value on the Wald test of <=0.01, for at least one category, were retained. Those with large p-values were removed, one by one, starting with those on the left of the conceptual framework. Interactions were explored for selected variables. Regression analysis was only conducted on respondents with complete data and, for HSRC, only those who were also tested for HIV. In case of missing data, the respondent's record was excluded from the regression model.

In a combined analysis, datasets from the three HSRC and two NCS surveys were jointly analysed, using a set of core variables available in most of the surveys. Only respondents aged 16 to 55 years were used, although those outside the age range were retained in the dataset since they were required for the correct calculation of standard errors adjusted for the survey design. The combined dataset was used to estimate regression models for:

- HIV prevalence across the HSRC surveys, accounting for changes in the survey sample
- Trend in the proportion of men reporting more than one partner in the past year
- Trends in age at first sex.

Pre-existing analyses and the new analysis were all drawn together, looked at side-by-side, written up and presented in a HIV epidemic review report which was reviewed by stakeholders.

CHAPTER 3. KNOW YOUR EPIDEMIC

The Know Your Epidemic (KYE) synthesis draws together available data about HIV prevalence trends and patterns, HIV incidence, modes of transmission, sexual behaviours, and community and macro level factors influencing the South African HIV epidemic. National figures conceal major differences among South African provinces, population groups, urban and rural localities, and formal and informal settlements. These patterns of heterogeneity are explored in several ways to determine which variables are significantly linked to HIV risk.

4.1 HIV Prevalence Estimates

The two established ways of tracking HIV prevalence in the general population are used in South Africa: population-based household surveys, and sentinel surveillance surveys of pregnant women attending antenatal care.

4.1.1 Population-based household survey of a representative sample of the general population

These surveys collect data about sexual and reproductive behaviours and samples for HIV testing. South African has conducted such national population-based household surveys in 2002 (Shisana & Simbayi, 2002), 2005 (Shisana *et al.*, 2005) and 2008 (Shisana *et al.*, 2009). A national youth survey was conducted in 2003 (Pettifor *et al.*, 2004) – see Table 1.

In household surveys, some persons will be missed because they are migrants or otherwise away from home, some persons will refuse to be interviewed, and some persons will agree to be interviewed, but not tested for HIV. See "response rates", Table 1.

Table 1: Summary table of sample sizes and response rates in HIV population surveys in South Africa (2002, 2003, 2005, 2008)

Survey	Survey population	Sample for HIV testing	Actual sample size	Response rates
National HIV prevalence, behavioural risks and mass media household survey 2002*	Children 2-14 y Youth 15-24 y Adults 25+ y	Oral fluid sample	9,963 completed interview, 8,428 with HIV test result	Interview: 74% (9963/13518) HIV test: 62% (8428/13518)
National HIV Prevalence, Incidence, Behaviour and Communication Survey 2005&	Children 2-14 y Youth 15-24 y Adults 25+ y	Capillary blood sample (dried blood spot)	23,275 completed interview, 15,851 agreed to HIV testing	Interview: 96% (23275/24236) HIV test: 65% (15851/24236)
National HIV Prevalence, Incidence, Behaviour and Communication Survey 2008#	Children <2 y Children 2-14 y Youth 15-24 y Adults 25+ y	Capillary blood sample (dried blood spot)	20,826 completed interview, 15,031 agreed to HIV testing	Interview: 89% (20826/23369) HIV test: 64% (15031/23369)
HIV and sexual behaviour among young South Africans 2003+	Youth 15-24 y	Oral fluid sample	11,904 individuals completed interview and agreed to HIV testing	Interview & HIV test: 77.2% (11904/15414)

Sources: (*) Shisana & Simbayi, 2002; (&) Shisana *et al.*, 2005; (#) Shisana *et al.*, 2009; (+) Pettifor *et al.*, 2004.

Non-participation can lead to under- or overestimation of HIV prevalence.[7]

- In the three rounds of national HIV surveys by HSRC, advances were made in interview response rates but not in HIV testing rates.
- In the 2005 survey, least likely to agree to be HIV tested were whites and Indians[8], children aged 2-14 years[9], and respondents in KwaZulu-Natal and Gauteng Provinces.[10]
- In the 2008 survey, 21% of all females and 23% of males refused to provide a blood sample for HIV testing although they had been interviewed. Overall, 31% of males and 27% of females refused survey participation in 2008.[11] Refusal rates were highest in KwaZulu-Natal and Mpumalanga Provinces (35%) and Gauteng Province (33%), and lowest in Northern Cape Province (17%). As in 2005, refusal was particularly high among Indians (42%) and whites (41%).
- In the national survey in the tertiary education sector in 2009, the only group with a high blood test refusal rate were the Indian students (63%), but the survey was conducted during Ramadan when Muslims are not allowed to provide blood specimens.

Potential biases in the HIV prevalence data[12]:

The 2005 and 2008 survey data were used to analyse **HIV risk-associated characteristics** in survey participants who were interviewed and tested and those who were interviewed but refused HIV testing, in order to understand potential sources of bias in the HIV prevalence estimates.

- In the 2005 survey data (but not the 2008 survey data), there are indications that individuals at higher risk for HIV infection might have been more likely to accept HIV testing compared to those who refused the test[13] (potentially leading to an overestimation of HIV prevalence)[14]
- The 2002 survey report does not provide an analysis on imbalances of behavioural risk factors among those who agreed to HIV testing versus those respondents who refused the HIV test.

HIV testing: The 2002 survey used oral specimens – like the 2003 youth survey – and not blood specimens. Since oral HIV tests are highly sensitive but not very specific, this can lead to considerable errors in the HIV estimates among populations or population strata where HIV prevalence is low.

[7] Reniers & Eaton (2009) found that persons who know their HIV status are more likely to refuse consent for an HIV test during a population-based HIV survey. This biases the sample of persons who consent to HIV testing, to be less likely to be HIV-positive. In the Malawi DHS, for example, the population level estimate for HIV needed to be upwardly adjusted because of the high refusal bias (Reniers & Eaton, 2009).

[8] For differential response rates between races, also see section 1.1.4 (HIV prevalence pattern by race)

[9] For children, parents were asked to give consent, and the child to give assent.

[10] The principal reasons for not participating (described in 2005 survey report) were: Apprehensive of blood sample being taken (58% of non-participation), blood sampling against religious beliefs (16%), did not want to know HIV status (7%), and not willing to participate in any survey or interview (5%).

[11] Other reasons for non-participation were being absent, missing or other reasons.

[12] Information on background characteristics was available for all those interviewed (whether tested or refused to be tested) but not for those who were absent and therefore not interviewed, or who refused to be interviewed..

[13] Two factors associated with increased risk for HIV infection were more prevalent among the respondents who agreed to be tested compared to those not tested: penile discharge in men ($p=0.01$), and genital ulcers in women ($p=0.029$). Neither awareness of own HIV status ($p=0.8$) nor number of sexual partners in the last 12 months ($p=0.4$) were significantly associated with refusal of HIV testing. However, significantly more respondents perceiving themselves as "not at risk of getting HIV" agreed to be tested ($p=0.032$), but absolute differences were very small (31.2% vs. 28.8%).

[14] Although among those accepting the testing, the proportion of sexually active in the last 12 months was smaller than in those refusing ($p<0.001$), other risk indicators pointed the opposite way (history of STI symptoms and multiple partners were both higher in those accepting the HIV test).

For the multivariate analysis on HIV prevalence data, only respondents with complete data were included. **Table 1.4 in Annex 1 section 1C** shows the samples included from each of the three HSRC surveys.

4.1.2 Ante-natal care (ANC) sentinel surveillance surveys of pregnant women

These surveys have been carried out annually in South Africa since 1990 (DOH, 2008). The ANC surveys provide measured HIV prevalence data for a representative sample of clients at ante-natal clinics and provide a data source for estimating population HIV prevalence with modelling software. Since the number and characteristics of sentinel sites has varied over the years, trends in HIV prevalence among ANC clients need to be interpreted with caution. South Africa has gradually improved the ANC surveillance system with the most significant improvements introduced in 2006, when sentinel sites increased from about 400 to about 1,400, and the sample size doubled from about 16,500 to 33,000, which made it possible to estimate HIV prevalence amongst pregnant women in each district. Dorrington (2009) reiterates that any interpretation of longer-term trends in ANC HIV prevalence data is difficult because of the major changes in the sample in 2006.

Monitoring the HIV epidemic by ANC sentinel surveillance works best if coverage of antenatal care for pregnant women is nearly universal and fertility is high enough that sexually active women are likely to present to an antenatal clinic every few years (WHO, 1988). In South Africa, approximately 92% of pregnant women attend ANC at least once during each pregnancy (DHS 2003), and the total fertility rate is estimated at 2.4 children per woman (2009 estimate, Statistics SA, 2009). ANC sentinel surveillance uses **unlinked anonymous testing** of blood left over from routine syphilis testing of pregnant women, in order to minimise refusals and bias in the HIV prevalence data. As pregnant women may have lower condom usage rates than other sexually active women, their HIV risk may be different from their age peers.

HIV prevalence also can be monitored using routine service data from clients of Prevention of Mother-to-Child Transmission (PMTCT) services, blood donors, STI patients and counseling and testing (CT) clients, but HIV prevalence in these sub-groups cannot be generalised to the general population. For instance, CT clients are self-selected and not representative of the general population.

The national HIV prevalence survey results and HIV prevalence data from the ANC surveillance system provide **population-based HIV prevalence estimates for South Africa and enable HIV prevalence projections to be done.** The 2009 Spectrum application was based on the 2008 ANC data calibrated with population-based HIV prevalence data (see Gouws *et al.*, 2008 on calibration).

Apart from the two systems for monitoring HIV prevalence at national level described above (population-based national household surveys and national ANC sentinel surveillance), the most significant HIV monitoring system is the HIV cohort of the Africa Centre Demographic Information System (ACDIS).

HIV prevalence data from the Africa Centre Demographic Information System:

The ACDIS HIV cohort is near the market town of Mtubatuba in the Umkanyakude district of KwaZulu-Natal.[15] Participation rates for household data collection within ACDIS are high (Tanser *et al.*, 2007: >99%). In the HIV cohort, the consent rate to test for HIV has decreased from approximately 60% in 2003–2004 to 40% in 2005 and 2006 (Tanser *et al.*, 2007). In order to minimise selection bias, a range of activities have been implemented to increase consent rates, such as rapid testing and home-based delivery of test results. In addition, demographic, socio-economic and behavioural data are used to diagnose and adjust for selection effects between HIV test consenters and non-consenters (Tanser *et al.*, 2007; Barnighausen *et al.*, 2008).[16]

The sampling of both residents and non-residents ('migrants') within the Africa Centre HIV cohort provides unique data about HIV and mobility/migration.

- Non-resident members of the households are tracked to their migration destinations (Welz *et al.*, 2007).
- Pre-existing data from longitudinal demographic surveillance provided a complete sampling frame that virtually eliminates the problems affecting cross-sectional surveys such as the non-inclusion of mobile individuals (Gregson & Garnett, 2000; Nunn *et al.*, 1994; Serwadda *et al.*, 1992; Zaba *et al.*, 2004; Welz *et al.*, 2007) and passive refusal to participate by absent high-risk individuals (Calleja *et al.*, 2005).

There is therefore a large body of HIV prevalence data in South Africa available for analysis. However, some HIV testing data were not accessible, such as those collected in private sector companies within workplace interventions (mining houses, etc.) and those from medical aid companies and the military forces. Also, HIV data from routine services may not be complete or not include some data from health facilities in the private and civil society sectors.

Overview of available HIV prevalence data:

- South Africa has national HIV prevalence data from three national population-based household surveys (2002, 2005, 2008); a national youth survey (2003); and sentinel surveillance data from pregnant women (1990 to present). There were some changes in sampling procedure and questionnaire across the three surveys[17], which need to be

[15] The ACDIS, a demographic surveillance system within the ALPHA Network, was started in 2000 (Solarsh *et al.*, 2002; Tanser *et al.*, 2007). The area is 438km^2 in size and includes a population of approximately 85 000 people who are members of approximately 11 000 households. The area is typical of many rural areas of South Africa in that while predominantly rural, it contains an urban township and informal peri-urban settlements. The area is characterized by large variations in population densities (20–3000 people/km^2). ACDIS collects information on resident and non-resident members of households. Nested within the ACDIS cohort is the population-based HIV cohort (Welz *et al.*, 2007). Between 2003 and 2006 (3 rounds of collection of HIV data), all women aged 15–49 years and men aged 15–54 years resident in the surveillance area were eligible for HIV testing. In 2007, eligibility was extended to cover all residents aged ≥15 years of age. In addition to the resident sample, a 12.5% stratified sample of non-residents is also included in each round of data collection. These non-resident study participants are sampled randomly into equally sized strata by sex and frequency of their return pattern.

[16] Welz *et al.* (2007) reported from ACDIS that consent rates for HIV testing were comparatively low and 10 variables associated with HIV status were also associated with non-participation. However, overall HIV prevalence estimates did not change substantially when adjusting for selection effects in the statistical analyses (Tanser *et al.*, 2007).

[17] In 2005, 15 households were sampled in each enumeration area, compared to 10 in 2002 (same household master list). In 2008, a new list of enumeration areas was used and 15 households sampled in each. Since children under 2 years were also included in the 2008 survey, up to four individuals were sampled in each household due to this new age stratum. Compared to the 2002 survey, the 2005 survey used a different definition of a household member (everybody 'who slept here last night' versus 'who spent at least 4 nights a week in the household' in 2002), and it visited each household only

borne in mind when assessing trends in HIV prevalence

- There are sub-national HIV prevalence data: a health workers survey in four provinces (2002); a health facility-based study of children aged 2-9 years in Free State (2004); a survey among staff and offenders in the Department of Correctional Services (2006)[18]; a survey in 15 private security companies (2008); a national survey in the tertiary education sector including students, service staff, academic & administrative staff in seven provinces (2009); and longitudinal data from a cohort of the Africa Centre Demographic Information System in the Umkanyakude district of KwaZulu-Natal (2003 to present).
- Routine services provide HIV prevalence data from clients of Prevention of Mother-to-Child Transmission (PMTCT) and counseling and testing (CT) services, from STI patients and blood donors.
- There are various small HIV prevalence studies in specific populations, these studies are presented in the separately published provincial KYE analyses.

In the secondary data analysis conducted for this KYE assessment, all the factors (variables) observed to be important in the bivariate analysis were included in a **logistic regression model for female and for male respondents**. Most of these factors were not significant once adjusted for the other variables; however, the factors which came out as important are presented in this chapter in conjunction with all the other data identified.

The details of the multivariate analysis on HIV status are found in Annex 1:

Section 1C - Narrative of the findings of the HIV outcome models

Section 1G - HIV status models for 2002, 2005 and 2008

Section 1H - Trend over time in HIV prevalence 2002 - 2008

4.2 Levels and Trends in HIV Prevalence

4.2.1 HIV Prevalence at the National Level

SUMMARY:

The population-based sero-surveys and sentinel surveillance of pregnant women both suggest that **the HIV epidemic has plateaued in South Africa:**

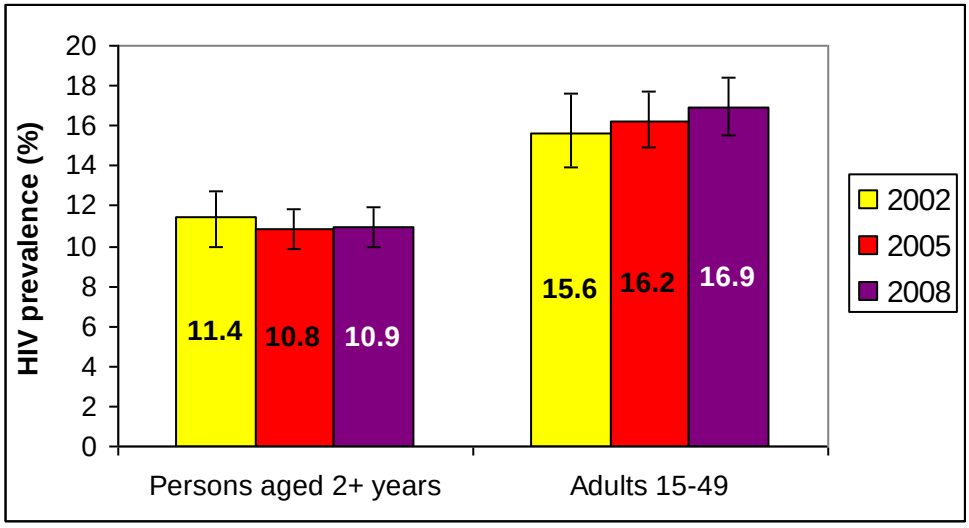
1. **In adults aged 15-49 years, the three national surveys in 2002, 2005 and 2008 estimated HIV prevalence at 15.6%, 16.2% and 16.9%, respectively** (increase not reaching statistical significance) – see **Error! Reference source not found.**.
2. **In all survey respondents aged 2+ years, the 2002, 2005 and 2008 HIV prevalence was 11.4%, 10.8% and 10.9%, respectively** (differences not statistically significant) **–** see **Error! Reference source not found..**

once instead of twice as in 2002 (potentially affecting selection of respondents). The key changes in both the youth and adult questionnaires from 2005 to 2008 were the inclusion of a module on MC (as in 2002), as well as a new module on social values and norms.

[18] The results of this survey are not included here, since the national participation rate was at only 29% for staff and 46% for offenders, and therefore the resulting HIV prevalence estimates cannot be trusted.

3. **In ANC clients, HIV prevalence has gradually levelled off just below 30%, after a steep increase occurring over more than 10 years from 7.6% in 1994 to 29.5% in 2004** (note that sample size and sentinel sites changed after 2005). The ANC prevalence estimates for 2006, 2007, 2008 and 2009 are very similar with 29 of 100 sampled ANC clients HIV-positive. In the 2009 survey, maternal HIV prevalence was 29.4% (95%CI 28.7% - 30.2%).
4. **Although the percentage of HIV-positive people ('HIV prevalence') has plateaued, the absolute number of PLHIV is on a steep increase of approximately 100,000 additional PLHIV each year** (estimated number of PLHIV in 2010: 5.5 million – ASSA2008 model)

Figure 1: Estimations of HIV prevalence in persons aged 2+ years in South Africa (2002, 2005, 2008)



Source: Table 3.5, South African National HIV Survey (Shisana *et al.*, 2009)

Between the 2002 and the 2008 population surveys, HIV prevalence among persons aged 2+ years has seen a small downturn from 11.4% to 10.9%, and prevalence in adults changed slightly from 15.6% to 16.9%. The respective confidence intervals show a large overlap indicating that **the changes are small, not reaching statistical significance** – see **Error! Reference source not found.**. The downturn in the group aged 2+ years mainly arises from falling HIV prevalence in children aged 2-14 years (see section 1.1.3 on age pattern of HIV prevalence). See also the detailed analysis of HIV prevalence in age and sex strata of the general population in section 1.1.3.

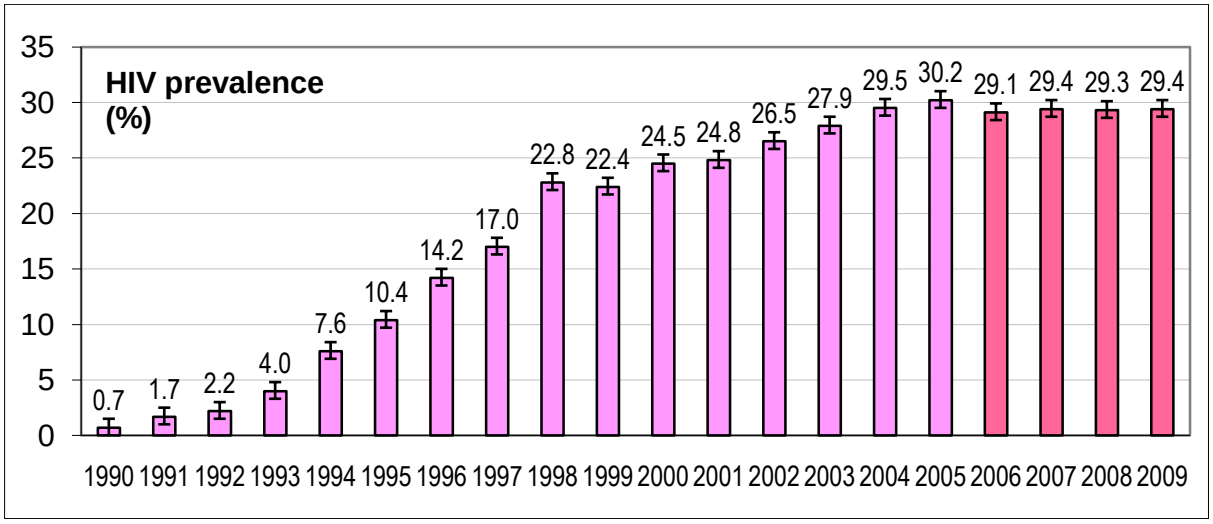
In the multivariate analysis of HIV trends across the three surveys, the changes were again small and not statistically significant (the analysis accounted for changes in the survey samples – see Annex 1 section 1H).

HIV prevalence in ANC clients has levelled off just below 30%, after a steep increase occurring over more than 10 years - see Figure 2. The highest estimate of maternal HIV prevalence was obtained in 2005 at 30.2% (95%CI 29.1% – 31.2%). The official DOH estimates for 2006, 2007[19], 2008 and 2009 are very similar with 29 out of 100

[19] For 2007, DOH initially published the value of 28.0%, which was subsequently corrected to 29.4% by Dorrington & Bourne (2008) and by the 2008 DOH report.

sampled ANC clients HIV-positive (it needs to be borne in mind that in 2006, the sample changed dramatically and that post-2005 data cannot be compared with data up to 2005[20]).

Figure 2: Trend in HIV prevalence in ANC clients in South Africa (1990-2009)



Sources: National HIV and syphilis prevalence surveys 1990-2009 by DOH. For 2007, DOH initially published the value of 28.0%, which was corrected to 29.4% by Dorrington & Bourne (2008) and by the 2008 DOH report.
Note: Change of bar colour indicates change in sample (sentinel sites increased from about 400 to about 1,400, and sample size doubled from about 16,500 to 33,000, which made it possible to estimate HIV prevalence amongst pregnant women in each district).

HIV prevalence, mortality, fertility and ART:

The new ASSA2008 model estimates that in 2010, about 10.9% of the South African population was HIV-infected, or an estimated 5.5 million HIV-positive people (ASSA, 2011 - in line with the 2009 Spectrum estimate of 5.63 million PLHIV).

Although adult HIV prevalence has stabilised at about 17%, the absolute number of PLHIV is on a steep increase of approximately 100,000 additional PLHIV each year (Spectrum estimate) – see Figure 3. This is due to the number of annual new infections exceeding annual AIDS-related deaths, with ARV treatment prolonging the lives of PLHIV, and the denominator of HIV prevalence - population size - increasing each year (in 2009, the total fertility rate is estimated at 2.4 children per woman, Statistics SA, 2009).

The HIV epidemic is estimated to have reduced life expectancy in South Africa by about 13 years, from 64 in 1990 to 51 in 2005 (Dorrington *et al.*, 2006). According to the new ASSA 2008 model estimates, there is a **substantial downturn in AIDS related mortality** in recent years, with annual number of AIDS deaths reduced from about 257,000 in 2005 to about 194,000 in 2010 (ASSA, 2011). This is **largely due to the expansion of the ART programme**.[21]

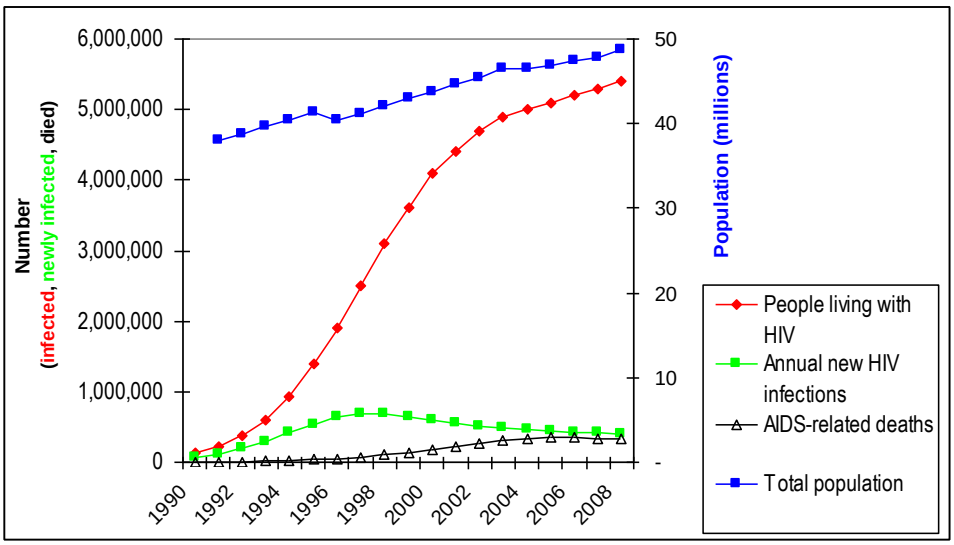
In the ACDIS demographic surveillance, the **probability of dying** (all causes) between

[20] Sample size doubled and new sentinel sites were added after 2005, providing higher precision and better national representation.

[21] The ASSA 2008 model also has revised assumptions about mortality rates in untreated HIV-infected individuals prompted by studies showing higher survival rates in African adults than had previously been assumed (ASSA, 2011).

ages 16 and 60 years was estimated at 58% for women and 75% for men in 2000 (Hosegood *et al.*, 2004). However, a recent study has suggested that the upward trend in mortality rates is being reversed by the ART programme which has contributed significantly to an increase in life expectancy (Herbst & Cooke, 2008; Herbst *et al.*, 2009).
In 2000, AIDS caused 73% and 61% of the female and male deaths respectively among the 15–44 age groups. Among males, deaths from injuries were high (Hosegood *et al.*, 2004).

Figure 3: Modelled absolute numbers of PLHIV, annual new infections, AIDS-related deaths and total population size, adults aged 15-49 years in South Africa (1990-2008)



Sources: Spectrum estimations and mid-year population estimates from www.statssa.gov.za.

Studies of fertility in the ACDIS surveillance area show marked declines during the late 1990s (TFR 4.4) and early 2000s but have recently stalled at around three births per woman (Tanser *et al.*, 2007; Moultrie *et al.*, 2008). Unlike in other countries, the stall is correlated neither with education level, nor contraceptive use. Preliminary findings suggest that HIV prevalence is a less important determinant of fertility than other factors of socioeconomic, social and demographic nature.

4.2.2 HIV Prevalence at Sub-national Level

SUMMARY:

- **There is tremendous differences in provincial HIV prevalence levels** (3.8% in Western Cape to 15.8% in KwaZulu-Natal, 2008 HSRC survey).
- In 2008, compared to men in Western Cape, men in KwaZulu-Natal, Mpumalanga and North West were significantly more likely to be HIV-positive (KZN aOR 5.1 p=0.0004; MP aOR 3.2 p=0.025; NW aOR 2.6 p=0.042 in multivariate analysis). Women in Mpumalanga and KwaZulu-Natal were also significantly more likely to be HIV-positive (MP aOR 2.4 p=0.009; KZN aOR 2.0 p=0.012) (OR adjusted for year of birth, race and other socio-demographic and behavioural variables, see Annex 1 section 1G).
- **Provincial HIV prevalence levels appear to have stabilised between 2005 and 2009, which is in line with the trends in national HIV prevalence**
- **There is an even greater range of HIV prevalence levels among South African**

districts (ANC data, 0% in Namakwa/Northern Cape to 46.4% in Uthukela/ KwaZulu-Natal)

- There is evidence of **localised high HIV transmission** in areas such as close to national roads.

Province Level

HIV prevalence levels vary hugely across the provinces – see Figure 4 for data on pregnant women, showing that very high maternal HIV prevalence levels are concentrated in the East of the country.

Figure 4: Provincial HIV prevalence levels in ANC clients in South Africa (2008)

Source: ANC report 2008 (DOH, 2009)

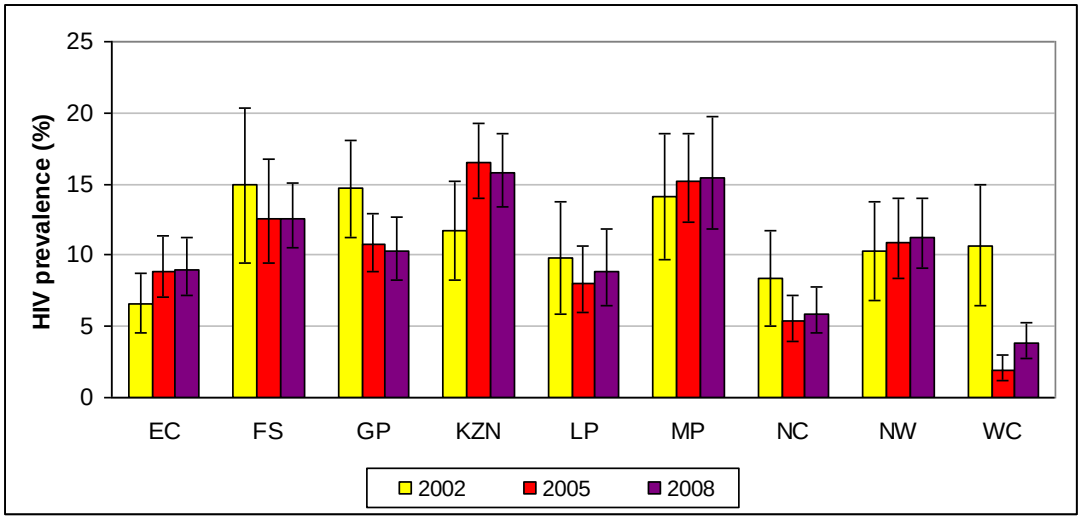
Figure 5 (purple columns) illustrates the provincial heterogeneity for the general population aged 2 years and above in 2008 (5a) and for youth 15-24 (5b).

The trends between 2002 and 2008 in the provincial HIV prevalence levels vary (same figures) and, due to sometimes wide confidence intervals, are not always clear-cut. However, the measured HSRC survey data suggest that **population prevalence levels stabilised between 2005 and 2008 in most provinces**. In KwaZulu-Natal and Mpumalanga, it is estimated that more than 15% of the population is HIV infected, and in Gauteng, North West and Free State, more than 10% are estimated to be HIV infected. In Eastern Cape, Limpopo, Northern Cape and Western Cape, an estimated less than 10% are HIV infected. The HIV prevalence change over the three surveys in Western Cape does not

look plausible; in fact, it is believed by the study implementers that the 2002 prevalence level (10.7%) is an overestimate, and the 2005 level (1.9%) is an underestimate.[22]

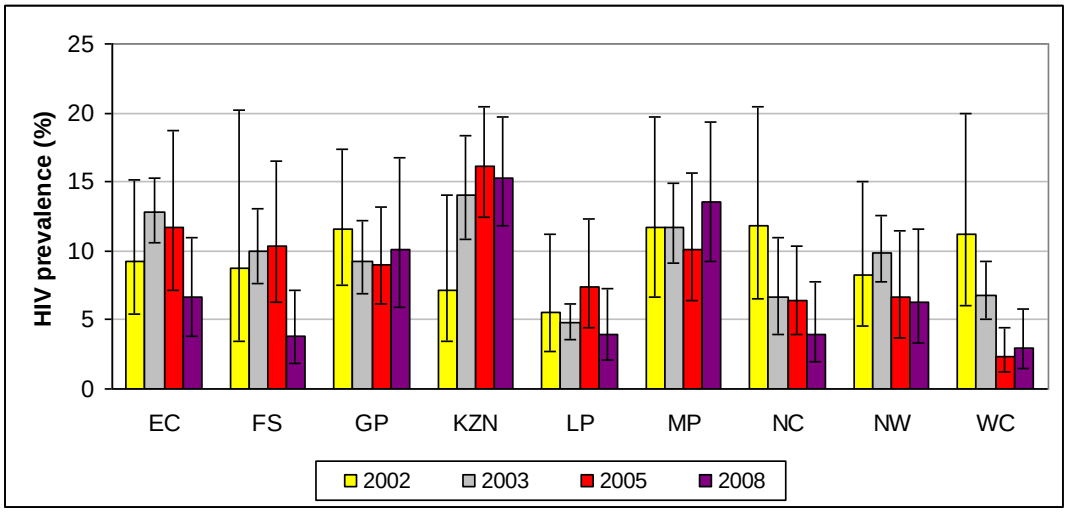
Figure 5: Provincial HIV prevalence levels in South Africa (2002, 2005, 2008)

a) Respondents 2+ years



Sources: Shisana & Simbayi (2002), Shisana *et al.* (2005, 2009)

b) Youth 15-24 years



Sources: Shisana & Simbayi (2002), Pettifor *et al.* (2004), Shisana *et al.* (2005, 2009)

The youth survey in 2003 allowed HIV prevalence estimates for youth at province level (Pettifor *et al.*, 2004) - see Figure 5b, grey bars. The trends from 2002 to 2008 in youth aged 15-24 in the provinces suggest:

- **Contracting epidemics in young people in 6 of the 9 provinces** (Eastern Cape, Free State, Limpopo, Northern Cape, North West, and Western Cape).
- **Possibly fast-contracting epidemic in Western Cape, based on the youth data and the population data** - the findings for this province must be interpreted with

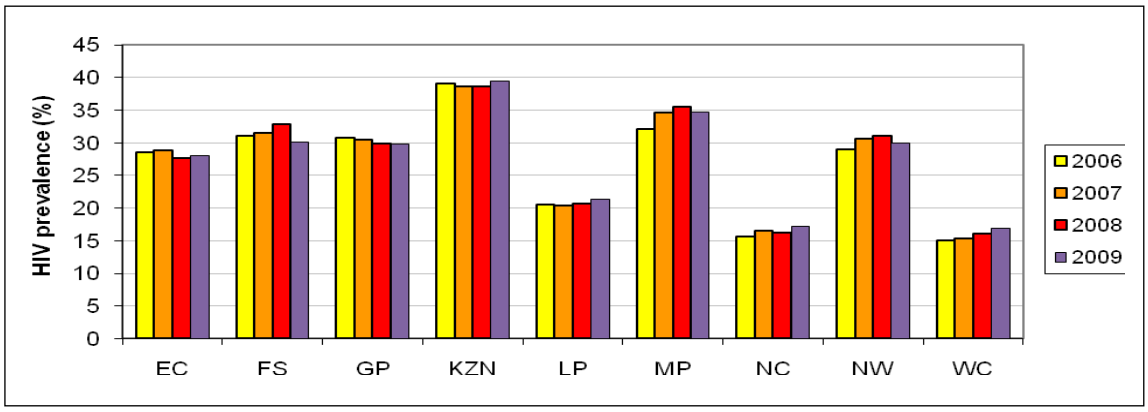
[22] In 2005, the same survey enumeration areas were used as in the 2002 survey, but in some Western Cape urban informal areas (where HIV prevalence tends to be higher than average), whole clusters of enumerated households had been burned down and residents had moved (HSRC communication).

caution, since the coefficient of relative variation exceeds 0.20 (Shisana *et al.*, 2005 p46 and appendix 5.1). Other provinces with signs of rapidly contracting epidemics in youth are Northern Cape, and to some extent also Eastern Cape and Free State.

- **Stable epidemics in young people in 3 provinces** (Gauteng, Mpumalanga, possibly KwaZulu-Natal [2008 prevalence level only a little lower than 2005 level]).

Maternal HIV prevalence levels show a very similar pattern, with lowest prevalence levels in Western Cape and Northern Cape, followed by Limpopo and Eastern Cape – see Figure 6. Again, KwaZulu-Natal and Mpumalanga have the highest HIV prevalence levels, with more than 1 in 3 pregnant women HIV infected.

Figure 6: Provincial HIV prevalence levels in ANC clients in South Africa (2006-2009)



Sources: National HIV and syphilis prevalence surveys 2006-2009 by DOH.
Note: Pre-2006 data not shown due to changes in 2006 with sample size doubled and new sentinel sites added, providing higher precision and better national representation, but reducing comparability with pre-2006 data.

In the **2009 survey among tertiary education students**, the province with the highest HIV prevalence at 6.4% (CI 4.6%–8.9%) was Eastern Cape, followed by KwaZulu-Natal at 6.1% (CI 4.5-8.2), while Western Cape was lowest at 1.1% (CI 0.7%–1.7%) (HEAIDS, 2010).[23] However, there were often wide variations in HIV prevalence among participating higher education institutions (HEI) within provinces (for example, Eastern Cape had the HEIs with the lowest HIV prevalence nationally and the second highest HIV prevalence).

The following pages show some within-province heterogeneity in HIV prevalence levels. Much more striking are the vast differences in *density* of PLHIV within individual provinces.

District Level

The ANC surveys from 2006 onward permit analysis of HIV prevalence at the health district level: **Districts' HIV prevalence levels range enormously -- from 0% (95%CI 0.0-7.1) in Namaqua, Northern Cape, to 46.4% (95%CI 41.1-51.8) in Uthukela,**

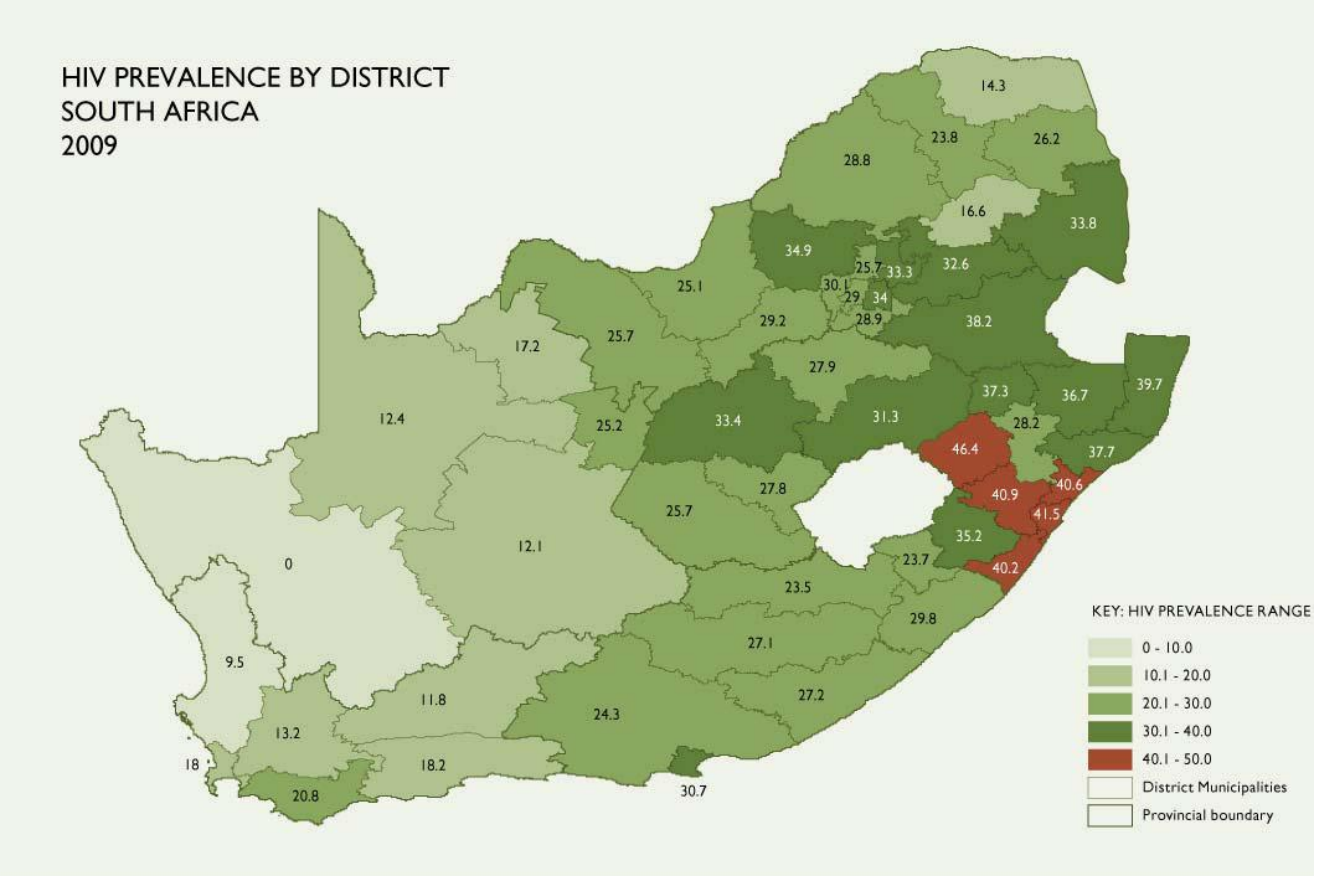
[23] The study population consisted of students and employees at 21 Higher Education Institutions in South Africa where contact teaching occurs. Out of a total of 29 856 eligible participants available at testing venues, 79.1% participated fully by completing questionnaires and providing specimens. The final database comprised 23,375 individuals made up of 17,062 students, 1,880 academic staff and 4,433 administrative and service staff (HEAIDS, 2010). The only other sizable HIV prevalence survey among students was conducted at Rand Afrikaans University (now University of Johannesburg) in 2000, where a HIV prevalence level of 1.1% was found (Uys *et al.*, 2002). This was noted to be below what was expected based on extrapolation from other surveys.

KwaZulu-Natal in 2008.

There are very large differences across South Africa's districts in:

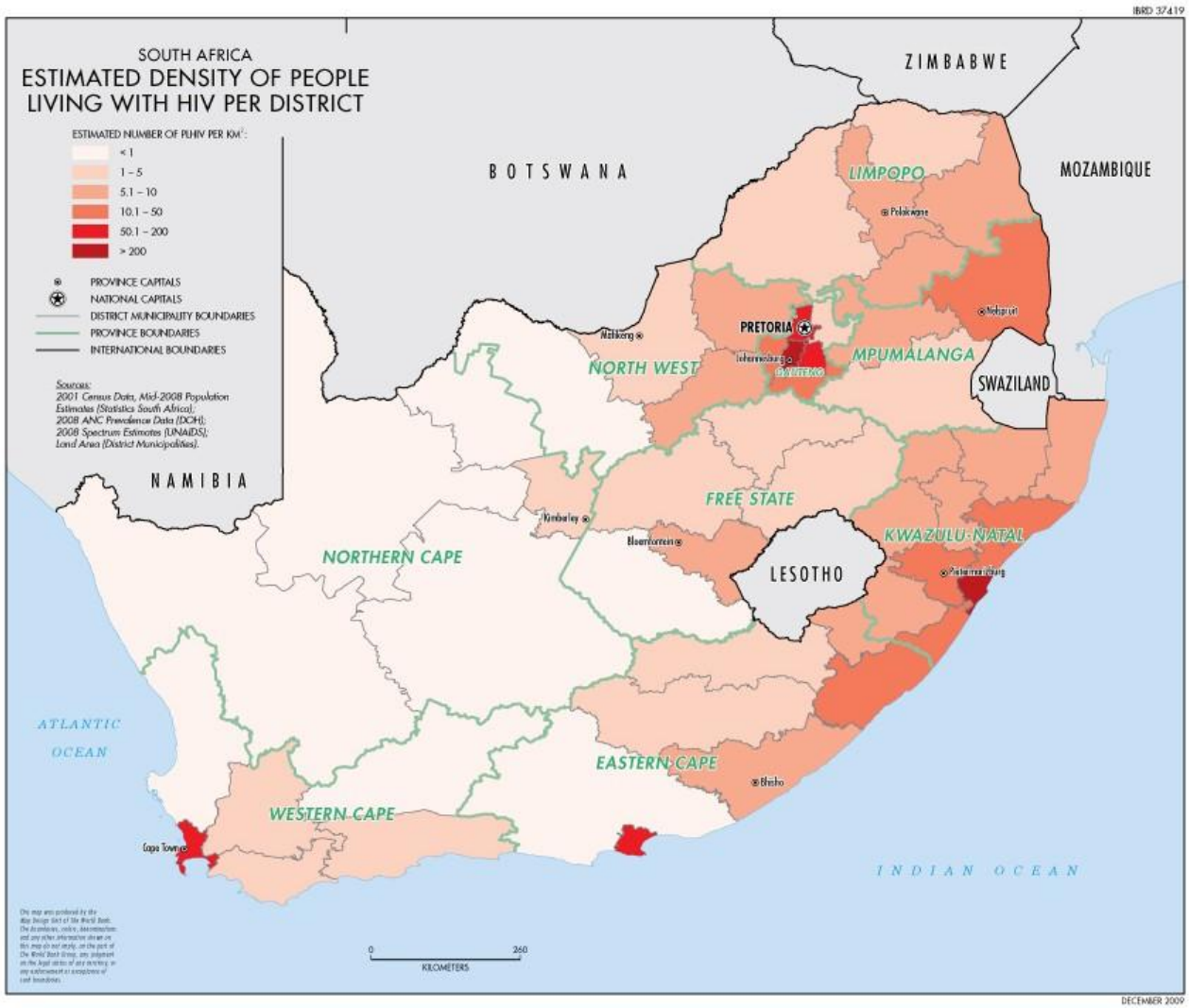
- **HIV prevalence levels** - see
-
- Figure 7 for maternal HIV prevalence variations
- **Estimated density of PLHIV** - Figure 8 clearly shows very high density of PLHIV in urban districts due to high urban HIV prevalence and high population density in urban areas
- **Estimated number of PLHIV** - Figure 9 shows considerable clustering of PLHIV in the Eastern parts of the country.

Figure 7: District HIV prevalence levels in ANC clients in South Africa (2009)



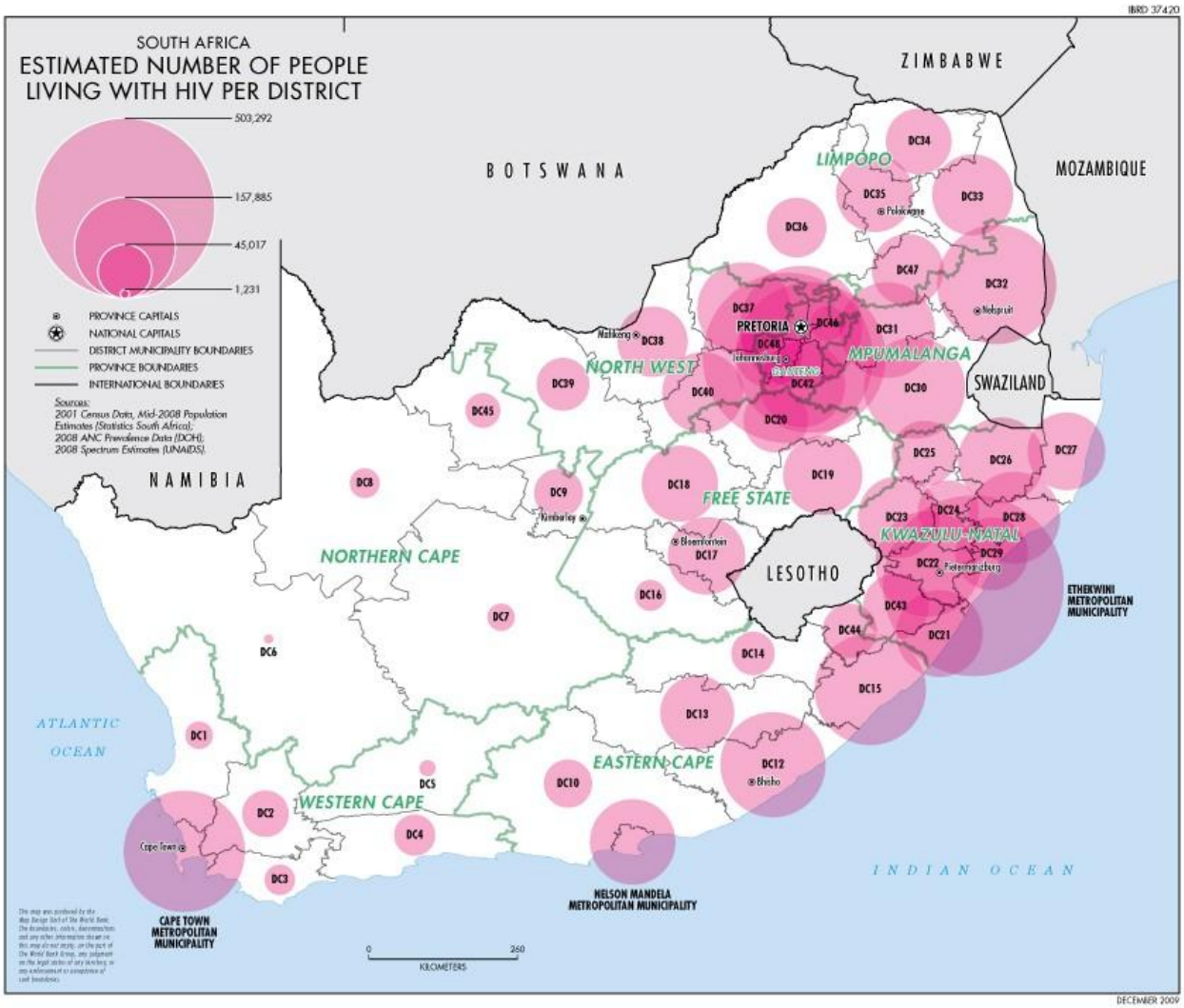
Source: ANC report 2009 (DOH, 2010)

Figure 8: Estimated density of people living with HIV per district in South Africa (2008)



Sources: 2001 census data, mid-2008 population estimates (Statistics SA), 2008 ANC HIV prevalence data (DOH), and 2008 Spectrum estimates (UNAIDS), Land area (District Municipalities)

Figure 9: Estimated number of people living with HIV per district, South Africa (2008)



Sources: 2001 census data, mid-2008 population estimates (Statistics SA), 2008 ANC HIV prevalence data (DOH), and 2008 Spectrum estimates (UNAIDS)

Local Level

At local level, there is emerging evidence that HIV prevalence shows large variation within small areas: In the Africa Centre HIV cohort, residents of informal, high-density settlements located near the national road had the highest prevalence (>35%); whilst the more inaccessible rural areas are characterized by the lowest prevalence (<10%) (Tanser *et al.*, 2009). Since the data does not say *where* and with whom the HIV infections were acquired, it cannot be concluded that these infections along the national road were transmitted from local partners. Members of households near major roads are likely to have characteristics that increase their exposure to sexual mixing with people from outside the local area through their own mobility or the mobility of the sexual partners (for activities like trading, temporary labour, etc.).

In the 2005 national survey, a person's HIV status was strongly related to the HIV prevalence in the area (i.e. sampling cluster) they lived in (Kincaid & Parker (2008) - an individual was significantly less likely to be HIV-negative if living in an area characterised by

high HIV prevalence (aOR=0.34, p<0.001, after controlling for province, type of residence, and all other variables in the model). This may suggest that a large proportion of HIV infections are acquired in the area of residence.

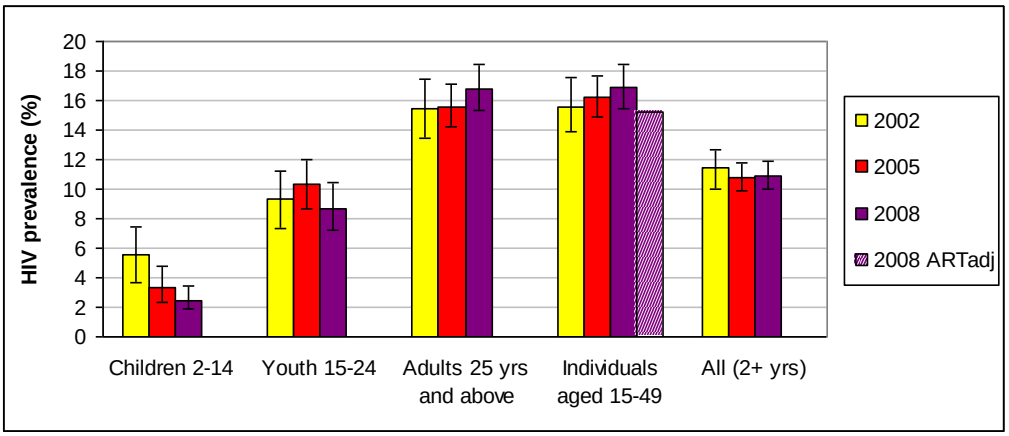
4.2.3 HIV Prevalence Pattern by Age and Gender

SUMMARY:

- **Adult females aged 15+ years are significantly more likely to be HIV-positive than males.** This also holds true in all provinces except Northern Cape & North West.
- **In adult women aged 15+ years, HIV prevalence showed a significant increase between the 2005 and the 2008 survey from 15.1% to 17.4%** (men's prevalence staying at 10%). This is mainly due to the effect of ARV treatment.
- **The majority of adult PLHIV (54%) live in just two provinces** – KwaZulu-Natal and Gauteng, far more than these provinces' 44% share of the South African population.

Overall, national HIV prevalence in the general population shows a downward trend in children and a slight upward trend in adults (Figure 10). HIV prevalence levels have gradually decreased since the first survey 2002 in children aged 2-14 years, chiefly due to the PMTCT programme[24]. Among youth aged 15-24 years, HIV prevalence was lower in 2008 (8.7%) than in 2005 (10.3%, the difference was not statistically significant); a further data point is required to see if this is the start of a downward prevalence trend in young people (the 2008 HSRC report was entitled *"A turning tide among teenagers?"*).

Figure 10: HIV prevalence levels in different age groups of South Africans (2002, 2005, 2008)



Sources: Shisana & Simbayi (2002), Shisana *et al.* (2005, 2009). ART adjusted data from Rehle *et al.*, 2010.

In adults aged 25 years and above, HIV prevalence was higher in 2008 (16.8%) compared to 2005 (15.6%, differences not statistically significant). This is largely due to the longer survival of people on ARV treatment in the age groups who are predominantly receiving

[24] The Mid-Term Review of the NSP reported that in 2008, 95% of public health facilities provided PMTCT services, and 63% of pregnant women received HCT (SANAC 2010, p36). The UNGASS 2010 report states that in 2008, 86% of HIV-positive pregnant women received ART to prevent MTCT (83% in 2009, but data incomplete) (DOH/SANAC 2010, p35).

ART.[25] It has been worked out that if the 2008 HIV prevalence level of adults aged 15-49 (16.9%) was adjusted for the excess HIV prevalence due to ART, the level would be at 15.2%, a pre-2002 HIV prevalence level (Rehle *et al.*, 2010)[26] – see Figure 10 (hashed bar).

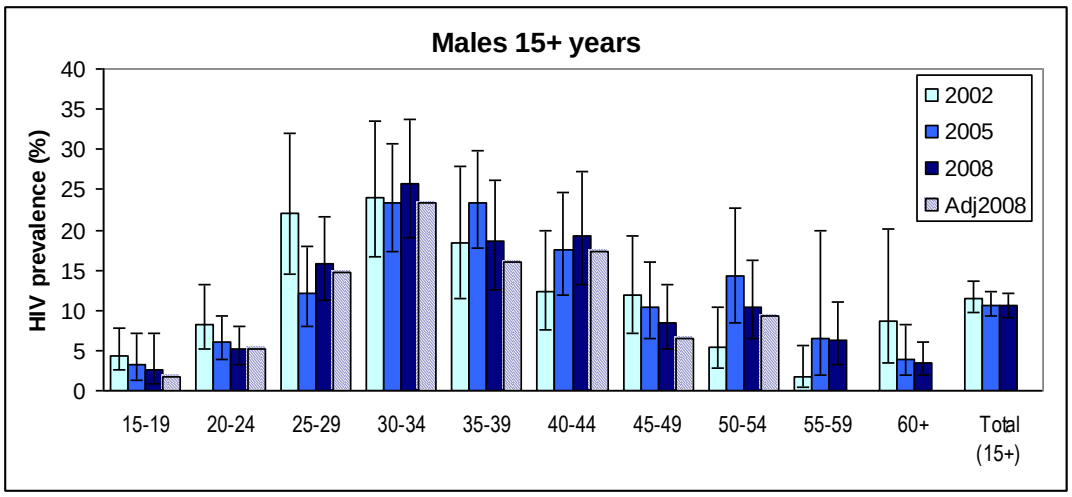
Adults and Youth

SUMMARY

- **Adult females aged 15+ years are significantly more likely to be HIV-positive than males of the same age** (aOR=1.45, p<0.001, Kincaid & Parker, 2008).
- **HIV prevalence in young women is much higher than in young men, especially in the 20-24 age group** - in 2008, HIV prevalence was over four times higher in women aged 20-24 (21.1% HIV-positive) compared to men aged 20-24 years (5.1%).
- **There is evidence of a downturn in HIV prevalence in youth aged 15-19 years and 20-24 years between 2005 and 2008.** In youth aged 15-24 years, the prevalence drop between the two surveys is 3% for females and 0.8% for males, difference not statistically significant. This downturn is corroborated by mathematically derived HIV incidence data for this age group (see later sections), and also reflected in the new ASSA2008 estimates.

In adult men aged 15+ years, HIV prevalence was virtually the same in the 2005 and 2008 surveys at about 10% - Figure 11. In young men <30 years, HIV prevalence shows a downturn, while it is increasing in some age groups of older men (e.g. 40-44 years), but confidence intervals are wide and any recent increases are essentially due to ART (dashed columns show ART-adjusted HIV prevalence, removing those individuals from the pool of PLHIV who would have died in the absence of ART, based on Rehle *et al.*, 2010).

Figure 11: HIV prevalence in adult males in South Africa (2002, 2005, 2008)
Adj2008 = Adjusted HIV prevalence without ART in 2008 (for age groups 15-54 years only)



Sources: Shisana & Simbayi (2002), Shisana *et al.* (2005, 2009). ART-adjusted HIV prevalence levels from Rehle *et al.* (2010).

[25] By July 2009, the cumulative number of adults and children on ART provided by the public sector was 871,914 (official statistics of the Department of Health, South Africa, July 2009, referred to in Rehle *et al.*, 2010).

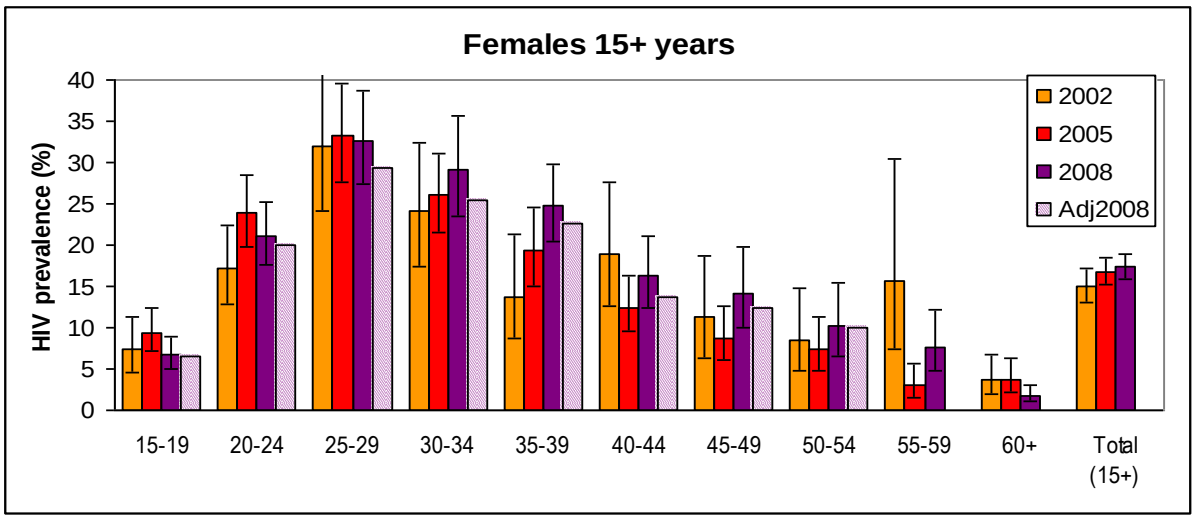
[26] Qualitative determination of commonly used ARVs in HIV-positive dried blood samples by High Performance Liquid Chromatography coupled to Tandem Mass Spectrometry (Rehle, 2010).

The small second peak in HIV prevalence in older men (see graph, 2005 and 2008 data of men aged 50-55 years) is not unique to South Africa – ALPHA network[27] data from Tanzania and Zimbabwe also found such a second peak. It was attributed to men entering unions, often marital unions, with widowed HIV-positive women (Lopman *et al.*, 2009 for the Manicaland site in Zimbabwe).

In adult women aged 15+ years, HIV prevalence showed a significant increase between the 2005 and the 2008 survey from 15.1% to 17.4% (respective 95%CIs 14.3-15.9 and 16.5-18.3 are not overlapping, and there is a statistically significant difference at the p<0.001 level) - see Figure 12. According to Rehle *et al.* (2010), most of this overall increase is due to ART, as are some of the HIV prevalence increases in the age strata of women.

Figure 12: HIV prevalence in adult females in South Africa (2002, 2005, 2008)

Adj2008 = Adjusted HIV prevalence without ART in 2008 (for age groups 15-54 years only)



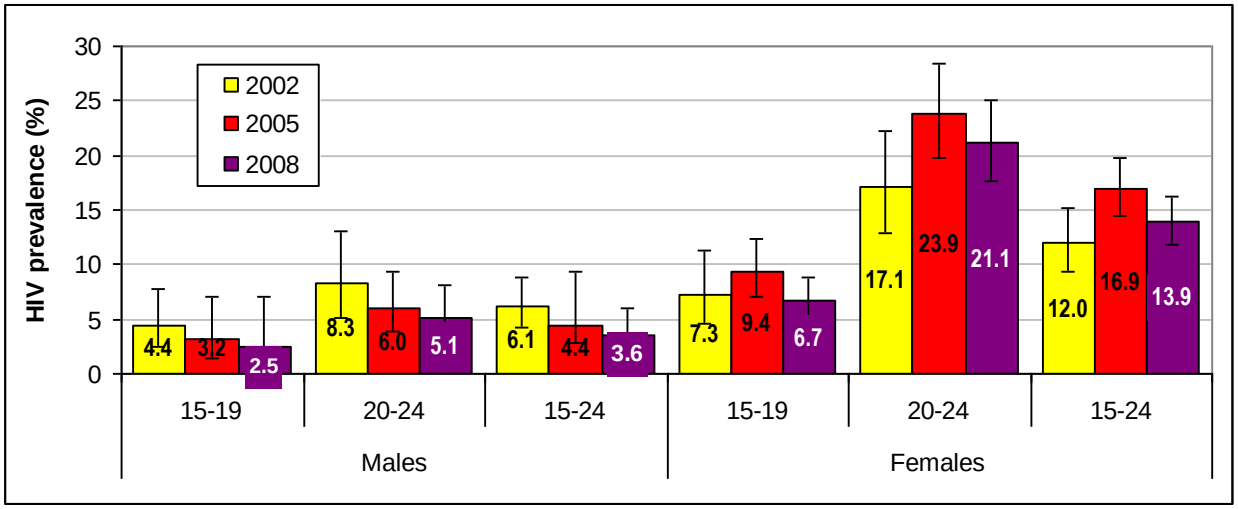
Sources: Shisana & Simbayi (2002), Shisana *et al.* (2005, 2009). ART-adjusted HIV prevalence levels from Rehle *et al.* (2010).

This increasing HIV prevalence trend in South Africa's female adult population is therefore different to the overall stable HIV prevalence observed in pregnant women in recent years. Only when looking at prevalence trends in age groups, are ANC based data reflective of population based data: In young women below 30 years of age, HIV prevalence levels show a downward trend, whereas in older women, HIV prevalence is increasing (also see following discussion).

The **downturn in HIV prevalence in male and female youth aged 15-24 years in the 2008 survey compared to 2005 is encouraging** (Figure 13). It is not statistically significant, but it may be that there has indeed been a decrease in HIV prevalence in youth and that the survey was too small to detect it. The downturn is corroborated by mathematically derived HIV incidence data for this age group (Shisana *et al.*, 2008 table 3.12) – see section 1.3.1. The ASSA2008 model estimates a downturn in young people's HIV prevalence, from 9.2% in 2005 to 7.7% in 2010 (ASSA, 2011).

[27] The **ALPHA network** links several HIV cohort studies and undertakes comparative studies. Its members are: The Africa Centre for Health and Population Studies (South Africa), the Karonga Prevention Study (Malawi), the Kisesa Cohort Study (Tanzania), the Masaka District Cohort Study (Uganda), the Manicaland Panel Study (Zimbabwe), and the Rakai Health Sciences Program (Uganda). See http://www.lshtm.ac.uk/cps/alpha/ (accessed 15 August 2009).

Figure 13: HIV prevalence in youth in South Africa, by sex and age group (2002, 2005, 2008)



Source: Secondary data analysis HSRC for KYE

- **The nationally representative youth survey implemented in 2003 found the same pattern of very high HIV prevalence in young women compared to young men** (Pettifor *et al.*, 2004). Overall the HIV prevalence among 15-24 year olds was 10.2% (95% CI 9.3-11.3).[28] Analysis by single-age group suggested that **HIV prevalence in females increases rapidly after the 20th birthday** (age 20: 14.4% HIV-positive, age 21: 31.2% HIV-positive – the difference however not reaching statistical significance due to wide confidence intervals). This jump in HIV prevalence was concomitant with onset of sexual activity: Among females aged 15-19, less than half reported having had sex (47%), but in the age group 20-24, sexual inception was almost universal (91%) (Pettifor *et al.*, 2004).

- The **2009 survey among tertiary education students also found a large differential between female HIV prevalence (4.7%) and male HIV prevalence (1.5%, difference statistically significant p<0.001)** and this pattern was consistent across the provinces (HEAIDS, 2010).

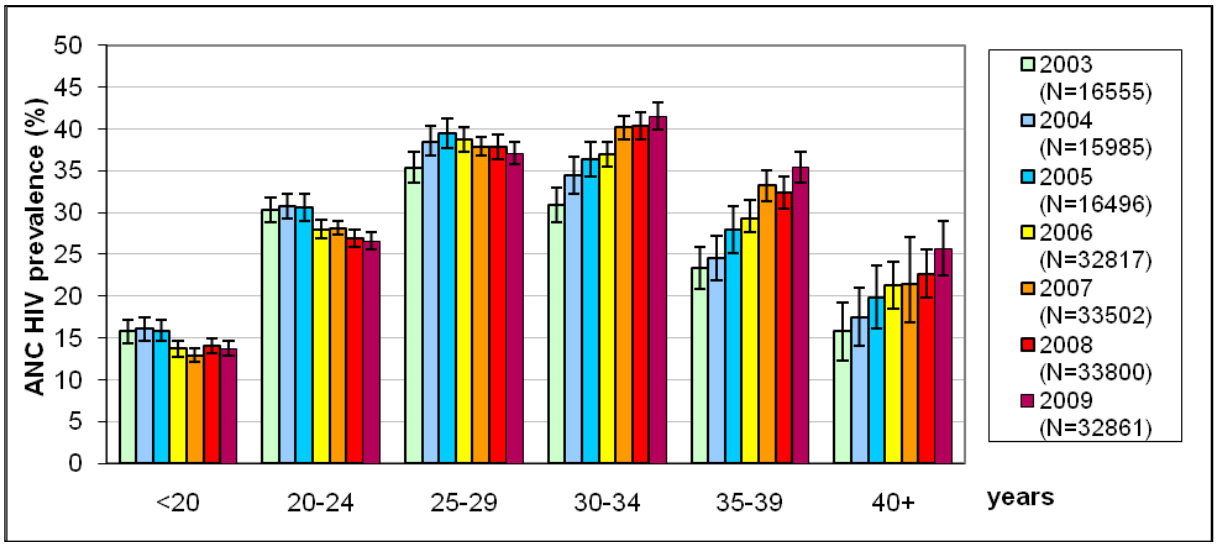
Age-specific HIV prevalence trends in ANC clients:

In all age groups of pregnant women, HIV prevalence is alarmingly high – among pregnant teenagers, HIV prevalence was already at 13.7% in 2009, and it reached its maximum in 30-34 year old pregnant women at 41.5% - Figure 14. In the women below 30 years of age, HIV prevalence has been fairly stable in each 5-year age group over the last three surveys - only in women aged 20-24 was the 2009 value significantly lower than the 2007 value. In contrast, **HIV prevalence increased significantly in women aged 30-34 and 35-39 years** between 2007 and 2009.

[28] HIV prevalence among males 15-24 was 4.8% (95% CI 3.9-5.9) and among females 15-24 it was 15.5% (95% CI 13.7-17.6). For those age 15-19 years the prevalence among males was 2.5% (1.8-3.4), while for females it was 7.3% (5.9-9.0) which is identical to the level measured in the 2002 national survey in this group of females. Among those age 20-24 years the prevalence among males was 7.6% (6.3-9.3), which fits very well into the downward trend seen in the 2002, 2005 and 2008 surveys. Among females it was 24.5% (20.3-29.3), similar to the prevalence level reported from the 2005 survey in this group (Pettifor *et al.*, 2004 p29).

The increasing trend in HIV prevalence in older ANC clients can partly be attributed to ART. Rehle *et al.* (2010) documented that in women in the general population aged 25-29, 30-34 and 35-39, an estimated 3.4%, 3.6% and 2.1%, respectively, of HIV prevalence is due to individuals who are alive due to ART (but who would have died already without ART and left the pool of HIV-positive people).

Figure 14: Maternal HIV prevalence by age group in South Africa (2003-2008)



Source: Sentinel reports 2003-2009 (DOH 2003, 2005, 2006, 2007, 2008, 2009, 2010)
Note: Pre-2006 data and data from 2006 onwards are not comparable. In 2006, the sample size was doubled and new sentinel sites added, providing higher precision and better national representation.

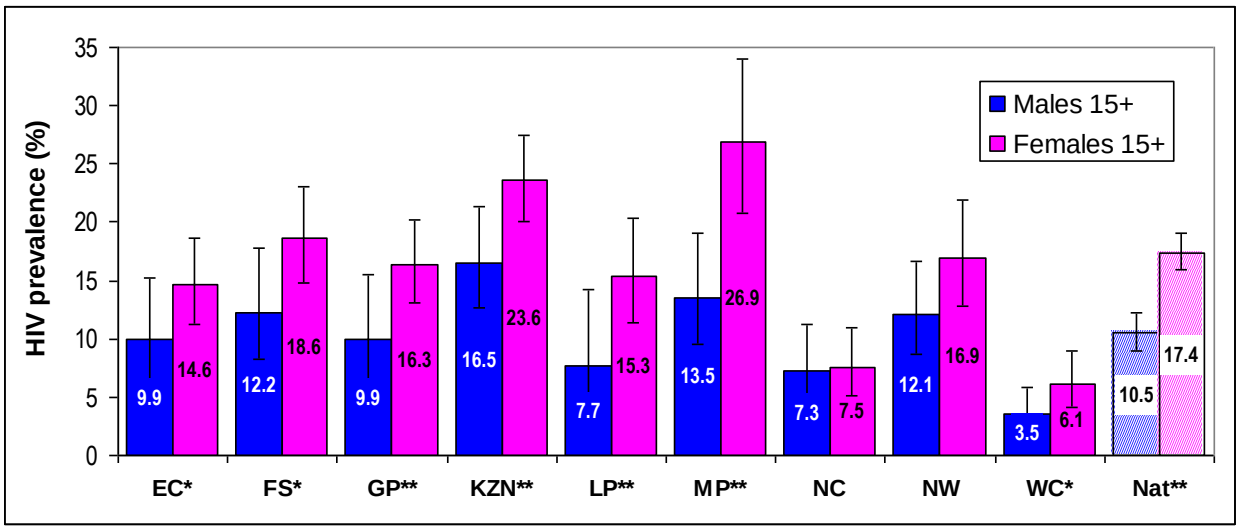
This pattern of stabilising or falling HIV prevalence levels in young women, and increasing HIV prevalence in pregnant women in their 30s, is mirrored by the population level data on women in Figure 12. It is a typical sign of a mature epidemic and with ART increasing the longevity of PLHIV.

Sex-specific HIV prevalence levels in the South African provinces:

In most provinces, HIV prevalence in women aged 15+ is significantly higher than in men – see Figure 15 with significance levels indicated with asterisks. In Mpumalanga, HIV prevalence in females is twice the prevalence in males. Only in the Northern Cape, male and female are similar, and in the North West, the prevalence difference between the sexes is non-significant.

Figure 15: HIV prevalence in male and female adults aged 15+ years, by South African province (2008)

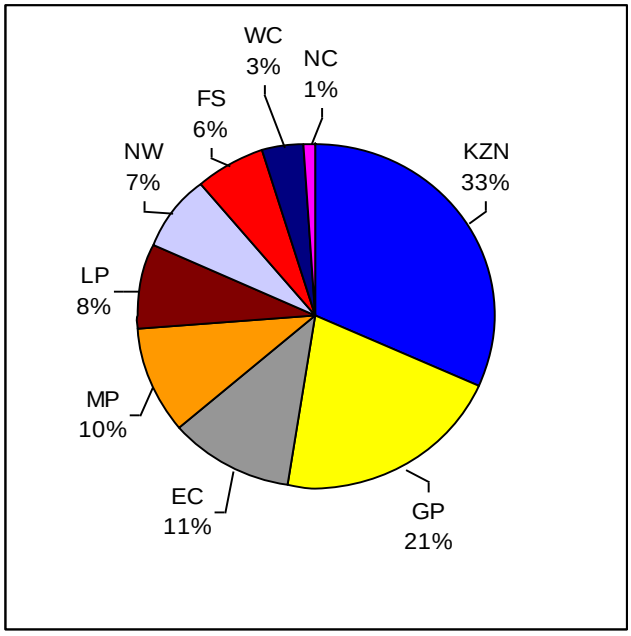
Note results of significance testing between provincial male and female HIV prevalence levels



Sources: Prevalence data provided by HSRC.
Asterisks: denote significance levels of statistical testing for difference between provincial male and female HIV prevalence * = p<0.05; ** = p<0.001.

More than half of all adult PLHIV live in just two provinces – KwaZulu-Natal and Gauteng. Figure 16 shows the relative distribution of PLHIV aged 15-49 years in the nine provinces.

Figure 16: Estimated number of PLHIV aged 15-49 years in each South African province (2008)



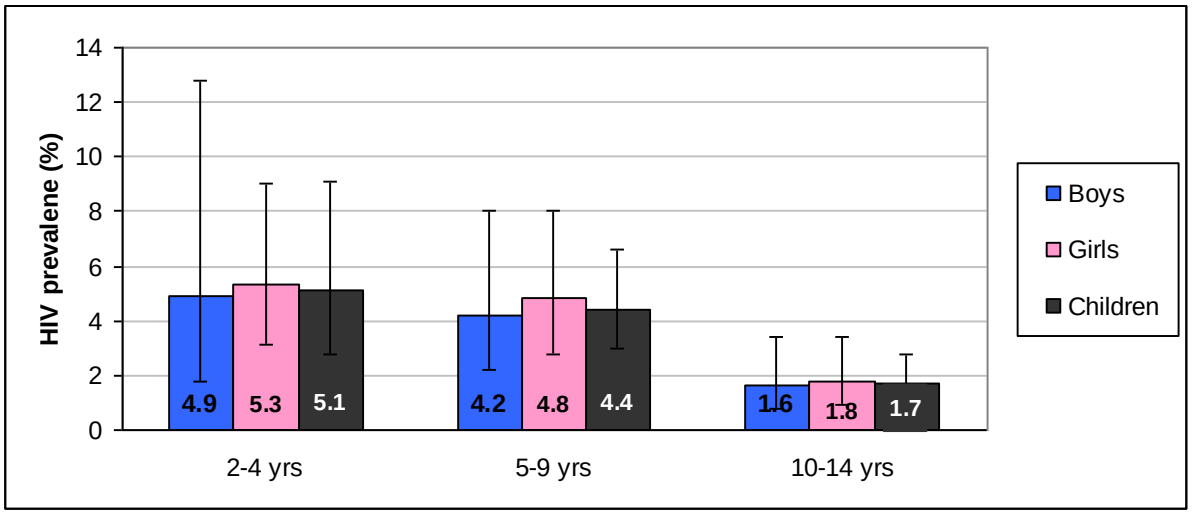
Sources: Estimated population 15-49 years in mid-2008 from SSA website times-series data, HIV prevalence in persons aged 15-49 years in 2008 from Shisana *et al.* (2009), table 3.10.

Children

The first population-based study of HIV prevalence in South African children was conducted in 2002 (Shisana & Simbayi, 2002) and revealed much higher HIV levels in children aged 2-14 years than expected – 5.6% (95% CI: 3,7%–7.4%) were found infected. Subsequent surveys found lower HIV levels of 3.3% (2005) and 2.5% (2008) in children - see Figure 10. The high levels found in 2002 motivated a health facility-based "HIV risk exposure study" to investigate all possible routes of HIV transmission among 2–9 year old children to better understand the sources of paediatric infections (15% of study sample found HIV infected, see sections 4.4.4 and 4.4.5 for detailed results of this study regarding modes of transmission) (Shisana *et al.*, 2005).

Population-based data from 2005 suggest that paediatric HIV prevalence levels are lowest among older children (<2% among those aged 10-14) and that girls and boys have very similar HIV prevalence levels - see Figure 17. Due to low HIV testing response rates among children in such surveys (63% in 2002, 55% in 2005, 59% in 2008), confidence intervals are wide in some strata. The health facility-based "HIV risk exposure study" implemented in 2004 reported 14.3% HIV prevalence among boys aged 2–9 years and 15.3% among girls (difference not statistically significant, p = 0.844) (Shisana *et al.*, 2005). Based on South African and Zimbabwean data, Ferrand *et al.* (2009) estimate that 64% of HIV-infected infants are fast progressors with median survival of 0.6 years and 36% are **slow progressors with median survival of 16 years**. It is therefore plausible that among the HIV-positive older children identified in the 2005 survey, there are a substantial number of slow progressors of the HIV infections acquired through vertical (mother-to-child) transmission.

Figure 17: HIV prevalence in South African children aged 2-14 years (2005)



Source: Shisana *et al.* (2005, table 3.10)

There is a cluster of variables which are strongly interrelated in South Africa - race, education, socio-economic status and place of residence **– and they all impact on HIV prevalence levels and trends.**

4.2.4 HIV Prevalence Pattern by Race

SUMMARY

- Survey participation rates differ by race, and HIV prevalence of whites and Indians need to be interpreted with caution due to high survey refusal rates.
- **The African population of South Africa has the highest level of HIV infection**. Coloured people are 3.4 times less likely to be HIV-positive than Africans, Indians 16.2 times and whites 7.8 times.
- In 2008, African men and women were significantly more likely to be HIV-positive than non-African men and women (M: aOR 14.3, p<0.0001; W: aOR 9.1, p<0.0001). This was also true in 2005 and 2002 (see models in Annex 1 section 1G).
- **HIV prevalence dropped significantly in whites and coloureds between 2002 and 2005** and has shown a non-significant downturn in Indians between 2005 and 2008 – these changes are likely to be influenced by participation bias.
- **HIV prevalence levels in the African population show a small, non-significant upward trend over the three surveys**, which is mainly due to ART.
- Race is an important epidemiological variable because it embodies socio-economic contexts that influence risk of HIV infection.

The composition of the South African population by race is 79.2% Africans, 9.2% whites, 9.0% coloureds and 2.6% Indians (mid-year population estimates 2008, Shisana *et al.* 2009 p23).

Participation rates in HIV surveys (and in other national surveys like the population census) have varied across race groups, and have generally been lower for Indians and whites than for coloureds and Africans (Shisana *et al.*, 2009).[29] Low participation appears to be due to several reasons:

1. Respondents' perception that HIV was not a problem in whites' and Indians' communities (HSRC 2008, unpublished[30])
2. Security concerns due to high local crime levels - many Indians and whites did not open their doors to the survey fieldworkers (Shisana *et al.*, 2009 p71)
3. Orphaned youth having a stronger concern regarding HIV - 5% of African youth and 2% of coloured youth had lost both parents compared to 0% of Indian and white youth, which might affect the motivation to participate (Pettifor *et al.*, 2004)
4. Higher risk perception of contracting HIV among Africans and coloureds compared to whites and Indians (Shisana *et al.*, 2005, p75)

In the Cape Area Panel Study (CAPS)[31] on adolescents, attrition rates between 2002 and

[29] For instance, in the 2008 population survey, 75% of Coloureds and 69% of Africans, but only 53% of Whites and 48% of Indians, agreed to HIV testing (Shisana et al, 2009), and over-sampling was necessary to allow meaningful comparison between race groups (report, p70). In the 2003 youth survey, interviews were completed with 83% of the African youth selected, 71% of the coloured youth, but only 60% of the Indian youth, and a mere 38% of the White youth (Pettifor *et al.*, 2004).

[30] "Social cultural values and norms relating to HIV risk perception and behaviour: National qualitative study, South Africa", HSRC 2008, unpublished.

[31] CAPS is a representative longitudinal study of adolescents aged 14-22 (in 2002) living in Cape Town conducted in three waves in 2002, 2004 and 2005. It uses a two stage probability sample of households. The first stage sample used the 1996

2005 were considerably higher for whites (43%) than Africans (29%) and coloureds (16%) (Kenyon *et al.*, 2009).

Race is an important epidemiological variable because it embodies socio-economic contexts that influence risk of HIV infection (Shisana *et al.*, 2005 p46). Race and type of residence area often go together, for instance, the vast majority of whites and Indians live in formal urban areas (idem, p9). Other sections in this report highlight other variables linked to socio-economic status and HIV risks.

In multivariate analysis of HSRC data, for men and for women, race (African or not) was the most important predictor of HIV status. Differential susceptibility and the underlying biological reasons are not well understood to date.

In the multivariate analysis of STI symptoms in the CAPS dataset, Kenyon *et al.* (2009) found that race was a strong predictor of STI symptoms in univariate analysis, but incorporating partner concurrency into the multivariate model removed race as a significant variable - implying that **differences in concurrency are a key mediating factor responsible for differences in racial/ethnic STI transmission**.

The African population of South Africa has the highest level of HIV infection – see Figure 18. All other racial groups are significantly more likely to be HIV-negative than Africans - the adjusted odds of whites being HIV-negative are 7.8 times greater than for Africans ($p<0.001$, logistic regression analysis of 2005 survey data by Kincaid & Parker, 2008). Adjusted odds for being HIV-negative are also 3.4 times greater for coloureds ($p<0.001$), and 16.2 times greater for Indians ($p<0.001$). However, the differential survey participation needs to be taken into account in these comparisons (in 2008, only 53% of whites and 48% of Indians, but 75% of coloureds and 69% of Africans, agreed to HIV testing - Shisana *et al*, 2009)

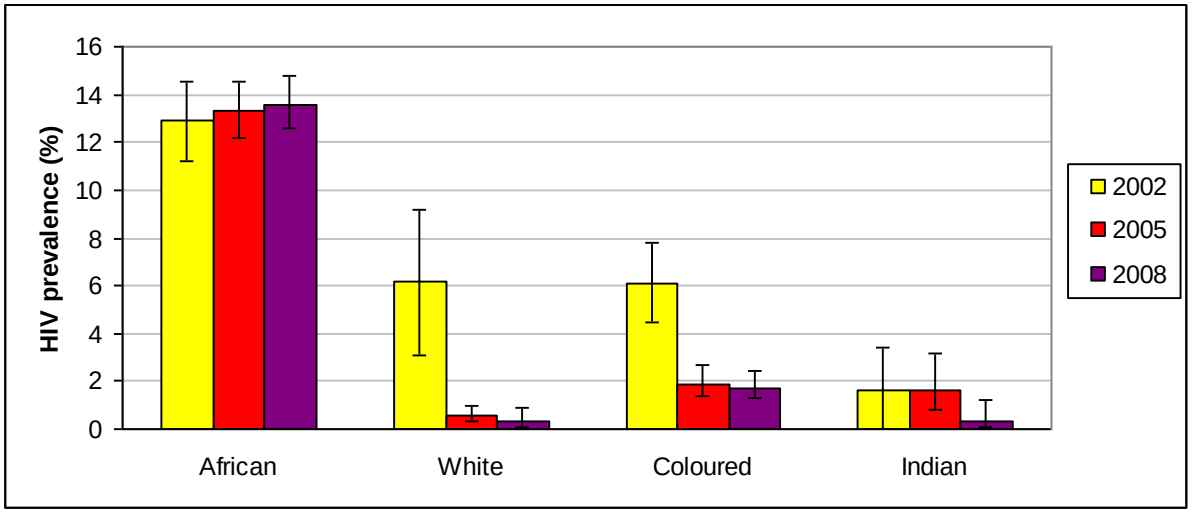
In the 2007 KZN HIV Impact Study among company employees, HIV prevalence was 30.6% in African employees and 1.5% in non-African employees (Colvin *et al.*, 2007).

HIV prevalence dropped significantly in whites and coloureds between 2002 and 2005 - see Figure 18. These decreases may partly explain the large drop in overall HIV prevalence in Western Cape -- whites and coloureds comprised about 20% and 56%, respectively, of the WC survey sample in 2005.

HIV prevalence levels in the African population show a small, non-significant upward trend – see Figure 18. Prevalence in the Indian population decreased between 2005 and 2008, but the difference is not statistically significant.

census enumeration areas as a sampling frame. Since these areas are generally homogenous as far as race is concerned, the White and African areas were over-sampled so as to obtain relatively equal numbers of youth in each of the three racial categories. The second stage randomly sampled households in each of the chosen enumeration areas (for details of sampling methodology, non-response and attrition rates, see Lam *et al.*, 2006).

Figure 18: HIV prevalence by race group in South African aged 2+ years (2002, 2005, 2008)



Sources: Shisana & Simbayi (2002), Shisana *et al.* (2005, 2009)
Note: Differential survey participation needs to be taken into account. For instance, in 2008, only 53% of whites and 48% of Indians (but 75% of coloureds and 69% of Africans), agreed to HIV testing (Shisana *et al*, 2009)

In the 2003 youth survey, HIV prevalence in African youth was three times higher than in youth of any other race (Pettifor *et al.*, 2004):

- 11.8% among African youths (similar to the 12.3% found in African youth in 2005)
- 3.8% among coloured youths (higher than the 1.7% found in 2005)
- 2.0% among white youths (higher than the 0.3% found in 2005)
- 0.9% among Indian youths (similar to the 0.8% found in 2005)

The 2009 survey among tertiary students found an even larger HIV prevalence differential across racial groups with the following HIV prevalence levels: African 5.6%, coloured 0.8%, Indian 0.3%, and white 0.3% (HEAIDS, 2010).

4.2.5 HIV Prevalence Pattern by Marital Status

SUMMARY

- The multivariate analysis of HSRC data found that in 2008, **married women had lower odds of HIV infection than unmarried women.** While married women in their 20s, 30s and 40s had the same odds of HIV infection as unmarried teenage girls, unmarried women in these older age groups had significantly higher odds of HIV infection (Annex 1). For men, marriage was not important for their likelihood of being HIV infected.
- **HIV prevalence tends to be higher in provinces with higher levels of polygyny.**
- Age of first marriage has been increasing in South Africa, especially in women, leading to **long periods of time spent single and sexually active.**

Surveys assessing marital status have found evidence that the age of first marriage has been increasing in South Africa, especially in women.[32] [33] In the 2003

[32] Note that age at first marriage (AFM) and age at first sex (AFS) are both prone to reporting biases - recent studies reported evidence for inconsistent reporting of AFS and AFM in Masaka, Umkhanyakude, Manicaland (Wringe *et al.* 2009)

SADHS, the median age at first marriage for women 25-49 had increased considerably to 27.0 years from 24.2 years in the 1998 SADHS (DOH 2007, table 2.17).[34] The proportion of women 15-49 in the never married category increased from 48% in the 1998 SADHS to 54% in 2003. Fifty-six percent of men aged 15-59 years had never married (2003 SADHS). Data presented by Budlender *et al.* (2004) suggest that in the late 1990's the mean age at marriage for South Africans was around 25 years, which was at that time already considerably higher than the ages reported for most other African countries. Bongaarts *et al.* (2007) reported that in sub-Saharan Africa, the four highest median ages at first marriage are found in Botswana (25.7), Swaziland (25.8), South Africa (26.7) and Namibia (28.9) - four countries with some of the most severe HIV epidemics in the world. Bongaarts *et al.* suggested that high age at first marriage in populations may be a key factor in these hyper-epidemics.

The multivariate analysis of HSRC data found that in 2008, **married women were less likely to be HIV-positive than unmarried women**[35] (it cannot be excluded that there is some 'survival effect' in this with some HIV-positive women not surviving long enough to get married). Women aged 20 and above who were married had a similar likelihood of being infected as unmarried female teenagers aged 15-19 years. In contrast, unmarried older women had much higher odds of infection than unmarried teenagers: those unmarried and aged 20-29 were 2.7 times more likely to be HIV-positive and those aged 30-39 were 3.0 times more likely (see Annex 1 section 1G for all adjusted ORs and p-values). Older women (born before 1950) were less likely to be infected regardless of marital status, because when they were younger, HIV prevalence was much lower and women from that cohort who were infected probably died before their fifties (assuming those infected in the 1980s and 1990s had no access to ART). In men, marriage was not correlated with HIV status. In the 2005 data, married women were again significantly less likely to be HIV-positive than single women (aOR 0.44 $p<0.0001$). Cohabitation had a similar but weaker association with HIV status compared to marriage. In 2002, the same observation of marriage being associated with lower HIV infection levels could be made (aOR 0.52 $p=0.09$).

The 2009 National Communication Survey found that at province level, there was **an inverse relationship between the proportion of sexually active people who reported sex with a married spouse and provincial HIV prevalence** (HDA secondary data analysis). In provinces where few sexually active women reported sex with a spouse, HIV prevalence was especially high (KwaZulu-Natal, Mpumalanga – only 25% and 27%, respectively, reported sex with spouse). To a lesser extent, this was also true for males.

In Umkhanyakude (Africa Centre study site in KZN), a decline in marriage among

[33] Budlender *et al.* (2004) highlight the challenges of collecting and interpreting data regarding marital status in South Africa, resulting from the cultural and religious diversity in the forms of marriage, as well as the language issues in translating questionnaires. They note that surveys and censuses reflect perceptions of marriage, and point out that the customary practice of *lobola* (bridewealth) could introduce complexity to perceptions of marriage because such marriages take place over an extended period of time. The authors also highlight that changes in legislation in 1998 with the passing of the Recognition of Customary Marriage Act, giving new legal status to customary marriages, may affect perceptions differently from before. Budlender *et al.* (2004) demonstrate gender differences in reporting of marriage, with more men reporting being married than women.

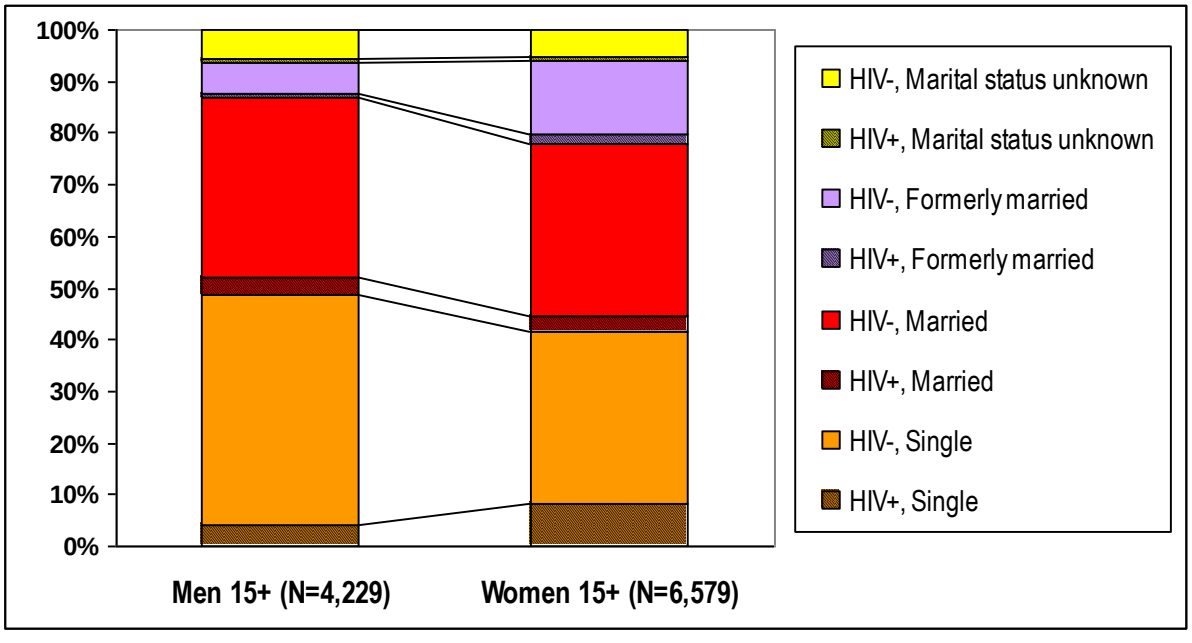
[34] The observed extreme increase between the two SADHS surveys needs to be interpreted with some caution: The 1998 median AFM ranged from 22.6 for women aged 45-49 to 24.7 for women 30-34, while the 2003 median ranges from 25.7 years to 27.0 for women of the same age groups—showing a full year's difference between 1998's highest and 2003's lowest median age.

[35] This relationship showed an interaction with birth cohort so a combined variable was created. The baseline is single women born 1990-94. See Annex 1 section 1C for details and section 1G for model.

the Zulu population has been observed for decades (Hosegood & Preston-Whyte, 2002; Udjo, 2001). Marston et al (2009) describe trends in age at first sex (AFS), age at first marriage (AFM) and time spent single using data from several countries.[36] In the South African site Umkhanyakude, a very different pattern was observed compared to the study sites in the other countries, with lower marriage rates and later marriage, leading to **long periods of time spent single and sexually active for men and women**. In 2006, only 14% of all women in Umkhanyakude were married or cohabiting at the age of 25–29 years, and 47% at the age of 45–49 years (Hosegood *et al.*, 2009).

An estimated 60% of all adult people living with HIV (PLHIV) are not married or cohabiting – see Figure 19 (based on 2005 population survey data published by Rehle *et al.*, 2007). This is largely explained by the late age of marriage in South Africa, and the low percentage of people who ever get married. Furthermore, **an estimated 32% of all adult PLHIV are married people**, and an estimated 5% and 3% are widowed and divorced, respectively. An ecological analysis on marriage patterns and HIV prevalence levels in Sub-Saharan Africa by Bongaarts *et al.* (2007) showed a significant positive correlation between HIV prevalence and the median AFM, and between HIV prevalence and the interval between AFS and AFM.

Figure 19: HIV prevalence in South Africans aged 15+ years, by marital status (2005)



Source: 2008 National survey data (HSRC)

Kincaid & Parker (2008) found that when controlling for all other variables including age, **people of single status were 1.7 times more likely to be HIV infected than those of other marital status** ($p<0.001$, multivariate logistic regression analysis of 2005 national survey data).

In the KZN HIV Impact Study among employees, "cohabitation" (not married but living with partner) was associated with very high HIV prevalence in African

[36] Data from cohort studies and DHSs implemented in South Africa (Umkhanyakude), Uganda (Masaka, Rakai), Tanzania (Kisesa), Zimbabwe (Manicaland) and Malawi (Karonga) – Marston *et al.*, 2009.

employees (44% HIV-positive, vs. 34% of unmarried, 33% of divorced/widowed, 24% of married but living apart, and 20% of married and living together) (Colvin *et al.*, 2007).

In Umkhanyakude, preliminary findings suggest that **HIV prevalence is higher in the marital status categories associated with a higher rate of multiple partner acquisition** i.e. polygamous marriage[37], remarriage and being separated, widowed or divorced; that widows and widowers have exceptionally high HIV prevalence; and that older men are significantly less likely to use condoms than younger men (McGrath *et al.*, 2009). Hosegood et al (2009) write that *"the impact of adult mortality on the rate of widowhood may be masked by the subsequent death of widowed spouses, as well as by re-marriage"* and *"the low rate of divorce likely reflects the high proportion of marriages contracted through customary rites … there may also be an under-reporting of divorce, particularly in families whose faith tradition does not permit divorce".*

4.2.6 HIV Prevalence Pattern by Education and Socio-economic Status

SUMMARY

Higher education appears to be protective: In past HSRC surveys, men and women with tertiary education were significantly less likely to be HIV-positive than those with no school education (multivariate analysis, Annex 1). Students, as opposed to unemployed, were also significantly less likely to be HIV-positive. In 2008 in Eastern Cape and KwaZulu-Natal, men with matriculation (the qualification received on graduating from high school) or tertiary education were significantly less likely to be HIV-positive than those with less education.

Low economic status is a risk factor: In 2008, Africans in all income categories up to 8000 Rand/month had significantly higher HIV prevalence levels than non-Africans in the same income category. Deprivation was linked to significantly higher HIV prevalence especially in Africans. Respondents working in the informal sector had overall the highest HIV prevalence, with almost one third of African informal workers HIV-positive. In 2005, respondents who experienced any form of economic deprivation were significantly more likely to be HIV-positive. In women, the greater the lack of money, the more likely they were HIV-positive.

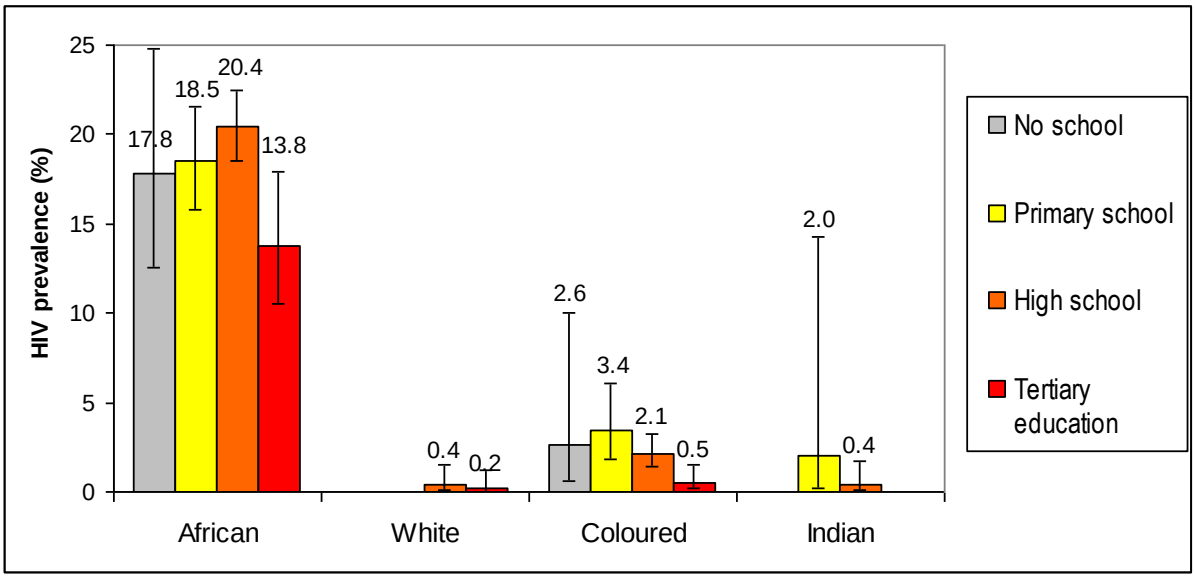
Education

It is important to bear in mind that the age-specific pattern of education reflects secular changes in South African education policy (Maithufi, 1997). For instance, the matriculation pass rate (i.e. attainment of grade 12) increased from 40% in the late 1990s to 68% in 2005 (SouthAfrica info, 2006).

In 2008, the educational strata most likely to be HIV infected were Africans with less than tertiary education – see Figure 20. Africans with tertiary education were significantly less likely to be HIV infected.

[37] National figures for polygamous unions can be drawn from the 1998 DHS. Overall, about 1 in 8 married women lived in a polygynous union (SADHS 1998, table 2.16 – **polygyny** meaning that a man has more than one wife). Urban married women had lower frequency of polygynous marriage (10%) compared to rural married women (17%). Among African women, where polygynous unions most often occur (16%), no discernible trend according to birth cohort was apparent from the data.

Figure 20: HIV prevalence by educational level and race in South Africans aged 15+ years (2008)



Source: Shisana & Simbayi (2002), table 23

The 2009 survey among tertiary students found that among the youngest students aged 18-19 years, HIV prevalence was significantly lower at 0.7% than among older students aged 20-25 years (2.3%) and 25+ years (8.3%) (HEAIDS, 2010).

The KZN HIV Impact Study among employees found in bivariate analysis that HIV prevalence was highest in Africans who had some or completed secondary education (34%) compared to no/primary/tertiary education (27%/26%/21%, Colvin *et al.*, 2007).

In contrast, Dunkle et al (2004) found among ANC clients in Soweto/Gauteng in 2001-2002 that pregnant women with lowest educational attainment had highest HIV prevalence (39%) and those with highest educational attainment had lowest HIV prevalence (24%).

The multivariate analysis of HSRC survey data showed that **in 2008, women with tertiary education were significantly less likely to be HIV-positive** (60% lower chance than women without education) (see Annex 1 section 1G). **In 2005, men with tertiary education were 2.5 times less likely to be HIV-positive than men without education** (p=0.043). The tertiary education effect in 2005 was comparatively smaller in women (1.56 times less likely to be HIV-positive than those without education, p n.s.). From the same 2005 data, Kincaid & Parker (2008) reported that when controlling for all other variables, students, as opposed to unemployed, were significantly less likely to be HIV-positive (aOR=0.38, p<0.001).

Similarly, in logistic regression analysis of 2008 survey data from men in Eastern Cape and KwaZulu-Natal, **men with matriculation or tertiary education were significantly less likely to be HIV-positive** than those with less education (Jewkes *et al.*, 2009).

The trend over time between educational attainment and risk of HIV infection described by Hargreaves *et al.* (2008) for several African countries - HIV prevalence falling more consistently over time among highly educated groups than among less educated groups – could not be confirmed in South Africa (analysis of African population stratum only due to

sample size limitations). **In Africans in all education strata, HIV prevalence increased between 2002 and 2008, with the steepest increase in those without school education** (8.2% to 17.8% from 2002 to 2008, difference significant).

Socio-economic status

National HIV prevalence data were available against three indicators of SES (all 2008 data): i) Monthly income, ii) Levels of deprivation, and iii) Employment status.

i) Monthly income: In 2008, HIV prevalence levels were highest in Africans with very small monthly incomes below 500 Rand (24.9%, see Table 2). However, even Africans earning 2000-4000 Rand per month had a very high HIV prevalence of 21.6%. Respondents in income categories above 4000 Rand monthly had much lower HIV prevalence levels.

Africans in all income categories up to 8000 Rand had significantly higher HIV prevalence levels than non-Africans in the same income category (few respondents had incomes above 8000 Rand, confidence intervals were therefore lacking for comparison).

Table 2 : HIV prevalence by level of monthly income in South Africans aged 15+ years (2008)

Income (R per month)	Africans		Non-Africans	
	HIV (%)	95 % CI	HIV (%)	95 % CI
No income	21.5	17.2-26.7	1.3	0.5-3.0
<500	24.9	19.5-31.1	1.9	0.7-4.7
501 – 1000	20.5	14.7-27.7	1.5	0.6-3.5
1001 – 2000	15.5	11.2-20.9	3.2	1.7-6.2
2001 – 4000	21.6	14.3-31.3	1.1	0.2-5.5
4001 – 8000	11.0	6.4-18.1	0.3	0.1-1.3
8001 – 16000	6.4	3.1-12.5	0.0	-
16001 – 32000	0.0	-	0.1	0.0-1.0
> 32000	4.7	0.6-28.4	0.0	-

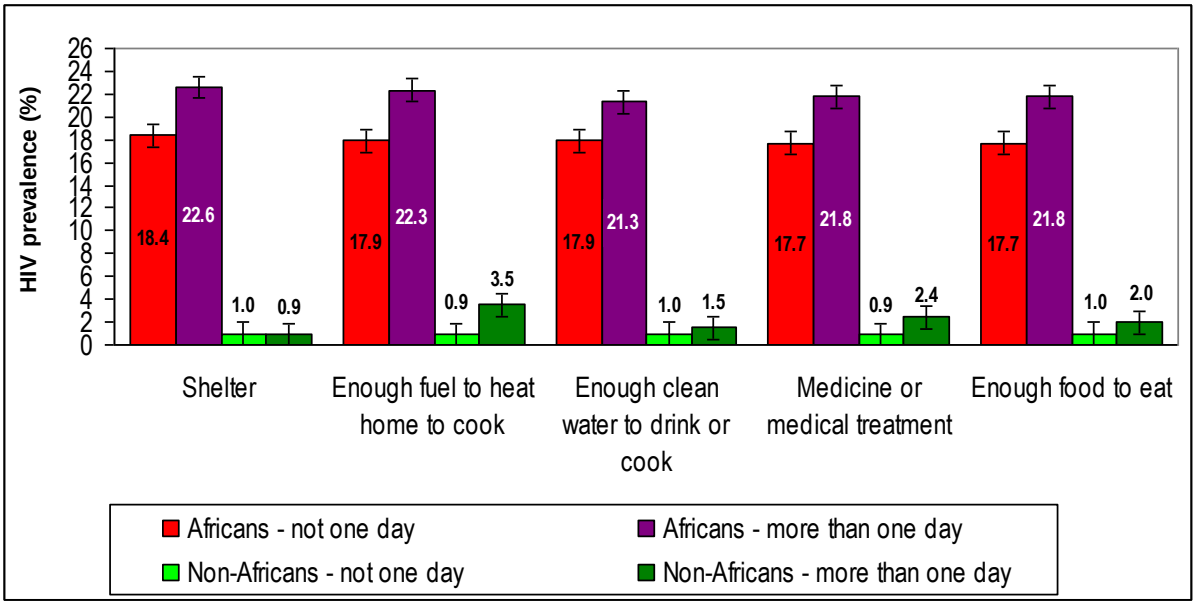
Source: HSRC secondary data analysis

ii) Levels of deprivation: In 2008, respondents were asked how often in the past week they had gone without shelter, enough fuel, enough clean water, medicine or enough food - Figure 21.

In Africans, HIV prevalence was significantly higher in those reporting deprivation using any of the five measures. In non-Africans, respondents reporting sometimes going without enough fuel to heat or cook also had significantly higher HIV prevalence compared to those not experiencing this form of deprivation.

Figure 21: HIV prevalence by measure of deprivation and race in South Africans aged 15+ years (2008)

Question posed was: *"In the past week, how often have you gone without the following?"*



Source: Secondary data analysis HSRC

In the multivariate data analysis of HSRC 2005 data, women reporting sometimes or often "going without cash" were 45% and 58% more likely to be HIV-positive (sometimes: aOR 1.45 p=0.0074; often: aOR 1.58 p=0.005) (see annex 1 section 1G). **Women who often lacked money ('cash') had the greatest chance of being HIV-positive.**

Kincaid & Parker found in multivariate analysis of the 2005 national survey data that the 57% of all respondents who experienced **any form of deprivation**[38] in the last 12 months were **significantly more likely to be HIV-positive** (aOR=1.27, p<0.01, controlling for all other variables).

The KwaZulu-Natal HIV Impact Study among employees reported significantly higher HIV prevalence among African employees not owning their residence compared to those owning the residence (34% vs. 28%, p<0.001) (Colvin *et al.*, 2007).

Other sources on socio-economic status and HIV risk paint a varied picture:

- Dunkle *et al.* (2004) supported the findings on deprivation: among ANC clients in Soweto, **significantly more HIV-positive women experienced hunger in their household** (42%) than HIV-negative women (35%, p=0·01). In contrast, Jewkes *et al.* (2006) reported that among sexually active women resident in the rura**l Eastern Cape near Mthatha, HIV-positive women were of similar socioeconomic status to HIV-negative women** - they were also *just* as likely to be studying, came from similar communities, had similar club and church activities, and similar experiences of orphanhood.
- **Jewkes** *et al.* (2006) found the opposite for young men in 2002-2003: **a higher socio-**

[38] Having not enough fuel to heat or cook, not enough clean water to drink and cook with, not enough food to eat, not enough cash income, or lack of medicine or medical treatment

economic status score for HIV-positive men (0.167) than for HIV-negative men (-0.014, not significant) in the Mthatha area.

iii) Employment status: In 2008, respondents working in the informal sector had overall the highest HIV prevalence, with almost one third of the African informal workers HIV-positive (Table 3). Among non-Africans, HIV prevalence was highest among those unemployed, and sick or disabled (3-4%). In all employment groups, Africans had significantly higher HIV prevalence than non-Africans in the same employment category.

Table 3: HIV prevalence by employment type in South Africans aged 15+ years (2008)

Employment	Africans		Non-Africans	
	HIV (%)	95 % CI	HIV (%)	95 % CI
Housewife	23.8	19.3-28.9	0.7	0.3-1.7
Unemployed	27.6	24.7-30.7	3.6	2.1-6.2
Work in informal	31.7	17.0-51.1	1.2	0.3-5.2
Old age Pensioners	2.7	1.7-4.5	0.2	0.0-1.1
Sick/disabled	26.0	19.6-33.7	3.1	1.2-7.7
Student/pupil	5.3	3.3-8.6	0.2	0.0-0.9
Employed	20.1	17.5-22.9	0.8	0.5-1.4

Source: HSRC secondary data analysis

A factor possibly related to socio-economic status is **internet use**. In multivariate analysis (2008 HSRC data), **men reporting internet use once a week or once a day were 33 times (p<0.0001) and 12.5 times (p=0.0042) less likely to be HIV-positive. Women using the internet every day were 4.5 times less likely to be HIV-positive** (p=0.0017).

4.2.7 HIV Prevalence Pattern by Type of Settlement

SUMMARY

- **Several studies have shown that urban informal areas are associated with highest HIV prevalence.** In 2008, women living in urban informal areas were 57% more likely to be HIV infected than those in urban formal areas (multivariate analysis).
- **In urban formal areas, HIV prevalence has been falling since 2002 - by about 3%** between 2002 and 2008 (decrease not reaching statistical significance).
- **In rural areas – both informal and formal – HIV prevalence increased by over 5% between 2002 and 2008.** The increase is statistically significant for rural informal areas, but not for rural formal areas due to small sample size.

The following types of residence (geotype) have been distinguished in national surveys:

a. *Urban formal* - these are purely urban areas with formal street layouts, with electricity and other services generally available in urban areas such as flush toilets. These include formal townships and other residential areas. Building structures are mainly brick.

b. *Urban informal* - there are informal areas -- slums and squatter settlements -- in urban areas. These areas have informal street layouts, some have electricity some do not. These areas can be found in and around towns/cities or outskirts of townships.
c. *Rural formal (farms)* - these are farms where accommodation is built of bricks and often in well laid out streets, but in farming areas. This accommodation is usually for workers and residents of the farms. There are some basic amenities in these areas.
d. *Rural informal or tribal areas* - these are typical rural African villages often with no electricity or tarred roads, and informal street layout.

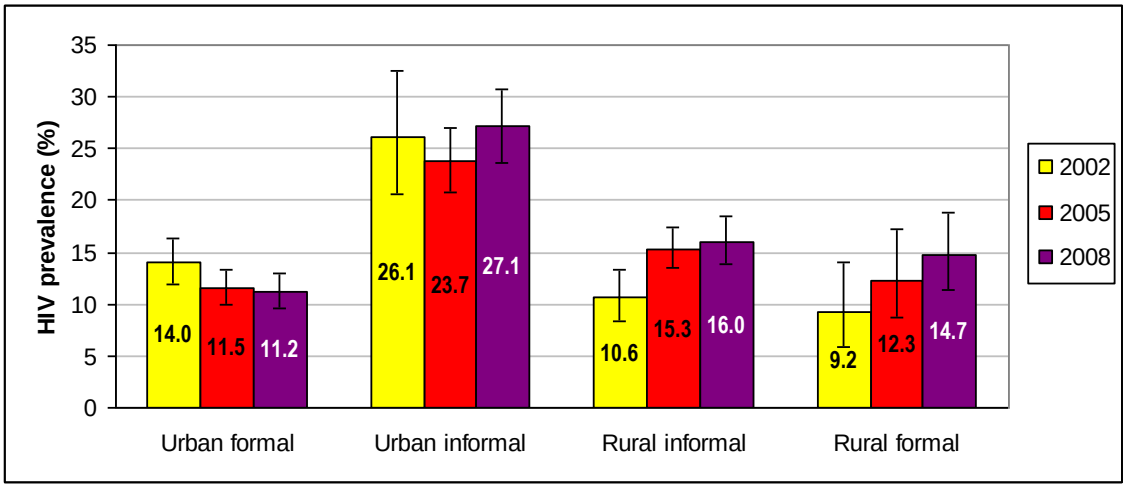
In 2008, just like in the two previous national surveys of 2002 and 2005, adult residents of urban informal areas were the most likely to be HIV-positive (27% in 2008) – see Figure 22. When controlling for race and other confounding variables in multivariate analysis, female residents of informal urban areas in 2008 were 57% more likely to be HIV infected than residents of formal urban areas (p=0.014) (see annex 1 section 1G). Geotype was not important for men.

In 2002 and 2005, rural informal and rural formal areas, respectively, were associated with lower odds of HIV infection, but with the increase in rural HIV prevalence over time and the simultaneous HIV prevalence decrease in urban formal areas, this association had disappeared by 2008 (see annex 1 section 1G for adjusted ORs and p-values).

In the KwaZulu-Natal impact study, differences in HIV prevalence by locality were relatively small among sampled employees, once data were disaggregated by race (African employees: 29% urban formal, 34% urban informal, 32% rural, 34% hostel) – **urban informal areas again associated with highest HIV prevalence** (Colvin *et al.*, 2007).

HIV prevalence increased in rural informal and rural formal areas by over 5% between 2002 and 2008 (statistically significant for rural informal areas, not significant for rural formal areas due to small sample size). In contrast, the HIV prevalence trend is falling in urban formal areas (not significant). Figure 22 shows trends.

Figure 22: HIV prevalence by locality of residence in South Africa (2002, 2005, 2008)



Source: HSRC secondary data analysis

In the 2003 youth survey (Pettifor *et al.*, 2004), **youth living in urban informal areas equally had the highest HIV prevalence at 17.4%** (95%CI 12.8-23.2). Those living in rural formal areas had a HIV prevalence of 13.5% (95%CI 9.8-18.3), followed by those in

urban formal areas at 9.8% (95%CI 8.5-11.3) and lastly those in rural informal areas at 8.7% (95%CI 7.3-10.5).

Welz *et al.* (2007) argue that in rural areas with high proportions of mobile and migrant individuals, cross-sectional sero-surveys may underestimate HIV prevalence, as these mobile and migrant individuals are at an increased risk of HIV and may be missed by cross-sectional surveys. Therefore the burden of HIV in rural areas of South Africa may be higher than previously estimated. In the Africa Centre **HIV cohort in KZN, non-resident men are nearly twice as likely (adjusted OR=1.8) to be infected in comparison with their resident counterparts**; whilst the corresponding ratio for women is 1.5 (Welz *et al.,* 2007).

4.2.8 HIV Prevalence by Male Circumcision Status

SUMMARY

- **Overall, there is strong evidence for MC being effective in reducing the risk of HIV and other STIs in men, and indirectly reducing HIV prevalence among women in the population.**
- In 2005, men who reported having been circumcised before first sex were **significantly less likely to be HIV-positive** (multivariate analysis).
- In the Orange Farm trial near Johannesburg, **the protective efficacy of MC was 61%**, which means that circumcised men have a 61% lower risk of getting HIV infected compared to non-circumcised men.
- **In field surveys, self-reported MC status has been found to be unreliable,** making interpretation of cross-sectional data on MC status and HIV status difficult. In 2008, 24% of 15-19 year old men and 47% of men aged 20 or above reported being circumcised (HSRC secondary analysis).

Male circumcision (MC) offers biological protection against HIV acquisition (Bongaarts *et al.,* 1989 ; Moses *et al.,* 1990; Auvert *et al.*, 2005; Drain *et al.*, 2006, Bailey *et al.*, 2007; Gray *et al.*, 2007). A recent **systematic review of the effectiveness and safety of MC** by the South African Cochrane Centre found a relative risk reduction of acquiring HIV of 50% at 12 months and 54% at 21 or 24 months following MC (Siegfried *et al.*, 2009), based on data from three randomised controlled trials. No significant differences between circumcised and uncircumcised men's sexual behaviour were found in the data from the Kenyan and Ugandan MC trials. For the Orange Farm trial in South Africa, the mean number of sexual contacts (acts) at the 12-month visit was 5.9 in the circumcision group versus 5.0 in the control group, which was a statistically significant difference ($p<0.001$). This difference remained statistically significant at the 21-month visit (7.5 versus 6.4; $p<0.01$). Incidence of adverse events following the surgical circumcision procedure was low in all three trials.

South African MC trial data suggest that MC is effective in protecting men against HIV – The Orange Farm Trial[39] provided the first experimental evidence of the efficacy of

[39] Orange Farm and surrounding areas is a semi-urban area close to the city of Johannesburg (Auvert *et al.*, 2005). The recruitment of participants took place in the general population from July 2002 to February 2004. Preliminary and partial trial results were presented at the International AIDS Society 2005 Conference, on 26 July 2005, in Rio de Janeiro, Brazil. In the trial, 3274 uncircumcised men aged 18–24 years were randomized to a control or an intervention group with follow-up visits at 3, 12, and 21 months. MC was offered to the intervention group immediately after randomization and to the control group at the end of the follow-up. The trial was stopped at the interim analysis, and the mean (interquartile range)

MC in protecting men against HIV infection and it was the first randomized control trial testing the impact on health of MC. In the trial, **the protective efficacy of MC was 61%**, which means that circumcised men have a 61% lower risk of getting HIV infected compared to non-circumcised men. In the trial follow-up, there was a significantly increased mean number of sex acts between 4 and 21 months among men in the circumcision arm, but not an increase in the number of sexual partners or a change in condom use (Auvert *et al.*, 2005).

Facts about male circumcision in South Africa:

1. **Performed mainly on youth as a part of initiation rites of passage into manhood, primarily among the Venda, Pedi, Ndebele and Tsonga**[40]**, as well as the Xhosa**[41] **and South Sotho** (Mayatula & Mavundla, 1997; Simbayi, 2002; Meissner & Buso, 2007; Connolly *et al.*, 2008) – see In the HSRC surveys, men were asked about their circumcision status. Around **40% of men** said they were circumcised, of whom about half had been circumcised before they first had sex. Table 4 summarizes the most recent population-based data on MC:

- There is a shift among young men to **getting circumcised in hospital by a doctor**, instead of having the procedure done in a remote location or as part of traditional initiation, which was more frequent among older men
- Men below 25 years of age are more interested in considering MC than older men
- There is a shift from MC for tradition to **MC for HIV/STI prevention and hygiene**.
- **Parents** of young men play an important role in getting the young man to go for circumcision.

Male circumcision has broad support by South Africans - the 2008 HSRC survey also found that over 60% of females would be supportive of their un-circumcised partner getting circumcised (HSRC secondary data analysis 2010). When men and women were asked if they supported the idea that all men should be circumcised, **almost two-thirds said yes**.

2. Figure 23. These are mostly post-puberty circumcisions (Connolly *et al.*, 2008). Stinson (undated) reports that historically, the Zulu circumcised, but the practice for ritual's sake has largely been modified/abandoned. Also, not all Xhosa-speaking groups circumcise, for instance it is not practised amongst the Bhaca, Mpondo, Xesibe or Ntlangwini. Table 4 presents MC prevalence data by age group from the HSRC 2008 survey.
3. **MC often takes place after sexual debut –** according to the 2002 survey, 41% of males underwent MC after sexual debut (Connolly *et al.*, 2008). The NCS 2009 found that of all male respondents reporting being circumcised, 73% had the procedure after their 18th birthday (HDA/JHHESA, 2010). This may weaken any protective effect of MC.[42] Considerable risk behaviour prior to MC was reported by Peltzer *et al.* (2008) from Eastern Cape - 9% of young men had been diagnosed with a STI in the past 12 months, 15% reported having had 3+ life-time partners, and 38% had not used a condom at last sex. Since traditional MC is part of

follow-up was 18.1 mo (13.0–21.0) when the data were analyzed. There were 20 HIV infections (incidence rate = 0.85 per 100 person-years) in the intervention group and 49 (2.1 per 100 person-years) in the control group, corresponding to an RR of 0.40 (95% CI: 0.24%–0.68%; $p < 0.001$). This RR corresponds to a protection of 60% (95% CI: 32%–76%). When controlling for behavioural factors, including sexual behaviour that increased slightly in the intervention group, condom use, and health-seeking behaviour, the protection was 61% (95% CI: 34%–77%).

[40] Residing primarily in the northern provinces of Limpopo, Mpumalanga and Gauteng

[41] Residing primarily in Eastern Cape.

[42] A similar explanation was given by Auvert *et al.* (2001) in the four city study, in which MC was found protective in Kisumu, Kenya (early MC) but not in Ndola, Zambia (later MC).

initiation into manhood, newly circumcised men are likely to have sex soon after the operation, and if healing is not complete, this may represent an HIV risk.

4. **Neonatal MC is generally performed on Jewish[43] and Muslim[44] babies** (Mayatula & Mavundla, 1997; Simbayi, 2002). Connolly *et al.* (2008) report 79% MC prevalence in Jews and Muslims combined. Table 4 presents data on the reasons for circumcision from the HSRC 2008 survey.
5. **MC levels vary by province with highest levels in Free State and Western Cape** (71% and 68%, respectively – SADHS 2003 table 5.17). In contrast, the lowest MC levels are reported from Gauteng (25%) and KwaZulu-Natal (27%). Reported MC levels are similar in urban and non-urban areas (43% and 49%).
6. **MC levels are highest in Africans (50%) and much lower in white, Indian and coloured race groups** (22%, 19%, 16%, respectively, SADHS 2003). The MC levels by race reported from the 2002 national survey are substantially different: African 42%, white 30%, Indian 25%, coloured 23% (Connolly *et al.*, 2008) (note the earlier comment on the inaccuracy of self-reported MC status).
7. **MC is done in both traditional and clinical settings** – Connolly *et al.* (2008) report that 57% of all circumcised males were circumcised in the mountains, bush, at initiation schools or at home, whereas 43% were circumcised in hospital. Almost all white, Indian and coloured circumcised men had undergone clinical MC. Median age at MC was 18 years for Africans, 10 years for coloureds, 2 years for whites, and 1 year for Indians. Table 4 presents data on where men were circumcised from the HSRC 2008 survey, and who performed the procedure.
8. **There are documented health risks associated with traditional MC procedures:** Traditional (ritual) MC mostly occurs in unsterile conditions, and may include repeated use of the same instrument (Mayatula & Mavundla, 1997; Crowley & Kesner, 1990; Stinson, undated). Peltzer *et al.* (2008) write that among the Xhosa, an unsterilized unwashed blade may be used on a dozen or more initiates in one session. Initiates are also dehydrated during their seclusion in the belief that this reduces weeping of the wound (Mayatula & Mavundla 1997). Dehydration and septicaemia can result in acute renal failure, gangrene, tetanus or even death.[45] Within clinical trial conditions, Auvert *et al.* (2005) noted 60 adverse events among 1,568 male circumcisions, which were mainly pain, swelling and bleeding (no deaths).
9. **In some contexts, circumcised men are encouraged to engage in premarital sex with women they do not intend to marry** (Shisana & Simbayi, 2002)
10. **Acceptability of MC is good among non-circumcised men** - Table 4 presents data on willingness to be circumcised from the HSRC 2008 survey. Lagarde *et al.* (2003) found that in Westonaria (west of Johannesburg), only 1 in 5 men reported being circumcised, but more than 70% of the uncircumcised men stated that they would want to be circumcised if MC were proved to protect against STIs. Scott *et al.* (2005) reported from northern KwaZulu-Natal that 51% of uncircumcised men favoured MC and 68% of women favoured MC of their partners. The same study found that among both sexes, the main barrier to MC was fear of pain and death. The greatest logistical barrier was that, at present, circumcision can only be carried out by trained hospital doctors.

There are large differences in MC prevalence across the ethnic groups of South Africa. In **the HSRC surveys, men were asked about their circumcision status. Around 40% of men said they were circumcised, of whom about half had been circumcised before they first had sex. Table 4 summarizes the most recent population-based data on MC:**

[43] According to the 2001 census, there were 75,745 Jews in South Africa, with about 48% of them in Johannesburg and 21% in Cape Town. http://en.wikipedia.org/wiki/Jewish_population_of_South_Africa

[44] According to the 2001 census, 1.5% of the South African population is Muslim

[45] The Eastern Cape DOH recorded 2262 hospital admissions, 115 deaths and 208 genital amputations for circumcisions between 2001 and 2006 (Meissner & Buso, 2007).

There is **a shift among young men to getting circumcised in hospital by a doctor, instead of having the procedure done in a remote location or as part of traditional initiation, which was more frequent among older men**

- Men below 25 years of age are more interested in considering MC than older men
- There is a shift from MC for tradition to **MC for HIV/STI prevention and hygiene**.
- **Parents** of young men play an important role in getting the young man to go for circumcision.

Male circumcision has broad support by South Africans - the 2008 HSRC survey also found that over 60% of females would be supportive of their un-circumcised partner getting circumcised (HSRC secondary data analysis 2010). When men and women were asked if they supported the idea that all men should be circumcised, **almost two-thirds said yes**.

Figure 23 shows the ethnic groups by dominant language and by prevalence of MC.

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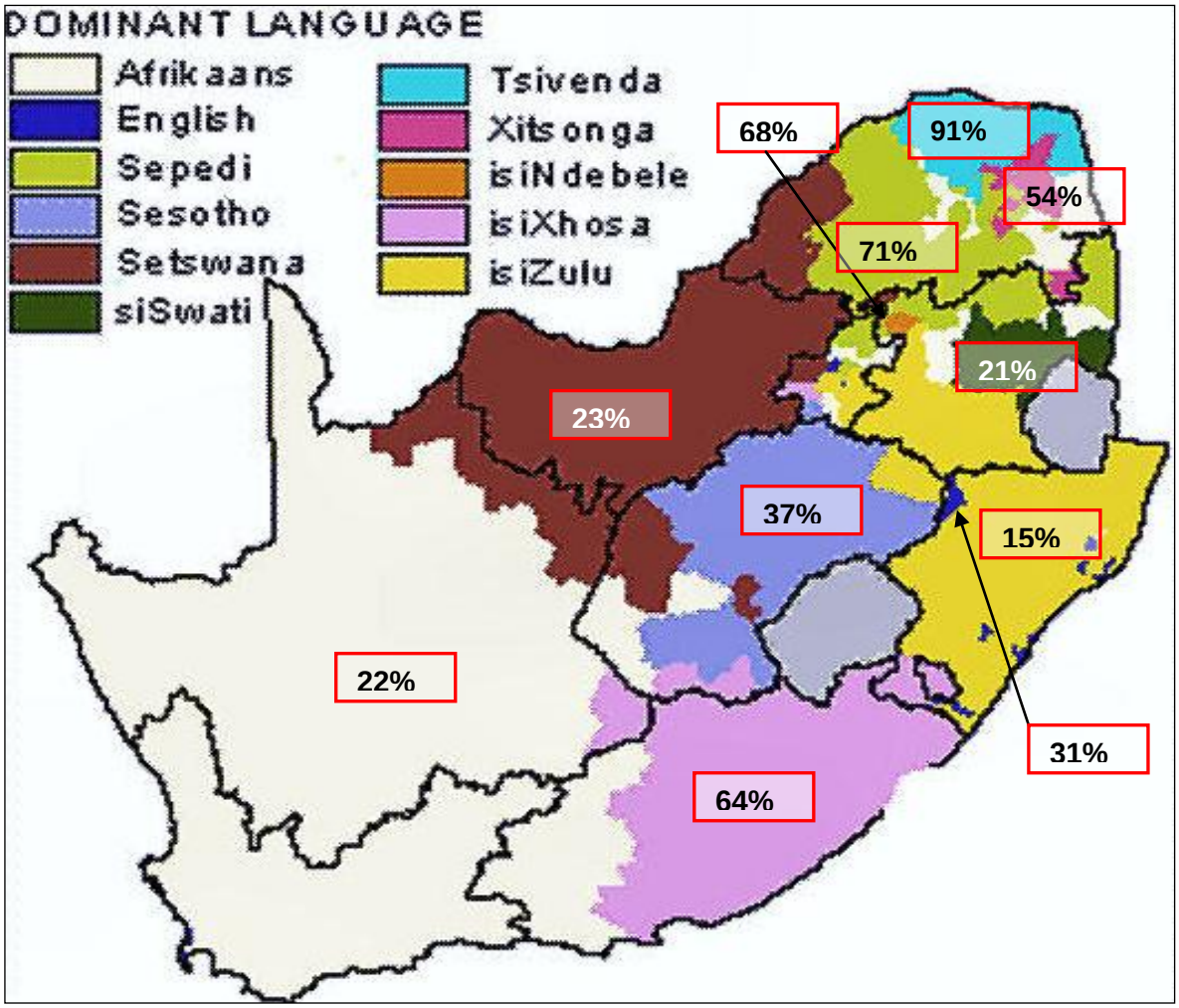
Figure 23: Language groups in South Africa and prevalence of male circumcision



Source: http://www.south-africa-tours-and-travel.com/bantu.html, Connolly *et al.* 2008, table II for MC prevalence by home language in 2002

Table 4: Male circumcision data by age group in South African men (2008)

	15-19 yrs		20-24 yrs		25+yrs	
	%	95 % CI	%	95 % CI	%	95 % CI
Have you been circumcised?						
Yes	23.6	20.0-27.6	46.1	40.8-51.5	47.0	44.1-50.0
Where were you circumcised?						
At home	1.5	0.5-3.8	2.3	1.0-4.9	3.5	2.5-4.9
In hospital	52.7	44.0-61.2	33.4	26.5-41.1	33.7	29.5-38.1
In mountain or bush or initiation	42.0	33.3-51.3	63.7	56.0-70.9	60.9	56.4-65.2
Other	3.8	1.7-8.3	0.6	0.2-2.1	1.9	1.2-3.1
Among the uncircumcised men: Would you consider being circumcised?						
Yes	46.1	40.8-51.6	44.8	38.4-51.4	28.3	24.9-31.9
No	53.9	48.4-59.2	55.2	48.6-61.6	71.7	68.1-75.1

Who performed the circumcision?						
Doctor	57.1	47.2-66.4	34.6	27.4-42.5	36.3	32.0-40.8
Spiritual/religious leader	0.9	0.3-3.0	1.9	0.6-6.1	2.9	2.0-4.2
Traditional circumciser	41.4	32.4-50.9	63.5	55.5-70.8	60.1	55.7-64.3
Other	0.7	0.1-4.6	-	-	0.7	0.4-1.5
What were your reasons for being circumcised?						
Traditional practice such as initiation	43.6	34.1-53.5	63.4	55.7-70.5	60.9	56.3-65.4
Religious reasons	5.6	3.8-8.2	6.7	4.0-11.0	6.4	5.0-8.2
My parents decided	27.4	20.1-36.1	16.6	12.0-22.5	14.8	12.1-17.8
Hygiene	9.5	6.1-14.6	5.5	3.2-9.4	10.1	7.7-13.1
Prevent HIV & STIs	9.4	4.6-18.3	2.6	0.9-7.4	4.0	2.1-7.2
Other	4.6	2.1-9.9	5.2	2.4-10.9	3.8	2.6-5.6

Source: HSRC secondary data analysis 2010

In 2005, men who reported having been circumcised before first sex were significantly less likely to be HIV-positive (multivariate analysis, aOR 0.53, p=0.047). However, the cross-sectional survey data on the association between MC and HIV infection are not always clear-cut:

- Connolly *et al.* (2008) found that in the 2002 national survey, HIV prevalence was equal among circumcised and uncircumcised men (11.1% vs. 11.0%), and when the analysis was restricted to sexually active men, MC still showed no protective effect. When men were classified by the reported timing of MC, there was a statistically significant difference in HIV prevalence between men with pre-puberty MC compared to those not circumcised ever (p=0.038), and this is likely to be due to different racial and religious composition of the strata. Among sexually active Africans, HIV prevalence was lower in circumcised men, but differences between non-circumcised and circumcised men did not reach statistical significance (p=0.22). Multivariate analysis, controlling for age, educational level, marital status and condom use did not change the MC effect.
- In a cross-sectional survey among 1 738 men in Eastern Cape and KwaZulu-Natal in 2008, circumcised men were significantly less likely to be HIV infected than uncircumcised men (aOR 0.42, 95%CI 0.28-0.62, Jewkes *et al.*, 2009).

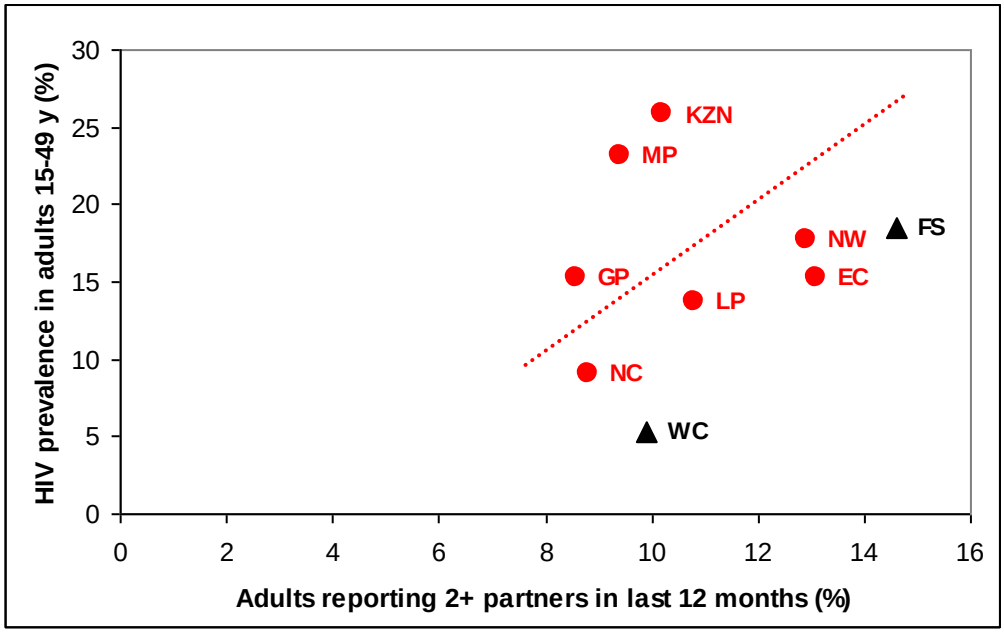
The relationship between MC and HIV infection data from cross-sectional surveys is difficult to interpret, since it is not known if infection occurred prior to MC or afterwards. In addition, it has been found that self-reported male circumcision status is not always accurate. Taljard *et al.* (2009) found in the Orange Farm trial that **self-reported MC status is a very unreliable indicator**: physical examination by a male nurse found that 45% of men who said they were circumcised had intact foreskin -- possible explanations for this were confusion between MC and initiation, confusion with words, and lack of knowledge about what MC is.[46]

Male circumcision might reduce the effect of multiple partner behaviours on HIV

[46] Similar data come from a Zambian study showing that self-reported male circumcision status is not always accurate: In the Ndola study described by Auvert *et al.*(2001), only 73% of men who reported being circumcised were confirmed circumcised on clinical examination. Reports of not being circumcised were more accurate – 99% of men who said that they were not circumcised were confirmed on clinical examination.

prevalence – in a province level analysis, there seemed to be some correlation between reported multiple partner frequency and HIV prevalence in adults (see Figure 24). The data points for the two provinces with highest MC levels (FS and WC, black triangles) appear at the lower fringe of the data field, suggesting that higher MC levels (which can, notably, only be termed "intermediate") might have some attenuating effect.

Figure 24: Interrelationship between reported multiple partner frequency, HIV prevalence and male circumcision in South Africans aged 15-49 years (2008, province level analysis)



Symbols: Red circles: Male circumcision levels <65%. Black triangles: MC level 71% (FS) and 68% (WC).
Sources: Multiple partners: Shisana *et al.*, 2009 table 3.16; HIV prevalence: table 3.10; MC levels: DHS 2003 table 5.17.

Male circumcision provides other sexual health benefits –

- In the Orange Farm trial, MC protected men against ***Trichomonas vaginalis*** infection (aOR 0.41, p=0.030), which is globally the most common non-viral STI (Sobngwi_Tambekou *et al.*, 2009). *T. vaginalis* infection causes severe morbidity among women; MC may therefore indirectly benefit women by reducing their exposure to *T vaginalis*, and provides an additional argument to recommend MC as a health intervention in areas with low MC prevalence and high MC acceptability.
- In the Orange Farm trial, the prevalence of urethral **high-risk human papillomavirus** was significantly reduced in circumcised men (14.8%) compared to the control group (22.3%, p=0.002, unchanged upon multivariate analysis) (Auvert *et al.*, 2009). This is in agreement with the finding that women with circumcised partners are at a lower risk of cervical cancer than women with a non-circumcised partner.
- **Herpes Simplex Virus-2** enhanced the risk of HIV acquisition by males, and vice versa, but these risks were significantly reduced by MC (Orange Farm trial data analysed by Mahiane *et al.*, 2009).

4.3 Estimations of HIV Incidence

While HIV prevalence is a cumulative measure of HIV risk over many years, HIV incidence expresses the current risk of HIV infection in populations or population strata. Estimating HIV incidence is crucial in order to disentangle the impact of prevention and treatment programmes on HIV prevalence.

HIV incidence estimates reported below used different incidence estimation methodologies:

a. Estimation from HIV prevalence data collected in repeated population-based surveys

b. Laboratory based method - BED capture enzyme immunoassay to identify recent infections

c. Mathematical modeling for indirect incidence estimates (EPP/Spectrum, ASSA2008)

d. Direct measurement of HIV incidence in epidemiological cohort studies

Experiences with using these methods were presented and compared in a technical meeting on the measurement of HIV incidence by SANAC in March 2010. Since each method has strengths and weaknesses, it was suggested at the meeting that the different incidence estimates should be triangulated and that more research and validation of these methods should take place in South Africa.

4.3.1 Estimated HIV Incidence at National Level

SUMMARY

- Estimates in young people aged 15-20 suggest that although **teenagers prevented infections more effectively in 2008 than in 2002**, they still acquire new HIV infections rapidly as they get into their twenties.
- **There is evidence that HIV incidence in females is falling** (2.8% in 2002-2005, 1.5% in 2005-2008).
- Using one estimation approach, it was suggested that **HIV incidence may have declined by 60% in young women aged 15-24 between the inter-survey periods 2002/05 and 2005/08**
- The different methods to estimate HIV incidence provide results in the range of **1.2%-2.4% for different time periods in the past years**:

Year	Age group	Estimated annual HIV incidence (%)	Method
2002-2005	15+	2.0	Model (synthetic cohort)
2005	15-49	2.4	BED assay
2005	15-49	2.2	Model (ASSA)
2005	15+	1.4	Model (EPP)
2005-2008	15+	1.3	Model (synthetic cohort)
2009	15+	1.2	Model (EPP)
2009	15-49	1.7	Model (MoT)

- The **BED assay, the ASSA model and the synthetic cohort method produced similar estimates** for 2005 (~2%), while the Spectrum estimate is lower (1.4%).
- **The NSP 2007-2011's main goal in prevention is to reduce the rate of new HIV**

infections by 50% by 2011. This would mean that HIV incidence in 2011 is reduced to ~0.65%, down from ~1.3 in 2007.

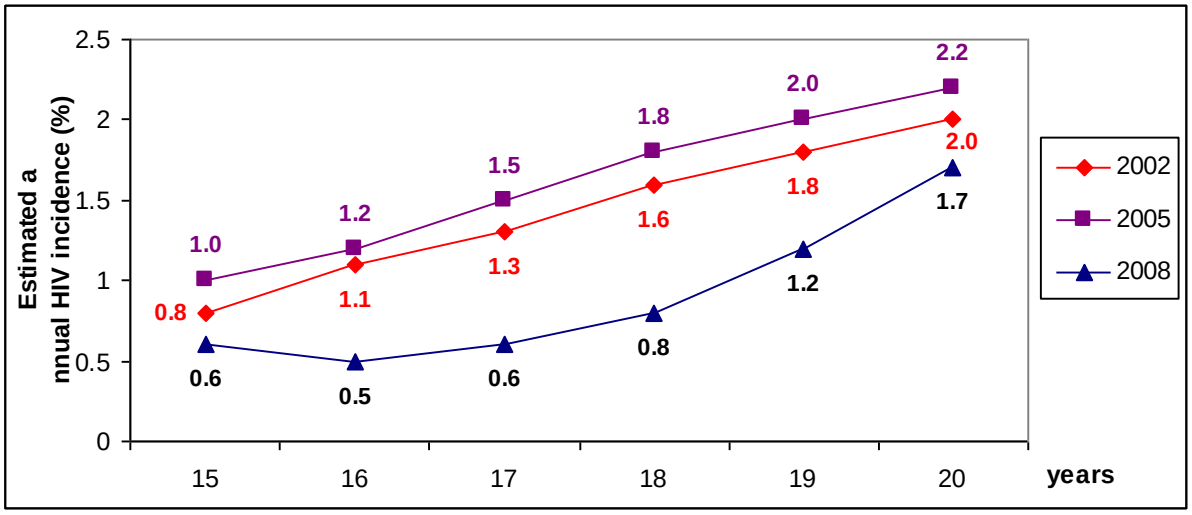
HIV incidence in 15-20 year olds

Using the method of estimating HIV incidence in young people from single-year age groups, the following has been observed (Figure 25):

- **Estimated HIV incidence in youth up to 20 has gradually decreased between 2002 and 2008**
- **While estimated HIV incidence in 16, 17 and 18 year olds has halved compared to 2002 levels, incidence in 19 and 20 year olds is still similar to 2002 levels.**

These results suggest that although teenagers prevented infections more effectively in 2008, they still acquire new HIV infections rapidly as they get into their twenties.

Figure 25: Estimated annual HIV incidence in youth aged 15-20 years in South Africa (single-year age groups, 2002, 2005, 2008)

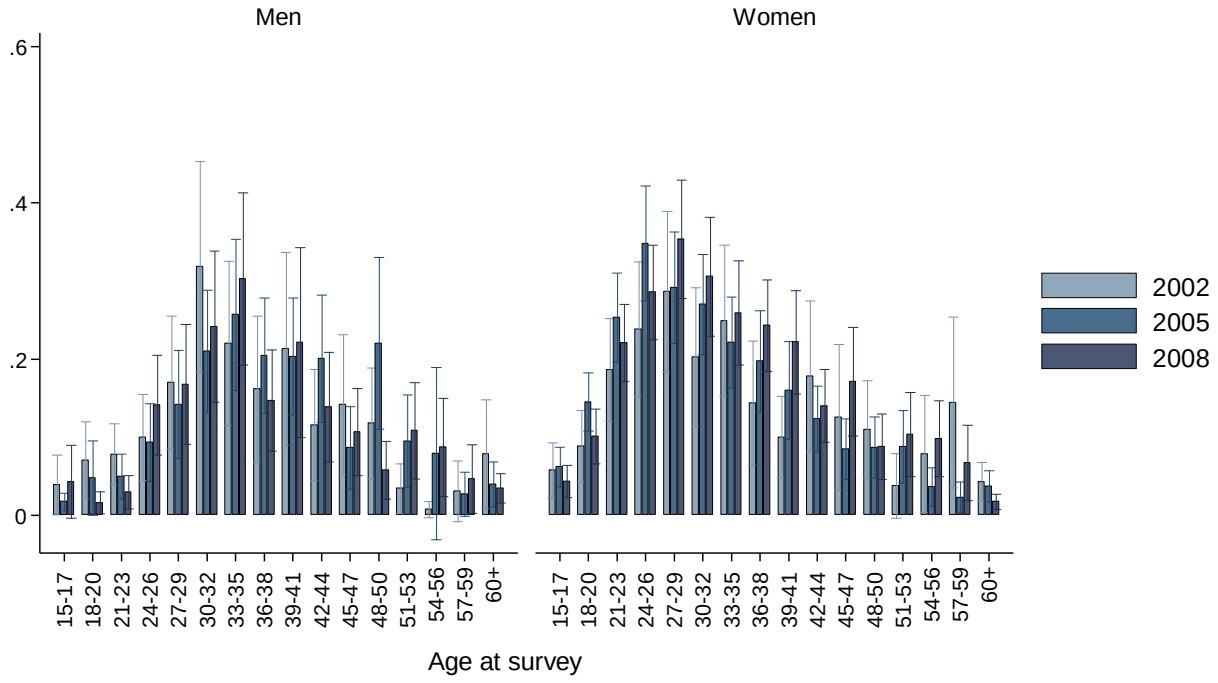


Source: T. Rehle, presentation HIV Incidence Consultation, March 24-26, 2010.

HIV incidence in the population 15 years and older

One approach to assessing HIV incidence is to look at age-specific HIV prevalence in three-year age groups by sex and survey (respondents all changed age group between surveys and comparisons within age group across surveys should reflect any changes in incidence at the younger ages) – see Figure 26. **The falling trend in HIV prevalence (suggesting falling HIV incidence) is apparent for the three youngest groups of women and the youngest group of men.**

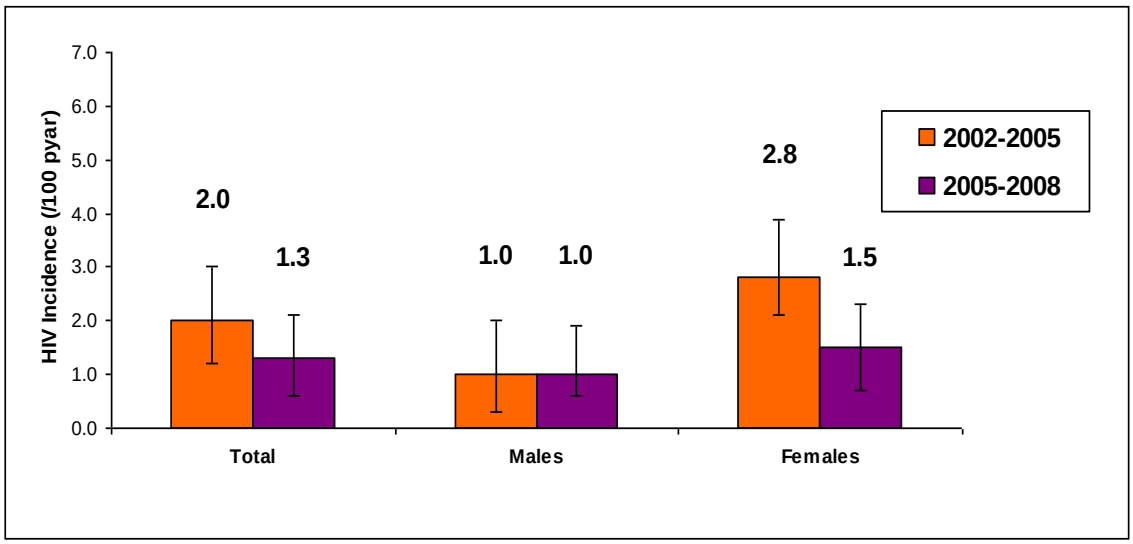
Figure 26: HIV prevalence by 3-year age groups and sex in South Africa (2002, 2005, 2008)



Using a "synthetic cohort" approach as described by Hallett *et al.* (2008) and accounting for the effect of ART, it has been estimated by Rehle *et al.* (2010) that (Figure 27):

- **Estimated annual HIV incidence decreased from 2.0/100 person-years (PY) in the 2002-2005 interval to 1.3/100 PY in the 2005-2008 interval** (35% decline, not significant)
- **Estimated annual HIV incidence decreased from 2.8/100 PY to 1.5/100 PY for women in these two periods (46% decline), and stayed the same for men** (both not significant)
- **In one stratum - young women aged 15-24 - there was a significant decrease in estimated HIV incidence from 5.5 to 2.2/100 PY – a 60% reduction**

Figure 27: Estimated annual HIV incidence in adults aged 15-49 years in South Africa (inter-survey periods 2002-2005, 2005-2008)

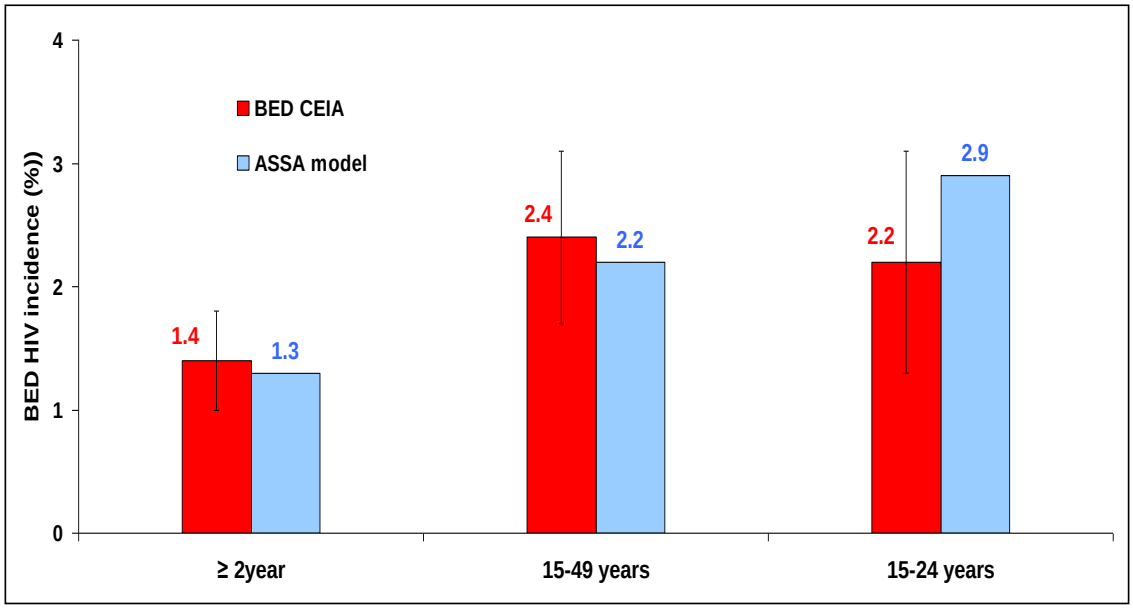


Source: T. Rehle, presentation HIV Incidence Consultation, March 24-26, 2010.

Using the laboratory-based method of BED assays on blood specimens, it has been found that (Figure 28):

- **Estimated annual HIV incidence in individuals aged 2+ years was 1.4% in 2005, 2.4% in adults and 2.2% in youth**
- These BED estimates were similar to those of the ASSA model, however, confidence intervals of the BED estimates are considerable, and, in conjunction with the intrinsic measurement errors of the BED assay (imprecision), leads to uncertainty on where the true value lies
- It was estimated that there were 571 000 new HIV infections in 2005 (Rehle *et al.*, 2007).

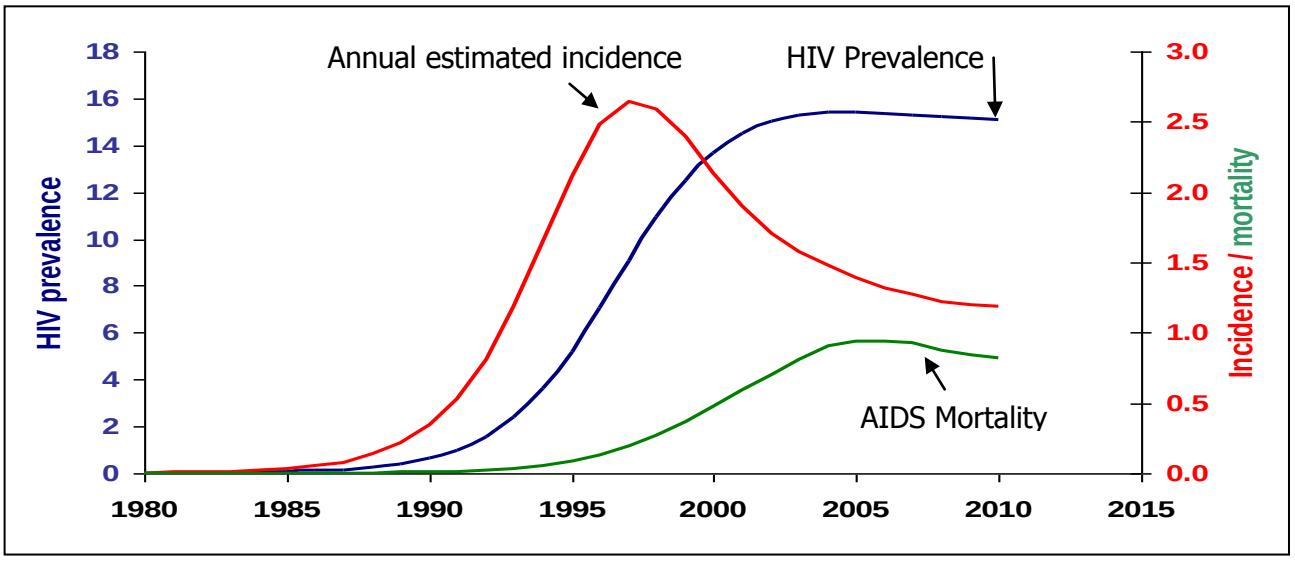
Figure 28: Estimated annual HIV incidence in adults aged 15-49 years in South Africa (2005)



Source: Rehle (2010), presentation HIV Incidence Consultation, March 24-26, 2010.

Using the EPP model, it was estimated that annual HIV incidence in adults had peaked in 1997 at 2.6%, and that it was at 1.2% in 2009 in South African adults – see Figure 29. Note that the incidence rate is higher than the mortality rate, and that although HIV prevalence has stabilised, the number of PLHIV is on a steep increase (see Figure 3).

Figure 29: Estimated annual HIV incidence in South African population aged 15+ years (up to 2010) Annual HIV incidence: red line



Source: Gouws (2010) 2009 EPP estimates.

4.3.2 Estimated HIV Incidence at Province Level

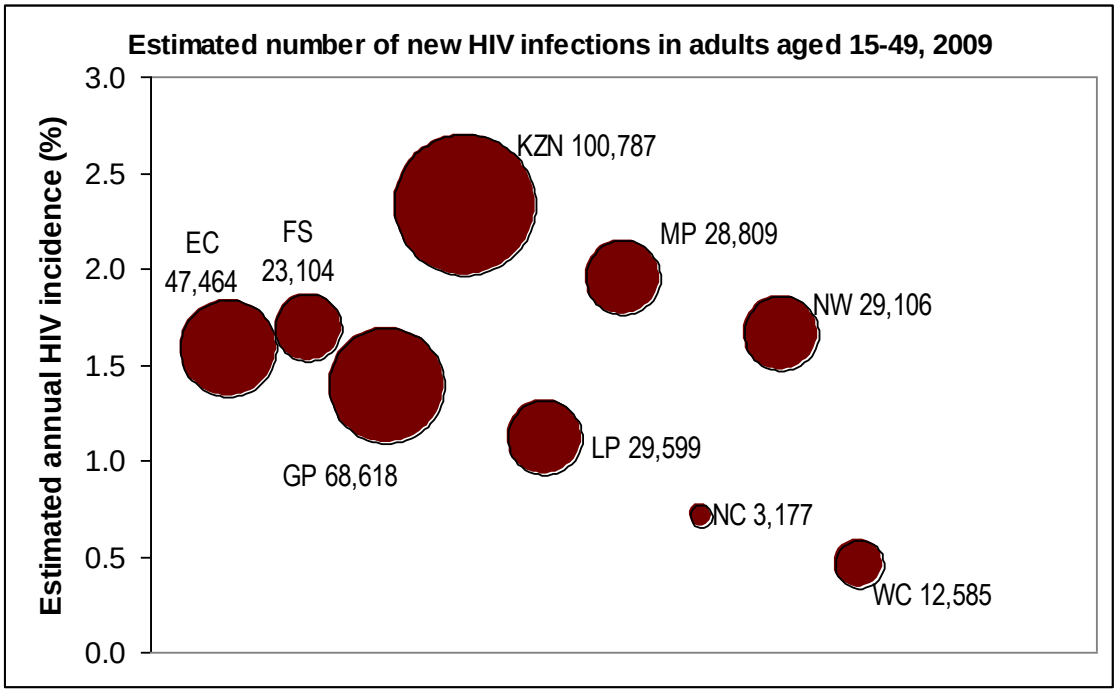
It is estimated that in 2009, annual HIV incidence in adults aged 15-49 was

highest in KwaZulu-Natal (2.3%) and lowest in Western Cape (0.5%) (EPP estimates, March 2010).

Half of all estimated new HIV infections in adults occurred in two provinces – KwaZulu-Natal and Gauteng – see Figure 30 (size of a bubble is proportional to the estimated number of new infections during the year). The vertical position of each bubble shows whether the new infections in a province occur in a context of higher HIV incidence rate or lower HIV incidence rate (annual HIV incidence rate on y-axis). For instance:

- In Gauteng province, it was estimated that about 68,600 new infections occurred in adults in 2009, at an estimated annual HIV incidence rate of 1.4%
- In Western Cape, it was estimated that about 12,600 new infections occurred in adults in 2009, at an estimated annual HIV incidence rate of 0.5%.

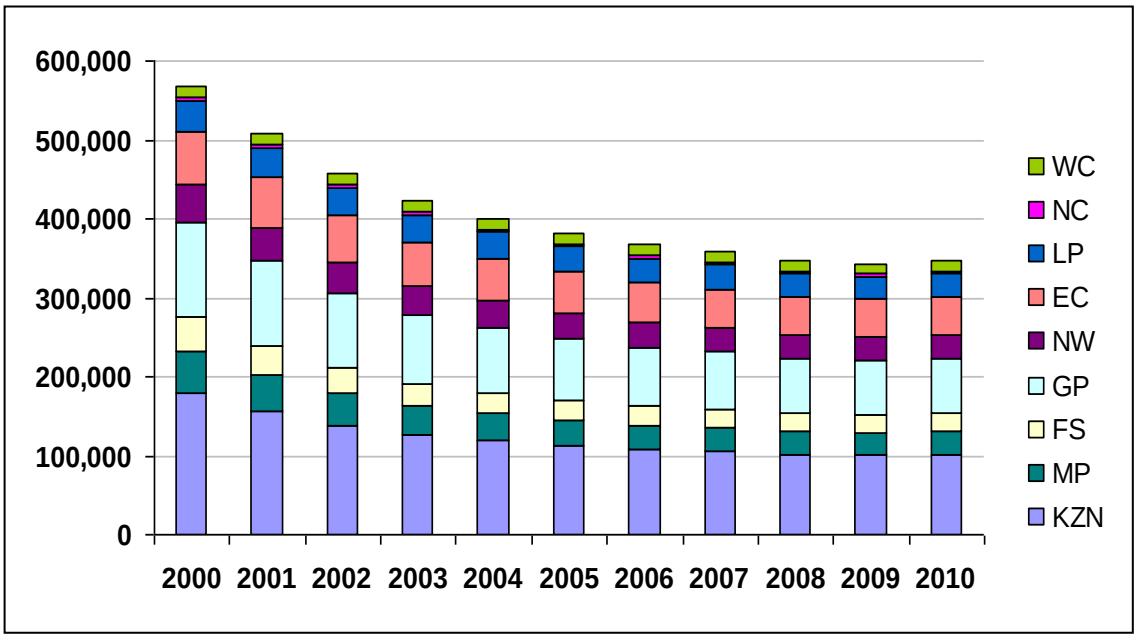
Figure 30: Estimated number of annual new HIV infections in South Africans aged 15-49, by province (2009, EPP estimates)



Source: Gouws (2010) 2009 EPP estimates.

The trend in new infections from 2000 to 2010 is shown in Figure 31. It illustrates again the decrease in HIV incidence over the decade and the large contribution of KwaZulu-Natal and Gauteng to the total number of incident infections.

Figure 31: Estimated number of new HIV infections by South African province (2009, Spectrum)



Source: Gouws (2010) 2009 EPP estimates.

4.3.3 Estimated Incidence by Age and Gender

The 2009 EPP model estimates for 2009:

- **New HIV infections in adults 15+ years: 352,000** (299,000- 420,000)
- **New HIV infections in children 0-14 years: 48,000** (27,000- 66,000)

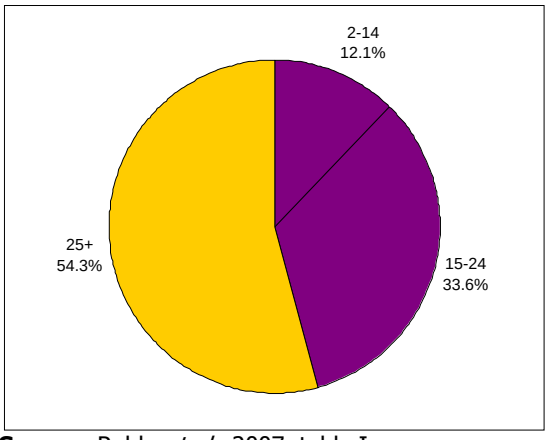
HIV incidence in females exceeds HIV incidence in males:

1. In the inter-survey period 2005-2008, estimated HIV incidence was 1.0% in men aged 15-49 and 1.5% in women aged 15-49 (see prior Figure 27 on inter-survey incidence data).
2. Using the BED assay on 2005 specimens, it was estimated that HIV incidence was 2.4% in men aged 15-49 and 6.3% in women. In young women aged 15-24, it was estimated that HIV incidence was over 8 times higher than in young men aged 15-24 (6.5% vs. 0.8%) (Shisana *et al.*, 2005, table 3.18).

More than half of all new HIV infections in 2005 (54%) were estimated to occur in South Africans aged 25 or above – see Figure 32.

HIV incidence in children aged 2-14 years was estimated at 0.9%, contributing an estimated 12% to all new HIV infections in South Africa in 2005 (Shisana *et al.*, 2005, table 3.18).

Figure 32: Estimated annual HIV incidence by age group in South Africa, BED assay (2005)

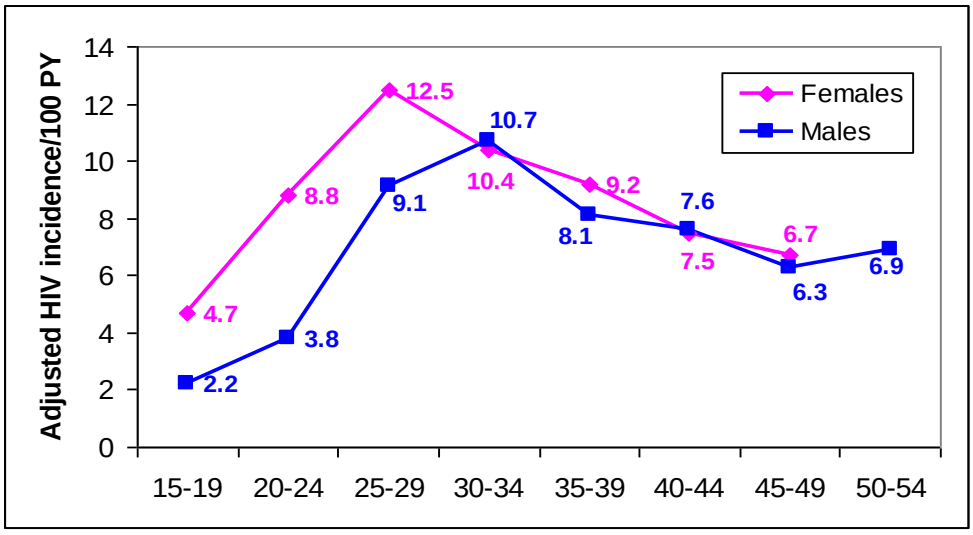


Source: Rehle *et al.*, 2007, table I

The following age and sex patterns were reported for 2004/2005 from the HIV cohort in Umkhanyakude, KZN (Barnighausen *et al.*, 2008):

- **Adjusted[47] HIV incidence rates in women aged 15-49 were 7.9% (95%CI 7.4–8.4), and 5.1% in men aged 15-54 (95%CI 4.1–6.2).**
- **HIV incidence peaked in the age groups 25–29 years in women and 30–34 years in men,** but HIV incidence remained high in older ages, suggesting that HIV prevention efforts need to include middle-aged and older people in addition to youth – see Figure 33.
- Holding other factors constant in multiple regression, **women faced a 53% higher hazard of HIV seroconversion than men** (p<0.001).

Figure 33: Adjusted annual HIV incidence in HIV cohort, Umkhanyakude, South Africa (2004/2005)



Source: Barnighausen *et al.*, 2008, table 1. Adjustment by multiple imputations.

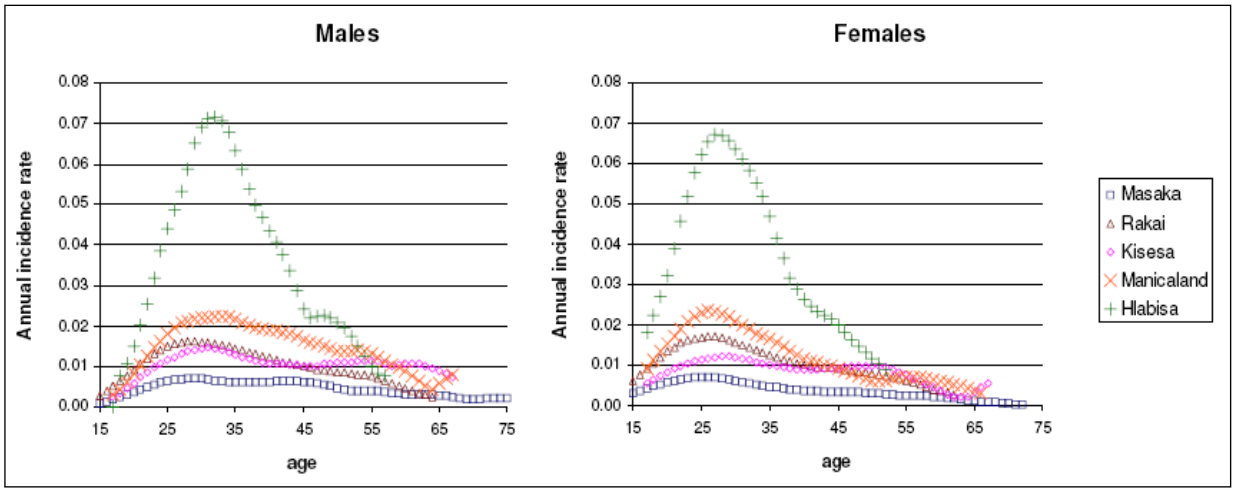
Barnighausen *et al.* (2008) also report from **very high life-time risks of HIV infection in the Africa Centre cohort: Life time risk at age 55 is estimated at 78% for males,**

[47] Multiple imputation was used to adjust for selection biases (population groups with higher risk of HIV infection were less likely to test for HIV in the two survey rounds than groups with lower risk of HIV infection)

and 75% for females[48].

HIV incidence is exceptionally high in Umkhanyakude, compared to other HIV monitoring sites in sub-Saharan Africa – see Figure 34. The tonofovir trial in sexually active, HIV-negative women aged 18-40 in urban and rural KwaZulu Natal (Durban and Vulindlela) found an incidence rate of 9.1/100PY in the placebo gel arm (Abdool Karim *et al.*, 2010)

Figure 34: Age pattern of HIV incidence in males and females in Umkhanyakude, South Africa 2001-2006, and comparison sites (smoothed age-specific incidence hazard rates)



Source: Barnighausen *et al.*, 2008 - Diverse age patterns of HIV incidence rates in Africa. Presentation XVII International AIDS Conference:Session TUAC02

4.3.4 Estimated Incidence by other Socio-demographic Variables

Variable	Findings
Race	National: • HIV incidence 1.8% in Africans, 0.2% in non-Africans in 2005 (BED assay, Rehle *et al.*, 2007, table II) • 97.5% of all new infections are in Africans, 2.5% in non-Africans, in 2005 (BED assay, Rehle *et al.*, 2007, table II) **The vast majority of new infections occur in Africans.**
Marital status	National: • HIV incidence 3.0% in singles, 1.3% in married/cohabiting, 5.8% in widowed, 0.5% in divorced in 2005 (BED assay, Rehle *et al.*, 2007, table III) Umkhanyakude, KZN: • HIV incidence 5.1% in currently married, 11.2% in not currently married, with partner, and 3.4% in not married & without partner (adjusted rates, Barnighausen *et al.*, 2008). ANC clients in MP/EC/FS Provinces: • Single (3.4%) or divorced/widowed women (7.7%) were more likely to sero-convert during pregnancy than married women (1.5%, p=0.017) (Moodley *et al.*, 2009). **New infections seem to occur more often in singles (unmarried individuals) and widowed/divorced people than in married people. Married women**

[48] Since the population pyramid is heavier at the bottom (more young people) and females get infected earlier, overall more women than men get infected every year. Nevertheless, female and male lifetime risk of infection, which is conditional on survival, is estimated to be similar.

Variable	Findings
	were significantly less likely to sero-convert in pregnancy than single or divorced women. **Being unmarried and sexually active bears a high risk of acquiring HIV.**
Residence	National: • HIV incidence 5.1% in urban informal areas, 1.6% in rural formal areas, 1.4% in rural informal areas, and 0.8% in urban formal areas (BED assay, Rehle *et al.*, 2007, table II) • 37% of all new infections are in rural informal areas, 29% in urban informal areas, 25% in urban formal areas, and 9% in rural formal areas in 2005 (BED assay, Rehle *et al.*, 2007, table II) Umkhanyakude, KZN: • Adjusted HIV incidence is 8.2% in urban or peri-urban residents, and 5.6% in rural residents (Barnighausen *et al.*, 2008). • Adjusted HIV incidence is significantly higher among those living within 5 km of nearest primary road (7.9%) and higher among those living 3 km or less from nearest government health clinic (7.2%) than among those with less access to road (5.2%)/clinic (5.7%) (Barnighausen *et al.*, 2008). ANC clients in MP/EC/FS Provinces: • HIV incidence in pregnant women (ANC clients) higher at the urban facilities than rural facilities but not statistically significant (12.4/100 PWY vs. 9.1/100 PWY) (Moodley *et al.*, 2009). **The HIV incidence rate appears to be highest in urban informal areas. Since the majority of the SA population lives in rural informal areas, the number of new infections is expected to be highest in these areas** (e.g., estimated number of new cases in rural informal areas in 2005: 211,000). **Living closer to transport axes and roads may increase current risk of HIV acquisition.**
Pregnancy	National: • HIV incidence 5.2% in women reporting current pregnancy (BED assay, Rehle *et al.*, 2007, table III) – for comparison, HIV incidence 2.4% in sexually active adults in same study. ANC clients in MP/EC/FS Provinces: • HIV incidence rate 10.7/100 pregnant-woman-years (Moodley *et al.*, 2009). • HIV incidence at least two-fold higher among ANC clients aged 25–29 and 30–34 (3.8% and 4.5%, respectively) as compared with the less than 20-year-old group (1.9%). • HIV incidence slightly lower among women with first pregnancy (2.7%) than among those with >1 pregnancy (3.3%) **Pregnant women seem to be at high risk of getting HIV infected during pregnancy.**
Education	Umkhanyakude, KZN: • Each additional year of educational attainment reduced the hazard of HIV seroconversion by 7% (adjusted hazard ratio), when controlling for sex, age, wealth, household expenditure, place of residence, migration status and partnership status (Barnighausen *et al.*, 2007).[49] ANC clients in MP/EC/FS Provinces: • HIV incidence lower among women with tertiary education (0.5%) than those with less education (2.9%) (Moodley *et al.*, 2009)

[49] Longitudinal data (2003–2005) on 3,325 adults from Africa Centre Demographic Information System in KwaZulu-Natal, South Africa. Semi-parametric and parametric survival models.

Variable	Findings
	Limpopo Province • Among women, HIV seroconversion was negatively associated with education. Hargreaves *et al.* (2007)[50] **There is evidence that by 2005, higher educational attainment reduced the risk of contracting HIV.**
Wealth	Umkhanyakude, KZN: • Adjusted HIV incidence highest in extremely poor (7.6%) and those comfortable/very comfortable (7.4%), and slightly lower in the poor (6.6%) and those "just getting by" (6.2%, all confidence intervals wide and overlapping) (Barnighausen *et al.*, 2008) Limpopo Province • No statistically significant association between HIV seroconversion and economic status (assessed through participatory wealth ranking methods) in either men or women (Hargreaves *et al.*, 2007) **In the limited data available, the level of wealth showed no association with new HIV infections.**
Migration	Umkhanyakude, KZN: • Adjusted HIV incidence was estimated at 7.8% among those migrating and at 6.5% among non-migrants (95%CIs wide and overlapping, Barnighausen *et al.*, 2008). **Data from one study only, not sufficient to conclude.**
Employment	Umkhanyakude, KZN: Adjusted HIV incidence 8.8% among those employed, 7.6% among those self-employed, and 5.9% among the unemployed (95%CIs wide and overlapping, Barnighausen *et al.*, 2008). **Data from one study only, not sufficient to conclude.**

The results from Umkhanyakude in rural KwaZulu-Natal provide little support for the assertion that "reducing poverty will be at the core of a long-term, sustainable solution to reducing HIV/AIDS" (Fenton, 2004). Although poverty reduction is important for obvious reasons, it may not be as effective as anticipated in reducing HIV transmission in rural South Africa. In contrast, there is evidence that increasing educational attainment in the general population, whatever the precise pathways of the effect, may lower HIV incidence.

The local and regional evidence that HIV incidence is particularly high in pregnancy is compelling. Rehle *et al.* (2007) reported an estimated HIV incidence of 5.2% (BED assay of 2005 samples) in South African women during pregnancy; and Moodley *et al.* (2009) measured HIV incidence of 10.7% (cohort study) in pregnant women in the three provinces MP, EC and FS. Elsewhere, Gray *et al.* (2005) found that women in Rakai, Uganda had a significantly increased risk of HIV acquisition during pregnancy compared with breastfeeding or other women after adjusting for behavioural and socio-demographic factors; and Taha *et al.* (1998) reported 2.2 fold higher rate of HIV incidence during pregnancy than in the post-partum period in urban Malawi. Recent evidence from sero-discordant couples in several countries including South Africa (Partners in Prevention HSV/HIV Transmission Study) suggests that the risk of men being infected by HIV doubles when their partners are pregnant (Mugo, 2010).

[50] Prospective cohort of 1967 individuals (14–35 years of age) in Limpopo province, South Africa (2001 and 2004). Multivariate logistic regression models, stratified by sex.

4.3.5 Estimated Incidence by Self-reported Behavioural Factors

Variable	Findings
Sexual partners	National: • HIV incidence 3.1% (95%CI 0-6.4) in individuals reporting more than one sex partner in the past 12 months and 2.1% (95%CI 1.3-3.0) in individuals reporting one sex partner in the past 12 months, in 2005 (BED assay, Rehle *et al.*, 2007, table III) ANC clients in MP/EC/FS Provinces: • HIV incidence very high in women reporting 3 or more partners in one year before the pregnancy (10.7%) and similar in those reporting 2 partners (2.8%) and one partner (2.7%) in one year before the pregnancy (Moodley *et al.*, 2009). **HIV incidence is higher in those reporting more than one partner.**
Sexual activity	National: • HIV incidence lowest in those reporting never having had sex (1.5%) and equal in those reporting no sexual activity in the last 12 months and those sexually active (2.4%) but confidence intervals wide and overlapping, in 2005 (BED assay, Rehle *et al.*, 2007, table III) ANC clients in MP/EC/FS Provinces: • HIV incidence at 3.0% among women abstaining from sex during the pregnancy and among those with regular sexual activity. HIV incidence 2.4% among those having sex once or twice a month only (Moodley *et al.*, 2009). **No clear association between level of sexual activity and HIV acquisition. HIV incidence surprisingly high among those reporting being virgins and in pregnant women abstaining from sex during pregnancy** (seroconversion could stem from transmission prior to pregnancy).
Condom use	National: • HIV incidence 6.1% in youth 15-24 not using a condom at last sex, and 2.9% in those using a condom at last sex, but CIs wide and overlapping. Among adults 25-49, HIV incidence was virtually the same in the two groups - 1.9% among those not using a condom and 2.2% among those using a condom at last sex (BED assay, Rehle *et al.*, 2007, table III) ANC clients in MP/EC/FS Provinces: • HIV incidence 2.7% in those never using a condom during the pregnancy, and 3.0% in those using a condom (Moodley *et al.*, 2009, difference not significant). **In youth reporting condom use at last sex, HIV incidence was lower than in those reporting non-use, but evidence is limited.**

4.4 HIV in different Exposure Groups

4.4.1 Heterosexual Transmission

In South Africa, there is compelling evidence that most HIV is transmitted between heterosexual partners in the general population (HIV prevalence in the general adult population at 17% in 2008 and in pregnant women at 29% in 2009). Survey information and

qualitative research suggest that most sexual relationships are heterosexual and not same-sex relationships. Heterosexual transmission as the dominant transmission pathway is typical for generalized epidemics.

Research is ongoing on the transmission probability of HIV between heterosexual partners in South Africa. Pettifor *et al.* (2007) reported very high estimated per-partnership probability of HIV transmission from men to women (0.74 - 1.00 with 95%CIs ranging from 0.56 to 1.00). Similarly, Auvert *et al.* (2001) found a per partner HIV transmission probability estimate close to 1.0 for young women in South Africa. Risk of HIV transmission from female to male may be two to three times higher during menstruation (Leynaert *et al.*, 1998 – supported by data from ESGHT 1992 and Seidlin *et al.* 1993), and there is evidence that male to female transmission is also more efficient during menstruation.[51]

4.4.2 Transmission between Men having Sex with Men[52]

The transmission efficiency of unprotected anal sex (especially for the receptive partner) is much higher than vaginal sex (*receptive anal intercourse*: Boily *et al.*, 2009; *male-to-male*: De Gruttola *et al.*, 1989, Vittinghoff *et al.*, 1999).

Since the early nineties, the homosexual epidemic has been eclipsed by the heterosexual epidemic. In the early phases of South Africa's epidemic, most HIV infections occurred in white homosexuals (Schoub *et al.*, 1988). Rispel *et al.* (2009) argue that while social networks tend to be racially segregated; sexual networks are probably less so. The HIV epidemic among homosexual MSM in South Africa is to some extent a parallel epidemic to the general heterosexual HIV epidemic, according to Rispel *et al.* (2009).[53] However, the Soweto-based study on men with anal sex experience by Lane *et al.* (2009) found that 64% of the participating men reported a regular female partner and 46% reported unprotected sex with a female, demonstrating the "bridge" between the epidemic among MSM and the general population.

The prevalence of MSM varies by place and definition of this sub-population:

- In the 2008 national survey (Shisana *et al.*, 2008), **3.2% of men** self-reported being MSM
- Jewkes *et al.* (2006) found among men aged 15-26 years in the rural Eastern Cape that **3.6% of men** reported sexual contact with a man, and the vast majority said they had been 'persuaded or forced to when they did not want to', and most of the men reporting coerced sex said there was one event only.

Serological data confirm that MSM are a high risk population (see Table 5 for HIV prevalence data for MSM):

- In the Eastern Cape survey among young men (Jewkes *et al.*, 2006), HIV prevalence

[51] Wira & Fahey (2008) concluded, based on extensive studies on the female reproductive tract (FRT) system that during a normal menstrual cycle, there is a period lasting 7–10 days when important components of innate, humoral, and cell-mediated immunity are suppressed within the FRT by estradiol and/or progesterone, enhancing the potential for viral infection.

[52] Men who have sex with men (MSM) include homosexual/gay men, bisexual men, heterosexual men who engage in sex with other men (such as male sex workers), and transgendered men (Baral *et al.*, 2007).

[53] Rispel *et al.* (2009) found in the Johannesburg/ eThekwini Men's Study (JEMS) that compared to HIV-negative participants, HIV-positive participants were significantly less likely to have had sex with a woman ever (20% vs 48%), or in the past year (3.5% vs 27%); were significantly less likely to have a female main partner (1.7% vs 13%); and were significantly more likely to identify as homosexual/gay (94% vs 66%)

overall was 2%, but men with same-sex experience were **3.6 times more likely to be HIV-positive** (p=0.05, logistic regression).

- Most studies found HIV prevalence levels in MSM higher than in the general male population.
- In the large MSM study by Sandfort *et al.* (2008), self-reported HIV status was not associated with race (12% of white MSM were HIV-positive), but older MSM were overall more likely to be HIV-positive. Similarly, Lane *et al.* (2009) found that MSM aged 25+ years were 3.8 times more likely to be HIV-positive than younger MSM.
- Household surveys are not suited for assessing high risk populations. In the 2008 national survey, HIV prevalence among self-identified MSM was **9.9%** (95%CI 4.6-20.2), which was substantially lower than the 23.7% HIV prevalence among men aged 25-49 years.

Table 5: Recent HIV prevalence data from men having sex with men in South Africa (2008-2009)

HIV prevalence (95%CI)	Characteristics of sample	Source
47%	Men with anal sex experience, aged 18-58 years, in Soweto, Gauteng	Lane *et al.*, 2009
43.6% (37.6-49.6)	MSM from Johannesburg and Durban, N=285	Rispel *et al.*, 2009
35%	MSM in Cape Town, Durban, Pretoria, N=37	Parry *et al.*, 2008
34%	Self-identified MSM from peri-urban townships in Capetown, N=200.	Burrell *et al.*, 2009
13.9%	MSM in Gauteng, KwaZulu-Natal and Western Cape, N=1021. Self-reported sero-prevalence among the 732 MSM who reported having been tested.	Sandfort *et al.*, 2008
10%	Self-identified MSM from urban areas in Western Cape, N=542.	Burrell *et al.*, 2009
9.9% (4.6-20.2)	National sample, N=86	Shisana *et al.* 2008

Risky sexual behaviour is frequent among MSM:

- ***Number of sex partners:*** JEMS study members reported having up to 60 male sex partners in the past 12 months, with HIV-positive men tending to have more partners (mean 7.5) than those who were HIV-negative (mean 5.0) (Rispel *et al.*, 2009). In the 2008 national survey, 17.5% of the self-identified MSM reported two or more sexual partners in the last 12 months (Shisana *et al.*, 2008).
- ***Unprotected sex:*** 46% of JEMS participants reported having unprotected anal intercourse (UAI) in the past 12 months; 30% reported UAI with someone with an unknown HIV status; and 4% reporting UAI with someone HIV-positive in the past 12 months (Rispel *et al.*, 2009). Compared to HIV-negative participants, HIV-positive participants were significantly more likely to have had UAI (58% vs 39%). HIV-positive participants were also significantly more likely to have had UAI with someone who they knew to be HIV-positive in the past 12 months (22% vs 8.7%), suggesting that there may be some degree of sero-sorting (choosing sexual partners with the same HIV status as oneself).
- ***Condom use and lubricant use*:** In the 2008 national survey, 58.3% of the self-identified MSM reported condom use at last sex (Shisana *et al.*, 2008). Experiences of condom unavailability and condom accidents were reported by many JEMS participants,

with 55% reporting not having a condom available when they needed one, 42% reporting at least one instance of condom slippage, and 58% reporting an instance of condom breakage in the past 12 months (Rispel *et al.*, 2009). Many participants reported having used substances that reduce the protective effect of condoms.

- ***Alcohol and drugs*** may play a role in sexual risk behaviour. Lane *et al.* (2008) found in MSM in peri-urban "township" communities in Gauteng province that an increased risk of UAI was associated with both regular drinking and regular drinking to intoxication. Rispel *et al.* (2009) found that 73% of JEMS participants reported having had sex while under the influence of alcohol, and 11% under the influence of drugs in the past 12 months, with no major differences by HIV status[54].
- ***Transactional sex*** was common among JEMS participants, with 29% reporting having *given* a man money, goods or favours, and 43% having *received* such in exchange for sex in the past 12 months. In the MSM study in Pretoria by Tun *et al.* (2010), MSM who engaged in transactional sex had a higher risk profile including UAI, multiple partners and forced sex. Using the capture-recapture method to assess the number of MSM involved in transactional sex in cities, Fipaza *et al.* (2010) estimated 496 MSM in Johannesburg and 612 in Durban.
- ***Sexual coercion*** was also common, with 36% of JEMS participants reporting having had sex with someone against their will, and 29% reporting that they had made someone have sex with them against that person's will (Rispel *et al.*, 2009). Compared to HIV-negative participants, HIV-positive participants were significantly more likely to have been made to have sex with someone against their will (47% vs 30%). Tun *et al.* (2010) reported that 16% of MSM experienced forced sex in the last 12 months, and had 5 times higher odds for STI symptoms.

Knowledge and disclosure of HIV status is limited among MSM. In the 2008 national survey, 27% of the self-identified MSM reported being aware of their HIV status (Shisana *et al.*, 2008 – awareness among all men aged 15+ years was 20%). Although 98% of participants in the JEMS study knew where they could be tested for HIV, only 48% had been tested for HIV in the past year and given the result (Rispel *et al.*, 2009). Of all participants, 57% reported that they "knew" their HIV status, but only 69% of them had disclosed their status to a sexual partner in the past 12 months. Sandfort *et al.* (2008) reported that among MSM in Gauteng, KwaZulu-Natal and Western Cape, African MSM were significantly less likely to have been tested (aOR=0.42, 95%CI 0.26-0.67) than MSM of other racial groups. According to Tun *et al.* (2010), many MSM are not informing HIV counsellors about their same sex behaviours, and are not seeking STI care or are not telling health providers about having had anal sex when they do seek care.

4.4.3 Transmission through Injecting Drug Use

The use of contaminated drug injecting equipment bears a high risk for transmitting HIV, and IDU are often linked to other risky practices such as sex work. Baggaley *et al.* (2006) reported (from a meta-analysis) three estimates of infectivity per IDU event ranging from 0.63% to 2.4% (median 0.8%, a summary estimate could not be calculated).

Injection drug use is low in South Africa compared with many countries, but with the increase over time in the use of drugs like heroin, the potential exists for this to change rapidly (Parry *et al.*, 2005). Plüddemann *et al.* (2005) reported that injecting of heroin has

[54] Baral *et al.* (2009) found in a study among MSM in Botswana, Malawi and Namibia that approximately one tenth of men reported injection of illegal drugs.

increased in recent years in the Gauteng and Mpumalanga provinces. The drafting of South Africa's second National Drug Master Plan (Department of Social Development, 2007) has given prominence to the need to address drug-related HIV risk behaviour.

While it seems that South Africa does not have a major IDU problem at present, it has a large and growing problem with crack cocaine, especially among sex workers (Leggett, 2008). According to Parry *et al.* (2008), heroin is the most commonly injected drug. Heroin (injected and smoked) has become most popular among white youth and among white sex workers (Leggett, 2008), and is marketed to sex workers as a come-down drug for crack cocaine.

The prevalence of IDU in South Africa is not known. The IDU population includes people with highly variable injecting frequency and HIV transmission risk:

- The 2005 national survey found that **4.7% of men and women** had ever injected drugs in their life time, and **1.6% had injected drugs in the last 3 months** (Shisana *et al.* 2005, p74). Only 0.1% of respondents said they had shared needles.

Little is known about HIV prevalence in IDUs due to few studies and very small sample sizes:

- In the International Rapid Assessment and Response Evaluation (IRARE), [55] HIV prevalence in a small sample of 35 IDUs was **20%** (Parry *et al.*, 2008), and HIV prevalence was highest among drug-using sex workers and MSM.
- In a study among arrested IDUs in three cities (Durban, Pretoria and Cape Town), HIV prevalence was **20%** (Parry & Pithey, 2006).

Injecting equipment is sometimes shared, re-used, inadequately cleaned and poorly disposed of[56] (IRARE results, Parry *et al.* 2008, Parry *et al.* 2010) - re-use of needles and syringes by IDUs is common, with some re-using equipment at least 2 or 3 times and up to 15 times. Stephens *et al.* (2007) report on needle-sharing among inmates in KZN and MP prisons. **Current sharing and needle disposal practices put IDUs and others at risk for contracting HIV.**

There is a strong relationship between drug use and risky sexual practices (IRARE results, Parry *et al.* 2008, Parry *et al.* 2010):

- Informants reported that with the exception of heroin, drugs generally increased sexual desire and improved sex, but led to impotence if too much was consumed. Heroin was not often used with sex. High-risk sexual behaviour was linked to drug use and people were less 'cautious' when on drugs.
- Many interviewees reported having sexual relations with a number of partners, such as strangers, sex workers, clients, drug dealers, friends, girlfriends/boyfriends and spouses, and having group sex. Sexual mixing across sub-populations and into the wider community was highly prevalent.

[55] Data were collected using rapid assessment methods, and included observation, mapping, key informant (KI) interviews and focus groups with service providers, injecting and non-injecting drug users, some of whom may also have been sex workers and/or MSM. Participants were recruited in the Point Road area of Durban; in Sea Point/Green Point and Salt River/Woodstock in Cape Town; and in the Sunnyside and Burger's Park area of central Pretoria, as well as in Mamelodi.

[56] Capturing the number of unprotected needle-sharing acts is problematic as one needs to distinguish between needle-sharers who use the needle first and those who use it subsequently. Also, IDUs themselves may not know whether a shared needle has been cleaned, for example, when purchasing needles from dealers. Additionally, when needles are cleaned, the extent of cleaning ranges from rinsing the needle or flushing the syringe with water to a thorough disinfection of the needle – certain methods of cleaning may only reduce the transmission probability.

Among IDUs assessed in the IRARE, there was a **widespread lack of awareness about where to access HIV treatment and preventive services, and numerous barriers to accessing appropriate HIV and drug-intervention services were reported** (Parry *et al.*, 2008).

4.4.4 Transmission through Medical Injections and Lack of Universal Precautions

The large uncertainty on the risk of HIV transmission from HIV-contaminated injections makes it difficult to measure the contribution of unsafe injections to the HIV epidemic (White *et al.*, 2007). Baggaley *et al.* (2006), based on a meta-analysis of transmission data on parenteral exposure, propose a range of 0.24–0.65% for the infectivity per contaminated medical injection.

Brody *et al.* (2003) suggested that the South African 2002 national survey (which indicated a HIV prevalence of 5.6% among 2–14 year-olds), provided evidence that iatrogenic transmission occurs in health care settings. However, Schmid *et al.* (2004) argued against this, saying that there was no increase in prevalence of infection in children by age, making iatrogenic infection an unlikely explanation, that the non-response rate in the national survey was high (potentially introducing bias in HIV estimates), and that HIV prevalence among children by race was the opposite of what other surveillance and death-registration data indicated.

The HIV exposure study among children found that children who had received a medical injection in the past 12 months were slightly more likely to be HIV-positive (aOR=1.3, p=0.07, Shisana *et al.* 2005), and those having had vaccinations at public health facilities had a very small and non-significant excess risk of being HIV-positive (aOR 1.1, p=0.7).[57]

More data are available for single, accidental percutaneous injuries with needles or other sharp objects, commonly involving health care workers and laboratory workers. According to the meta-analysis by Baggaley *et al.* (2006), infectivity estimates following a needle stick exposure ranged from 0.00 to 2.38% (weighted mean 0.23%; 95%CI 0.00–0.46%).

Schmid *et al.* commented in 2004 that there was **no database of injection safety practices within South Africa**, and that communication with ten South African health-care authorities in March 2003 indicated that **injection practices had been safe, with possible rare exceptions**, since the HIV-1 epidemic began 10 years earlier. However,

- Mendelson & Meintjes (2009) found at the GF Jooste Hospital, Cape Town that 66% of doctors had sustained at least one percutaneous injury or mucocutaneous splash exposure since qualification. Less than half of exposures were reported and only 35% of those who reported their incident received post-exposure counseling and appropriate management, with a median delay to PEP of two hours. The authors conclude that **unsafe practices are widespread within the South African health service** and need to be addressed to adequately protect health care staff.
- Karstaedt & Pantanowitz (2001) found at the Chris Hani Baragwanath Hospital Soweto

[57] Regression analysis controlling for age, sex and other exposure factors like number of hospital admissions, blood transfusion, visits to traditional healers, scarification, breastfeeding from a non-biological mother and children getting milk from a milk room at health care facilities (Shisana *et al.*, 2005 p27).

and the Johannesburg Hospital Gauteng that 69% of interns reported one or more percutaneous exposures to blood during the intern year, and 33% of interns recalled accidental percutaneous exposure to HIV infected blood. The authors propose that the **introduction of safer techniques and equipment, skills training and methods of reporting blood exposures** should be prioritised.

In 2002, 15.7% of health workers employed in public and private health facilities in FS, KZN, MP and NW provinces were HIV-positive (non-professionals: 20.3%, professionals 13.7%, data by Shisana *et al.*, 2004). Connelly *et al.* (2007) found that in the Helen Joseph and Coronation hospitals in Gauteng in 2005, 11.5% of health personnel were HIV-positive. The vast majority of HIV-positive health workers are likely to be infected through sex, not through occupational exposure. However, these data emphasize the **need for rigorous infection control practices to protect health care workers and patients from nosocomial HIV transmission**. Mendelson wrote in 2008 on occupational exposure in health care settings that *"South Africa is not doing enough, that there should be more education, access to safety devices and proper disposal of medical waste"*.

Other potential transmission pathways are linked to the sharing of sharp instruments - blades, needles and knives which are immediately re-used on another person without being sterilized. This may apply to tattooing (e.g. in prisons), scarification practices (e.g. in traditional medicine), shaving (e.g. barbers) and cuts (e.g. gang style initiations).

According to the 2005 South African HIV exposure study, not all the instruments used by traditional healers were sterilised (Shisana *et al.*, 2005). The study reported that children's HIV sero-positive status was significantly associated with having visited a traditional healer (aOR=1.5, p<0.001), and being scarified (aOR=1.6, p<0.001) – however, note that the children could be visiting traditional healers *because* they were HIV+ and sickly. Unsafe scarification and tattooing also occurs elsewhere, for instance in prison settings, where tattooing by inmates on other prisoners is an integral part of the prison sub-culture (Goyer, 2001; Akeke *et al.*, 2007).

4.4.5 Transmission through Blood and Blood Products

Infectivity estimates for confirmed contaminated blood transfusions range from 88.3 to 100.0% (weighted mean, 92.5%, meta-analysis by Baggaley *et al.* 2006).

Bird *et al.* reported back in 1997 that South Africa had the most highly developed health-care system in sub-Saharan Africa with a blood-transfusion system of developed-world standard. South Africa has two blood transfusion centres. The South African National Blood Service (SANBS) in Johannesburg covers eight of the nine provinces in the country; the Western Province Blood Transfusion Service (WPTBS) with its head office in Cape Town services Western Cape province (UNGASS 2008 report). Both services rely on a pool of voluntary blood donors and do not pay for blood donations. Most donors are repeat donors. The two services collaborate and co-ordinate their services and have similar Standard Operating Procedures (SOPs).

According to the UNGASS 2010 report (DOH/SANAC, 2010), both services have rigorous quality assurance programmes and are inspected by the South African Quality Assurance Systems (SANAS). They are also subject to external QA proficiency testing. The UNGASS

2008 and 2010 reports confirm that **in the years 2006 to 2009, 100% of donated blood units were screened in a quality assured manner**.
Table 6 shows for some previous years the number of donated blood units and numbers screened for HIV-1, HIV-2, hepatitis B and C, and syphilis. Since October 2005, all donations are screened for HIV-1, hepatitis B and C using nucleic acid amplification technology. The 2010 UNGASS report states that "*the safety of blood products in South Africa is currently on par with international standards and transfusion-associated infections are rare*".

Table 6: Number of blood units donated and screened in South Africa (April 2005 – March 2007)

	SANBS		WPTBS	
Year	**2005/6**	**2006/7**	**2005/6**	**2006/7**
Donated blood units	713 219	706 948	126 080	128 182
Blood screened in a quality assured manner	713 219	706 948	126 080	128 182

Source: UNGASS 2008 report, table 3.

According to Schoub *et al.* (1988) and Johnson & Budlender (2002), most of the infections that have occurred among blood transfusion recipients and haemophiliacs happened in the early years of the epidemic. Shisana *et al.* (2005) reported from the HIV exposure study that children who had ever had a blood transfusion were 1.5 times more likely to be HIV-positive, but the increase in risk was not statistically significant (multivariate regression, aOR=1.5, 95%CI=0.6-3.7, p=0.3).

4.4.6 Vertical Transmission

Mother-to-child transmission (MTCT) of HIV occurs in utero, during delivery, and post-partum during breastfeeding. Early natural history studies from South Africa had shown identical **18-month MTCT rates of 34%** in Durban and Johannesburg (Bobat *et al.*, 1996; Gray *et al.*, 1996).

Reducing MTCT of HIV is one of the main goals of the NSP 2007-2011, and, in order to curb sexual transmission as well, proposes to *"Integrate sexual & reproductive health services and HIV prevention guidelines and programmes into family planning, ANC, STI, TB, ARV treatment services and vice versa in the public and private sector"* (NSP p70). The NSP does not explicitly plan for the reduction of unintended pregnancies among HIV-positive women[58], however, nor give prominence to affordable, high-quality family planning services.[59]

In 2003, 23% of births in the last five years in South Africa were not wanted at the time they were conceived (24% were wanted at a later time, and 50% were wanted – data on women's HIV status not available) (DHS 2003). Almost 30% of recent first births were mistimed and 25% were unwanted. Peltzer *et al.* (2008) found in O.R. Tambo District

[58] The United Nations General Assembly Special Session on HIV/AIDS (UNGASS) in 2001 set the goal of reducing the proportion of HIV-infected infants, including through preventing unintended pregnancies among HIV-positive women. See: Prevention of HIV in Infants and Young Children: Review of Evidence and WHO's Activities. Geneva: World Health Organization, 2002.

[59] At a regional meeting, WHO stated that affordable, high-quality family planning services remain one of the most important interventions to reduce maternal and infant morbidity and mortality. See: World Health Organization. Hormonal Contraception and HIV: Science and Policy Africa Regional Meeting, Nairobi, 2005

in the Eastern Cape high pregnancy desires (yet lower than for HIV-negative women), low contraceptive use and low condom use among HIV-positive postnatal women. Among HIV-positive women in Johannesburg, pregnancy was planned in only 29% of women who became pregnant on ART and in 31% of those who started ART during pregnancy (Hoffman *et al.,* 2010). The international literature states that preventing unintended pregnancies among HIV-positive women could produce equivalent reductions in infant HIV incidence as ARV prophylaxis during pregnancy (Sweat *et al.*, 2004; Duerr *et al.*, 2005).

In 2009, an estimated 42,726 new infections happened in children aged 0-14 years - 11% of all new infections estimated for South Africa (Spectrum estimates, the model assumes that all childhood infections are vertically transmitted).

In 2009, an estimated 214,000 women needed PMTCT services in order to prevent transmission of the virus to the child. An estimated 159,000 children aged 0-14 years will need ART in 2009 (Spectrum). Service data from the Demographic and Health Information System report HIV prevalence of 22% in 2008 and 23% in 2009 in pregnant women testing within PMTCT.

The impact of PMTCT programmes on peripartum infection has been assessed through anonymous HIV screening of infants at immunization clinics. Rollins *et al.* (2007) report from HIV prevalence testing of infants attending immunization clinics at 6 weeks of age in KwaZulu Natal in 2004-2005 a **vertical transmission rate of 20.2%.** In Nevirapine (NVP) users, the rate was 15% compared with 26% in mothers who did not report having taken NVP (OR=0.50, p<0.001). Home delivery was associated with twice the transmission risk compared with clinic delivery. HIV-infected women who attended antenatal clinic on more than three occasions were less likely to transmit the virus. Women who lived alone were significantly less likely to have taken NVP, possibly indicating that such women would benefit from additional support. The authors conclude that *"the high transmission rate reflects a series of health system failures".*

The recently completed study by Hoffman *et al.* (2010) found that **MTCT rates were significantly lower in women who became pregnant on ART than those initiating ART during pregnancy** (0.7% versus 5.7%, p=0.01). Each additional week on ART reduced odds of transmission by 8% (explained by the fact that viral suppression typically occurs after 10-16 weeks of ART). There were no transmissions among women who were on ART for more than 32 weeks before delivery.

Breastfeeding

The proportion of infants exclusively breastfed was low in both the 1998 and the 2003 SADHS. Only 8% of infants under 6 months were reported to have been exclusively breastfed and a further 19% received breastmilk and water.[60] The median duration of breastfeeding was 16.6 months in 2003. The data show that there is an urgent need to strengthen programmes to promote and support breastfeeding.

HIV-1 transmission risks and survival associated with exclusive breastfeeding and other types of infant feeding: A non-randomised cohort study in KZN by Coovadia *et al.* (2007) reported that 83% of infants born to HIV-infected mothers initiated exclusive

[60] The proportion of babies being exclusively breastfed is probably even lower than 8% as the methodology is known to overestimate the amount of exclusive breastfeeding (DHS 2003 report p144).

breastfeeding from birth[61]. Breastfed infants who also received solids were significantly more likely to acquire infection than were exclusively breastfed children (HR 10.9, p=0.018), as were infants who at 12 weeks received both breastmilk and formula milk (HR 1.8, p=0.057). Cumulative 3-month mortality in exclusively breastfed infants was 6.1% versus 15.1% in infants given replacement feeds (HR 2.1, p=0.051). Doherty *et al.* (2006), assessing infant-feeding decision-making and practices among HIV-positive women in Eastern Cape, KwaZulu-Natal and Western Cape, concluded that maintaining exclusivity in breastfeeding or formula-feeding required a supportive environment.

Wet-nursing has been shown to be risky for the infant. Shisana *et al.* (2005) found that HIV sero-positivity in children was highly significantly associated with having been breastfed by a non-biological mother (aOR 17.0, p<0.001), but not with ever having received milk from a milk room i.e. a hospital room where baby milk is prepared (aOR 1.2, p=0.5).

There is therefore **great importance of promoting exclusive breastfeeding or safe replacement feeding to reduce the risks of MTCT, and warning of the dangers of mixed feeding practices.**

4.5 Individual and Couple Level Factors in the Sexual Transmission of HIV

This section is largely based on data from the five HSRC nationally representative household surveys conducted in 2002, 2005 and 2008 (Shisana & Simbayi, 2002; Shisana *et al.*, 2005; Shisana *et al.*, 2009), and the National Communication Surveys on HIV/AIDS (NCS) in 2006 and 2009 by HDA and JHHESA (HDA/JHHESA, 2006 and 2009).

1. The HSRC surveys assessed a wide range of knowledge and sexual behaviours regarding HIV. There were some changes in sampling procedure and questionnaire across the surveys, which need to be borne in mind when assessing trends in sexual behaviour variables (see section 1.1.2).
2. The NCS surveys equally assessed knowledge and sexual behaviours regarding HIV, as well as communication and media use. In 2009, the effectiveness of 11 South African HIV/AIDS communication programmes was evaluated, using 2006 as a baseline[62].

Extensive secondary data analysis, both bivariate and multivariate, was carried out on both data bases for this KYE assessment and is presented in this report.

Other national data sources were consulted as well: a 2003 Demographic and Health Survey (DHS), and a 2004 sexual behaviour survey of South African youth aged 15-24 (Pettifor *et al.*, 2004). The surveys differed in focus - the DHS covered a wider range of topics and included questions on sexual behaviour towards the end of the survey, whereas the youth survey focused on sexual behaviours and asked the questions early in the interview. The 2009 national survey among tertiary education students also contributes KAP data to the evidence base (HEAIDS 2010).

[61] Median duration of cumulative exclusive breastfeeding was 159 days. By age 6 weeks, 14.1% of exclusively breastfed infants were infected with HIV-1, and 19.5% by 6 months; risk was significantly associated with maternal CD4-cell counts below 200 cells per µl (adjusted hazard ratio [HR] 3.8) and birth weight less than 2500 g (HR 1.8). (Coovadia *et al.*, 2007)

[62] There were some imbalances between the 2006 and 2009 surveys in the sample due to different target groups in the two surveys: The mean age of the respondents was 33.3 years in 2006 and 30.2 years in 2009. The percentage of male respondents was 49.2% in 2006 and 48.7% in 2009 (HDA, 2010).

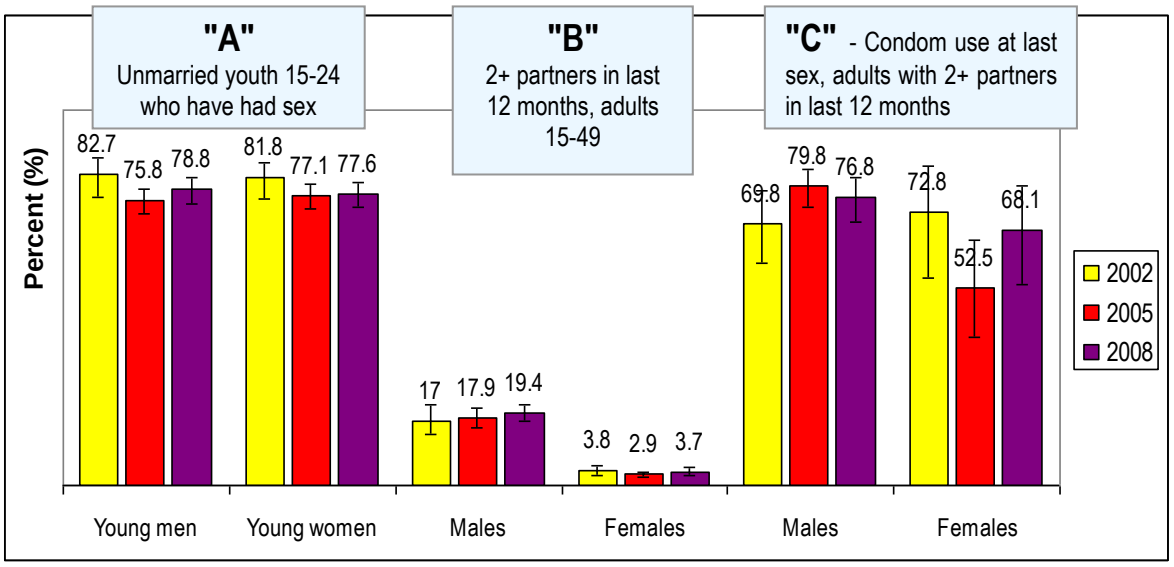
These national-level data were supplemented with behavioural data from smaller scale studies in the provinces, such as the CAPS study, the Concurrent Sexual Partnership study by Cadre, and the studies implemented in the ACDIS area.

The collection of sexual behaviour and partnership data is subject to several possible biases (e.g. Catania *et al.*, 1995; Plummer *et al.*, 2004[63]). For instance, social desirability may encourage men to exaggerate their number of sexual partners while married women may remain secretive about their own additional partners (e.g. Nnko *et al.*, 2004). See section 3.5.2 for further discussion of underreporting and bias.

Figure 35 gives an overview of trends in the "ABC" indicators (Abstinence, Being faithful, Condom use), based on reported sexual behaviours in the three HSRC surveys:

- The proportion of unmarried youth aged 15-24 reporting premarital sex was similar across the three surveys in the area of 80%
- There is no evidence of multiple partner reduction in males or females (2002-2008)
- Condom use in people reporting more than one partner has been quite stable in males but in females it decreased in 2005 and rebounded in 2008.

Figure 35: Changes in "ABC" indicators in South Africa (2002-2008)

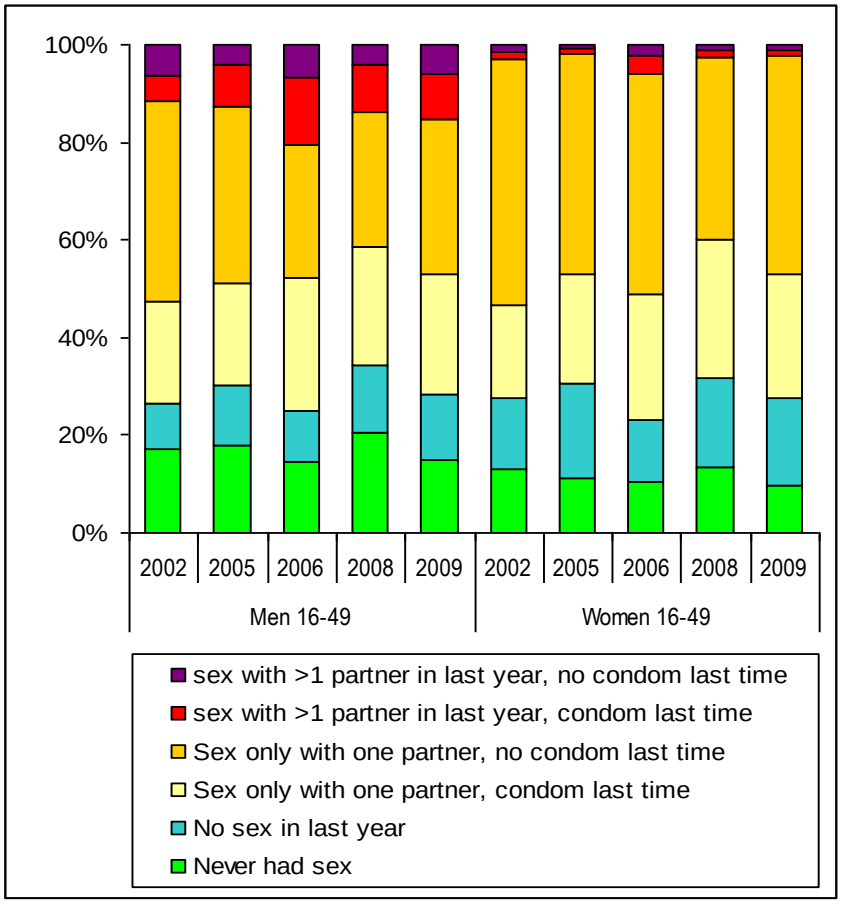


Sources: Secondary data analysis HSRC, 2010.

In order to explore temporal trends further, **data from all five national surveys were pooled.** Each survey respondent was allocated to one of six categories of reported sexual behaviour. Note that this analysis catered for any changes in, for instance, the proportion of people engaging in any sex, or in sex with more than one partner (which would lead to changes in the proportion of the total population at risk). The analysis included only respondents aged 16-49 who gave complete data, including HIV test in HSRC surveys. Figure 36 shows the results.

[63] Plummer and colleagues compared the reliability and validity of sexual behaviour data collected using biological markers, face to face questionnaires, self-completion questionnaires, in-depth interviews, and participant observation in a rural population in Tanzania. Overall, 38% of males and 59% of females reporting sexual activity did so in only one of the two 1998 questionnaires. Only 58% of males and 29% of females with biological markers consistently reported sexual activity in both questionnaires. 82% of in-depth interview respondents who had biological markers, provided an invalid series of responses about sex in the survey and in-depth interview series. Only one of six female in-depth interview respondents with an STI reported sex in any of the four surveys, but five reported it in the in-depth interviews.

Figure 36: Trends in reported sexual behaviours in male and female South Africans (2002-2009) 2002, 2005 and 2008 are HSRC survey data; 2006 and 2009 are NCS data.



Source: Secondary data analysis HSRC and NCS data, 2010.

4.5.1 "A" - Primary and Secondary Sexual Abstinence

SUMMARY

- **There is a trend towards earlier sexual debut amongst youth.** Sex before 15 years of age significantly increased in Free State, North West and Mpumalanga between 2002 and 2008. The changes over time were shown with combined HSRC and NCS datasets: **Median age at first sex was 20 years for men and women born before 1950 and 18 years for those born in the 1980s** (Annex 2).
- **Young Africans report higher levels of sexual experience than coloured, white and Indian youth.**
- In 2008, **women reporting sexual activity ever were significantly more likely to be HIV-positive** compared to those who reported never having had sex.
- **Nearly one third of adults reported secondary abstinence** (sexually abstinent in the last 12 months) and more than one-fifth of youth aged 15-24 years reported secondary abstinence.
- **Postpartum abstinence was 7.2 months in 2003 for South African women** and 8.2 months for African women (coloured: 3.3 months, Indian/white: 1.9 months).

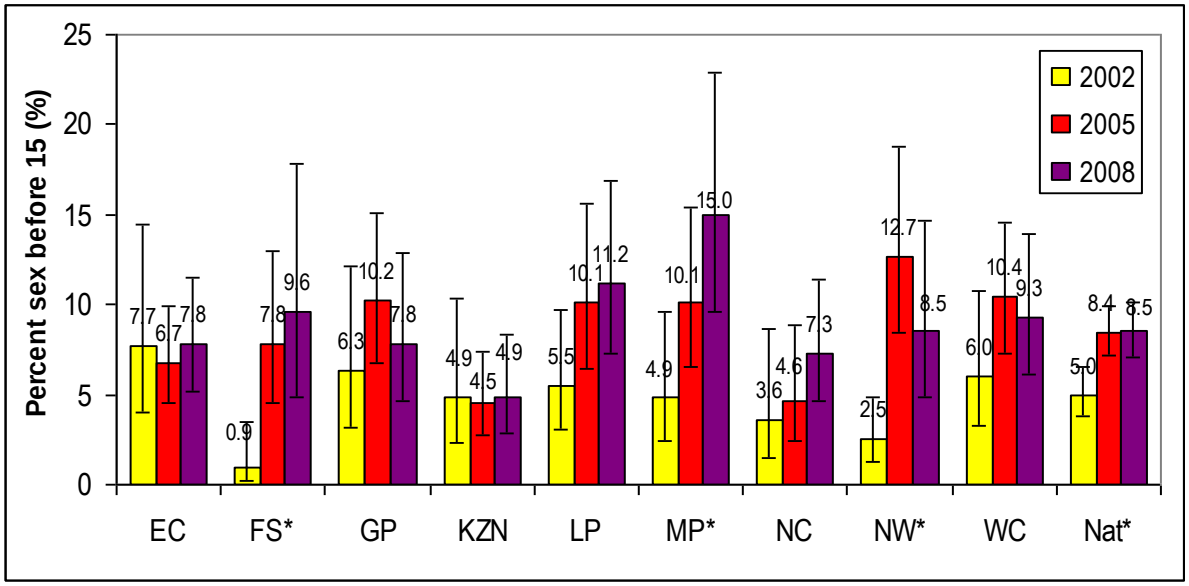
Primary abstinence refers to the delaying of sexual debut by young people. Secondary abstinence is the discontinuation of sexual activity after initial sexual activity. It includes postpartum abstinence by women after childbirth.

Primary abstinence

In some surveys, there are signs that young people are starting sexual activity earlier and that fewer are sexually abstinent. Both the 2002 and the 2005 HSRC survey reports conclude on the basis of an inter-age analysis that there is a trend towards earlier sexual debut amongst younger respondents.[64]

Sexual debut before the 15th birthday significantly increased between 2002 and 2008 nationally, as well as in Free State, North West and Mpumalanga – see Figure 37 (significant differences in 2002/2008 levels indicated by asterisk).

Figure 37: Percentage of youth aged 15-24 years reporting having had sex before age 15 in South Africa (2008)



Source: Shisana *et al.* 2009 (table 3.13)
Note: *=significant difference (p<0.05) between 2002 and 2008

However, the trend data from NCS 2006 and 2009 (16-24 year olds) suggest that in 2009, slightly more males, African, coloured and Indian respondents reported being virgins compared to 2006 (Table 7).

[64] In 2002, 55.6% of females aged 15-24 and 57.9% of males aged 15-24 reported having had sex. In 2005, 62.3% of females and 53.9% of males had had sex.

Table 7: Youth aged 16-24 years reporting never having had sex, South Africa (2006, 2009)

	2006		2009		p value (Chi^2 test)
	N	% never sex	N	% never sex	
Males 16-24	1,481	30.2%	2,007	33.0%	0.07
Females 16-24	1,184	27.6%	1,751	27.3%	0.85
Africans 16-24	2,198	25.7%	3,160	27.7%	0.11
Coloureds 16-24	213	35.9%	277	37.8%	0.64
Whites 16-24	195	51.9%	250	47.8%	0.43
Indians 16-24	60	51.3%	64	63.6%	0.16

Source: NCS secondary data analysis, HDA 2010.

When data were pooled from all five surveys for analysis of age at first sex (AFS) trends, the following was observed (see Annex 2 for full report):

- In men, AFS reported in the NCS surveys was much younger than in the HSRC surveys. Therefore, the type of survey seemed to have quite an impact on reported AFS. In women, AFS reported in the NCS was slightly younger than in the HSRC, but the differences were less pronounced than for men.
- For both men and women there has been a gradual decline in AFS over time for people born before 1950 up until the cohort born in the 1970s. Compared to men and women born in the 1980s, those born before 1950 were much less likely to ever have had sex at a given age.
- Median AFS was 20 for men and women born before 1950 and 18 for those born in the 1980s. The decline in AFS continued until the 1980s for women, but not for men.
- For men, the cohort born in 1990-1994 started sex later than the cohort born in the 1980s, according to self-reported behaviour.

Young Africans report higher levels of sexual experience than coloured, white and Indian youth. In 2005, 61% of Africans aged 15-24, 52% of coloureds, 38% of white and 32% of Indians reported having ever had sex (Shisana *et al.*, 2005). This is in agreement with NCS 2006 and 2009 data (Table 7).

In the ACDIS area in rural KwaZulu-Natal, it was found that the **median age at first sex (AFS) was 18.5 for females and 19.2 years for males** (McGrath *et al.*, 2009, based on four rounds of surveys from 2003 to 2007).

In multivariate analysis, factors associated with earlier AFS in males and females were periurban residence (vs rural), ever use of alcohol, and knowing at least one person who had HIV, while school attendance had a significant protective effect. Furthermore, maternal death was significantly associated with earlier AFS for women, in the same way that paternal death was for young men, while mother's membership of the same household significantly delayed AFS of young men. In females, the most important and highly significant factor protecting against early first sex (before 17 years of age) was school attendance. Therefore, factors at the individual, household and community level were associated with sexual debut.

In the NCS 2009, the main reasons 16-24 year olds gave for not have sex in the last 12

months[65] were: not having a partner available (F 42%, M 48%), not wanting to have sex (F 19%, M 18%), and the partner being away (F 17%, M 10%) (HDA, 2010 secondary data analysis).

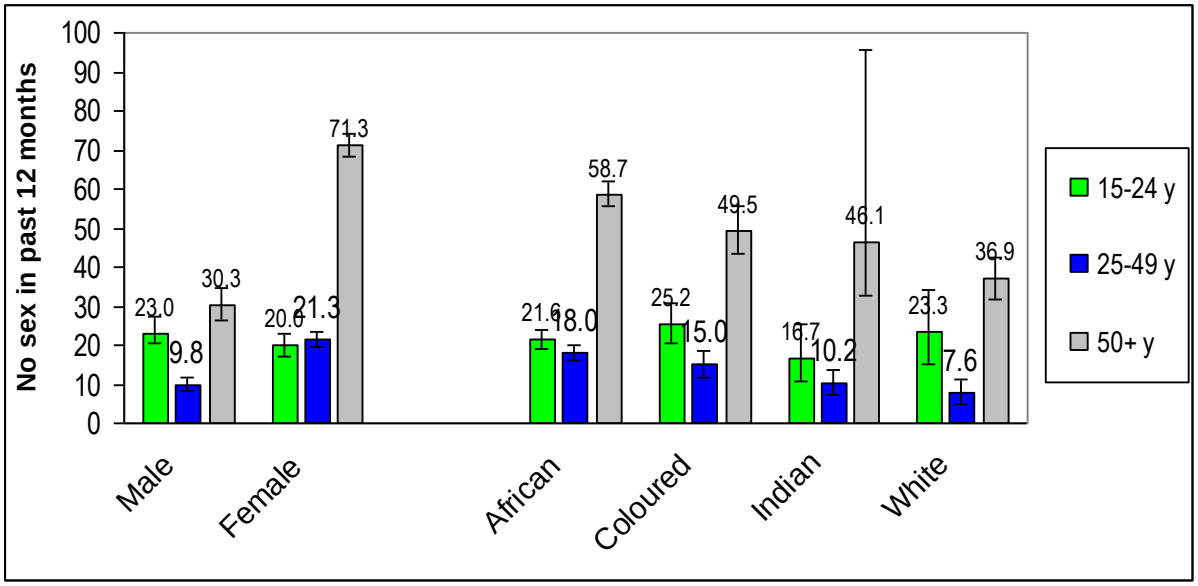
In 2008, **women reporting sexual activity ever were significantly more likely to be HIV-positive compared to those who never had sex** (sex in last year: aOR 9.5, p<0.0001; sex, but not in last year: aOR 7.7, p<0.0001; multivariate analysis HSRC data).

Secondary abstinence

Nearly one third of adults who have ever had sex report having been sexually abstinent during the previous 12 months. Figure 38 provides a breakdown of the data by gender, race and age group. Secondary abstinence was higher among youth than among adults aged 25-49 (except in females aged 25-49), and highest among older people aged 50+, especially in females and Africans. Overall a greater proportion of women than men were abstinent in the last year: in both the HSRC 2008 and NCS 2009 20% of women, compared to 14% of men, had had sex but not in the last year. The 2009 NCS found very similar levels of secondary abstinence in youth aged 16-24 years as the 2005 HSRC survey for youth aged 15-24 years.

Figure 38: Secondary abstinence among respondents aged 15 + years by age, gender and race in South Africa (2005)

Respondents were previously sexually active but had no sex in the past 12 months.



Source: Shisana *et al.* 2005 (table 3.22), and HSRC secondary data analysis

The 2003 SADHS assessed the length of postpartum abstinence, a form of secondary abstinence. **The median length of sexual abstinence after child birth increased from 4.9 months in 1998 to 7.2 months in 2003** (SADHS data). There are large racial differences in postpartum abstinence: African women 8.2 months, coloured women 3.3 months, Indian and white women 1.9 months. The majority of women (79%) reported abstinence for at least 2-3 months after child birth. Sixty-three percent abstain for 4-5

[65] This may be primary or secondary abstinence

months postpartum, 35% for a year and 27% for two years. Naidoo (2008) reported from North West Province that there is a belief that harm is caused to children if the mother is sexually active while breastfeeding.

The length of postpartum abstinence may be a concern in the context of the high HIV prevalence. There is evidence from West Africa and Zambia that long-term postpartum abstinence can lead to potential risky sexual behaviour in a relationship where the male partner may engage in other sexual relationships (Ali *et al.*, 2001; Cleland *et al.*, 1999; Kwatu 2008). Glynn *et al.* (2001) found a strong association between prolonged female postpartum abstinence and HIV status in Cameroon. Humphrey *et al.* (2006) found in Zimbabwe that prolonging postpartum sexual abstinence increased the hazard of HIV infection by 4% per 4 weeks (univariate analysis, p=0.006), but once sexual frequency and its interaction with marital status were adjusted for, duration of postpartum abstinence was not independently predictive of incident HIV. In the 2009 NCS, only 1% of females said that they did not have sex in the past 12 months due to pregnancy (HDA, 2010 secondary data analysis).

Reasons given by adults aged 25-55 years for not having sex in the last 12 months in the 2009 NCS were varied. Just like among youth, not having a partner was the main reason (49%). Six percent of respondents said they abstained to avoid HIV and STIs. Five percent of females 25-55 and 1% of males 25-55 abstained because their partner had died (HDA, 2010 secondary data analysis). This finding supports the notion that widowers are more likely to find new partners and resume sexual activity compared to widows.

4.5.2 "B" – Multiple and Concurrent Sexual Partnerships

SUMMARY

- "B" stands for Being faithful to one partner (or, in polygynous marriages, the husband being faithful to all his wives).
- Comparing multiple partner data across the five national surveys, **there is some indication of an increase over time in the proportion of 16-55 year old men who reported multiple sexual partnerships (MSPs) in the past 12 months** (Annex 1 section 1J).
- **Reported MSP frequency varies by race and is highest in African men. It peaks in people in their twenties**, but there may be underreporting in older age groups where marriage is more common. **The sexual concurrency analysis of the NCS 2009 data confirms the relatively higher concurrency prevalence for African men** (Annex 3).
- **HIV prevalence is higher in respondents reporting more sexual partners. Women reporting more than one partner at the time of survey in 2005 were 4.3 times more likely to be HIV-positive (p=0.0001).**
- **Sexual relationships were seen as a pathway towards a number of distinct benefits.**

HIV transmission during unprotected sexual contact is much more likely during the acute infection phase in the first weeks to months after someone has been infected, and during the much later phase of advanced HIV infection. In the meta-analysis by Boily *et al.* (2009), estimates of HIV transmission risk for the acute and advanced phases of HIV infection were 9.2 and 7.3 times larger, respectively, than for the asymptomatic phase in between.

Modelling based on Rakai data has indicated relative acute infectivity of 26-fold (Hollingsworth *et al.*, 2008) to 43-fold (Pinkerton, 2008). There is evidence that multiple sexual partnerships (MSPs) and concurrent sexual partnerships (CSPs) are linked to high HIV transmission, since people with high partner turnover and sometimes overlapping sexual partnerships are more likely to pass on the virus in the acute infection phase within their sexual network.

In sexual behaviour surveys, it is likely that multiple sexual partnerships are under-reported due to social desirability bias (e.g. Mah & Halperin, 2007; Gourvenec *et al.*, 2009). McGrath *et al.* (2009) found that in the ACDIS cohort in KZN, concurrency indicator levels were ten times higher if women self-completed the interview compared to face-to-face interviews.[66] To a lesser extent, this applied also to men.[67] These data strongly support the notion that face-to-face interviews lead to underestimations of sensitive sexual behaviours.

Men and women in HSRC 2008 were asked for their total number of lifetime partners. More than half of men and women reported more than one lifetime partner. This is very high for women compared to other countries in sub-Saharan Africa.

Multiple sexual partners (MSP):

In the literature, having more than one partner is frequently presented as a "way-of-life" which resonates with historical family structures.

- Leclerc-Madlala (2008) describes the ethnographic 'cattle complex cultural zone' which was traditionally polygamous, patrilineal and patrilocal, with large bride-wealth conferring large degrees of jural rights over women and children. Many socio-cultural norms and values for gender relations that support this system still persist, according to Leclerc-Madlala, and there is today a modified form of polygamy which is "multiple concurrent partnerships" (monogamy *de jure*, polygamy *de facto*).
- Sawyer-Kurian *et al.* (2009) argued that "*the socio-cultural norm of having more than one woman at the same time is historically well established in South Africa and it has gone unchallenged until recently*".
- In a study among African and coloured men living in townships in Capetown, men referred to sex partners in three ways – main, casual, and one-night stands (ibid). Casual partners were called "spare wheels" or "loose dates". Many respondents said that they were unaware of anyone who had only one partner: "*you grow up believing that you can have many partners…. it was a legacy that was left behind … see your father, grandfather had more than one wife*".
- Lomofsky & Wessels (2009) found in a student risk behaviour survey in South Africa that concurrency is a normative behaviour: "*it is not cheating, because it is different area codes"* (FGD, male student)

In South Africa, men consistently report much higher frequency of multiple partnerships than women:

- In the 2003 DHS, **14.2% of men** aged 15-59 years said that they had had more than one partner in the past 12 months, whereas only **2.5% of women** aged 15-49 years reported more than one partner in this period (DHS table 5.16).

[66] Currently in 2+ relationships: 3.4% (self-completed) vs. 0.3% (face-to-face); 2+ partners in the last month: 2.0% (self-completed) vs. 0.2% (face-to-face) (2003 survey data, McGrath *et al.*, 2009).

[67] Currently in 2+ relationships: 29.0% (self-completed) vs. 20.1% (face-to-face); 2+ partners in the last month: 15.1% (self-completed) vs. 8.0% (face-to-face) (2003 survey data, McGrath *et al.*, 2009).

- In the ACDIS, KZN, in 2003, **36.7% of men** aged 15-54 years and **1.2% of women** aged 15-49 years reported more than one partner in the last year (McGrath *et al.*, 2009).
- In the 2003 baseline survey for Stepping Stones in the Eastern Cape, **49% of men and 10% of women said that they had had more than 2 sexual partners in the past year** (Jewkes *et al.*, 2008).
- In the 2008 national survey, **19.3% of men** aged 15-49 years and **3.7% of women** aged 15-49 years reported more than one partner in the last 12 months (Shisana *et al.*, 2009 table 3.15)
- In the 2009 NCS, **16.7% of all men** and **2.3% of all women** aged 16-55 years reported two or more partners among those who ever had sex (age 16-55, HDA secondary data analysis 2010).

In consequence, the mean number of reported partners is higher among males than among females:

- In the 2003 youth survey, sexually active males[68] aged 15-24 years reported an average of 1.8 partners over the last 12 months, and sexually active females an average of 1.1 (Pettifor *et al.*, 2005)
- In the Cape Area Panel Study (CAPS) conducted in WC, men's average number of reported partners in the last 12 months was 1.4, 1.3 and 1.2 for African, coloured and white men, respectively, and it was 1.1, 0.9 and 1.2 for African, coloured and white females (Kenyon *et al.*, 2009).

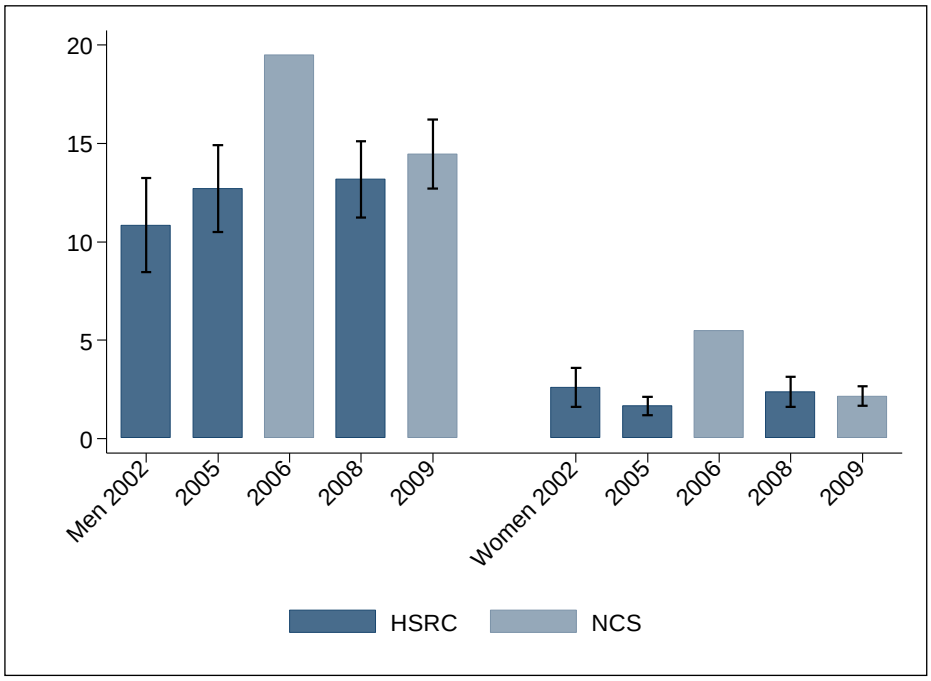
In the NCS 2009, respondents were asked whether they had ever had more than one partner at the same time and why. The **average prevalence of "never having had more than one partner at the same time" was 76%.** The main reason given for having ever had more than one partner was for having fun, variety and satisfying curiosity (M 25%, F 7%) (HDA, 2010). The second reason was that the main partner was away in another place (M 4.5%, F 1.8%), and the third was the need to have a spare partner (M 3.2%, F 0.9%).

Data on reported MSPs in the last 12 months from the five national surveys were assessed to look for trends. Comparing MSP frequencies separately for men and women aged 16-55 showed that there was **some indication of an increase over time in the proportion of 16-55 year old men who reported MSPs in the past 12 months** (Figure 39).[69] No trend was apparent for women. The 2006 NCS was an outlier for both men and women. Annex 1 section 1J shows the model results of time trends in MSP reports (men only).

[68] Those who reported having had sex in the past 12 months

[69] The NCS 2009 report, based on NCS data only, states that there has been a decline in reported multiple partners in the last 12 months over the last 3 years (denominator= respondents 16-55 who had sex in the last 12 months) - the 2006 values were 26%(M) and 8%(W), and the 2009 values were 20%(M) and 3%(W).

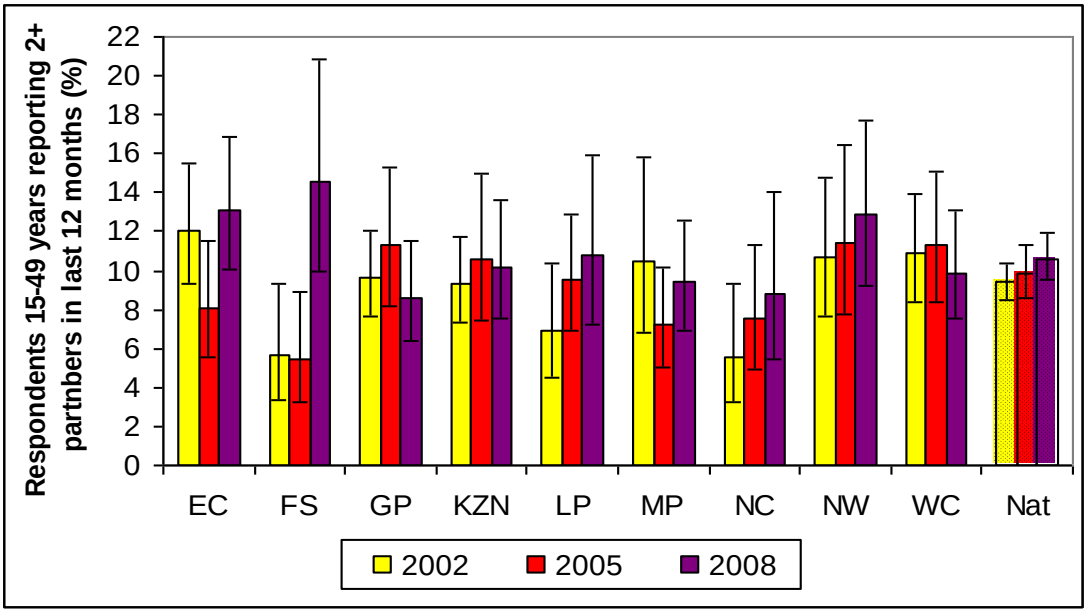
Figure 39: Trends in reported multiple partners in South African men and women aged 16-55 years (2002-2009)



Source: Secondary data analysis HSRC and NCS data. Data missing to calculate 95%CIs for NCS 2006.

The HSRC data on MSP were analysed by province. The provincial data did not suggest any significant change or clear pattern over time. Only in Free State, the MSP frequency reported in 2008 was significantly higher than in 2005 (see Figure 40). Overall, at national level, there was a small, non-significant increase of MSP frequency (right hand columns).

Figure 40: Trends in prevalence of reported multiple sexual partners in the last 12 months among 15-49 year olds in South Africa (2002, 2005, 2008)
Multiple sexual partners = Two or more sexual partners, may be serial or concurrent



Source: Shisana *et al.* (2009), table 3.16.

In the 2009 NCS, among those reporting ever having had sex, MSP frequency was highest in KwaZulu-Natal (11.3%) and Gauteng (11.2%) (HDA secondary data analysis 2010). In sexually experienced youth aged 16-24, highest MSP frequencies were found in Gauteng (20.1%) and North-West (19.0%).

Reported multiple partner frequency varies by race and is highest in African men. In the 2003 DHS and the three national surveys, African men consistently reported the highest frequency of multiple partners (e.g. 19.3% in 2005, compared to 11.2% of coloureds, 4.0% of Indians and 3.8% of whites). Among women, Africans also mostly report the highest frequencies (in 2005, coloured women reported higher frequency than African women). The observed racial patterns also hold in the Cape Area Panel Study (see subsequent sections on concurrency). **In the multivariate regression analysis on MSP, African men were 2.7 times more likely to report MSP than non-African men** (Annex 1 section 1J).

Reported multiple partner frequency appears to peak among people in their twenties (but there may be underreporting of multiple partnerships in older age groups where marriage is common):

- In the 2003 DHS, reported MSP frequency was highest in men in their 20s (24%) and in women in their 20s (4%). MSP frequency was exceptionally high in men currently in union aged 15-19 years (31%), and in men currently not in union aged 25-34 years (28%). In women, it peaked in those currently not in union aged 20-34 years (4-5%)
- In the 2003 youth survey, reported MSP frequency in 15-19 year olds was 16% (M) and 6% (F), and in 20-24 year olds it was 33% (M) and 8% (F) (Pettifor *et al.*, 2004).
- In the 2008 national survey, highest MSP frequencies were found in the age group 15-24 years (M 31%, F 6%).
- In the 2009 NCS, MSP frequencies above 20% were found in male youth, male residents of KwaZulu-Natal, and students in Gauteng and North-West.

The largest increases in reported MSP frequency over time were in males aged 15-24 years (23% in 2002, 31% in 2008) (Shisana *et al.*, 2009). A significant decrease was observed in males aged 50+ years in the last survey (drop from 9.8% in 2005 to 3.7% in 2008). Reported MSP frequency in females was highest in those aged 15-24 years (6% in 2005 and 2008) and lowest in women aged 50+ years (<1% in all three surveys).

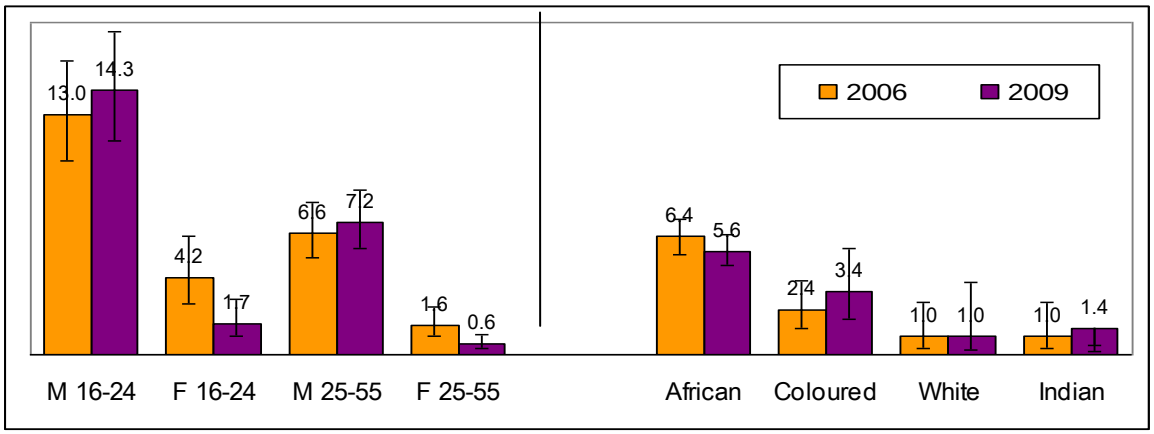
Concurrent sexual partners (CSP, overlapping sexual partnerships including extramarital partnerships of married persons – note that all the studies listed underneath do not comment on the possible contribution of polygynous relationships):

- A "roll-on" (seSotho: nyatsi; isiZulu: makwapheni) is a secret sexual partnership, by definition concurrent with, and hidden from, a primary relationship (Jewkes *et al.*, 2002).
- A survey in rural KZN found that 40% of sexually active men reported having 2 or more sexual partners in the past three months and it was thought likely that many of these were concurrent (Colvin *et al.*, 1998). In 2004, in the ACDIS area of KZN, among those who had ever had sex, 28% of men but very few women (1%) reported being in a concurrent relationship (McGrath *et al.*, 2009).
- A study of 15-26 year old men in the EC found that 55% of young men had engaged in one or more concurrent relationships in the past (Jewkes *et al.*, 2006).
- A household survey of Khayelitsha/Cape Town, WC, found that 29% of men and 8% of women in sexual relationships reported that they also had been sexually involved outside their regular relationship in the last 12 months (Boulle *et al.* 2008).
- In the Cape Area Panel Study, prevalence of respondent concurrency was considerably

higher among Africans than other groups and among males than females - among males, 41%, 21% and 4% of African, coloured and white respondents had ever engaged in concurrent relationships, and among females, 19%, 3% and 6% of Africans, coloureds and whites had done so. A commensurately higher proportion of African females (38% vs. 14% of other races) reported that at least one partner definitely had another sexual relationship during their relationship. The corresponding figures for partner concurrency for males were 28% for Africans and 10% for the others (Kenyon *et al.* 2009). Mah (2010) reported from wave 3 of the same study that 20.4% of males and 6.2% of females reported concurrency ($p<0.01$).

As a proxy for concurrency, respondents' reports of 2 or more sexual partners in the last month were analysed for 2006 and 2009 in different strata (Figure 41). As a general pattern, **reported multiple partners in the last month were lower in 2009 than in 2006 for females and Africans, and slightly higher for males and for coloureds**.

Figure 41: Respondents aged 16-55 years rep,orting 2 or more sexual partners during the past month in South Africa (2006, 2009) (among those sexually active in last 12 months)



Source: NCS 2006 and 2009 secondary data analysis by HDA (2010).

A secondary data analysis of the CAPS data by Kenyon *et al.* 2009 suggests that **partners' concurrency is more common among Africans, and networks are denser**:

- The percentage of what may be termed "mutually-concurrent" relationships (where the respondent and his or her partner both had other sexual partners during their relationship) was considerably higher in Africans than other races (15% vs. 1-3%, $p<0.001$).
- The percentage of persons who have had more than one concurrent partner ever (the serially-concurrent) and whose partner has had more than one lifetime concurrent partner was also considerably higher in Africans. The percentage of persons who have had two or more partners that had concurrent partners was 11%, 3% and 2% for Africans, coloureds and whites respectively ($p < 0.001$).
- Africans were both less likely to mention sticking to one-sexual-partner-at-a-time to protect oneself from HIV and less likely to perceive themselves to be at risk if they engaged in concurrent relationships. Africans were however considerably more likely to believe that condoms make sex safe (92% versus 67% in whites).

HIV prevalence is higher in respondents reporting more sexual partners – see Table 8. Estimated HIV prevalence for females reporting more than one partner in 2008 was

33.6%. Among young people, girls and boys with more than one lifetime partner are significantly more likely to be HIV-positive than those with one lifetime partner only. For each additional lifetime sexual partner the odds of HIV infection increased by 1.03 (95%CI 1.01–1.06) times for men and 1.09 (95%CI 1.01–1.16) times for women.

In 2005, **women reporting more than one partner currently were 4.3 times more likely to be HIV-positive (p=0.0001)** (multivariate analysis HSRC survey 2005). But the number of partners was not significant in either 2002 or 2008 models.

Table 8: HIV prevalence and number of sexual partners in South Africa (2003-2008)

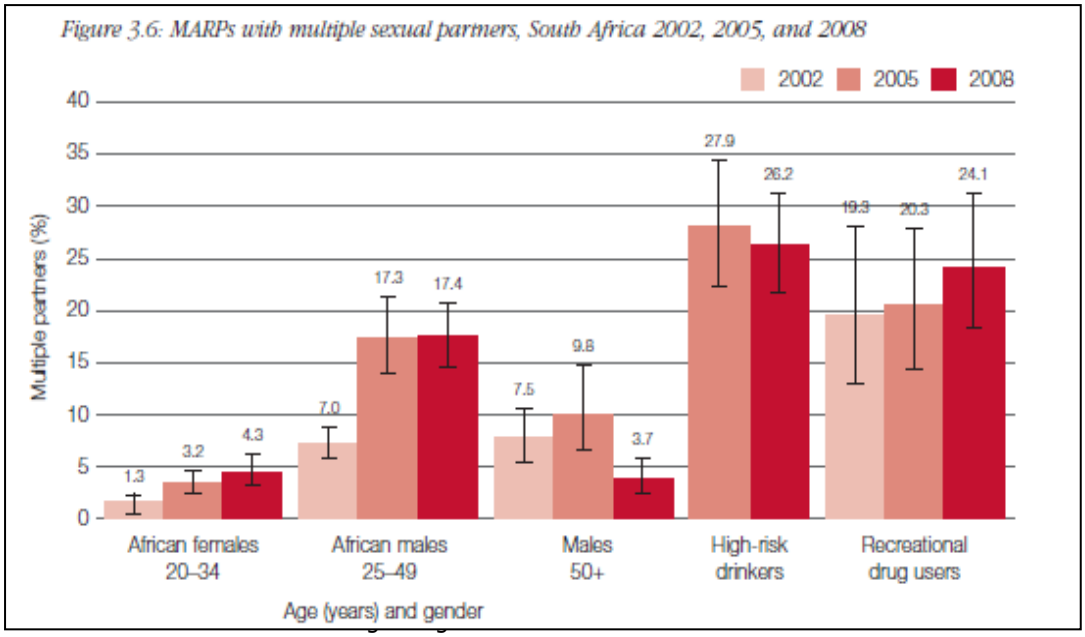
Indicator	HIV prevalence	95%CI	Sample	Source
Number of sexual partners in past 12 months			South Africans 15+ years	2008 National Survey, Secondary data analysis
- 1 partner	11.3% M 21.8% F	9.1 – 14.1 M 19.6 – 24.2 F		
- More than 1 partner	16.7% M 33.6% F	11.6 – 23.5 M 22.5 – 46.8 F		
Number of sexual partners in past 12 months			South Africans 15+ years	2005 National Survey, Shisana et al 2005, table 3.26
- 1 partner	16.3%	14.7 – 18.0		
- More than 1 partner	20.6%	15.6 – 26.6		
Number of sexual partners in past 12 months			Sexually experienced South African Youth 15-24 years	2003 National Youth Survey, Pettifor *et al.*, 2005
- 1 partner	7.0% M 19.2% F	5.4-9.0 M 16.1-22.8 F		
- More than 1 partner	6.4% M 23.0% F	5.0-8.1 M 16.6-31.0 F		
Lifetime number of sexual partners			Sexually experienced South African Youth 15-24 years	2003 National Youth Survey, Pettifor *et al.*, 2005
- 1 partner	3.8% M 15.0% F	2.2-6.4 M 9.7-22.6 F		
- More than 1 partner	6.6% M 26.1% F	5.4-8.1 M 22.5-30.1 F		

Jewkes *et al.* (2006) found in the rural Eastern Cape that **HIV-positive young women reported significantly more sexual partners in the last 12 months** (mean 1.78, 95%CI 1.60-1.97) than HIV-negative women (mean 1.38, 95%CI 1.33-1.43). Among the HIV-positive women, 22.2% (15.5-28.8) reported 3 or more sexual partners in past 12 months, while among HIV-negative women, 8.7% (7.3-10.1) reported 3 or more sexual partners in past 12 months (difference significant, aOR=2.48, p<0.0001).

There are many factors underlying the phenomenon of multiple and concurrent sexual partnerships - for the most part it involves an intersection between socioeconomic and cultural contexts and norms that are intertwined with individual psychological factors related to self-esteem and fatalism. Specific risk behaviours like alcohol or drug use may also be associated with higher MSP frequencies. Figure 42 shows higher MSP prevalence among individuals who reported high-risk drinking or recreational drug use in the HSRC surveys than in the general population.

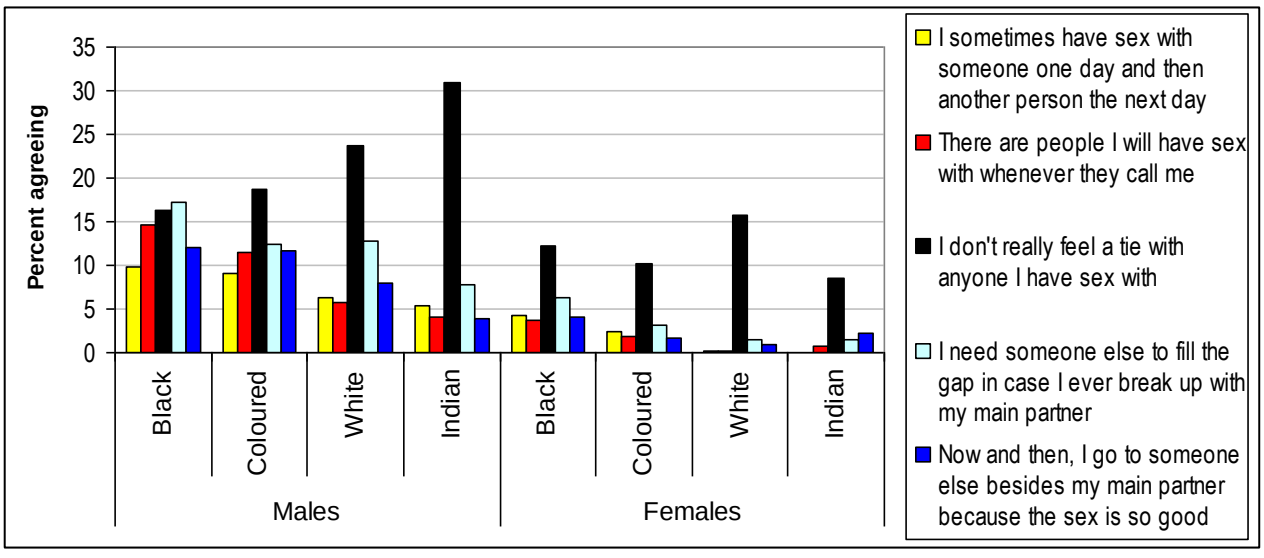
Figure 42: MARPs with multiple sexual partners in South Africa (2002, 2005, 2008)

Multiple sexual partners = Two or more sexual partners, may be serial or concurrent



Regarding norms and opinions on MCP, the NCS 2009 found that a large proportion of men agree with opinions and norms which support and encourage MCPs, like the idea that a second partner is an insurance against being alone when the primary partner breaks up (see Figure 43). African and coloured men frequently said that they "sometimes go to someone other than their main partner because the sex is so good", and "there are people they will have sex with whenever they call me". "Not really feeling a tie with anyone the respondent has sex with" was also prevalent among females.

Figure 43: Opinions and norms on multiple sexual partners in South Africa, by race (2009)



Source: NCS secondary data analysis by HDA, 2010.

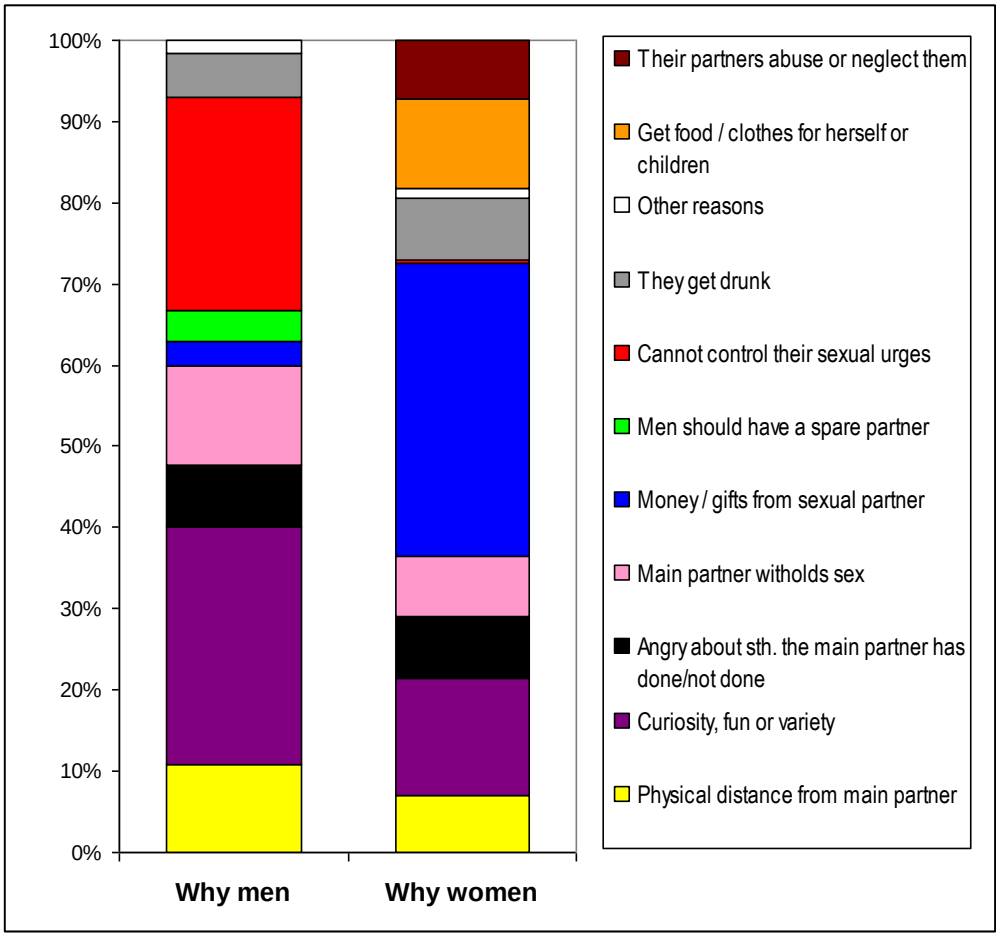
People believe that men mainly have more than one partner at a time because they are curious and want fun and variety, and because they cannot control their sexual urges (see Figure 44). For women, people believe that getting money, gifts and food are chief reasons for concurrent partners. Getting abused by the main partner can also

be another reason for women to have more than one partner at a time. In the 2009 NCS, 3% of married men and 12% of married women thought that their spouse currently had another partner, and 10% of cohabiting men and 19% of cohabiting women thought so (NCS 2009 secondary data analysis HDA 2010).

People also hold opinions as to why the main partner/spouse does not complain if the partner has other sexual partner (NCS 2009):

- Scared their partners will leave them (28%)
- Both are having an affair (20%)
- No love left (18%)
- Accept it due to financial dependency (16%)
- Forced by tradition (11%)
- Avoid any argument (14%).

Figure 44: Opinions and norms: Why some men and women around here would have more than one sexual partner at a time, South Africa (2009)



Source: NCS secondary data analysis by HDA, 2010.

Further research within the NCS 2009 into **attitudes and social norms on faithfulness** showed that:

- More males than females find it okay to have sex with others as long as the main partner does not find out (24% vs. 13%)
- More males than females agreed that if you have been with someone for a long time, you can trust them not to cheat on you (77% vs. 68%)

- More females than males agreed that when a relationship ends, one should wait a few months and not rush into a new sexual relationship (91% vs. 80%)
- More females said that they are confident about being able to resist the temptation of having sex with anyone else besides the main partner (84% vs. 74%)
- More females agreed that one cannot trust anyone because people are cheating everywhere (71% vs. 55%).

A qualitative study in five provinces (EC, GP, NC, WC, MP) in 2006/7 found that **sexual relationships were seen as a pathway to a number of distinct benefits** (Parker *et al.*, 2007). These include sex as a means of exchange for material goods and money. The concepts of sex and love were often separated, as is sex with love for a "main" partner, and sex without love for "other" partners. This duality was widely accepted as normative and leads to a re-categorisation of the concept of faithfulness, whereby "being faithful" shifted in meaning from *de facto* fidelity to a concept where keeping infidelity secret is a sufficient criterion for considering oneself to be faithful.

"*To us faithfulness is about using a condom on other partners*"

The study also showed that being part of a sexual relationship where one's partner is known to have another partner – often a 'main' partner – was not seen as a disincentive for initiating or sustaining a sexual relationship.

Research by the Soul City Regional Collaboration Programme[70] found very similar reasons for MSPs across ten countries in Southern and Eastern Africa: male domination, social norms (cultural, gender, and peer-pressure issues), dissatisfaction with main relationships, poverty and materialism, and alcohol use (Soul City, 2008).

Multiple sexual partnerships and the male psyche: According to Leclerc-Madlala (2000), there is a "widespread belief that males are biologically programmed to need sexual relations regularly with more than one woman, and often concurrently. Such beliefs are logically consistent with societies which were traditionally polygamous."

Women as active agents: The same author emphasises in 2004 that discourses on contemporary womanhood celebrate multiple partnering as a signifier of modern life and sex equality (Leclerc-Madlala, 2004).

Sexual dissatisfaction and boredom: Two studies that have examined MSPs in South Africa (Parker *et al.* 2007, Soul City, 2008) have found that sexual dissatisfaction has emerged as one of the reasons for both men and women finding other partners while retaining their main partner. Root causes are lack of effective communication about sex between partners, and sexual norms in marriage (Rassool, 2009)

Living away from home, mobility and migration: Data from ACDIS, KZN, suggest that migration is a key factor leading to MSPs – levels of sexual concurrency were 3-7 times higher in non-resident vs. resident women, and up to 3 times higher in non-resident vs. resident men (i.e residing or not residing with their primary partner, McGrath *et al.*, 2009) - see also section 1.5.5 on mobility and migration. In the 2009 NCS, **9% of respondents said their partner lived in a different town or area, 7% said the partner lived in a different province, and 0.5% said the partner lived in a different country** (HDA secondary data analysis 2010).

[70] In 2007, the Soul City Regional Collaboration Programme conducted 170 focus group and 116 in-depth interviews among persons aged 15 or older in its ten participating countries (Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe) to ascertain attitudes and practices around sexual relations with a focus on MSPs.

Alcohol abuse: A logistic regression analysis of 2005 national survey data by Kincaid & Parker (2008) indicated that two lifestyle variables, heavy drinking and having concurrent sexual partners, were closely related to one another. Only 8% of respondents with no current sexual partner reported heavy drinking, similar to the 10% of those with just one current sexual partner. In contrast, 27% of those with more than one current sexual partner reported heavy drinking. Heavy drinkers were 3.6 times more likely to have more than one partner (it is also likely that heavy drinking lowered the likelihood of correct and consistent condom use) – see also section 1.5.3 on alcohol.

Hunter (2007) revealed how three interlinked dynamics of post-Apartheid South Africa have come together to promote MSPs and thereby HIV spread: rising unemployment that leaves some groups such as poor women competing for the small pool of employed men; reduced marital rates amongst Africans; and rising levels of women's migration – see section 1.5 on the contextual factors of the South African HIV epidemic.

Morris (2008) writes that concurrency may help to explain two important disparities in HIV prevalence: the high prevalence in Sub-Saharan Africa vs. the rest of the world (long term concurrency is more common in the former, possibly a legacy of polygyny), and the racial disparities in HIV prevalence. The author argues that a **change in community norms**[71] is required to achieve partner reduction, and that household-based HIV testing and counseling provides a great opportunity to support this process.

Partner acquisition rates (PAR) were analysed using piecewise exponential models. The analysis is based on self-reported behavioural data from the NCS 2009. Note that people can acquire a new partner even when they already have one. **Annex 3** provides the detailed results of this analysis. It was found that partner acquisition rates vary by background characteristics and with other behavioural measures:

In men, PAR per person-year was estimated at 0.28, and in women it was estimated at 0.09, demonstrating the much higher rate of partner acquisition in men compared to women (three times higher, based on reported behaviour).

In men, partner acquisition was lowest in men with a spouse, and significantly lower in men with a non-spousal partner than men with no partner. Compared to single men, men who were unmarried but cohabiting were almost twice as likely to acquire a new partner. Other factors showed independent effects on the rate of partner acquisition. Compared to the rest of the country, men resident in Western Cape had lower hazards of acquiring a partner. Once adjusted for other variables, this was also true of men living in Free State and KwaZulu Natal. Compared to men living in formal urban settlements, men living in tribal areas had lower hazards of partner acquisition. African men had almost twice the hazards of other men (Hazard Ratio 1.85, p=0.001). **Men aged 20-24 had the highest rates of partner acquisition.** Men who reported starting sex at a young age also had higher PAR than those with AFS in the middle of the range or at a late age.

The Hazard Ratio for men who had recently had an HIV test, compared to men who had never had an HIV test, was 1.24 (p=0.03). There was no difference between men who had never had a test and those who had had a test more than a year before the survey. Education status and frequency of reading a newspaper were both associated with partner acquisition in men. Men with only primary education had lower hazards than men with

[71] As an example of community norm changing, the Tostan project on female genital cutting/mutilation is given (http://www.tostan.org/)

secondary education. Men who reported reading newspapers had higher hazards.

In women, partner acquisition was extremely low among those with a non-spousal or spousal partner. Unmarried cohabiting women had much higher hazards of acquiring a new partner than single women. African women had higher rates of partner acquisition than other women, but the difference was not as pronounced as for men. **Women living in tribal areas had significantly lower rates of partner acquisition than women living in formal urban areas.** The youngest women (aged less than 20) had lower rates of partner acquisition than women in their 20s and early thirties. Women aged 35 and over had statistically significantly lower hazards than women in their early 20s.

Women who had a recent HIV test, or had one more than two years before the survey, had higher hazards of partner acquisition than women who had never been tested. Women who had first sex before age 16 had higher rates of partner acquisition than women whose first sex was between ages 16 and 20. Women whose first sex was after age 20 had lower rates.

There are marked differences between men and women in PAR but, despite this, there are some similarities:

1. PAR were highest among those with no partner, and who are in their early twenties.
2. African men and women were more likely to acquire a new partner than non-Africans.
3. Men and women living in tribal areas were the least likely to acquire a new partner.
4. People who had an HIV test in the 12 months before the survey had higher acquisition rates in the same period (people might be getting tested as they enter a new relationship; alternatively, people who are aware that new partners present an HIV risk may get tested in response to their exposure).

4.5.3 "C" - Condom Use

SUMMARY

- **Condom use significantly increased overall between 2002 and 2008**, but not among people reporting multiple sexual partners.
- **Young singles (not married or cohabiting) and young people with MSPs are most likely to report using condoms.** People above 50 and married people are least likely to report condom use.
- In 2005, **PLHIV who knew their HIV status were significantly more likely to use a condom than PLHIV who did not know their HIV status.**
- **Sexual behaviour studies don't always focus on *consistent* condom use.** Available data indicated that condoms are least likely to be used *consistently* in partnerships characterised by long term concurrency (e.g. Youm & Paik, 2004; Kelly et al 2003). There is evidence that youth are more likely to use condoms consistently than older people (Kincaid & Parker, 2008).
- In provinces with higher HIV levels, sexually active women are more likely to choose **condoms for contraception** than in provinces with less HIV.

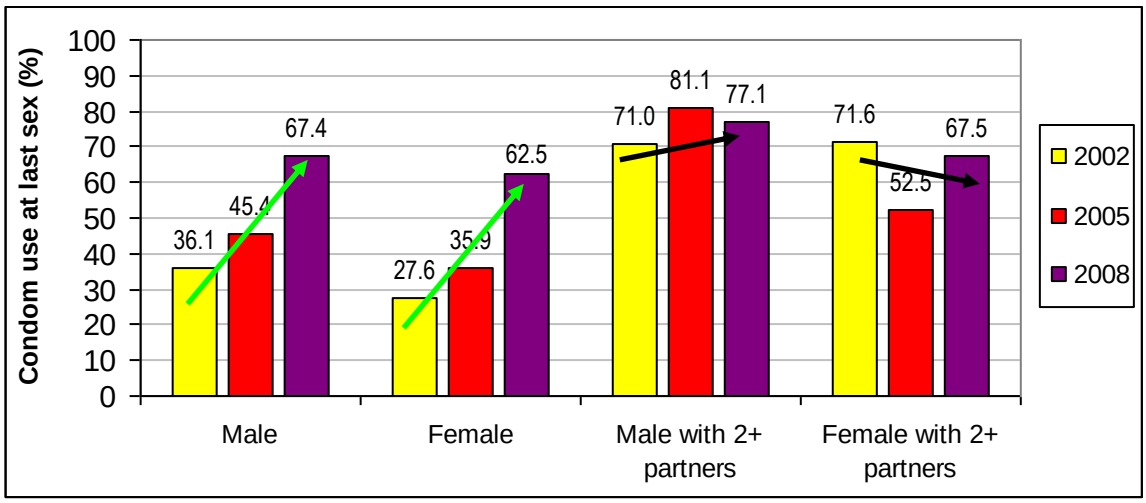
Condoms are an important means of preventing HIV and STI infection and unwanted pregnancy. In 2005, 13% of sexually active females aged 15-49 years had used the male condom as a contraceptive in the past 12 months (Shisana *et al.*, 2005).

There is evidence that condom use may be over-reported. Minnis *et al.* (2009) used Prostate

Specific Antigen (PSA) as a biomarker for recent exposure to semen, in order to validate reports of condom use and sexual activity in Zimbabwean women. Overall, 36% of the participants who tested positive for PSA reported condom-protected sex only, demonstrating the poor validity of self-reported condom use. KwaZulu-Natal data from Gafos *et al.* (2010a) on women's report of consistent condom use confirmed that reports on condom use have poor validity (see section on consistent condom use for details of this study).

Based on survey participants' answers, condom use has greatly increased in South Africa since 2002. In adults aged 15-49 years, condom use at last sex has gone up from 31% in 2002 to 40% in 2005 and to 65% in 2009 (Shisana *et al.*, 2009).[72] This increase applies to both male and female adults – see Figure 45. Among people reporting 2+ partners in the past 12 months, condom use was comparatively high in 2002 and 2005, but there was no dramatic increase in 2008 such as seen for all males and females.

Figure 45: Condom use at last sex by respondents aged 15-49 years, South Africa (2002, 2005, 2008)



Source: Shisana *et al.* (2009), tables 3.17 and 3.19.

Young singles and young people with multiple partners are most likely to report using condoms, whereas people above 50 and married people are least likely to report using condoms – see Figure 46. Of particular concern is the lack of universal condom use among people with multiple and/or concurrent sexual partners.

Increased condom use among youth may have contributed to the recent decline in HIV incidence in this age group (note that this is self-reported condom use data with known problems of validity). It has been shown that condom use in age-disparate sexual relationships could have a particularly large effect on HIV incidence among young women (Hallett *et al.*, 2007).

Data on reported condom use at *first sex* are consistent with the observations on reported condom use among youth (Kincaid & Parker, 2008, analysing 2005 national survey data). By 2005, reported condom use at first sex was over twice as high among young people compared to older age cohorts, for both males and females and for all racial groups. The authors suggest that this is **a sign of substantial behavioural change in response to**

[72] Pettifor *et al.* (2004) reported from the 2004 national youth survey that in 15 - 24-year-olds, 52% of sexually active males and 48% of sexually active females said they used a condom at last sex. 33% of all youth reported consistent condom use in the past 12 months.

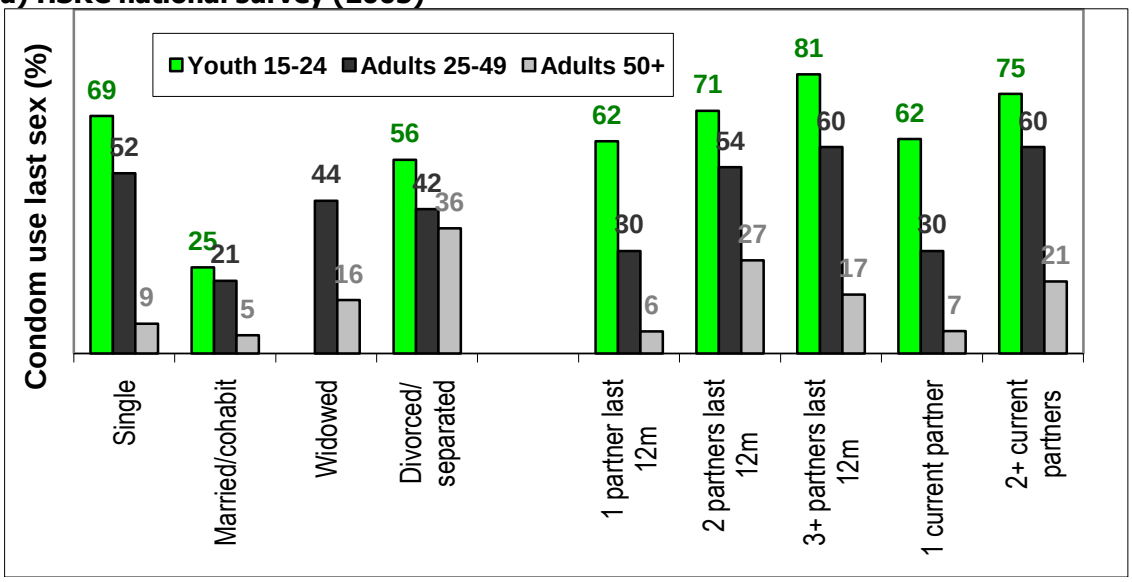
the HIV epidemic and to over a decade of campaign emphases on condom promotion alongside public sector, social marketing and commercial condom distribution. In the older age cohorts, reported condom use at first sex was considerably lower among Africans compared to non-Africans in 2005.

Condom use diminishes over time in sexual partnerships (Parker *et al.*, 2007). Condoms are least likely to be used consistently in partnerships characterised by long term concurrency (e.g. Youm & Paik, 2004; Kelly et al 2003). Figure 46a and b illustrate this with data from 2005 and 2009, and also confirm the overall higher condom use in younger age groups:

- **Reported condom use is lowest in married and cohabiting respondents**
- **Very low reported condom use in adults aged 50+** (2005 data) **and in young females having once-off partners** (2009 data)
- **Highest reported condom use in respondents with many partners, one-night stands and new partners** with the important exception of young females
- **Overall lower condom use reported by females than males**

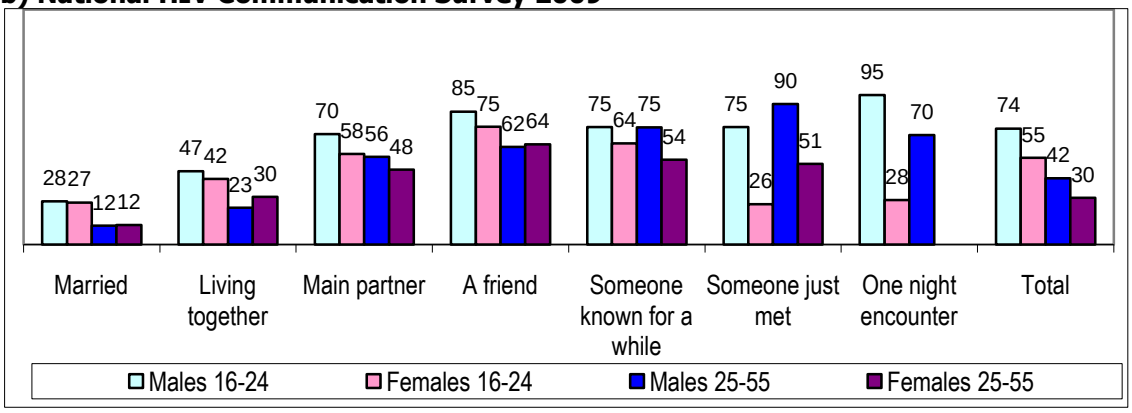
Figure 46: Reported condom use at last sex by partnership type, South Africa

a) HSRC national survey (2005)



Source: Shisana *et al.* (2005), table 3.36

b) National HIV Communication Survey 2009

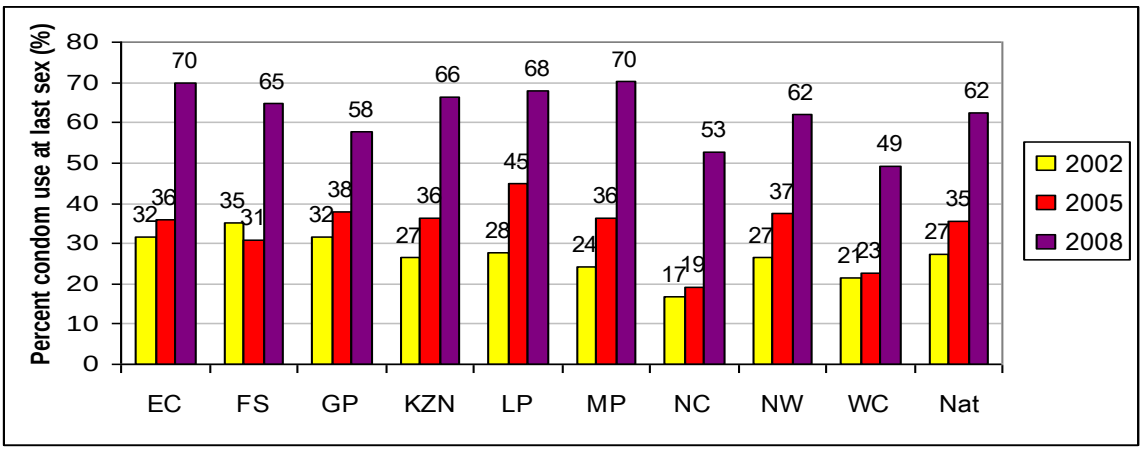


Source: NCS 2009, secondary data analysis HDA 2010 (Q3.5.15) **Note:** The data for females aged 25-55 years who report using a condom with a one night encounter is not shown since it was based on four individuals only.

Condom use in marriage is frequently associated with the notion that the spouse has been unfaithful, and Kenyon *et al.* (2009) found in the CAPS study that being faithful has shifted in meaning from having only one partner, to the idea that **using condoms with secondary partners is sufficient for considering oneself to be faithful**: "*I don't use a condom with my regular partner because I know that I'm faithful, but with anyone else I do, or else she can go because my need for her is not that much […] To us faithfulness is about using a condom on other partners*" (young male, Cape Town).

Reported condom use at last sex increased sharply in all provinces between 2005 and 2008 – see Figure 47. In NC and MP, reported condom use trebled between the 2002 and 2008 surveys. In all the other provinces but FS and GP, reported condom use more than doubled in 2008 compared to 2002.

Figure 47: Percentage of respondents aged 15+ years reporting condom use at last sex in South African provinces (2002, 2005, 2008)



Source: Shisana *et al.* (2009), table 3.18.

Consistent condom use is still low. Versteeg & Murray (2008) conducted qualitative research in communities in the North West Province and found positive results regarding accessibility and awareness of condoms. However, this often did not lead to the desired behavioural change of using condoms in risky sexual interactions. Most respondents still used condoms inconsistently, or were not in a position to negotiate protected sexual intercourse. The main **reasons for non-use were reduced pleasure, perceived and real physical side-effects, myths, lack of information, status, financial reasons, mistrust of the efficacy of condoms, family planning, cultural reasons, gender-related reasons and trust.** In Limpopo, Hargreaves *et al.* (2007) found that women, but not men, from wealthier households reported significantly higher levels of condom use (aOR comparing household 'doing okay' with 'very poor' 2.03, 95% CI 1.29–3.20).

Gafos *et al.* (2010a) used longitudinal data from clinic questionnaires in KwaZulu-Natal to approximate the proportion of women who reported consistent condom use over a year. In comparing reports from all the time points, the researchers found that different women reported inconsistent use each time – to the extent that the proportion of women reporting inconsistent use at least once during the study was 36%, the proportion always reporting consistent use was 41% and the proportion reporting that they never used condoms 21%. When these data were combined with more qualitative data and with "biomarker events" (HIV or STI diagnosis or pregnancy), **it was estimated that the true level of consistent condom use was about 25% – half the self-report level** (and given that the absence

of a biomarker was not proof of condom use, the 25% may be a maximum).

Kincaid & Parker (2008) assessed HIV prevention behaviours among self-perceived low-risk respondents in South Africa (2005 HSRC data).

- **Males were significantly more likely to report consistent condom use than females for all racial groups.**
- **Young people reported much higher consistent condom use** (African 15-24: M41%, F27%; African 25-43: M20%, F11%; African 44+: M6%, F2%).
- Therefore, a "generational jump" existed for always using a condom, but with significant gender differences across all age groups and all racial groups. Overall 14% of all respondents aged 15+ years said that they always use a condom (F10%, M18%, $p<0.05$).

Condom use by People living with HIV

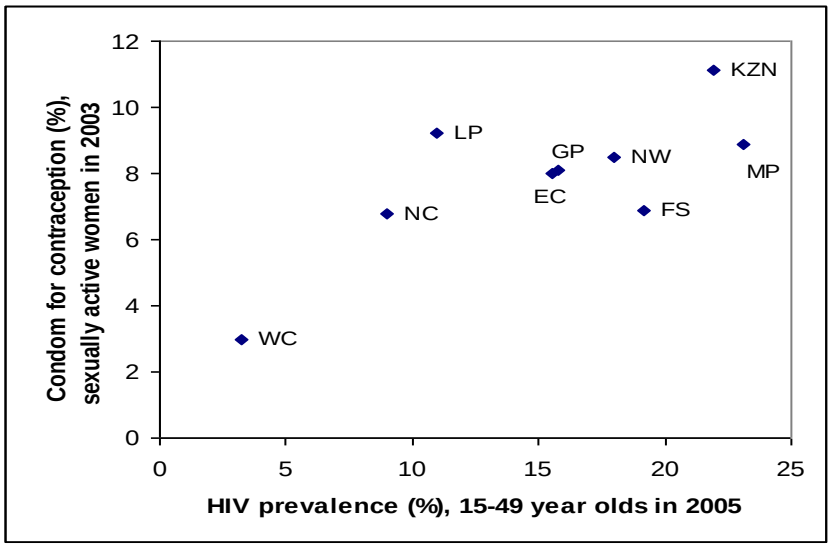
- In the 2005 national survey, **PLHIV who knew about their HIV status were significantly more likely to use a condom with their partner (66%) than PLHIV who did not know their HIV status (26%)** (Shisana *et al.*, 2005).
- Saleh-Onoya *et al.* (2009) found that among HIV-positive Xhosa women in South Africa, **personal and partner-related attitudes towards condom use, assertive negotiation skills of condom use, and positive self-esteem were key proximal determinants of condom use frequency**. Research data from Reddy *et al.* (2000) support the relationship between condom use and self-efficacy for condom use as well as assertive communication for condom use among STI clinic attendees in South Africa.
- Shuper *et al.* (2008) found that **45% of ART patients in KwaZulu-Natal reported unprotected sex during the past four weeks**. Factors associated with unprotected sex differed greatly between female PLHIV[73] and male PLHIV[74].
- Eisele *et al.* (2008) collected data in Cape Town on PLHIV who were on and about to start ART. **40% of the male PLHIV and 46% of female PLHIV reported having unprotected sex their last time**, regardless of ART status. The primary reason men gave for not using a condom was that they did not feel it was necessary, while the primary reason cited by women was partner refusal of condoms. These data reinforce the importance of underlying gender inequity within this setting where men are typically in control of negotiating condom use during sex and when they deem it unnecessary, women typically comply (Preston-Whyte, 1999).

For HIV-discordant couples, of all the FP methods, only condoms protect the negative partner from HIV **– in South Africa, condom use for contraception among sexually active women was 2.3% in 1998, 7.8% in 2003** (DHS data) **and 13.0% in 2005** (Shisana *et al.*, 2005). Figure 48 shows how HIV levels in a province correlate with condoms as the preferred method for contraception. **In provinces with higher HIV levels, sexually active women are more likely to decide on condoms for contraception than in provinces with less HIV**.

[73] Females: unprotected sex was associated with unemployment, negative condom attitudes, weaker condom use norms, weaker condom use intentions, lower behavioural skills, lower HIV stigma, lower perceived power, being threatened with physical violence, and experiencing physical violence (Shuper *et al.*, 2008).

[74] Males: unprotected sex was associated with lower education, lower HIV-related knowledge, negative condom attitudes, alcohol before sex, recent clinical STI treatment, and having a partner who was trying to conceive.

Figure 48: Provincial HIV prevalence and condom use for contraception in South Africa (2005, 2003)



Sources: Shisana *et al.*, 2005, DHS 2003.

4.5.4 Sexual frequency

SUMMARY

- **Sexual frequency is highest in people aged 25-49 years and in those cohabiting and married**
- **Modal sexual frequency was 1-4 times per month in 2005**
- **Males may have more transient partners. Females report more sex with steady partners.**

Population level data on the frequency of sexual intercourse come from the 2005 HSRC survey and the 2009 NCS. It is an important indicator of sexual behaviour, but unfortunately not always included in behavioural surveys. Minnis *et al.* (2009) found underreporting of sexual intercourse using a biomarker (PSA) in Zimbabwean women.

Respondents in HSRC 2005 and HSRC 2008 were asked if they had had sex in the month before the survey. In the NCS 2009, respondents gave a partner history from which sexual activity in the last month can be derived. **In all three surveys, just over half of male respondents and slightly fewer women had had sex in the past month.**

In 2005, adults aged 25-49 years reported higher levels of sexual frequency than youth and adults over 50 (Shisana *et al.*, 2005).

- The most frequent number of reported sex acts in the last month was 1-4 times in all three age groups.
- High sexual frequency of 15 or more acts in the last month were reported by less than 10% of adults aged 25-49, and by less than 5% of youth and people aged 50 or over.

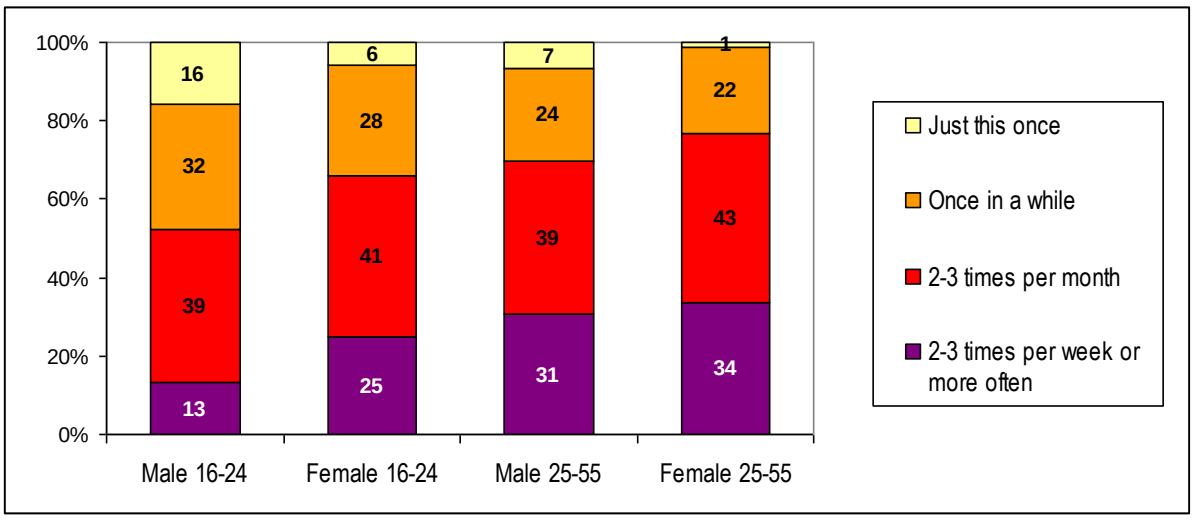
In 2009 also, adults aged 25-55 reported higher sexual frequency than youth (NCS 2009 data) - see Figure 49 (for last sexual partner only).

- Females in both age groups reported higher sexual frequency with the last partner than

males

- **Males reported more one-off sexual contacts**, suggesting that they have more transient sexual partners than females.

Figure 49: Reported frequency of sex with the last partner among South Africans aged 16-55 years (2009)



Source: NCS 2009, secondary data analysis HDA 2010

In 2009, respondents living together (cohabitation) reported highest sexual frequency (54% reporting coitus 2-3 times per week or more), followed by those married (41%) (NCS 2009 data). This was similar in males and females, youth and adults.

4.5.5 Sexual Practices

SUMMARY

- There is evidence from South Africa that **anal sex increases the likelihood of HIV infection in men and possibly women.**
- **Dry sex may increase the risk of STI acquisition by men** (no evidence of increased STI risk in women in South African).
- People reporting **sexual intercourse in the presence of genital bleeding (mostly menstrual bleeding) were over 3 times more likely to have been diagnosed with an STI.**

Sexual practices during intercourse influence the risk of HIV acquisition. Anal and dry sex acts are assumed to increase the transmission risks of HIV and STIs because they cause abrasions to the lining of the anus or vagina. Anifowoshe-Kehinde (2009) argues that it is unlikely that South Africans who engage in these high risk practices take preventive measures to avoid HIV infection given the stigma surrounding the acts.

Anal sex

The risk of HIV transmission during unprotected anal sex is higher than during vaginal sex. In a meta-analysis of data, Boily *et al.* (2009) found an estimate for the transmission risk of

receptive anal intercourse of 1.7% per act (95% CI 0.3–8.9) (for male-to-male anal sex, see section 1.3.2). Anal sex is practiced for various reasons: during menstruation (Ndinda *et al.*, 2008), to avoid pregnancy, to avoid STIs, to preserve a girls' virginity (Weiss *et al.*, 2000), and for sexual variety and satisfaction (Ramjee & Gouws, 2002). Berkowitz[75] reports for KwaZulu-Natal that *"young girls are opting for anal sex rather than lose their virginity".*

Data from the 2003 youth survey showed that among all sexually experienced youth, **5.5% of men and 5.3% of women reported ever engaging in anal intercourse. Sexually active men reporting anal intercourse were nearly twice as likely to be HIV infected** as men reporting only vaginal sex (OR 1.7, 95%CI 1.0–3.0) (Lane *et al.*, 2006). The associated risk was more pronounced among men aged 15–19 years (OR 4.3, 95%CI 1.5–12.1). **Among women, the association was not significant** (OR 1.2, 95%CI 0.7–2.0). Higher HIV levels have also been found in sex workers in South Africa who had anal sex with their clients (61% versus 43%, Abdool Karim & Ramjee, 1998).

Among men aged 15-26 years in the rural Eastern Cape, 3.6% reported sexual contact with a man, and these men were significantly more likely to be HIV-positive (Jewkes *et al.,* 2006). Findings from rural KwaZulu-Natal by Ndinda *et al.* (2008) suggest that anal sex is perceived as being rare in the general population, and that it is felt to be unacceptable.

Dry sex[76]

A meta-analysis of data on vaginal practices and HIV infection from ten African cohorts by Chersich *et al.* (2009) found that **the use of products to dry or tighten the vagina increased women's risk for HIV infection by 23%**, but the risk difference was not statistically significant (95% CI 0.97-1.56) (Chersich *et al.*, 2009). Van de Wijgert 2009 argued that there is inconsistent evidence for other vaginal practices in Africa.

Dry sex practices have been reported from some studies in South Africa. In a study by Beksinska *et al.* (1999) conducted with men and women aged 16-35 years in Gauteng Province, dry sex practices were reported by 60% of men and 46% of women. Among younger individuals dry sex was far more common among the less educated, but there was no significant difference among education groups in the older respondents. **A higher proportion of men practising dry sex than not practising dry sex reported having a past history of STIs** (56% versus 41%) although this difference was only marginally significant (p=0.05). There was no difference in reported history of STIs between women who practised dry sex and those who did not. Baleta (1998) wrote that dry sex was prevalent among prostitutes in the midlands of KwaZulu-Natal with at least 80% of them favouring the practice. In the microbicide study conducted by the Africa Centre, intravaginal use of a variety of products was widely acknowledged (Gafos *et al.*, 2010b). The experience of using trial gels - which made sex 'hot', 'tight' and 'dry' - matched the desired outcomes of intravaginal insertion. The findings provided evidence that in communities where intravaginal insertion is practiced, use of vaginal microbicide gels may be acceptable.

Sex in the presence of genital bleeding

The main source of data on coital bleeding and risk comes from a study conducted among

[75] "Virginity testing in South Africa", accessed 18 February 2011 on http://www.slideshare.net/EricaMouse/final-ant39-virginity-testing-south-africa

[76] The insertion of herbal aphrodisiacs, household detergents, and antiseptics into the vagina to dry and tighten the vagina for sexual intercourse (http://www.rho.org/html/hthps_overview.htm#drysex).

STI patients in Cape Town (Kalichman & Simbayi, 2005; Kalichman *et al.*, 2006). Thirty-one percent of men and 26% of women had a lifetime history of engaging in sexual intercourse that involved genital bleeding, and 21% of men and 16% of women reported coital bleeding in the previous 3 months. Over 75% of coital bleeding was attributed to menses. Across genders and controlling for demographic, sexual behavior, and life history factors, coital bleeding in the previous 3 months was associated with being an indigenous African, having multiple sexual partners, and higher rates of unprotected intercourse during the relevant time period. **People who reported coital bleeding were over 3 times more likely to have been diagnosed with an STI** even after controlling for having had genital ulcers. Sexual exposure to blood was found to be associated with other risky behaviour (greater numbers of sex partners, higher rates of unprotected vaginal intercourse and transactional sex). There is evidence from elsewhere that **heterosexual transmission of HIV is facilitated by sex during menstruation** (Edwards, 1992).

4.5.6 Prevention Knowledge, Risk Perception and Adoption of HIV Prevention Behaviours

SUMMARY

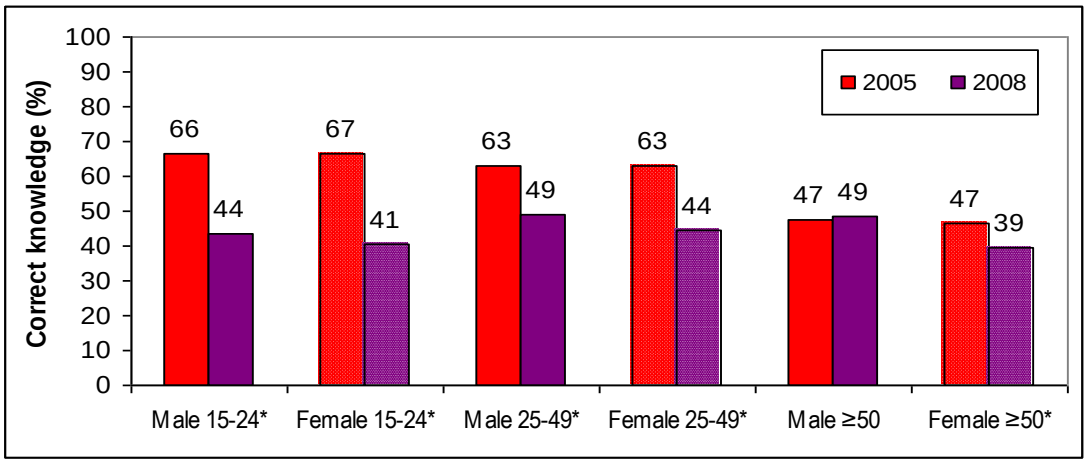
- **Correct knowledge on the prevention of sexual transmission of HIV has decreased in all age and sex strata except in males aged 50 or above** (comparison of 2005 and 2008 national survey data).
- **Equally, correct knowledge on prevention and rejection of misconceptions regarding HIV transmission has decreased**, especially in Limpopo, KwaZulu-Natal, Mpumalanga, and Eastern Cape.
- **A relatively small proportion of the population regard themselves to be at any significant risk for HIV.**
- **Significantly more HIV-positive respondents perceived themselves to be at high risk of HIV compared to HIV-negative respondents.**
- **The practice of HIV prevention behaviours increases the probability of staying HIV-negative.**
- **In 2005, HIV prevention behaviour was significantly less likely among specific population strata:** females, adults in the middle age group, those with no schooling at all, the unemployed, respondents with children, Africans, and respondents from KZN.
- **HIV testing behaviour varies across the provinces;** the three highest prevalence provinces KwaZulu-Natal, Mpumalanga and Free State have comparatively fewer people recently tested for HIV.

Knowledge and beliefs about prevention of sexual transmission of HIV

Correct knowledge about preventing sexual transmission decreased significantly between 2005 and 2008 - in all adults combined, it decreased highly significantly from 60.7% in 2005 to 44.4% in 2008 ($p<0.0001$) (Shisana *et al.*, 2009). Figure 50 shows the level of correct responses to two questions about the prevention of infection (consistent condom use, partner reduction). In all age and sex strata, the decrease was significant except for men aged 50+ years.

Figure 50: Correct knowledge about prevention of sexual transmission of HIV, South Africa (2005, 2008)

Figure shows the percentage of respondents who correctly identified two ways of preventing the sexual transmission of HIV (consistent condom use, partner reduction)

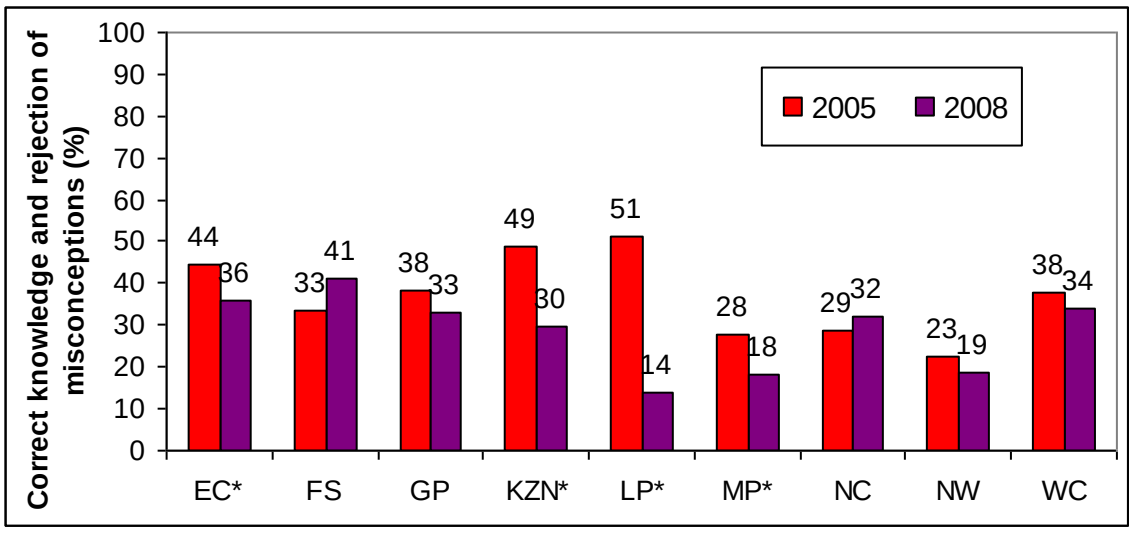


Source: Shisana *et al.* (2009), table 3.24
Note: Asterisk (*) denotes significant difference between 2005 and 2008 level (p<0.05)

The percentage of people who correctly identify ways of preventing HIV and reject misconceptions about HIV transmission also decreased between 2005 and 2008 - in all adults combined, it decreased highly significantly from 40.2% in 2005 to 29.0% in 2008 (p<0.0001) (Shisana *et al.*, 2009). It is important to note that it is challenging to score correctly on this composite measure. Figure 51 shows the results for each province. Two provinces had a small improvement in the indicator (FS, NC), three provinces had a non-significant decrease (GP, NW, WC), and four provinces had a significant decrease (EC, KZN, LP, MP).

Figure 51: Correct knowledge about prevention of sexual transmission of HIV and rejection of major misconceptions about HIV, South Africa (2005, 2008)

Figure shows a composite measure of two questions on prevention knowledge (consistent condom use, partner reduction) and four myths and misconceptions (AIDS cure, witchcraft, link between HIV and AIDS, and sex with a virgin)



Source: Shisana *et al.* (2009), table 3.28
Note: Asterisk (*) denotes significant difference between 2005 and 2008 level (p<0.05)

The 2009 NCS assessed beliefs on how HIV infection can be prevented:

1. There was a high belief in **condoms as a prevention measure** (86% overall, 89% of youth aged 16-24, 84% of adults aged 25-55).
2. This was followed by the belief that **one sexual partner only** will prevent HIV infection (39% overall, 32% of youth, 42% of adults 25+).
3. The third most important measure mentioned was **abstaining from sex** (37% overall, 44% of youth, 34% of adults 25+).
4. **Male circumcision, getting tested for HIV and partner reduction were less often mentioned.** Very few respondents said HIV cannot be prevented.

HIV risk perception

Perception of risk is a key dimension of most health behaviour models (Prohaska *et al.*, 1990). The health belief model, for example, explicitly theorizes that perceived risk results in behaviour change. According to this model, individuals would stick to one partner at a time, if they perceived that the risk of becoming infected with HIV outweighs the costs of fidelity (Becker & Janz, 1987). Cognitive theory adds an extra dimension to this perspective. Here, individuals are understood as active processors of information – data is not merely uncritically assimilated, but rather it is filtered and interpreted by the perceiver. Community norms, ideology and historical experience can all impact on how the information is processed, altered and stored (Eiser, 1986).

Overall, only a relatively small proportion of the population regard themselves to be at any significant risk for HIV.

- In the 2009 NSC, **78% of respondents aged 16-55 years said that they would not get infected** (21% said they will get infected) – for both groups, it is not clear what proportion already know their HIV status (HDA 2010 secondary data analysis). **Young people aged 16-24 had slightly lower risk perception** with 84% saying they would not get infected compared to the 25-55 year group (76%), and **males had lower risk perception than females** (85% vs. 72%). There were also **racial differences in risk perception** (95% of Indians, 88% of whites, 85% of coloureds and 76% of Africans believed they will not get infected). Table 9 shows respondents' reasons for believing they will not get infected; Table 10 shows the reasons they believe they will get infected.
- In the 2003 youth survey, among sexually active young people, 67% thought of themselves as being at low risk for HIV infection, and **49% of young people with more than one partner and a history of no condom use felt at low risk for HIV** (Pettifor *et al.*, 2004). More females than males perceived themselves to be at great risk for HIV (18% vs. 11%, $p<0.01$).
- A study by MacPhail & Campbell (2001) found that 70% of young South African men in the mining district of Carletonville thought that they were at no risk of contracting HIV.
- In the 2005 national survey, only 2% of all respondents thought that they would definitely get infected (Shisana *et al.*, 2005).

- The main reasons for not feeling "at risk" among youth are never having had sex and always using a condom.
- Being faithful to one partner is the chief reason for not feeling "at risk" among the older age group (same result in males and females).

Among males and females, lack of condom use and an unfaithful partner constitute the main reasons for feeling "at risk" (more females feel at risk due to unfaithfulness of their partner).

Table 9: Reason given by respondents for believing they will not get infected, by age group (2009)

	16-24 (%)	25-55 (%)	All (%)
Have never had sex before	30.1	2.3	12.0
Now abstaining from sex	17.9	19.3	18.8
Faithful to one partner/trust my partner	28.3	61.1	49.7
Always use condoms	32.5	21.2	25.1
Do not have sex with prostitutes/sex workers	3.6	5.6	4.9
Do not share used needles or body piercing instruments	7.3	5.6	6.2
Know that both my partner and I have tested HIV negative	3.0	7.2	5.8
My ancestors protect me	0.2	0.4	0.4
God protects me	3.0	2.0	2.3
I am lucky	0.7	0.3	0.4
Cannot predict the future	0.1	0.3	0.2

Source: NCS 2009, secondary data analysis HDA

Table 10: Reason given by respondents for believing they will get infected, by sex (2009)

	Male (%)	Female (%)	All (%)
Don't/Didn't use condoms	54.3	45.7	48.6
Partner is or was unfaithful	21.9	41.6	35.0
More than one sex partner	12.8	2.8	6.2
Too many sex partners	3.3	0.8	1.6
Have/had sex with prostitutes/sex workers	1.0	0.5	0.7
I am/was unlucky	1.6	2.7	2.4
My ancestors are/were angry with me/do not protect me	0.4	0.1	0.2
Anything can happen	3.7	1.6	2.3
HIV already	1.0	3.1	2.4
Condoms not safe	0.4	0.4	0.4
Blood transfusion	4.7	6.0	5.6

Source: NCS 2009, secondary data analysis HDA

In the 2005 national survey, significantly more HIV-positive than HIV-negative respondents perceived themselves to be at high risk. The perceived high-risk group had a HIV prevalence of 20.8% (F23.1%, M17.4%, n.s.), and the perceived low-risk group had a HIV prevalence of 10.1% (F12.8%, M7.5%, $p<0.05$) (Shisana *et al.*, 2005). The 10 percentage point difference in infection between the self-perceived high and low risk groups was investigated by Kincaid & Parker (2008), in order to elucidate risk prevention behaviours in the self-perceived low risk/lower infection group. Among this perceived low-risk group, 36% said they were faithful and/or trusted their partner, 14% said that they always used a condom, 14% said that they were abstaining from sex, 4% said they avoided sex with sex workers, and 3% said that they did not share needles.

Adoption of HIV prevention behaviours

The most frequent HIV prevention strategy adopted in sexual intercourse is condom use (45%) (NCS, 2009). Only a few sexually active people report thigh sex (0.1%), anal sex (0.1%) and oral sex (<0.1%) as prevention measures. Some people report

erroneous prevention strategies like "faithfulness & trust" (6%), or contraceptive use, withdrawal, and using the natural method (all <1%).

The practice of HIV prevention behaviour increases the probability of staying HIV-negative (multivariate analysis of the 2005 national survey data by Kincaid & Parker, 2008, using a composite measure for prevention behaviours[77]).

The analysis showed that **the odds of remaining HIV-negative among those who practice one or more prevention behaviours is 50% greater than among those who do not.**

The following significant associations were found, based on *reported* behaviours:

HIV prevention behaviour is …

- significantly less likely among **females** than males (aOR=0.77, p<0.001)
- significantly more likely among young adults 15–24 (aOR=1.29, p<0.001) compared to older adults 44+, and significantly less likely among **adults in the middle age group**, 25–43 years (aOR=0.77, p<0.001)
- significantly more likely among those with matriculation (aOR=1.46, p<0.001) and tertiary levels of education (aOR=1.30, p<0.05) than **those with no schooling at all**. Those with primary/secondary education are not significantly different from those with no schooling.
- significantly more likely among those currently employed (aOR=1.17, p<0.01), students (aOR=1.55, p<0.001) and those on pensions (aOR=1.65, p<0.001) compared to the **unemployed**
- significantly more likely among respondents without any children (aOR=1.54, p<0.001).
- significantly related to race - the odds of practicing HIV prevention behaviour is 48% greater among coloureds (aOR=1.48, p<0.001), twice as great among whites (aOR=2.05, p<0.001), and four times greater among Indians (aOR=4.08, p<0.001) compared to **Africans**
- significantly less likely among respondents from **KwaZulu-Natal** (aOR=0.63, p<0.001) and significantly more likely among respondents from Mpumalanga (aOR=1.31, p<0.05) compared to the reference province Western Cape
- not related to marital status, living away from home, or type of residence

The analysis by Kincaid & Parker (2008) also found that **awareness of national level mass media AIDS communication programmes has an indirect effect on HIV status through its effect on several HIV prevention behaviours**.

HIV testing behaviour

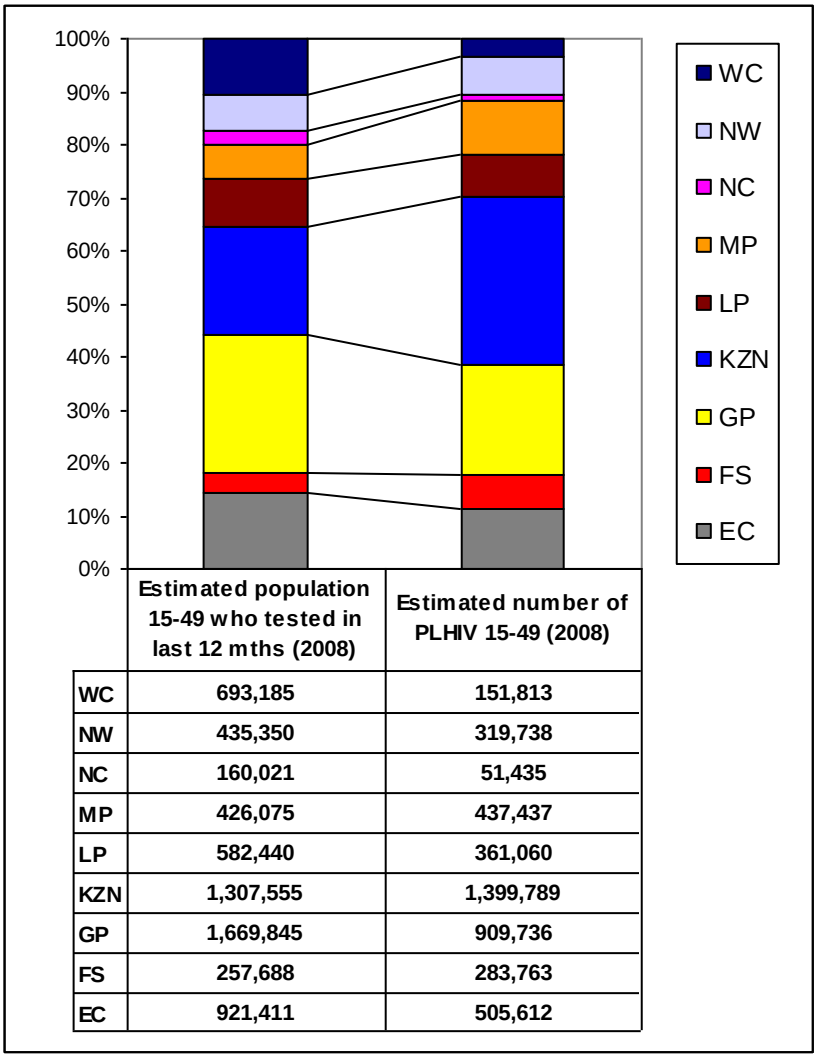
In 2008, 28% of residents of Northern Cape, Gauteng and Eastern Cape reported having been tested for HIV in the last 12 months and knowing their result, compared to only 17% in Free State (Shisana *et al.*, 2009). Figure 52 shows an analysis of the estimated population

[77] Single dichotomous variable composed of any of the following: 1) faithful and/or trust partner, 2) always use a condom, 3) abstaining from sex, 4) avoid sex with sex workers, 5) not sharing needles, 6) used a condom when having sex for the first time (Kincaid & Parker, 2008, p7)

in each province who had tested for HIV during the year, compared to the estimated number of PLHIV in each province. **HIV testing intensity does not always match the burden of HIV infection in the provinces**Figure 52. Taking into account the burden of HIV infection in the province;

- Relatively high numbers of people have been tested for HIV in EC, GP, NC and WC provinces
- Relatively low numbers of people have been tested for HIV in FS, KZN and MP provinces, the three provinces with highest HIV prevalence.

Figure 52: Comparison of estimated number of people tested for HIV per province and burden of HIV infection per province in South Africa (calculated as relative proportions between the provinces, 2008)



	Estimated population 15-49 who tested in last 12 mths (2008)	Estimated number of PLHIV 15-49 (2008)
WC	693,185	151,813
NW	435,350	319,738
NC	160,021	51,435
MP	426,075	437,437
LP	582,440	361,060
KZN	1,307,555	1,399,789
GP	1,669,845	909,736
FS	257,688	283,763
EC	921,411	505,612

Sources: Left column: Population estimates from SSA website time series data, Shisana *et al.* (2009) table 3.22. Right column: Estimated population 15-49 years & Shisana *et al.* (2009) table 3.10.

In 2008, men who took the HIV test for reasons of feeling sick or curiosity were 4.9 times ($p<0.0001$) and 1.9 times ($p=0.0062$) more likely to be HIV-positive than those who had never been tested (multivariate analysis). Those who were tested for HIV within a campaign were 3.2 times less likely to be HIV-positive than those who had never been tested ($n=76$, p n.s.). In 2005, men and women whose last HIV test was prompted by sickness were significantly more likely to be HIV-positive than those who had never been tested.

In 2005, among all respondents who tested HIV-positive in the survey, 64% had never had an HIV test. This illustrates the large number of HIV-positive people who did not know that they are HIV infected. **In 2005 and 2008, HIV-positive individuals were significantly more likely than HIV-negative people to know their status**.[78]

4.6 Contextual Factors in the Sexual Transmission of HIV

The importance of contextual, population-level characteristics is spelt out by Aral *et al.* (2007): *"Whereas individual-level parameters may influence which individuals in a given population acquire infection, it is population-level parameters that affect the presence and prevalence of infection to be acquired".*

Several factors in South Africa impact the course of the HIV epidemic, such as, for instance, culturally based sexual and gender norms that render women subservient to male partners, cultural acceptance of MCP, low rates of marriage, widespread alcohol use and illicit drug abuse among certain sub-populations, a high prevalence of physical and sexual violence, high mobility and migration especially in some occupational groups, and inequality in wealth and income. Links between socio-cultural and economic conditions, and HIV risk and vulnerability are too complex for a single explanation. A major analytical challenge is to define the causal pathways operating from distal (contextual, structural) factors to proximal individual level behavioural behaviours which ultimately lead to new HIV infections. For instance, a large body of literature has described *structural* causes of multiple sexual partner behaviours (e.g. Hunter 2002; Selikow *et al.* 2002, Luke 2003; Kaufman & Stavrou, 2002).

4.6.1 Sexual and Gender Norms

SUMMARY

- Traditionally, in many parts of sub-Saharan Africa, **women have played a subordinate role in reproductive and sexual decision making, and culturally based gender norms have rendered women subservient to male partners** (e.g. Jewkes *et al.*, 2003).
- **Gender norms and roles are undergoing change in South Africa** (Jolly *et al.*, 2009), and it has been reported that the gender gap is closing (WEF, 2009).
- **Couples are required to renegotiate gender roles and relations. Women need to refrain from risk-taking that is part of a mistaken understanding of what "female empowerment" means**.

The principle of gender equality is enshrined as a fundamental right in the 1996 Constitution and since 1994 there have been major advances for women in certain areas, most notably in the political and legal spheres (ICRW, 2008). These have co-existed with high levels of gender-based violence (see section 1.6.4.) and the widespread persistence of social norms that continue to regard women as subordinate to men. While "equal opportunity" legislation has begun to change the gender profile of the workforce in certain sectors of the economy, most women do have sufficient resources or education to benefit from these developments.[79]

[78] In 2008, 51% of HIV-negative respondents had never been tested ($p<0.0001$); in 2005 it was 70% ($p=0.013$)

[79] Official unemployment July-Sept 2009: 26.5 (W) and 22.9% (M) (Statistics South Africa, 2009). Employment same period: 35.5% (W) and 47.7% (M)

In South Africa, the gender hierarchy and dominant constructions of South African masculinities legitimate the control of women (Jewkes *et al.*, 2009). Research conducted in South Africa consistently shows that men believe they are more powerful than women and that men are expected to control women in their relationships (Jewkes *et al.* 2001, 2008; Kalichman *et al.* 2005; Morrel 2002). The gender hierarchy leads to expectations of female obedience, women assuming a passive role in sex, and male sexual entitlement (Soul City, 2008). The racially-defined masculinities all valorise physical strength and courage. As a consequence, violence is often used by men to communicate to women their place within the gender hierarchy and the limits of their agency within sexual relationships. These sexual and gender norms restrict women's capacity to demand monogamy from their partners, negotiate safer sex, or require behaviour change from their partners (Gupta, 2002; Meyer-Weitz *et al.*, 2003).

South Africa is witnessing major changes in the position of women, and gender norms and relations are in flux (ICRW, 2008). The equality provisions in the law, modern lifestyles and education have a profound effect on men's and women's view of gender relations. According to Jolly (2009), there is "gender role confusion" with men feeling threatened and women disempowered, and couples lacking skills to renegotiate relations. In many areas of the country, individual rights is a new concept and patriarchal values and norms are still strong.

South Africa has made great strides in closing the gender gap and in 2009 reached 6th place in the global comparison of the gender gap index[80] (22nd position in 2008, WEF 2009). This excellent score is mainly due to the high educational attainment of girls, the high proportion of women in parliament and in ministerial positions, and the high percentage of women professional and technical workers.

Ironically, women who break out of the traditional sexual and gender roles can incur increased HIV risks – this concerns for instance those women who seek secondary sex partners as a revenge for a partner's infidelity (Soul City, 2008) or those who use their economic and social empowerment to adopt the same risky sexual behaviour, including MSPs, that men have long practiced (Leclerc-Madlala *et al.*, 2007; Shelton, 2009). Data from Mozambique demonstrate that women are mindful of the factors constraining their future goals (lack of employment opportunities and access to education, corruption, low wages), and may see relationships with older men as the easiest and most natural way to acquire the means to a better life.[81]

Analyses at aggregate national level on gender inequality and HIV provide somewhat counter-intuitive results - it has been found that the narrower the gender gap (the more empowered women are), the greater the prevalence of HIV (Alnwick, 2008). The countries scoring best in Africa on the Gender Gap Index are South Africa (6th), Lesotho

[80] The Gender Gap Index scores are on a 0% to 100% scale (0% = inequality, 100% = equality), roughly interpreted as the percentage of the gender gap that has closed. It is composed of four sub-indices (Economic empowerment & opportunity; Educational attainment; Health & survival; Political empowerment).

[81] Regional data provide further insight: in Mozambique, Bagnol & Chamo (2004) and Karlyn (2005) examined how young women in intergenerational relationships constructed their identities and manipulated sexual and economic power imbalances. Those studies revealed that urban young women perceived themselves as active decision-makers, and their identity as modern empowered women was related to a strategy of extracting financial and material resources from older men through sex. Such relationships were said to be relatively widespread and largely accepted by society. The authors discussed how the goals and aspirations of young urban women in Mozambique are contextualized within changing social and economic conditions. Young women were seeking to forge new roles for themselves in societies in which sexual expectations were shifting.

(10th) and Namibia (32nd). These countries are among the small group of countries with HIV prevalence above 15%.

A phenomenon which illustrates well how sexual and gender norms affect sexual behaviours is "age-disparate sexual relationships". The disproportionately high HIV infection levels in young women have been attributed to their greater involvement in relationships with older-aged partners.[82]

Age-disparate sexual relationships

SUMMARY

- **Young girls aged 15-19 years reporting an age-disparate relationship were 72% more likely to be HIV infected than girls with similar-aged partners** (HIV prevalence 29.5% vs. 17.2%, Shisana *et al.*, 2005).
- **Men and women with much younger/older partners are more likely to be HIV-positive than people who reported partners of similar age only.**
- **Age-disparate sex is closely interlinked with transactional sex** (section 1.6.2).

Age-disparate relationships generally refer to those in which the age gap between partners is 5 years or more (Leclerc-Madlala, 2008). **Intergenerational (or cross-generational) relationships** usually refer to relationships with a 10-year or more age disparity between partners (ibid.). For purposes of this report, the term age-disparate sex is used, unless a study clearly refers to intergenerational partnerships. Findings from studies of age-disparate relationships help to shed light on patterns in sexual dynamics between young women and older men.

The following pattern of age-mixing has been reported

National communication survey 2009 (HDA, 2010):

- 29% of young women (16-24) reported the partner being 5-9 years older and 9% reported the partner being 10 or more years older

National communication survey 2006 (HDA, 2010):

- 21% of females and 18% of males reported an age difference of 6-9 years between their partner and themselves, and
- 12% of females and 15% of males reported an age difference of 10 years or greater.

National prevalence survey in 2005 (Shisana et al., 2005):

- About one third of sexually active men report having a partner 5+ years their junior and about a third of sexually active women report having a partner 5+ years their senior.
- Less than 2% of sexually active men report having partners who are 5+ years older, and less than 2% of sexually active women report having partners who are 5+ years younger.

[82] Gregson *et al.* (2002) examined sexual mixing patterns and used mathematical modelling to better understand the high HIV prevalence in teenage girls in rural Zimbabwe. The authors postulated that the age difference between the partners is a major determinant of the rapid rise in HIV prevalence among young women. Condom use in age-disparate relationships was reported to be rare.

National youth survey in 2004 (Pettifor et al., 2004):

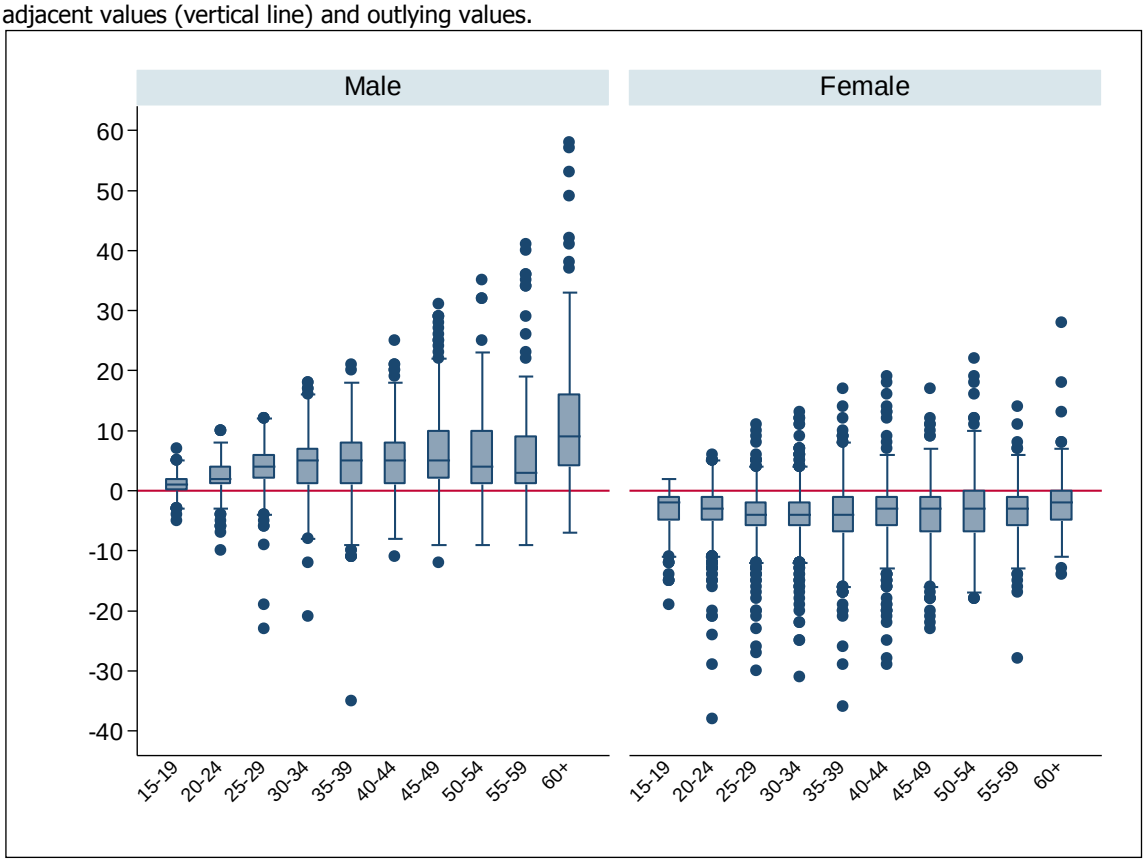
- One third of females aged 15-24 years reported that the most recent partner was aged 5+ years older
- One percent of young males reported a 5+ years older partner

In Carletonville, women aged 20 years had partners with an average age of 25.2, women aged 30 had partners whose average age was 36.4, and those aged 40 had partners whose average age was 44.2 (MacPhail *et al.*, 2002).

Analysis of the reported age gaps between sexual partners suggests that as men get older, the age gap widens (Figure 53). Most males tend to be older than their female partners (median above zero, left part of figure), whereas most females are younger than their male partners (median below zero, right part).

Figure 53: Largest age gap (respondent's age-partner's age) reported in the last year, South Africa (2008)

Gaps were calculated for each of the last five partners reported by respondents, for each respondent the largest is shown on this graph. Graph shows the median (central line); interquartile range (box); upper and lower adjacent values (vertical line) and outlying values.



Source: HSRC 2008 secondary data analysis 2010

Men and women who have partners much younger/older than themselves are more likely to be HIV-positive than people who reported partners of similar age only. In multivariate analysis of 2005 HSRC data, men and women reporting an age gap of 10+ years between themselves and a sexual partner were 85% and 58% more likely to be HIV-positive than people with a maximum gap of 0-4 years between them and any partner in the last 12 months (M: aOR 1.85 p=0.022; W: aOR 1.58 p=0.024).

Findings from the 2003 Youth Survey are similar with women significantly more likely to be HIV-positive if their partner was 5+ years older (24.2% vs. 16.7%, RR=1.6) (Pettifor *et al.*, 2005). **The association between having an older partner and the female's HIV status was strongest among women aged 15-19 years**: these young women had a 3.2 times higher odds of being HIV infected compared to their age peers with a partner of the same age (p=0.02). **Age-disparate sex provides one of the possible social explanations for the disparity in the relative rates of HIV infection in young men and women of similar age in South Africa.**

Several factors have been identified within age-disparate relationships that increase the risk of HIV and STIs:

1. Risk perception is often very low. Young South African women often view older men as 'safe' partners because they appear to be less risk-taking, more stable and more responsible (Leclerc-Madlala, 2003). Frequently, young women are more concerned about the risk of becoming pregnant or of being 'found out' in their relationships with older men, than of STI or HIV. Men often report a preference for young sexual partners, viewing them as more likely to be free from HIV infection.

2. Condom use is low. Throughout sub-Saharan Africa, studies have shown that young women's ability to negotiate condom use is often compromised by age disparities and economic dependence. Young women have reported that they often cannot insist on safe sex practices, and doing so would jeopardize their economic goals in the relationship (e.g. 2001 survey of the "*Transitions to Adulthood in the Context of AIDS*" study from KwaZulu-Natal province by Hallman, 2004). Luke (2003) established that there was a significant and negative association between the age disparity and the likelihood of condom use.

3. HIV/AIDS knowledge does not necessarily prevent risk behaviours. Research findings suggest that even when knowledge of HIV/AIDS is relatively high among the men and women involved, the benefits they derive from age-disparate relationships often outweigh the cost of contracting HIV (Leclerc-Madlala, 2008). Some studies have identified young women's high awareness of high rates of AIDS illness and death in their immediate environment as a factor promoting their involvement in age-disparate liaisons, largely because they brought with them the possibility for enjoying life now while young, beautiful and still alive (Leclerc-Madlala, 2003).

Age-disparate relationships are often valued because they provide access to different kinds of capital that young women seek to acquire, including social, emotional, symbolic and financial (Leclerc-Madlala, 2008):

- Money and material acquisition, increased financial security
- Feeling loved or wanted
- Gaining social status among one's peers
- Boosting self-esteem, self-confidence and self-perception as modern & sexually liberated
- Having fun
- Hope of marriage (older men more likely to support children)
- Desire to avoid marriage and instead seek to become economically independent
- Gaining social mobility through securing better jobs and opportunities that could come through socio-sexual networking
- Meeting physical and emotional needs
- Better sex than with age peers, patience and tenderness of older men

Southern African research suggests that young women hold contradictory norms and values about age-disparate relationships (Karlyn, 2005; Nkosana, PhD thesis). Whereas many young women hold positive perceptions and attitudes towards these relationships, they are also to some extent simultaneously aware of dangers including dependency and the common occurrence of unsafe sex that can result in pregnancy, STI and HIV. For these reasons young women often judged relationships with wide age disparities as not good, with many claiming that they wished the benefits could be derived by other means (Leclerc-Madlala, 2006). Similar negative views on intergenerational relationships were obtained from the four country sub-Saharan Africa analysis of adolescent sexual behaviour by Moore *et al.* (2007).[83]

Reducing the amount of intergenerational sex, especially in the case of young women having sex with older men, could contribute substantially to the control of the epidemic. An analytical model looking at how the age range of people's sexual partners affects the extent of the epidemic (Pretorius *et al.*, 2009) showed that the HIV epidemic will be sustained if, for example, 90% of people have sex with people of the same age while 10% of young people have sex with people who are ten or more years older than they are.

A study on urban schoolgirls in Botswana found that **a combination of personal, social and institutional factors may protect against young women's involvement with older men** (Nkosana & Rosenthal, 2007) – these factors included a strong sense of self-worth, knowledge of sexual risks, acceptance of socioeconomic circumstances, social support and religious values.

4.6.2 Transactional and Commercial Sex

SUMMARY

- In South African surveys, **2 - 52% of females and 4 - 30% of males report transactional sex experiences**. In 2005, about 2% of men reported ever having paid for sex.
- Research in a number of sub-Saharan African contexts has conclusively demonstrated that **exchange of sex for material resources is common practice, and that the vast majority of women who engage in such transactions do not identify as sex workers** (e.g. Hunter, 2002; Leclerc-Madlala, 2003; Luke, 2003; MacPhail & Campbell, 2001; Wojcicki & Malala, 2001; Wood & Jewkes, 2001).
- **Transactional sex is part of a cluster of closely related violent and controlling practices**, and may often be motivated by ideas of sexual conquest as much as sexual desire (Dunkle *et al.*, 2007).

Transactional sex – the exchange of money, goods or services - occurs in different types of sexual relationships. As stated earlier, it is closely linked with age-disparate sex[84].

[83] Based on national survey data from Burkina Faso, Ghana, Malawi, and Uganda

[84] E.g. Parker *et al.* (2007, p34) 25-year old male from Eastern Cape: "I've had relationships mostly with people in employment. Some have been older than me… I do get choosy but money tends to make you overlook all faults."

Studies among South African youth find that young women often receive gifts from primary dating partners (Wood & Jewkes, 2000; Jewkes *et al.*, 2001; Kaufman & Stavrou, 2002; MacPhail & Campbell, 2001). While these gifts are rarely the sole motivation for the relationship, they do provide an incentive for young women to both have sex and eschew condom use. Hunter (2002) drew attention to socioeconomic changes through time that have led to a decline in formal marriage[85] and a rise in casual partnerships in which **economic transfers have become a normative part**. Such casual partners may be "roll-ons" (Jewkes *et al.*, 2002), or the father of the women's child/children with whom she continues having sex to secure financial support (Jewkes, *et al.*, 2002). Or they may be partners for "one-off" sex as a thank you for, for instance, drinks bought in a bar (Wojcicki & Malala, 2001), a car ride (Kaufman & Stavrou, 2002), or a bed for the night (Jewkes *et al.*, 2002; Wojcicki & Malala, 2001). Dunkle *et al.* (2007) conclude that *"in South Africa, casual and secondary sexual relationships seem far more likely than main partnerships to be driven explicitly by transactional motives*".

In surveys, the following frequencies of transactional sex have been reported:[86]

- In the 2009 NCS, the overall prevalence of providing sex in exchange for gifts or money in the past year among 16-55 year old respondents was **3.2%**.[87] In some population strata, it was over three times higher (Free State: males, those aged 25-55 years, Africans, and the employed; Gauteng: coloured people – secondary data analysis HDA 2010).
- In the same survey, the prevalence of giving money or gifts in exchange for sex in the past year was **2.5%**, with over three times higher values for some strata (Free State: males, those aged 25-55 years, Africans, the employed; Gauteng: coloured people; North-West: youth, males, white people, and the employed; Western Cape: males, the employed).
- In the 2004 national youth survey (Pettifor *et al.*, 2005): **2.1% of females** aged 15-24 and **3.5% of males** aged 15-24 reported ever having engaged in transactional sex.[88]
- In Cape Town, 21% of pregnant and 19% of non-pregnant teenagers reported having sex for money or presents (Jewkes *et al.*, 2001).
- In Soweto, 21% of pregnant women reported having ever had sex with a non-primary male partner in exchange for material goods or money (Dunkle *et al.*, 2004).
- In the rural Eastern Cape, one in six men reported the transfer of material resources or money to both casual and main partners (Dunkle *et al.*, 2007).
- In Limpopo and Mpumalanga Provinces, 52% of female farm workers had exchanged sex for food, clothing, gifts or money[89].
- In pre-intervention villages in the Eastern Cape, a quarter of women and almost 30% of

[85] Dunkle *et al.* (2007) emphasise that transactional sexual relationships fundamentally differ from lobola as they do not involve formal negotiation and exchange between families.

[86] Dunkle *et al.* (2007) summarize the main methodological weaknesses in the available qualitative data on transactional sex: 1. There is poor distinction between financial or material transfers which function as gifts, or even entitlements (e.g. child support), and those that function as transactions. ***Gifts*** can be defined as material or monetary transfers whose primary intention is to express affection or otherwise solidify and enhance affective dimensions of a relationship. ***Transactions***, in contrast, are primarily motivated from the giver's side by a desire to secure or maintain sexual access (or other services) and from the receiver's side by a desire to generate resources. 2. Standard survey questions have generally defined transactional sex only in terms of giving money or gifts to a sexual partner, and few have distinguished exchanges within primary relationships from those with casual or concurrent partners.

[87] Sexual calendar question

[88] Question: 'Have you ever had sex with someone so that they would give you material or any other kind of support such as money, presents, alcohol, food, clothes, better grades, transportation etc in exchange?'

[89] IRINPlusNews, Hoedspruit, 8 February 2007 http://www.irinnews.org/Report.aspx?ReportId=70042

men said they had ever had transactional sex (Stepping Stones intervention, Jewkes *et al.*, 2008).

Gifts for love versus gifts for sex - Qualitative research has consistently demonstrated that exchange of money and material resources takes on different meanings in different kinds of relationships. The distinction between gifts and transactions is critically important because while gifts often form an integral part of courtship or expressions of care and affection within relationships, they may not be a critical motivating factor underpinning the existence of the relationship or motivating a particular sexual encounter (Hunter, 2002; Kaufman *et al.*, 2004; Luke, 2005).

In the 2009 tertiary education survey, the qualitative data provided **evidence that less direct forms of material transaction are pervasive, and carry much greater social acceptance**. The degree to which transactional sex was acknowledged and spoken about by students indicated that the general concept of exchanging sex for social and material gains is commonplace. One respondent described how additional partners are sought:

"Even though you know and I know I have a boyfriend, I would do my things on the side because my boyfriend can't afford all the things that I want. They will be able to cover these other things that my boyfriend and my parents can't cover". (female student)

An under-privileged student in one higher education institution commented, poignantly illustrating the vulnerability of students with few means, and the lack of parental support:

"They [parents] never ask, 'What are you eating?', until March. Nobody looks into that. Our parents don't even know. We get this [admission to university] ourselves, we get inside, get ourselves registered, find accommodation somehow, get into a class, and nobody's asking you, 'How did you get in?' And yes, I've slept my way through that. [….] We don't have anybody looking after us. So we're looking after ourselves and the only option we have at this point, to take care of ourselves, is our vagina". (female student)

Self-reported participation in transactional sex is associated with HIV infection and other risky behaviours:

- In ANC clients in Soweto, Dunkle *et al.* (2004) found that transactional sex was significantly associated with HIV seropositivity after controlling for lifetime number of male sex partners and length of time a woman had been sexually active (OR=1.54, 95%CI 1.07 - 2.21). Transactional sex was associated with gender-based violence, substance use and socio-economic disadvantage.
- In South African youth aged 15-24 years, Pettifor *et al.* (2005) found that HIV prevalence in females who had ever had transactional sex was 26.3% versus 20.9% in those who had not (not statistically significant in multiple logistic regression).
- In men aged 15–26 in the rural Eastern Cape, Dunkle *et al.* (2007) found that transactional sex was associated with more lifetime sexual partners, alcohol use, adverse childhood experiences, and higher socio-economic status.
- Accepting financial or material assistance from a man means accepting sex on his terms, which very often means without condoms (Hunter, 2002; MacPhail & Campbell, 2001; Meekers & Calves, 1997; Wood & Jewkes, 2001). It has been found that the larger the gift given in transactional sex, the less likely safer sex is practised (Luke, 2005).
- Women may also face rape and physical violence from men who anticipated that financial outlay would be reciprocated by sex (Wood & Jewkes, 2001), and women often tolerate physical or sexual violence in order to sustain relationships which provide critical income (Wood & Jewkes, 2001).

Common reasons for transactional sex:

- **Economic** – Qualitative research with young people aged 13-25 years in Khutsong, Gauteng Province, revealed that a primary reason for young women to have sex is economic (MacPhail & Campbell 2001). Basic survival and subsistence needs of women are key motivators for transactional sex (Hunter, 2002; Leclerc-Madlala, 2003; Luke, 2003; Wojcicki, 2002).
- **Material** – Research in Durban led to the conclusion that for women, especially young unmarried women, sexuality is seen as a resource that can be drawn upon for material advantage (Leclerc-Madala, 2002). Young women may also use transactional sex to help advance their education, or gain employment or business opportunities (Hunter, 2002; Kaufman et al, 2004; Leclerc-Madlala, 2001; Luke, 2003; Silberschmidt & Rasch, 2001).
- **Meeting aspirations** - Media images of glamorous and prosperous lives are an important influence in shaping the aspirations of many young women, and transactional relationships are considered useful in helping them to meet these aspirations (Leclerc-Madlala, 2008).

Commercial sex - There is a continuum between transactional sex and commercial sex (sex in exchange for money). Women, men and transgender persons are involved in the sex industry and in most instances, the provider is a woman and the buyer a man (Gardner, 2009). The same author writes that "*despite the industry's criminal status, sex work has proliferated in South Africa over the last decade. Street-based sex workers are visible on major roads of every South African city, mainstream magazines feature articles on the sex industry, and newspapers generate income through advertising the services of sex workers*".

It is difficult to find statistics on sex work or the population size of sex workers. This has much to do with the hidden nature of the industry and difficulties related to the definition of sex work. In Cape Town, there are just over 1 200 sex workers, according to Gould & Fick (2008), with about 250 sex workers on the streets – 'the outdoor industry', and some 964 in brothels or working from houses or apartments – 'the indoor industry'. Clients of the Cape Town sex workers are a very mixed group of all ages and income groups; many of them married and over 30 years of age (ibid).

Sex workers have high HIV prevalence levels – see Table 11. In the study published by Leggett (2009), HIV levels are especially high in African FSW. The author emphasizes that information on race composition of study samples and race-specific HIV prevalence levels is often missing in data sources, although ethnicity may be a stronger predictor of HIV prevalence than risk behaviours such as drug use or sex work *per se* (Leggett, 2009).

Table 11: HIV prevalence data from sex workers in South Africa (2005-2009)

HIV prevalence (95%CI)	Characteristics of sample	Source
46.4%	Female sex workers in Johannesburg, N=295	Dunkle *et al.*, 2005
59.6%	Self-identified sex workers and women with multiple transactional partners, urban KwaZulu-Natal, N=775	van Loggerenberg *et al.*, 2008
34%	Commercial sex workers in Cape Town, Durban, Pretoria, N=50	Parry *et al.*, 2008

HIV prevalence (95%CI)	Characteristics of sample	Source
66% (African) 18% (white) 17% (coloured)	Female sex workers in Cape Town, Durban and Johannesburg, N=249	Leggett, 2009
59%	High-risk women in Pretoria who conduct sex work and/or report engaging in unprotected sex, abuse alcohol and other drugs, N=276	Luseno & Wechsberg, 2009

In turn, men who report visiting sex workers are at increased HIV risk. In the multivariate analysis of 2008 HSRC survey data, men who reported sex with a sex worker were 2.9 times more likely to be HIV-positive (n very small [13], p=0.078).

In multivariate analysis of men's 2008 survey data, having had sex with a CSW was the only behavioural variable to remain associated with HIV status in the HIV outcome model – **having had sex with a CSW almost trebled men's odds for HIV infection** (aOR 2.9, p=0.078, N=13). See Annex 1 section 1I for model.

The BSS by Gauteng Health Department (not dated) had the following results from 1,170 female sex workers (FSW) in Hillbrow, Marshalltown, Berea and Yeoville:

- The median age was 26 years, and the women had been in the industry for an average of 3 years.
- 98% of all interviewed FSW were African.
- Nearly 80% of the sex workers interviewed had migrated to the area from other provinces, mostly rural areas and even those from Gauteng had not all grown up in the city or its suburbs. They had moved there to find a better life and, to survive, had become involved in sex work.
- Three quarters of the sample had 6 or more partners in the seven days before the survey (median: 8).

The intensity of sex work varies. A study on self-identified FSW in Durban found a comparatively low intensity of sex work. The median number of days performing sex work per week was 3 days with a median of 2 clients per day and a range of 1–10 (Van Loggerenberg *et al.* 2008).

Sex work, alcohol use and consumption of drugs overlap. Wechsberg *et al.* (2005) report that using alcohol and other drugs helps the FSW to solicit clients and overcome their shyness. Campbell (2003) found in the Summertown HIV Project that "*… alcohol served as a psychological coping mechanism, a form of medication for dealing with the violence, poverty and stress of daily life. It served as an essential component of the loss of inhibition that women felt when proposing sex to men, in a cultural context where women were strongly prohibited from taking the sexual initiative*".

Richter (2009) sums up the environment of sex workers in South Africa as follows:

- Sex workers suffer violence from clients, their partners and the police.
- Sex workers work in unsafe and dangerous conditions.
- Sex workers don't have easy access to health, social, police, legal and financial services.
- There is a stigma around sex work.

4.6.3 Alcohol Use

SUMMARY

South African data demonstrate that alcohol consumption is associated with risky sexual behaviour, a higher likelihood of being HIV infected, and poor HIV prevention behaviours. The most commonly used substance of abuse in South Africa is alcohol and there is considerable evidence that alcohol abuse contributes to the spread of HIV (Cook & Clark, 2005; Kalichman *et al.*, 2007). Findings from the South African Community Epidemiology Network on Drug Use demonstrate that acute alcohol intoxication is associated with increased mortality and morbidity in South Africa due to accidents, violence, unsafe sexual practices, and misuse during pregnancy (Parry *et al.* 2002).

South Africa falls into the group of countries exhibiting the most hazardous pattern[90] of drinking (Peltzer & Ramlagan, 2009).

- In the 2009 NCS, 26% of men and 12% of women aged 16-55 years confirmed that they take 4-5 drinks on one occasion several times each month (HDA, secondary analysis).
- Between a quarter and a third of drinkers drink at risky levels over weekends, and drinking to intoxication is common (Parry *et al.*, 2005).
- With regard to young people, 29% of males and 18% of females between grades 8 and 11 in the 2002 National Youth Risk Behaviour Survey reported past month binge drinking[91] (Reddy *et al.* 2003).
- In pre-intervention villages in the rural Eastern Cape, 25% of men and 3% of women reported problem drinking (Stepping Stones study, Jewkes *et al.*, 2008).

A recent systematic review of alcohol use and sexual risks for HIV in Sub-Saharan Africa showed a consistent association between alcohol use and sexual risk taking (Kalichman *et al.*, 2007). Among people who drink, **greater quantities of alcohol consumption were associated with greater sexual risks, frequency of drinking less so**. The review also showed a clear gender difference in alcohol use and sexual risks; men were more likely to drink and engage in higher risk behaviour whereas women's risks were often associated with their male sex partners' drinking.

Of particular importance are the social dynamics of alcohol use which center around the places where people drink and socialize including taverns, beer halls, and informal drinking establishments (Kalichman *et al.*, 2008), e.g.

- Individuals who met sex partners at shebeens drank more heavily, had more sex partners, and had higher rates of unprotected intercourse relative to their counterparts who did not meet sex partners at shebeens (Kalichman *et al.*, 2008).
- In the 2009 NCS, 68% of men and 56% of women felt that it is a lot easier to have sex with people who go to shebeens, nightclubs or bars.
- Morojele *et al.* (2006) report from Gauteng Province that alcohol establishments are often themselves sex venues, where back rooms, corners, and adjacent buildings, shacks, or lots afford locations for sex.
- Weir *et al.* (2003) mapped the linkages among places where people meet new sex partners and places where people drink alcohol, and demonstrated a remarkable overlap between meeting sex partners and drinking in these venues: over 85% of the locations where people met sex partners were also alcohol serving establishments. Across three

[90] Hazardous patterns of drinking are indicated by the level of the population drinking first thing in the morning, drinking to intoxication, drinking apart from meals, etc.

[91] Drinking alcoholic beverages with the primary intention of becoming intoxicated over a short period of time

South African cities, between 78% and 87% of new sex partners were met at shebeens. Between 30% to 57% of men and 19% to 46% of women drinking at shebeens reported having two or more sex partners in the past two weeks.

There is a large body of evidence that drinkers and heavy drinkers have higher levels of sexual risk behaviour than non-drinkers, for example

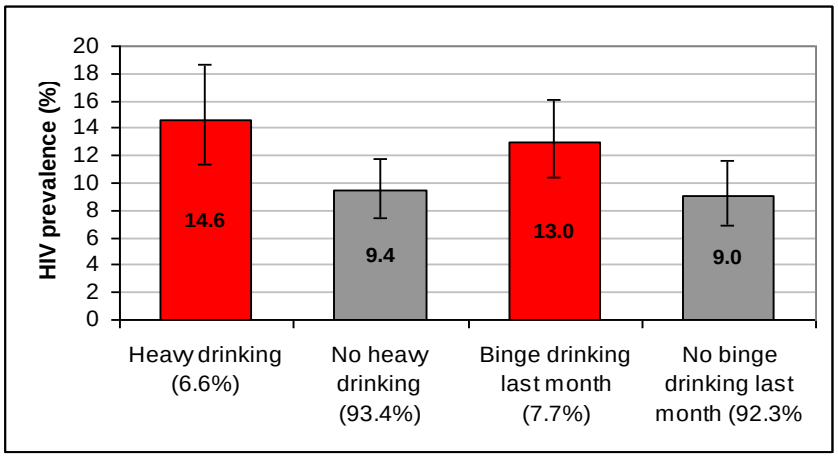
- Qualitative and quantitative studies conducted among adolescents and young adults in Gauteng Province between 2002 and 2003 point to strong links between drinking and engaging in sexual risk behaviours (Matzopoulos *et al.*, 2003).
- In the 2009 NCS, Over half of men and women held the view that when they are drunk neither they nor their partners care about HIV (HDA, secondary analysis). The survey also found that partners reported having had too much to drink when having sex especially if they had "just met" (26%) or if it was a "one-night encounter" (48%).
- In the 2005 and 2008 national surveys, MSP prevalence among high-risk drinkers[92] was 28% and 26%, respectively (Shisana *et al.*, 2009).
- In the 2005 national survey, hazardous, harmful or binge drinking was related to having more than one regular partner and with having irregular partners (Shisana *et al.* 2006).
- Drinking before sex was found to be more common with non-regular than with regular sex partners (Myer *et al.,* 2002).
- Alcohol use frequency, quantities consumed and problem drinking are associated significantly with the number of sexual partners a person has had and engaging in sex that was later regretted (Morojele *et al.*, 2004, 2006).
- Alcohol has been identified as a risk factor for partner violence leading to coerced sex and rape (Krug *et al.*, 2002; Jewkes *et al.*, 2002; Simbayi *et al.*, 2006).

Regional and local data demonstrate the strong link between alcohol use and HIV infection at the individual level:

- In a meta-analysis of African studies, Fisher *et al.* (2007) concluded that **alcohol drinkers were more likely to be HIV-positive than non-drinkers** (pooled OR from 20 studies =1.70, 95%CI 1.45-1.99). When compared with non-drinkers, the pooled estimates of HIV risk were 1.57 (95% CI 1.33-1.86) for non-problem drinkers versus 2.04 (95% CI 1.61-2.58) for problem drinkers, a statistically significant difference ($p<0.04$).
- In the 2005 national survey, PLHIV were more likely to be hazardous, harmful or binge drinkers than HIV-negative persons (Peltzer & Ramlagan, 2009; Shisana *et al.* 2006) – Figure 54.
- In the 2008 national survey, HIV prevalence in high-risk drinkers was 13.9% (demographics of sample not given).

[92] High-risk drinking = Score of 8 or higher in the 10-point Alcohol Use Disorder Identification Test (AUDIT)

Figure 54: HIV prevalence in alcohol use groups in South Africa (2005)



Source: Peltzer & Ramlagan, 2009 (table 9), based on data from 2005 national survey. Heavy drinking= Score of 8 or higher in the 10-point Alcohol Use Disorder Identification Test (AUDIT)

At an ecological level, the link between heavy alcohol consumption and HIV is not evident in South Africa - in the 2005 national survey, it was found that:

- Men have a higher frequency of heavy drinking (14%) than women (2%), but lower HIV prevalence;
- Coloured adults have a higher frequency of heavy drinking (18%) than African adults (6%), but lower HIV prevalence;
- Rural formal residents have a higher frequency of heavy drinking (11%) than urban informal resident (9%), but lower HIV prevalence; and
- Residents of the Western Cape and Northern Cape have highest frequencies of heavy drinking (16%, 12%), but lowest provincial HIV prevalence levels.

Heavy drinking is negatively related to HIV prevention behaviour (Kincaid & Parker 2008)- those who frequently drink 4–5 alcoholic drinks at a time are significantly less likely to practice HIV prevention behaviours (aOR=0.91, p<0.01).

An important effect of alcohol consumption is that it can impair adherence to ART (which may lead to increased HIV transmission) - a meta-analysis of 40 studies outside Africa on alcohol use and antiretroviral adherence by Hendershot *et al.* (2009) found a significant and reliable association of alcohol use and non-adherence to ART. In South Africa,

- Dahab *et al.* (2008) found in a qualitative study in a South African workplace programme that alcohol was one of the main barriers to ART adherence;
- Almost one in five HIV patients studied at a large infectious disease clinic in Cape Town in 2003 met criteria for an alcohol use disorder. These patients were more likely to have symptomatic HIV infection (Olley *et al.* 2005).

4.6.4 Violence and Rape

SUMMARY

- South African data suggest a **direct link between violence and HIV infection** – HIV-positive women are more likely than HIV-negative women to have experienced partner physical abuse (e.g. Jewkes *et al.*, 2010). **Data from the SADC region support these**

observations of violence leading to greater risk of HIV infection (e.g. Garcia-Moreno & Watts, 2000; Maman *et al.*, 2000 and 2002).

- **In Soweto, women with violent or controlling male partners were more likely to be HIV-positive, and abusive men were more likely to have HIV and impose risky sexual practices on their partners** (multivariate analysis, Dunkle *et al.,* 2004).

In South Africa, there is huge concern about the consequences of violence and rape for the HIV epidemic. Sexual violence[93] and gender based violence (GBV)[94] are serious issues for human rights and public health, and disproportionately affect women and girls of all ages. These types of violence take many forms, including rape, domestic violence, exploitation and harassment, sexual slavery, forced prostitution and human trafficking. It is increasingly recognised that intimate partner violence has significant impact on women's physical, reproductive and sexual, and mental health (Campbell, 2002; Garcia-Moreno *et al.*, 2006).

Refusing sex, inquiring about other partners, or suggesting condom use have all been described as triggers for intimate partner violence; y*et all* are intimately connected to the behavioural cornerstones of HIV prevention (e.g. Maman *et al.*, 2000).

Perpetrators of violence themselves are an unlikely but crucially vulnerable group, many of whom live in wider contexts of risk, such as substance abuse (Jewkes *et al.*, 2006). It was also found that:

- People who have been sexually abused as children are more likely to become abusers themselves (Jewkes *et al.*, 2002);
- Men who had forced sex with their partners were also more likely to force others and to have transactional sex (Dunkle *et al.*, 2006; Simbayi *et al.*, 2006); and
- Abusers tend to perpetrate abuse on people who have already been abused (Dunkle *et al.*, 2004).

Violence is prevalent in South Africa and young people are exposed to and adopt a culture of sexual violence.

- According to the 2003 SADHS, 13% of adult men and 7% of women experienced at least one physical attack in past 12 months (province specific values not available). Most attacks on men were in a public road (53% of episodes), but for women, the most attacks occurred at home (48%).[95] Questions about rape, other forms of intimate partner violence (IPV) and the perpetrators of the attacks were not asked in the 2003 SADHS.
- In Durban, more than one third of women from a low-income community had experienced violence at home (Mbokota & Moodley, 2003).
- In Johannesburg, 50% of male adolescents and 52% of females reported involvement in IPV (Swart *et al.*, 2002).
- In Capetown, 21% of adolescents reported perpetrating IPV (Fisher, *et al.*, 2007), and one in five men in a Cape Town settlement had perpetrated sexual assault (Kalichman *et al.*, 2007).
- In rural Eastern Cape, the most frequently cited reason for sexual initiation among Xhosa

[93] Person has been physically forced to have sexual intercourse; had sexual intercourse because of being afraid of what the partner might do; or been forced to do something sexual found degrading or humiliating

[94] Any type of violence directed at groups or individuals on the basis of their gender

[95] International data show that globally, men are much more likely to be attacked by a stranger or an acquaintance than by someone in their close circle of relationships, whereas in women one of the most common forms of violence is that performed by intimate partners and acquaintances, and mostly in their homes (Krug *et al.*, 2002).

females was being forced to have sex by a partner (Buga *et al.*, 1996). Among young men, 32% had perpetrated some form of sexual violence against their main partner (Dunkle *et al.* 2006).

- It is estimated that as many as 60% of all marriages in South Africa involve physical and sexual violence (Ackerman & de Klerk, 2002).
- A cross-sectional survey[96] on men, masculinities, rape and HIV in 2008 in three districts in the Eastern Cape and KwaZulu Natal Provinces had the following preliminary findings (IMAGE study, Jewkes *et al.*, 2009):
  - 27% of the men reported having committed rape, 14% reported sexual IPV, and 9% reported gang rape; 3% of the rape incidents involved another man or a boy;
  - 47% of the rape perpetrators had done so with 2 or more persons ('victims');
  - 42% of ever partnered men reported physical IPV and 15% reported sexual IPV.
  - The study concluded that in South African rape/sexual violence prevention strategies, the reduction of alcohol consumption, the construction of more gender-equitable and less violent ideals and practices of manhood, as well as the reduction of childhood trauma, are highly relevant.

The views of South Africans on sexual violence are compatible with acceptance of sexual coercion and adaptive attitudes to survival in a violent society.

- In a national school-based survey in 2002, 29% of males aged 15-19 agreed that "girls enjoy rape", and 56% agreed that "girls mean yes when they say no". In the same survey, 54% of girls aged 15-19 believed that "Sexual violence does not include forcing sex with someone you know" (Andersson *et al.*, 2004).
- In the 2008 IMAGE survey, there was widespread endorsement of rape myths among rape perpetrators: 40% believed "she caused it", 40% believed "she wanted it", 50% believed "real victims fight back", and 44% believed "she may be promiscuous".
- A study in townships in Cape Town showed that adherence to masculine norms is linked with violence and crime within the African and coloured communities (Sawyer-Kurian *et al.*, 2009).

Violent practices are linked to sexually risky practices including concurrency.

- Jewkes *et al.* (2009) found that men reporting more than one episode of physical IPV were significantly more likely to have had 20+ sexual lifetime partners, transactional sex, paid sex, heavy alcohol consumption, inconsistent condom use, or raped a woman or man.
- There is evidence that the practice of multiple sexual partners is associated with violence at home - women who had another partner in the year suffered disproportionately more domestic violence (Jewkes *et al.*, 2002 and 2003). **Partner reduction could therefore reduce both HIV transmission and domestic violence**. Although no data could be identified, it is perfectly plausible that violence in marriage may cause some women to seek another partner - in that case, reduced violence would reduce concurrency.
- In the 2005 national survey, those who were ever forced to have sex against their will were also significantly less likely to practice prevention behaviours (aOR=0.69, $p<0.01$) (Kincaid & Parker 2008).

[96] Linked to the Intervention with Microfinance for AIDS & Gender Equity (IMAGE)

The number of HIV infections transmitted during rape per annum in South Africa has been estimated at 100-300 (Jewkes *et al.*, 2009). This estimate assumes an annual number of rape cases of 28 228 adults and 17 597 children (extrapolated figure from case report register), and an HIV transmission probability of 0.003 in the absence of genital injury, and 0.1-0.03 in the presence of a genital injury). The number appears small in an epidemic of about 400 000 new infections (2008 estimate by Spectrum), however:

1. The South African Police Service estimates that only one in every 35 raped women actually report the rape and that most report to clinics or hospitals, not police[97];
2. Victims of sexual abuse and rape are highly vulnerable to future infection through depression, alcohol abuse, abusive and sexually risky behaviours. In the 2002 survey by Andersson *et al.* (2004), 66% of male and 71% of female adolescents who admitted to forcing someone else to have sex had themselves been forced to have sex.

At the individual level, a positive relationship has been identified between perpetration of violence and HIV infection.

- The study by Dunkle *et al.* (2004) on ANC clients in Soweto identified violence as an *independent risk factor* for HIV infection. Intimate partner violence (physical, sexual) was significantly and independently associated with HIV sero-positivity (HIV prevalence 1.4 times elevated, from 28.6% to 40.2%). Child sexual assault, forced first intercourse, and adult sexual assault by non-partners were *not* associated with HIV sero-status.
- In the IMAGE survey, HIV-positive men were significantly more likely to report physical IPV than HIV-negative men (39% vs. 29%, p=0.004 – Jewkes *et al.*, 2009). Ever having raped a woman did not impact men's likelihood of being HIV-positive, but men who had ever raped a man or boy were significantly more likely to be HIV-positive (aOR 2.55, p=0.04, age and race adjusted estimates).
- In an HIV-negative cohort of young women in Eastern Cape, Jewkes *et al.* (2010) found that **relationship power inequity and intimate partner violence significantly increased the risk of incident HIV infection** (population attributable fractions were 13·9% for relationship power equity and 11·9% for intimate partner violence).

4.6.5 Mobility and Migration

SUMMARY

There is convincing empirical evidence of a link between human mobility & migration and the risk of HIV transmission. In South Africa, the risk of HIV infection has been found to be higher among individuals who either have personal migration experience or have sexual partners who are migrants (Barnighausen *et al.* 2007; Lurie *et al.*, 2003; Zuma *et al.*, 2003).

Migrant labour was one of the most brutal consequences of colonialism; it restricted Africans from settling in urban areas and forced men to be absent for long periods from their rural homes (Hunter, 2009). In urban South Africa, some migrant men, separated from their wives, engaged in sexual relationships with a relatively small number of female sex workers (Bonner, 1990; Walker, 1990). Kark (1949) demonstrated how important this process was in the genesis of the syphilis epidemic in South Africa. During the course of the 20th century, however, several major shifts took place that reconfigured connections between wage labour, rural households, and the sexual economy (Hunter, 2005). The dramatic rise in

[97] http://www.rapeoutcry.co.za/resources/stats.html

unemployment from the mid-1970s undermined the ability of men to act as reliable providers. Economic necessity led to men and women adopting multiple migration patterns including circular migration (Hunter, 2009). Short-term migration of both men and women – for employment, trading and commerce – has become frequent, helped by the trends towards casualisation and outsourcing in the private sector (Bodibe, 2006).

In South Africa, migration plays a key role in socio-economic mobility and development (e.g. van der Berg *et al.* 2002; Zuberi & Sibanda 2004; Massey, 2006; Tienda *et al.* 2006). Households clearly benefit from having any member who is a temporary labour migrant: these households have a higher socio-economic status than those who do not (Collinson *et al.* 2003; Kahn, Collinson *et al.* 2003). Yet households especially benefit if the migrant is female: they remit more income to households than male migrants, despite lower likelihood of formal employment (Posel & Casale, 2003) and their lower earnings (Collinson, Tollman *et al.* 2003). Several authors have described the health and education risks to children living apart from their mothers (Collinson *et al.* 2003; Case & Ardington, 2004; Case *et al.* 2005; Ardington *et al.*, 2007).

Migration is a generally accepted risk factor for HIV infection in Africa (Pison *et al.*, 1993; Mbizyo *et al.*, 1996; Nunn *et al.*, 1995; Lurie *et al.*, 2003; Zuma *et al.*, 2003). In South Africa, 40% of the population live in rural communities where circular migration for work is the norm (Lurie, 2000; SSA, 2003). In the ACDIS surveillance area, mobile non-residents make up 30% of household members (Welz *et al.*, 2007). In rural areas, a large proportion of children live apart from their mothers and fathers due to labour migration, child migration related to care giving and schooling, parental separation and divorce, and orphanhood (Jones, 1992; Ford & Hosegood, 2005; Hosegood & Timaeus, 2005).

There is strong evidence that migration and mobility have crucially contributed to the magnitude of South Africa's HIV epidemic. Since the early stages of the epidemic, infections in rural areas have been traced to those who had been in urban areas (Jochelson *et al.*, 1991); HIV prevalence levels have been higher along roads (Tanser *et al.* 2000; Tanser *et al.*, 2009); and truckers have been found to be at higher risk because of their greater mobility (Ramjee & Gouws, 2002). According to Hargrove (2007), oscillating migration is an essential component for an epidemic to be as severe as the one witnessed in South Africa.

The link between migration and HIV risk in South Africa has been demonstrated by the following studies:

- An early study by Abdool Karim *et al.* (1992) found that migration increased infection risk by almost three-fold for women and seven-fold for men in KwaZulu-Natal.
- Zuma *et al.* (2003) examined migration among women residing near the Carltonville mining area and found 60% higher odds of HIV infection in migrant vs. non-migrant women (migrant women were older, were more likely to report having had two or more partners in the past year, and were less likely than non-migrant women to have used condoms).
- In the study by Lurie *et al.* (2003), migrant men from Hlabisa and Nongoma Districts in KwaZulu-Natal were 2.4 times more likely than non-migrant men to be HIV-infected.
- Barnighausen *et al.* (2007) found that migration was significantly associated with HIV incidence in Kwa-Zulu/Natal (aHR migrant vs. non-migrant: 0.48);

Crush et al (2006) argued that the link between mobility and the spread of HIV is determined by the structure of the migration process, the conditions under which it occurs,

including poverty, exploitation, separation from families and partners, and separation from the socio-cultural norms that guide behaviours within communities.

It is important to recall that migrants and mobile individuals may be missed by cross-sectional surveys, potentially leading to an underestimation of HIV prevalence (Welz *et al.*, 2007). For instance, adjusting HIV survey estimates to reflect the age structure of the population of Umkhanyakude District increased the HIV prevalence among women aged 15–49 years from 26.8 to 29.3% and that among men aged 15–49 years from 13.2 to 16.9% (Welz *et al.*, 2007). In contrast, Tanser *et al.* (2007) reported that HIV prevalence remained similar in an Africa Centre database after statistical adjustment.

Several studies have found labour migration to be a risk factor for men and their non-migrant female partners (Jochelson *et al.* 1991; Lurie *et al.* 2003; Zuma *et al.* 2005). In the study by Lurie *et al.* (2003), in 71% of discordant couples in which the male partner was a migrant, the male was the infected partner; but in 29%, the female – who stayed behind but whose patterns of mobility were not measured - was the infected partner. Camlin (2008) found in KwaZulu-Natal that women's involvement in migration exacerbates their disproportionate infection risk relative to men.

Mathematical modelling of migration and HIV:

The frequent return home of migrants has been identified as an important risk factor, especially when coupled with increased sexual risk behaviour. Coffee *et al.* (2007) describe an epidemiological model of the impact of migration, developed by the Hlabisa Migration Project. The model predicted that the impact of migration depends upon the epidemic stage and the pattern of migration. Based on the model outputs, Coffee *et al.* concluded that in the Hlabisa setting, migration primarily influences HIV spread by increasing high-risk sexual behaviour, rather than by connecting areas of low and high risk. The recommendation was that intervention programmes in South Africa needed to target the sexual behaviour of **short-term migrants** specifically, even though these individuals may be more difficult to identify.

Several studies have described sexual risk behaviours of male and female migrants in South Africa, which include MSP, transactional sex, unprotected sex, transactional sex, and alcohol abuse (e.g. Lurie *et al.*, 2003; IMS, 2008; IOM, 2009; Hunter, 2009; McGrath *et al.*, 2009 poster). In South Africa, mining, plantations and related agricultural industries are often associated with situations of significant risk. Risks may be enhanced by regularized single-sex migration as in the case of the mines, high and seasonal demands for agriculture labour on estates, workers moving on their own, sometimes from considerable distances and lodged in single-sex dormitories, long and often irregular pay intervals, and a dependent population of occasional or commercial sex workers from nearby communities.

- A report from a plantation in Hoedspruit in Limpopo Province on casual fruit pickers (mostly women), says that it is not uncommon for young women to have sex with male supervisors, known as 'indunas', in exchange for a job.[98] "*I can promise a job to a woman in exchange for sleeping with her*" (male superviser); "*a lot of supervisors have maybe 10 girlfriends through the season*".
- A bio-behavioural survey in Limpopo Province among farm employees found high levels of risk behaviours (unprotected sex with multiple partners, sex when drunk, forced sex,

[98] IRINPlusNews, 8 February 2007: http://www.irinnews.org/Report.aspx?ReportId=70042 (accessed 9 Nov 2009)

etc.) and 39.5% tested HIV-positive (Colvin & Ibbetson, 2010).

4.6.6 Inequality in Income and Wealth

SUMMARY

- **Lower socio-economic status is frequently associated with higher risk behaviours, and Africans in South Africa are much more likely to be HIV infected if they are in lower wealth categories** (Section 1.1.6 - HIV prevalence in African adults without disposable household in 2005 at 14-16%, in those with some disposable income at 9-10%).
- The **significant association between deprivation or lack of possessions and high HIV risk** in South Africa is further strengthened by analyses by Kincaid & Parker (2008), Colvin *et al.*, (2007), and Dunkle *et al.* (2004).

Internationally, income inequality – rather than poverty - has been shown to be a correlate of population HIV prevalence (Stillwaggon, 2002; Bonnel, 2007). Fortson (2008), Mishra *et al.* (2007) and Drain et al (2004) could not find any clear link between HIV and wealth or HIV and poverty in multi-country analyses. However, Dinkelman *et al.* (2008) emphasise that identifying a causal link between income and HIV risk is difficult, since:

1. Few data sets include detailed information on sexual behaviours and household income.
2. Most of the data sources in which household assets and behaviour can be correlated are cross-sectional, and drawing conclusions based on current income measures may be spurious (this is especially the case for adults who have been in the sexual market for longer and may have experienced important disadvantage earlier in life).
3. Unobserved individual and/or household characteristics are likely to be correlated with measures of sexual behaviour as well as with incomes. Such correlation will bias estimates of the effect of resources on sexual behaviours.

South Africa has very high levels of inequality in wealth and income. The Gini coefficient[99] is estimated at 57.8 (HDR2009[100]). South Africa's income inequality is more severe than in Mozambique (47.1), Zimbabwe (50.1), Swaziland (50.7), Zambia (50.7) and Lesotho (52.5) but less severe than income inequality in Botswana (61.0) and Namibia (74.3).

Wealth continues to be stratified along gender and racial lines (ICRW, 2008). Female headed households are, on average, poorer than those headed by men (Hoogeveen & Ozler, 2006), and the white minority dominate the upper income strata. According to the Income and Expenditure of Households Survey 2005/2006, the estimated average annual household income for white households was R280 870 and R37 711 for African households. The Indian/Asian and coloured average household incomes were in between these extremes at an estimated at R134 543 and R79 423, respectively.

Lower socio-economic status often correlates with higher risk behaviours, e.g.:

- In the Cape Area Panel Study[101], Dinkelman *et al.* (2007, 2008) found that girls in lower

[99] The Gini coefficient (or index) expresses income inequality among individuals. The higher – or closer to 100 - the Gini coefficient, the larger the income inequality. Perfect equality of income would give a Gini score of 0.

[100] 2009 Gini coefficient values: http://hdrstats.undp.org/en/indicators/161.html;

[101] Cape Area Panel Study data that surveyed 4 752 boys and girls, 14–22 years of age in Cape Town, South Africa (2002–2005). Analysis with multivariate probit models

income households tended to have earlier sexual debut, and economic shocks were associated with girls having MSPs. Community poverty rates predict earlier sexual debut and higher rates of unprotected recent sex for boys.

- Low socioeconomic status, according to Gillespie *et al.* (2007), increases females' odds of having transactional sex and of experiencing coerced sex, and males' and females' odds of having MSPs. It also lowers females' chances of abstinence, female and male age at sexual debut, condom use at last sex, and communication with most recent sexual partner about sensitive topics.
- Hallman (2004) concluded that low socioeconomic status has more consistent negative effects on female than on male sexual behaviours; it also raises the female risk of early pregnancy.
- In the 2005 national survey data (Shisana *et al.*, 2005), youth aged 15-24 and women in the poorest urban and rural informal areas reported the highest number of recent sexual partners and the lowest incidence of condom use. Equally, they had the highest levels of HIV infection which suggests that **vulnerability to HIV is indeed higher in poorer areas.**

4.6.7 Social Cohesion and Social Capital

SUMMARY

A couple of studies have provided evidence that **there may be a link between levels of social cohesion or social capital and HIV prevalence**:

1. the IMAGE study described by Gillespie *et al.* (2007) and Pronyk *et al.* 2008, and
2. a study in a South African mining community published by Campbell *et al.* (2002).

However, the interface between HIV infection and social capital is clearly a complex area that defies easy generalization. Membership in some organisations may be associated with lower HIV risk (e.g. being a member of sports groups, church organizations, women's organizations) or with higher HIV risk (e.g. *stokvels* membership).

Several authors have made the case that social cohesion and social capital are important conditioning factors of the South African HIV epidemic (e.g. Whiteside & Sunter, 2000; Campbell *et al.*, 2002; Gilbert & Walker, 2002; Gillespie *et al.*, 2007). Whiteside & Sunter (2000 p61) regarded social cohesion and wealth levels as the two key variables for the trend and magnitude of HIV epidemics. Saegert *et al.* (2001) argued that the health-enhancing processes of empowerment, solidarity and critical consciousness are most likely to take place in communities characterized by high levels of social capital. Gilbert & Walker (2002) point out that the existence of familial, organisational and community networks may provide an important source of social capital from which to build.

Social capital is often defined in terms of people's membership of voluntary community organizations (e.g. churches, residents' associations, youth groups). Social capital is in many respects the medium through which individuals operate collectively in order to thrive (Whiteside & Sunter, 2000). Campbell C *et al.* (2002) distinguish bonding and bridging[102] social capital in the community:

[102] Bonding social capital refers to the existence of trusting and supportive relationships within a local community, which form the context within which people can work collectively to achieve goals of mutual interest). Bridging social capital refers to the extent different actors and constituencies are able to work together to achieve a common objective. The distinction was popularized by R Putnam (2000).

- **Bonding social capital** is important because people who live in trusting and cohesive communities, where their voices are heard and they are able to articulate their views, are more likely to take ownership of the HIV problem than to regard it passively as the responsibility of professionals or government officials (Campbell & Jovchelovitch, 2000).
- **Bridging social capital** is seen as especially relevant in the HIV epidemic with its complex mix of biomedical, behavioural and social roots, rendering it too complex for any one constituency to deal with. Therefore, HIV prevention efforts are most likely to succeed where 'bridges' are built between local projects and actors and outside actors in the public, private sector and civil society sectors who can each assist in achieving programme goals (Woolcock, 1998).

There is limited evidence on the link between levels of social cohesion or social capital and HIV prevalence.

- Gillespie et al (2007) reported from the IMAGE study in rural Limpopo that **HIV prevalence was higher in settings in which the social order had broken down or had never been established** (among men, higher HIV prevalence was also seen among communities with easier access to a local mine, a higher density and activity of local bars, higher numbers of sex workers per village, and lower proportions of out-migrants).
- A study on sexual health and social capital[103] in a South African mining community highlighted that **the interface between HIV infection and social capital is complex and defies easy generalization** (Campbell *et al.*, 2002). Results from multivariate analysis varied across age and gender, and were not all in the hypothesized direction. For example, young men and women who belonged to sports clubs were less likely to be HIV-positive, and young women who belonged to sports clubs were more likely to use condoms with casual partners than non-members. In contrast, amongst members of *stokvels*[104], young men were more likely to be HIV-positive, women of all ages were more likely to have a casual partner, and both young men and young women were more likely to drink alcohol than non-members.
- Other findings from the IMAGE study underscore **the complex and nuanced relationship between social capital and HIV risk** (Pronyk *et al.* 2008): among males, after adjusting for potential confounders, residing in households with greater levels of cognitive social capital[105] (CSC) was linked to lower HIV prevalence and higher levels of condom use (similar patterns among females). However, while greater structural social capital[106] was associated with protective psychosocial attributes and risk behaviour, it was also associated with higher rates of HIV infection.

Not all social capital is protective or health promotive. In the Carletonville Mothusimpilo Intervention Project 1998 to 2001 (Ndhlovu *et al.*, 2005), some of the ways that group membership may influence individual behaviour were identified. For example, some organizations provided members with information and education and social support to develop skills to negotiate gender and sexual behaviour norms. But competing factors neutralizing the positive effects of group membership included the promotion and consumption of alcohol, acceptance of multiple sexual partners, and macho ideas about masculinity. **Negative aspects were more easily identified in *stokvels*, political**

[103] In this study, social capital was defined in terms of people's membership of voluntary community organizations (e.g. churches, residents' associations, youth groups).

[104] Rotating credit schemes based on voluntary saving by members

[105] Perceptions of trust, solidarity, sense of belonging, and mutual aid (Pronyk *et al.* 2008)

[106] Social group membership (Pronyk *et al.* 2008)

parties, and burial societies, while positive elements were found in sports groups, church organizations, and women's organizations.

CHAPTER 4. DISCUSSION & CONCLUSIONS

Datasets and data analysis

1. The know your epidemic (KYE) synthesis provides important information on HIV prevalence trends and patterns, HIV incidence, modes of transmission, sexual behaviours and community and macro level factors influencing the South African HIV epidemic. The country has a considerable amount of population-level data. The study demonstrated that the collected data need to be organized and looked at "side-by-side" on a regular basis in order to reap the benefits of the data collection efforts for strategic planning and programme improvements.

2. In the course of the KYE process, the following special data analysis activities were implemented:

- Detailed bivariate analysis of HSRC 2008 data, and of NCS 2006 and 2009 data
- Some bivariate analysis of combined datasets (HSRC 2002, 2005 & 2008, NCS 2006 & 2009)
- Multivariate regression analysis of HSRC data – models were fitted for men and women to identify the factors associated with HIV status at survey, and for men to explore the factors associated with sex with a sex worker
- Multivariate regression analysis of NCS data – models to explore partner acquisition rates
- Multivariate regression analysis of combined datasets – models to estimate the trend in HIV prevalence across the three HSRC surveys, the trend in the proportion of men reporting multiple partners in the five surveys, and reported age at first sex in the five surveys
- Basic sexual concurrency analysis using NCS 2009 data

These analytic activities showed that South Africa's large datasets offer good opportunities for data analysis – using local analytic capacity and building it further, and sharing data across organizations. This will allow comparisons across datasets that can further the understanding of the HIV epidemic.

3. Although some analysis could be done on pooled HSRC and NCS datasets, the possibilities were limited by the different target age groups in the surveys, the different measures tracked across surveys, and other methodological differences between the surveys. A major drawback is the low participation of non-Africans in surveys in general and in HIV prevalence surveys in particular. The available HSRC survey data from white and Indian respondents are not representative of these groups. The multivariate analysis adjusted for levels of non-response, but this cannot correct for systematic differences in participation.

4. A large amount of epidemiological literature from South Africa was identified, classified and used in the synthesis writing process. This included over 700 individual data

sources (academic publications, data and information from websites, grey literature, conference abstracts, etc). The working hypothesis helped to drive the analysis of the key factors related to the South African HIV epidemic. A conceptual framework for the factors associated with HIV infection was used to guide the more complex data analysis. This framework separates factors into three levels, the background (most distal) factors, factors that determine exposure to an infected partner, and factors that affect transmission (most proximate). The Africa Centre in KwaZulu Natal -- with its demographic surveillance system, tracking of migrants, HIV cohort and extensive data analysis activities -- provided data on the hyperendemic HIV situation of immense value to this synthesis.

HIV prevalence patterns

5. South Africa had in 2010 about 5.5 million people living with HIV (PLHIV), which means that worldwide, one in six PLHIV is South African. The number of new infections continues to outstrip the number of AIDS-related deaths - an indication that prevention efforts are failing to keep pace with the HIV epidemic. South Africa has made significant progress in scaling up some key interventions, with the main goals of reducing the HIV incidence rate of 2007 by 50% and expanding access to ART to 80% of people in need of ART by 2011. The prevention target (HIV incidence) is difficult to measure and there is no consensus in the country on how HIV incidence should best be estimated.

6. National level HIV prevalence data suggest that HIV prevalence has stabilized in South Africa. In adults aged 15-49, HIV prevalence is in the range of 16-17%, and in ANC clients HIV prevalence has gradually levelled off just below 30% (2009 data points). Although HIV prevalence has plateaued, the absolute number of PLHIV is on a steep increase of approximately 100,000 additional PLHIV each year due to population growth and the life-prolonging effect of ART reducing the mortality rate to below the HIV incidence rate. The epidemic is estimated to have reduced life expectancy of South Africans by about 13 years, from 64 years in 1990 to 51 years in 2005.

7. The large differences in provincial HIV prevalence levels as well as provincial population sizes lead to a concentration of PLHIV in certain provinces. Overall, 54% of South Africa's PLHIV live in KwaZulu-Natal and Gauteng. In contrast, Northern Cape only has about 1% of all PLHIV and Western Cape about 3%. At district level, there is a very large spectrum of HIV prevalence differentials: in 2008, maternal HIV prevalence in uMgungundlovu District in KwaZulu-Natal was about 20 times higher than in Namakwa District in Northern Cape Province. In 2009, Namakwa's reported maternal HIV prevalence was zero (0/68), while it was 46.4% in Uthukela, KwaZulu-Natal. The HIV burden on district health systems therefore varies to a great extent.

8. ART has begun to have an important effect on HIV prevalence levels (adding close to 2% to HIV prevalence through PLHIV who would have died already without ART). The life-prolonging effect of ART is the chief reason for the observed increases in HIV prevalence in older people. This 'ART effect' – excess HIV prevalence through ART-attributable survival of PLHIV – is estimated to be largest in people in their mid-20s to late 40s.

9. The PMTCT intervention is believed to be the main factor leading to a halving of the HIV prevalence level in children aged 2-14 years between 2002 and 2008. By 2008, 95% of public health facilities provided PMTCT services. It is plausible that many of the HIV-positive older children identified in the national surveys were infected vertically and are slow progressors (local and Zimbabwean estimates predict that about one-third of infected infants

are slow progressors with median survival of 16 years).

10. On average, females are infected about five years earlier than males, with 7% of young women aged 15-19, and 14% of pregnant teenage girls, already infected. Females have a statistically significant, higher HIV prevalence than men, nationally and in seven of the nine provinces (not in Northern Cape and North-West). Nevertheless, the life time risk of HIV for men and women is probably similar. Estimates for the Africa Centre cohort on life time risk at age 55 were 78% for males and 75% for females, despite the typical imbalance of women getting infected earlier and having higher peak prevalence rates of HIV.

11. The downturn in HIV prevalence in male and female youth aged 15-24 years in the 2008 survey compared to 2005 is encouraging. It is not statistically significant, but it may be that there has indeed been a decrease in HIV prevalence in youth and that the survey was too small to detect it. The downturn is corroborated by mathematically derived HIV incidence data for this age group.

12. HIV prevalence is significantly higher in the African population than in the other three race groups. In the regression models, being African was the strongest predictor of HIV status - in 2008, African men were 14 times more likely to be HIV-positive compared to non-African men, and African women were 9 times more likely to be HIV-positive than non-African women.

13. Married women have lower odds of HIV infection than unmarried women. While married women in their 20s, 30s and 40s have the odds of HIV infection of unmarried teenage girls, unmarried women in these older age groups have significantly higher odds of HIV infection. It cannot be excluded that there is some 'survival effect' contributing to this, with some HIV-positive women not surviving long enough to marry (median age at first marriage is exceptionally high in South Africa at 27 years). For men, marriage was not important for their likelihood of being HIV infected. It is of note that age at first marriage has been increasing in South Africa, especially in women, leading to many years of being single and sexually active. It is also estimated that about 60% of all adult PLHIV are not married or cohabiting.

14. The effect of education on HIV risk is very important to acknowledge - men and women with tertiary education are significantly less likely to be HIV-positive than those with no school education. Low socio-economic status is associated with HIV infection. In 2008, Africans in income categories up to 8000 Rand per month had significantly higher HIV prevalence levels than non-Africans in the same income categories. Respondents working in the informal sector had overall the highest HIV prevalence, with almost one third of African informal workers HIV-positive. In women, the greater the lack of money, the more likely they were to be HIV-positive.

15. Urban *informal* areas are associated with highest HIV prevalence compared to the other three types of location. In 2008, women living in urban informal areas were 57% more likely to be HIV infected than those in urban formal areas. In urban *formal* areas, the HIV prevalence trend has fallen since 2002 by about 3% (decrease not reaching statistical significance), whereas in rural areas – both informal and formal – HIV prevalence increased by over 5% between 2002 and 2008. The increase is statistically significant for rural informal areas.

16. Men who reported in the 2005 survey that they had been circumcised before first sex

were significantly less likely to be HIV-positive. Overall, there is strong evidence from South Africa and elsewhere for MC being effective in reducing the risk of HIV and other STIs in men, and indirectly HIV prevalence among women in the population. Recent data confirm that male circumcision has broad support among South African men and women, that there is a shift among young men to getting circumcised in hospital by a doctor instead of having the procedure done in a remote location or as part of traditional initiation, and to HIV/STI prevention and hygiene being the motivation for MC instead of tradition. Parents of young men may play an important role in getting the young man to go for circumcision.

HIV incidence

17. The estimation of HIV incidence is crucial in order to disentangle the impact of prevention and treatment programmes on HIV prevalence. South Africa has been producing HIV incidence estimates using several different methodologies. The Spectrum/EPP tool estimated that annual HIV incidence in adults had peaked in 1997 at 2.6%, and that it was at 1.2% in 2009 in South African adults. This translates into approximately 400,000 new infections in 2009 (of which 12% in children aged 0-14 years). It is of note that the 2009 incidence rate is higher than the mortality rate, which contributes to the further increase in PLHIV numbers in the country.

18. HIV incidence estimates for young people aged 15-20 suggest that although teenagers prevented infections more effectively in 2008 than in 2002, they still acquire new HIV infections rapidly as they get into their twenties. There is evidence that HIV incidence in adult females is falling (2.8% in 2002-2005 inter-survey period, 1.5% in 2005-2008). In young women aged 15-24, there was a significant decline in estimated HIV incidence which translated into a 60% incidence reduction between the two inter-survey periods.

19. HIV incidence in women may still exceed HIV incidence in men despite recent declines - in the inter-survey period 2005-2008, estimated HIV incidence was 1.0% in men and 1.5% in women. Another point from the next HIV prevalence survey will greatly assist the understanding of HIV incidence trends in men and women, as well as in broad age groups. The BED assay, which has been optimized for South African conditions, will also give further information on proportions of new infections in different population strata (Spectrum/EPP only provides overall HIV incidence estimates).

20. There is evidence from South Africa that HIV incidence is exceptionally high in pregnant women. Recent data from sero-discordant couples in several countries including South Africa (Partners in Prevention HSV/HIV Transmission Study) suggest that the risk of men being infected by HIV doubles when their partners are pregnant. This is put down to physiological and immunological changes that occur with pregnancy, including increased shedding of virus resulting in a higher HIV concentration in a pregnant woman's genital tract.

21. HIV incidence, just like HIV prevalence, varies greatly across provinces, ranging from an estimated 0.5% in Western Cape to an estimated 2.3% in KwaZulu-Natal in 2009. Half of all new HIV infections in adults were estimated to occur in two provinces – KwaZulu-Natal and Gauteng (where over half of the country's PLHIV live already).

Modes of HIV transmission

22. The South African HIV epidemic is clearly primarily driven by heterosexual transmission, which is typical for generalized and hyperendemic epidemics. Research is

ongoing on the transmission probability of HIV between heterosexual partners. Two estimations both reported very high estimated per-partnership probability of HIV transmission, nearing 1.0 for young women.

23. Serological data confirm MSM as a high risk population; recent studies in South Africa found HIV prevalence levels in MSM up to 47%. Unprotected anal intercourse with someone with an unknown HIV status is common among MSM. There is some evidence of sero-sorting among MSM i.e. choosing sexual partners with the same HIV status. Transactional sex, sexual coercion and sexual risk taking under the influence of alcohol or other substances have been documented.

24. Two small studies on injecting drug users found HIV prevalence of 20%, which is similar to the level found in the general population. HIV prevalence was highest among drug users who are also sex workers or MSM. Injecting equipment is sometimes shared, re-used, inadequately cleaned and poorly disposed of. Injection drug use is low in South Africa in comparison with many other countries. While it seems that South Africa does not have a major IDU problem at present, it has a large and growing problem with crack cocaine, especially among sex workers.

25. Vertical transmission: With about a quarter of births unwanted at time of conception, there is further scope to reduce the number of HIV-positive births through prevention of unintended pregnancies among HIV-positive women. The dual therapy regimen of Nevirapine and AZT is being introduced and well justified: one South African study reported a vertical transmission rate of 15% in Nevirapine users and 26% in non-users. Some national programme data are conflicting: 63% of pregnant women received HIV counseling (according to the MTR report 2010), and 86% of HIV-positive pregnant women received ART to prevent MTCT (according to the UNGASS report 2010), indicating weaknesses in PMTCT programme monitoring. It is likely that wet-nursing - breastfeeding by a non-biological mother - is responsible for some HIV transmission to infants.

26. Transmission through blood and blood products, and transmission through unsafe medical injection, are considered to be low in South Africa.

Sexual behaviours

27. Several South African studies point to the limited or even poor validity of self-reported data in sexual behaviour surveys. For instance, a study in KwaZulu-Natal estimated that the true level of consistent condom use was about half the level reported by the female study participants. Also in KwaZulu-Natal, it was found that concurrency indicator levels were ten times higher if women self-completed the interview compared to face-to-face interviews. In the Orange Farm trial on male circumcision, physical examinations found that 45% of men who said they were circumcised had an intact foreskin. The use of biomarkers and the comparison of different interview techniques are two ways researchers in South Africa are trying to understand the validity of self-reported data in order to get truer estimates of sensitive sexual behaviours.

28. There are important secular changes in age at first sex (AFS) according to our analysis. AFS was highest for men born before the 1950s and lowest for men born in the 1970 and 1980s. Men born in the 1990s might be starting sex later, but it is too early to tell as they are still very young. There were some inconsistencies in the AFS results for men – AFS reported in the NCS surveys was much younger than in the HSRC surveys. For women,

AFS has got steadily younger between those born before the 1950s and the cohort from the 1980s. Again, there was some evidence that those born in the 1990s may be starting sex later than those born in the 1980s. HSRC and NCS data confirm that young Africans report higher levels of sexual experience than coloured, white and Indian youth. The proportion of unmarried youth aged 15-24 reporting premarital sex is around 80% (all 3 HSRC surveys) and this is linked to the fact that on average, South Africans marry late.

29. Secondary abstinence (had sex but not in the last 12 months) is practiced by a sizable proportion of the adult population, according to self-reports. Nearly one third of adults who had ever had sex reported sexual abstinence during the previous 12 months. Overall a greater proportion of women than men reported secondary abstinence (20% versus 14%), and about 1 in 5 youth aged 15-24 say they have had sex but not in the last year. Some of the secondary abstinence in women is after child birth – the median length of postpartum abstinence was 7.2 months in 2003, and there are large racial differences with African women abstaining longest (8.2 months) and Indian and white women shortest (1.9 months). NCS 2009 data suggest that after the loss of a partner, widowers are more likely to find new partners and resume sexual activity compared to widows.

30. Our analysis of the combined HSRC and NCS data provide some indication of an increase over time in the proportion of 16-55 year old men who report multiple sexual partners (MSP) in the past 12 months. Reported MSP frequency varies by race and is highest in African men (with sexual networks being denser than in the other race groups). The sexual concurrency analysis of the NCS 2009 data confirms the relatively higher concurrency prevalence for African men compared to non-African men. Reported MSP frequency peaks in people in their twenties, but there may be underreporting in older age groups where marriage is more common. HIV prevalence is higher in respondents reporting more sexual partners - women reporting more than one partner at the time of survey in 2005 were over 4 times more likely to be HIV-positive ($p=0.0001$). MSPs are seen as a pathway to a number of distinct benefits. MSPs may also be a legacy of polygyny - having more than one sexual partner is frequently presented as a "way-of-life" which resonates with historical family structures.

31. In recent years, much quantitative and qualitative information has been accumulated on the attitudes and beliefs towards multiple and concurrent sexual partnerships (MCP), the norms and opinions regarding MCP and faithfulness, the factors underlying MCP practices and the perceived benefits of having more than one partner (and some large scale national campaigns have been rolled out). A large proportion of men were found to agree with opinions and norms which support and encourage MCPs. Local studies have shown that both migration and alcohol are contributory factors to MCP practices. Furthermore, changes in living conditions in post-Apartheid South Africa have been identified as structural factors contributing to MCP practices: rising unemployment (that leaves some groups such as poor women competing for the small pool of employed men), reduced marital rates, and rising levels of women's migration.

32. Reported new partner acquisition rates are three times higher in men than in women. Our analysis of NCS 2009 data suggest that partner acquisition is highest among those who have no partner, and who are in their early twenties. African men and women are more likely to acquire a new partner than non-Africans, and men and women living in rural informal areas are the least likely to acquire a new partner.

33. Data on condom use are encouraging, but some of the apparent increase in use is

probably due to over-reporting. Reported condom use overall significantly increased between 2002 and 2008, but there was no increase among people reporting MSPs. Nevertheless, young people with MSPs and young singles are most likely to report using condoms, and people above 50 and married people are least likely. There is evidence that youths are more likely to use condoms *consistently* than older people. Increased and more consistent condom use among the youth may have contributed to the recent decline in HIV incidence in this age group. An important finding on 'positive prevention' is that in 2005, PLHIV who knew their HIV status were significantly more likely to use a condom than PLHIV who did not know their status. Furthermore, in provinces with higher HIV levels, sexually active women were found more likely to use condoms for contraception compared to provinces with lower HIV prevalence levels.

34. Anal sex is practiced in the general population and associated with higher HIV prevalence, and the same holds for sex workers. Anal sex is practiced to avoid pregnancy, to avoid STIs, to preserve a girl's virginity, during menstruation, and for sexual variety and pleasure. Dry sex practices are widespread but there were no local data identified on the role of this practice in HIV transmission.

35. Correct knowledge on preventing sexual transmission of HIV has decreased in all age and sex strata except in respondents aged 50 or above. Equally, comprehensive HIV knowledge (ways to prevent HIV and rejection of misconceptions about HIV transmission) has overall decreased, especially in Limpopo, KwaZulu-Natal, Mpumalanga, and Eastern Cape. A relatively small proportion of the population regard themselves to be at any significant risk for HIV, however, significantly more HIV-positive respondents perceived themselves to be at high risk of HIV compared to HIV-negative respondents. Data show that practicing HIV prevention behaviours increases the probability of staying HIV-negative. Awareness of national level mass media AIDS communication programmes has an indirect effect on HIV status through its effect on several HIV prevention behaviours. It was also found that HIV testing behaviour varies among the provinces, and that the three highest prevalence provinces KwaZulu-Natal, Mpumalanga and Free State have comparatively fewer people recently tested for HIV.

Contextual factors

36. Several key contextual (or distal, structural) factors of HIV transmission were included in the analysis, since *"it is population-level parameters that affect the presence and prevalence of infection to be acquired"*. It is an analytical challenge to define the causal pathways operating from contextual factors to proximal individual level behavioural behaviours which ultimately lead to new HIV infections. Clearly, the links between socio-cultural and economic conditions, and HIV risk and vulnerability are manifold and complex.

37. Sexual and gender norms are chiefly important to how the sexes interact, what partnerships are formed, and to what extent HIV transmission can occur. In South Africa, it has been reported that gender norms and roles are changing, and that the gender gap is closing. However, local research consistently shows that men believe they are more powerful than women and that men are expected to control women in their relationships. The gender hierarchy and dominant constructions of South African masculinities legitimate the control of women, and lead to expectations of female obedience, women assuming a passive role in sex, and male sexual entitlements. The racially-defined masculinities all valorise physical strength and courage, and violence is often used by men to communicate to women about their place within the gender hierarchy. Such sexual and gender norms restrict women's

capacity to demand monogamy from their partners, negotiate safer sex, or require behaviour change from their partners. In many areas of the country, the individual rights-based system is a new concept and patriarchal values and norms are still strong.

38. Women who break out of traditional sexual and gender roles can incur increased HIV risks; for instance, women who seek secondary sex partners as revenge to partner's infidelity or those who use their economic and social empowerment to adopt the same risky sexual behaviour, including MSPs, that men have long practiced. It has been reported that there is "gender role confusion" in South Africa with men feeling threatened, and couples lacking skills to renegotiate relations.

39. Age-disparate sexual relationships (which include 'intergenerational sex' relationships) are linked to increased HIV prevalence in teenage girls who have experienced such a relationship – in the 2005 survey, they were 72% more likely to be HIV infected than girls with similar-aged partners. In general, men and women who have partners much younger or older than themselves are more likely to be HIV-positive than people who reported partners of similar age only. Our analysis of the reported age gaps between sexual partners suggests that as men get older, the age gap gets larger. Age-disparate relationships are often valued because they provide access to different kinds of capital that young women seek to acquire, including social, emotional, symbolic and financial.

40. Frequencies of reported transactional sex vary widely across studies: 2 - 52% of females and 4 - 30% of males report transactional sex experiences. Qualitative data from the 2009 tertiary education survey provided evidence that less direct forms of material transaction are pervasive and carry much greater social acceptance, and the degree to which transactional sex was acknowledged and spoken about by students indicated that the general concept of exchanging sex for social and material gains is commonplace. Some data from this survey are shocking and point to the lack of parental support for young students, leaving them with few options but to fend for themselves.

41. Commercial sex work has been documented in several studies. Studies that included HIV testing of sex workers usually found HIV prevalence between 30% and 60% in sex workers, although white and coloured sex workers may have lower HIV prevalence in the range of 10-20%. In turn, men who report visiting sex workers are at increased HIV risk. Our analysis of men's data in the HSRC 2008 survey showed that having had sex with a CSW almost trebled men's odds for HIV infection (not statistically significant due to small sample). Sex work, alcohol use and consumption of drugs overlap and due to the industry's criminal status, sex workers are vulnerable and lack protection.

42. South African data demonstrate that alcohol consumption is associated with risky sexual behaviour, a higher likelihood of being HIV infected, and poor HIV prevention behaviours. The social dynamics of alcohol use centre around the places where people drink and socialize including taverns, beer halls, and informal drinking places - individuals who met sex partners in drinking places drink more heavily, have more sex partners and higher rates of unprotected intercourse relative to those who don't meet sex partners at shebeens. In the 2009 NCS, 68% of men and 56% of women felt that it is a lot easier to have sex with people who go to shebeens and the like. Alcohol abuse has wide public health and social impacts in South Africa: findings from the Community Epidemiology Network on Drug Use demonstrate that alcohol abuse is associated with increased mortality and morbidity due to accidents, violence, unsafe sexual practices, and misuse during pregnancy.

43. South African data suggest a direct link between violence and HIV infection – HIV-positive women are more likely than HIV-negative women to have experienced partner physical abuse. The views of South Africans on sexual violence are compatible with acceptance of sexual coercion and adaptive attitudes to survival in a violent society. There is a large body of local data on people's experiences of violence and rape. In the IMAGE study in the Eastern Cape and KwaZulu-Natal, 27% of men reported having committed rape, 14% reported sexual intimate partner violence, and 9% reported gang rape. It is estimated that as many as 60% of all marriages in South Africa involve physical and sexual violence. There is evidence that the practice of multiple sexual partners is associated with violence at home. Partner reduction could therefore reduce both HIV transmission and domestic violence.

44. There is empirical evidence of a link between people's mobility and migration and HIV status. Individuals who either have personal migration experience or have sexual partners who are migrants are more likely to be infected. However, migration plays a key role in socio-economic development -- households that include a temporary labour migrant have higher socio-economic status. Households especially benefit if the migrant is female; they remit more income to households than male migrants, despite lower likelihood of formal employment and lower earnings. Several studies have found labour migration to be a risk factor for the migrating partner *and* their non-migrant partner staying back home.

45. South Africa has very high levels of inequality in wealth and income. Wealth continues to be stratified along gender and racial lines - female headed households are, on average, poorer than those headed by men, and the white minority dominates the upper income strata. Africans are more likely to be HIV infected if they are in the lower wealth categories. Overall, lower socio-economic status often correlates with higher risk behaviours, for instance, in 2005 youth aged 15-24 and women in the poorest urban and rural informal areas reported the highest number of recent sexual partners and the lowest condom use.

46. Several authors have made the case that social cohesion and social capital are important conditioning factors of the South African HIV epidemic. However, it appears that the interface between HIV infection and social capital is complex, defying easy generalization. In rural Limpopo, HIV prevalence was higher in settings in which social order had broken down or had never been established. In Carletonville, it was found that membership in some organisations may be associated with lower HIV prevalence (e.g. being a member of sports groups, church organizations, women's organizations), while membership in other organisations such as *stokvels* was associated with higher HIV prevalence. Studies use different definitions of social capital - cognitive social capital, structural social capital, bonding and bridging social capital - and generally underscore the complex and nuanced relationship between social capital and HIV infection.

CHAPTER 5. RECOMMENDATIONS

Note that these recommendations are purely based on the HIV epidemic review findings and that full programmatic and policy recommendations are made in the KYE/KYR national synthesis report.

Datasets and data analysis

1. **Promote data analysis across datasets whenever possible, in order to understand changes over time and obtain better estimates around less frequently reported behaviours through data pooling.** This will require more collaboration among research institutions to ensure the same measures can be tracked across surveys and that the survey protocols are harmonized to the greatest extent possible. People involved in the analysis must be involved in questionnaire and survey design from the start. The sharing of databases would encourage better data management and permit some useful analysis.

2. **Strengthen programming, data management and analysis capacity in the main research and survey institutions to be able to address the increasingly complex data analysis and modelling challenges.** The goal of such capacity strengthening would be to have a core group of programmers and statisticians with the skills needed for complex data analyses and modelling as well as technical exchange. There is already specialist analytical capacity and skill in a few institutions in South Africa, but this is not sufficient for the amount of population level data collected. Datasets are frequently not fully analysed due to limited human resource and capacity. This KYE analysis calculated for the first time sexual concurrency rates and partner acquisition rates for South Africa from available national survey data.

3. **Reinforce communication campaigns prior to surveys with the aim of high participation rates in all race groups.** The cited reasons among whites, Indians and coloureds for non-participation in the surveys must be taken seriously and specific solutions found which increase the trust of sampled individuals and the perception that HIV concerns all South Africans. Even if sophisticated data analysis methods are used to allow for non-participation, as done in this KYE study, biases arising through systematic differences in participation cannot be ruled out.

4. **Establish a knowledge hub which centralises, stores and archives HIV survey and research study protocols, the actual databases and reports and publications.** The aim is to make HIV research and survey data and information accessible in one central repository. This study showed that data are scattered and although some institutions have searchable lists of their own publications (e.g. Medical Research Council, HSRC, Africa Centre), survey protocols, grey literature and data bases often are not accessible or shared, and there is no centralisation in one hub.

HIV incidence

5. **Further strengthen the methodological work on the measurement and estimation of HIV incidence.** The aim is to improve the understanding of each method of incidence measurement and its relative performance compared to other

methods, and to agree on the best method to track national HIV incidence. This KYE process with its HIV incidence workshop showed that South Africa is already leading in this methodological work but that there is still no consensus on how to track the main indicator in the NSP on HIV prevention – national HIV incidence.

Sexual and prevention behaviours

6. **Support research into the methodologies of behavioural surveys in order to broaden the spectrum of available measuring tools and to deepen the understanding of the validity of responses obtained from survey/study participants.** The overall aim would be to improve the research tools – both quantitative and qualitative - for behavioural surveys and studies. This KYE analysis demonstrated that unless data with better validity can be obtained, it is difficult to understand people's behaviours and practices in their sexual lives. Any research results need to be communicated effectively to other research institutions working in the country in order to impact the quality and validity of behavioural research results in South Africa.

7. **Aim to better understand the prevention behaviours of different categories of PLHIV** (those on ART, those in the pre-ART cohort, those who know they are positive but are well, those who are unaware that they are positive, as well as children living with HIV). This KYE analysis summarized the available evidence, and findings like the one on significantly higher condom use by PLHIV if they know that they are positive are crucially important and supportive of HIV testing campaigns. Findings of high rates of unprotected sex in pre-ART patients is alarming and points to a lack of communication and counseling activities with these patients. In order to make 'Prevention for Positives' activities work in a context of fast-growing PLHIV numbers, prevention behaviours in the different categories of PLHIV must be better understood.

8. **Strengthen research on vertical transmission and monitoring & evaluation of PMTCT interventions.** The overall aim would be to understand better the factors leading to HIV transmission in pregnancy and how the PMTCT programme impacts HIV transmission. Specific areas of focus would be the use and non-use of family planning services by positive couples (many pregnancies in positive couples are unwanted), the prevention and sexual behaviours of positive couples during pregnancy (pregnant women and their partners have an increased chance of HIV acquisition during pregnancy), the use of PMTCT services (testing as a couple, re-testing in late pregnancy, etc.). Apart from such research studies, routine PMTCT programme monitoring also needs improvements.

Contextual factors

9. **Strengthen the legal and policy context for interventions for female and male commercial sex workers**. The overall aim would be to decriminalise sex work and move towards the protection of male and female sex workers. The KYE study showed the deficiencies in addressing sex work in South Africa, and the problems with violence, discrimination and stigma of commercial sex workers, who are sometimes even attacked by police officers instead of protected. Making sex work safer requires policy provision and may entail medical follow-up and issuing permits for sex workers. In addition, a concerted programme focus is required on sex work in urban hotspots.

10. **Explore possibilities of interventions to promote earlier marriage.** The objective would be to stop and reverse the trend of late marriage in South Africa, which undoubtedly contributes to the HIV epidemic. This analysis summarised the evidence on the extended periods of sexual activity with different partners where there is no marital commitment and where people compete for partnering with those few who have a good income. The *lobola* payment for marriage is a major contributor to late marriage. Possible structural interventions could be policy provisions on preferential access to housing and work programmes for married people.

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Annex 1. Multivariate analysis of South African survey data on HIV status and sexual behaviour

(E. Slaymaker & V. Hosegood)

Section 1A. Introduction

This annex describes the methods and results of survey specific and pooled analyses of nationally representative surveys on HIV related behaviours. The five surveys included are all nationally-representative household surveys which collected information on sexual behaviour, HIV knowledge and awareness, and exposure to HIV prevention activities, in addition to socio-demographic background information. They are:

- Human Sciences Research Council (HSRC) surveys: the "*National HIV prevalence, behavioural risks and mass media household survey 2002*", the "*National HIV Prevalence, Incidence, Behaviour and Communication Survey 2005*" and the "*National HIV Prevalence, Incidence, Behaviour and Communication Survey 2008*", subsequently referred to as HSRC 2002, HSRC 2005 and HSRC 2008.
- Surveys by a team from Health & Development Africa (HDA) and Johns Hopkins Health and Education in South Africa (JHHESA): the "*National Communications Survey 2006*" and the "*National Communications Survey 2009*", subsequently referred to as NCS 2006 and NCS 2009.

In addition to interviews, the HSRC surveys collected samples from consenting respondents which were tested for HIV. In 2002 saliva-based tests were used; in 2005 and 2008 blood samples were taken. HIV status was not collected in either NCS.

A conceptual framework for the factors associated with HIV infection (show in **Figure** 1.1.**1**) was used to guide analysis. This was based on the proximate determinants framework[1] and separates factors into three levels: the background (most distal) factors, factors that determine exposure to an infected partner, and factors that affect transmission (most proximate). In the framework, the socio-demographic factors include "time and place" variables for each individual that describe the HIV prevalence among their potential sex partners. Individual factors such as mobility, education, socio-economic status (SES), religion and marital status can influence HIV risk by modifying the opportunity, motivation and choice of sexual partners and can also influence the risk of transmission via condom use and STI prevention and treatment. These datasets contained information on prevalent, rather than incident HIV cases. Analysis of HIV status therefore focussed on describing who was infected, and what their current behaviour was, rather than trying to understand what factors led to their infection.

Exposure to an HIV-infected partner is determined by the rate at which partners are acquired and the duration of partnerships. Greater numbers of partners present more risk, whether the risk is increased more by many new partners, or even just a small number of long term partners will depend on the epidemic stage and incidence rate. New, short term partners, are most risky if already infected because in relationships of very short duration (i.e. a few days) there is little chance for a new partner to sero-convert and transmit HIV. However, longer term partners have more opportunity to acquire HIV-infection from a third partner, sero-convert and infect the first partner (the survey respondent in our data). The relative risks of short- and long-duration partners therefore depend on HIV incidence rates and HIV prevalence. Where the HIV status of partners is unknown (as in these data), it can be approximated by other characteristics: age, how the relationship is described by the respondent, where the index person met the partner, the partner's age and marital status.

At the level of individual sex acts, HIV transmission is influenced by coital frequency, male circumcision, presence of other STI in either partner and condom use. This is the area with the least available information, not least because to truly capture this one would need information on each sex act with every partner.

The framework was used to derive variables and to structure the regression models for analysis of HIV status and behavioural outcomes.

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1 Boerma JT & Weir SS (2005). Integrating demographic and epidemiologic approaches to research on HIV/AIDS: the proximate determinants framework. Jour Inf Dis; 191(Suppl 1):S61-S67.

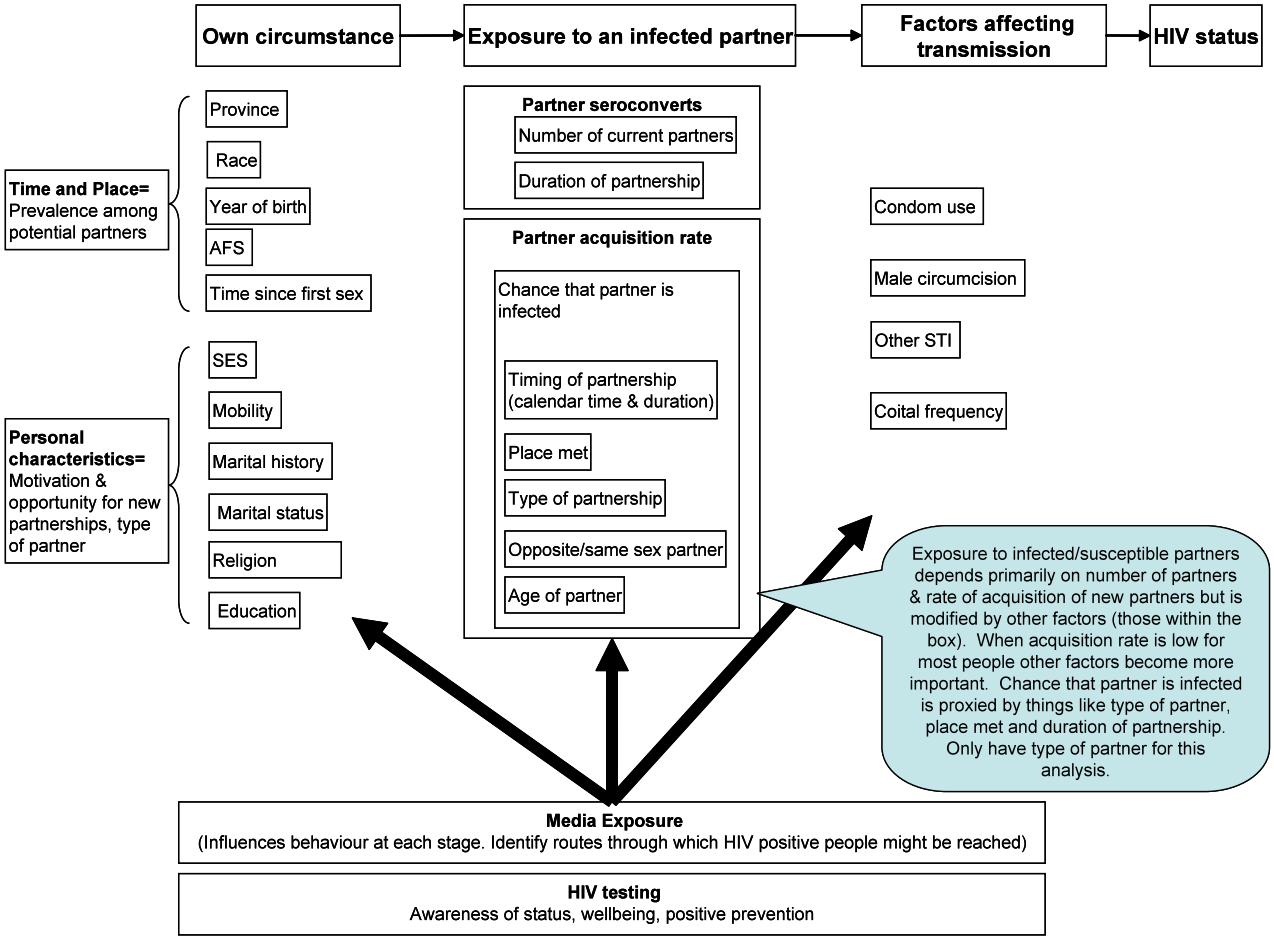


Figure 1.1: Conceptual framework used for analysis

Aims of the multivariate analysis

1. To identify and characterise HIV positive individuals, including any current behaviours which might facilitate onwards transmission.
2. To describe factors associated with any risky sexual behaviours that were found to be associated with HIV status at survey.
3. To compare the proportion reporting multiple partners in the five different surveys, to look for evidence of a trend over time.
4. To compare the proportion HIV positive in the five different surveys, to look for evidence of a trend over time.
5. To describe acquisition rates for new partners, and factors associated with this.

The first aim was focussed on finding factors which were more common among HIV positive people at survey, and which might contribute to onwards transmission of infection, rather than finding factors that might explain their infection. With cross-sectional data, and prevalent rather than incidence cases, it is impossible to establish to order of events and highly unlikely that the survey captured the behaviour during the period prior to infection. It is therefore unwise to use these data to try and explain the current HIV status of respondents.

Section 1B. Methodology

Datasets for 2002, 2005 and 2008 surveys were supplied by HSRC for respondents aged 15 and over. Different questionnaires had been used in each survey and so there is some difference between the years in the information available. Standard variables were derived from the datasets (see **Table 1.2**) based on the conceptual framework and the bivariate results carried out by HSRC for all respondents in the 2008 survey.
Datasets for the 2006 and 2009 NCS were supplied by HDA for respondents aged 15 to 65 and 16 to 56, respectively. Questionnaires were different to each other, and to the HSRC surveys. The same set of standard variables were derived, so far as was possible, and these are also shown in **Table 1.2**.

Each survey used a different approach to collect information on sexual partners in the year before the survey. In HSRC 2005 and HSRC 2008 respondents were asked to classify their sexual partners in the last year as regular, non-regular (had sex only a few times) and commercial sex workers (CSW) and these categories were used for analysis. In the 2009 NCS the relationship to the partner was collected in the partner history. The categories reported were combined into spouse or cohabiting partner, boyfriend or girlfriends (those described as "main partners") and casual (those described as "friends", "someone I've known for a while", "Someone I just met", "One night encounter"). Respondents were asked if they had given money or resources to any of their partners in the last year. Those described as casual, and who were given money or resources were identified as CSW for this analysis. Therefore the partner types from the HSRC 2005 and HSRC 2008 are not directly comparable with those from NCS 2009.

Missing values
Values missing by design because of skips in the questionnaire were replaced with the appropriate code. For example, respondents who had never had sex were not asked the questions about sexual behaviour and had been coded as missing on those variables. For this analysis those respondents were coded as "never had sex" for all the sexual behaviour variables to maintain the same denominator throughout the analysis.
For many variables, there were also some missing values where there should have been a response. These were coded as "missing" to ensure a consistent denominator, and to explore whether there were any patterns to the missing values.
Complete information was not available for all respondents. Multivariate analysis is only possible for complete records and we examined two approaches to handling missing data in the analyses:
1) Give missing values a numerical code and include these as a category in the model. This means that only categorical variables could be included, because it is not possible to distinguish a missing value from a real response in a continuous variable.
2) Use only complete data for analysis. The variables identified for the regression model were used to define a respondent's data as complete or not.

The second option was chosen because, although it meant losing about a substantial proportion of respondents from some surveys, the resulting models are be easier to interpret. The missing values were present for all variables which meant the addition of an extra parameter to the model for each variable and, for most variables, this extra category contained only a small number of respondents which made the coefficient for the group difficult to interpret and reduced the statistical power.

Methods for Analysis
Analysis was conducted on respondents with complete data and, for HSRC, only those who were also tested for HIV. For the HSRC data, the weights used were those for respondents tested for HIV which included an element to adjust for non-response to the HIV testing component of the survey. For these reasons, the results presented here differ from those in the 2008 HSRC report, which included all respondents (included those not tested for HIV) and used a different weighting scheme for the non-HIV outcomes. All standard errors, confidence intervals and statistical tests were calculated accounting for the complex survey design using Stata 11's svy commands and using the survey design variables listed in **Table 1.1.1.**

Table 1.1: Survey design information in each dataset. EA stands for Enumeration Area and refers to the standard enumeration areas used for the most recent South African census.

	Strata (variable name)	PSU (variable name)	weight (variable name)
HSRC 2008	Province & age group (prov & agegrp)	EA (ea)	ibreal1
HSRC 2005	Province (province)	EA (eanumber)	ibreal1
HSRC 2002	Province (cprov)	EA (ceanum)	cweight
NCS 2009	Province (province)	EA (psu)	weight_stdpost
NCS 2006	Province (provincs)	n/a	weight

Univariate Analysis
The percentage distributions of respondents by each variable listed in **Table 1.1** were tabulated, accounting for the complex survey design, separately by sex and year of survey.

Bivariate Analysis (HSRC data only)
The percentage HIV positive by each variable was tabulated and chi-squared tests calculated, allowing for the survey design using Stata 11's svy commands.

Bivariate Analysis (2009 NCS data only)
The NCS 2009 collected information on partners with whom the respondent had had sex during the 12 months before the survey. The data from this partnership history were rearranged to form a sequence of events (partner acquisition, partner loss, censoring at survey date) by date for each respondent. The number of partnerships in which each respondent was engaged was calculated for the time of each reported event. This makes it possible to distinguish respondents who embarked on a new partnership when they already had at least one current partner. Survival analysis was used to calculate partner acquisition rates (PAR) where the outcome event was starting a partnership, defined by the date of first sex with a partner.

Multivariate analysis

HIV status (HSRC data)
Logistic regression models were fitted separately for men and women to identify the factors associated with HIV status at survey.
All variables identified as important in the univariate analysis were put into a fixed effects logistic regression model adjusted for survey design. Variables with a p-value on the Wald test of <=0.01, for at least one category, were retained. Those with large p-values were removed, one by one, starting with those on the left of the conceptual framework.
Once unimportant variables had been removed, interactions were explored for selected variables.

Media Exposure

Respondents were asked how often they listened to, saw or read the: radio, TV, newspapers, magazines, internet. Response categories were: Never, once a week, 2-6 times a week, every day. These variables were examined separately in logistic regression models for the HIV outcome and then all combined into one model. Variables which showed a non-linear association with HIV were treated as categorical variables, the others were treated as continuous variables for the multivariate analysis.

Province level effects (HSRC 2008)
After establishing the fixed effects for province (as covariates in the logistic regression models) and looking for evidence of effect modification (by fitting interaction terms) the crude odds ratios for HIV infection were calculated for each factor separately for each province. These results were used to assess whether any of the variables revealed to be important in the regression models was operating differently at provincial levels.

Partnership behaviours: HSRC 2008
A regression model was fitted to explore the factors associated with sex with a commercial sex worker among men in the 2008 HSRC survey because this was the only behavioural factor to remain associated with HIV once other variables were controlled for.

Partnership behaviours: NCS
Piecewise exponential models, adjusted for survey design, were fitted to the NCS 2009 data to estimate the effects of covariates on the hazard of acquiring of a new partner. Analysis time was split into pieces corresponding to partner status categories (no partner; at least one non-spousal partner; at least one spousal partner; at least one non-spousal plus one or more spousal partners) for the respondent during the year prior to the survey. A crude model was fitted showing the effect of partner status on partner acquisition. An adjusted model was then fitted to explore the effects of partner status and other characteristics. This was done separately for men and women.

Pooled Analysis
Datasets from the three HSRC and two NCS surveys were combined using a set of core variables available in most of the surveys (see **Table 1.2**). Only respondents aged 16 to 55 years were used for these analyses, although those outside the age range were retained in the dataset since they were required for the correct calculation of standard errors adjusted for the survey design. Information from each survey regarding the strata and primary sampling units was recoded to ensure that these were unique across the datasets. The combined dataset was used to estimate regression models for:

- Trend in HIV prevalence across the surveys, accounting for changes in the survey sample (HSRC data only);
- Trend in the proportion of all men reporting more than one partner in the year before the survey.

Limitations

1. Differential participation. The conclusions drawn from the results in this report rest on the assumption that the survey samples are representative of the population of South Africa, and are therefore free from selection, participation and response bias. Since the samples were drawn from a good quality national sample frame a noticeable selection bias seems unlikely. Participation bias is more difficult to detect or quantify. **There is evidence that participation was lower among certain population groups** (white, urban, wealthier) than among the poorer, rural African population. Levels of non-response were adjusted for in the survey weighting but this would not correct for any systematic differences in participation introduced by this pattern of non-response.

2. Incomplete HIV test results. In addition to concerns about the survey response rates, the validity of the results for HIV status estimates is undermined if HIV test non-response has introduced a bias. **Response to the HIV testing component was around 75% in the 2005 and 2008 HSRC surveys**. If the 25% who did not consent to HIV testing were systematically different to other respondents this could undermine the validity of the results presented here. The report on the HSRC 2008 survey found little evidence for a systematic difference in the characteristics of those who were interviewed only and those who were interviewed and tested for HIV. However, they **did not separate non-response to the HIV test component by reason** and it is possible that there may have been an

effect once those who refused (the majority of non-responders) were separated from the other non-responders. This information is not in the dataset and could not be investigated here.

3. Missing information. A substantial number of respondents were missing information for a few variables each. This entailed the **exclusion of a substantial proportion of respondents**. This may have introduced a bias if those with incomplete data were systematically different to other respondents. For example, if respondents who have had a lot of partners had difficulty reporting accurately on all their partners and therefore did not give answers to some questions. Comparison of the characteristics of those with complete data for analysis and other respondents did not reveal any systematic differences, which suggests that most of the missing information was essentially missing at random. Therefore exclusion of the incomplete respondents should not have introduced a bias.

4. Reduced power. Exclusion of respondents with missing key data greatly reduced the power of the analysis since the multivariate analysis of the HSRC surveys was based on around two thirds of the total sample. It is therefore possible that some associations might not have been apparent in this reduced sample.

5. Differences between the surveys (design, implementation, survey instruments). All these differences undermined comparisons over time. Each of the five surveys had a different target population, sampling strategy and questionnaire. It is impossible to distinguish real changes over time from changes in response to the differences in the surveys. Where trends over time are consistent, then changes due to the survey methods, which should be non-directional, would seem a less likely explanation than a real change over time. There was an apparent trend over time for men reporting multiple partner in the last year but this was not significant. However it is possible that this trend was muted by the differences in the survey designs. Subsequent, comparable surveys would make it easier to detect trends.

6. Complex survey designs. The impact of the complex survey designs used, especially in HSRC 2008, have not been fully explored in the multivariate analysis. Stratification for this survey was on several variables known to be strongly associated with HIV prevalence: province, race, type of settlement. In order to fully understand the processes it would have been necessary to break down the individual sample weights to the components for each level of stratification and the information needed to do this was not available.

7. Correct standard errors could not be calculated for NCS 2006 because the PSU variable was missing from the dataset. This is needed to properly correct the standard errors for the clustering in the data.

8. Information on religion was available in the HSRC 2005 survey but could not be used in this analysis because it was stored as un-coded, open-ended responses. Socio-economic had been collected in the HSRC 2008 survey, but was not available for analysis.

Table 1.2: Definitions of variables used in the analysis

Variable	varname	Categories	HSRC 2002	HSRC 2005	HSRC 2008	NCS 2006	NCS 2009
Age group	agegrp	15-19 to 60+ in 5-year groups	✓	✓	✓	✓	✓
Birth cohort (5 year)	birth_cohort	pre-1940, 1940-49, 1950-54 to 1990-1994 in 5-year groups	✓	✓	✓	✓	✓
Birth cohort (10 year)	bc10	pre-1940, 1940-49, 1950-59 to1980-89 in 10-yr groups, 1990-94	✓	✓	✓	✓	✓
Education	educ	None, Primary, Secondary, Tertiary	✓	✓	✓	✓	✓
Marital status	mstat	Single, Married, Unmarried cohabiting, Ex-married, missing	✓	✓	✓	✓	✓
Race	african	Other, African	✓	✓	✓	✓	✓
Province	province		✓	✓	✓	✓	✓
Radio	radio	Never, once a week, 2-6 times a week ,every day	✓	✓	✓		✓
TV	tv	Never, once a week, 2-6 times a week ,every day	✓	✓	✓		✓
Newspaper	newspaper	Never, once a week, 2-6 times a week ,every day	✓	✓	✓		✓
Magazine	magazine	Never, once a week, 2-6 times a week ,every day	✓	✓	✓		✓
Internet	internet	Never, once a week, 2-6 times a week ,every day	✓	✓	✓		✓
Ever had sex	sexever	No, yes, no response,missing	✓	✓	✓	✓	✓
Sex in last year	sexuallyactive	No, yes, no response, missing	✓	✓	✓	✓	✓
Sex in last month	active30	No, yes, no response, missing		✓	✓		✓
Lifetime partners	lifetime_ptnrs	Total number of opposite sex partners in lifetime			✓		
	lifesamesex	Total number of same sex partners in lifetime			✓		
>1 lifetime partner	multilife	No, yes, missing			✓		
Age at first sex	lt_agefirstsex	reported age at first sex, current age for virgins	✓	✓	✓	✓	✓
	afscat	Never had sex, <16, 16-20, 21+	✓	✓	✓	✓	✓
Time since first sex	tfs	Time since first sex in years, 0 for virgins	✓	✓	✓		
Partners in last year	num_ptnrs	Total number of opposite sex partners in last year	✓	✓	✓	✓	✓
>1 partner in last year	multiyear	No, yes, missing		✓	✓	✓	✓
Parners in last month	ptnrs30	Total number of partners in last month			✓	✓	✓
>1 partner in last month	multimonth	No, yes, missing			✓	✓	✓
Partners at interview	ptnrsnow	Total number of current partners	✓	✓			
>1 partner at interview	multinow	No, yes, missing	✓	✓			
Types of partner in last year	regular	No, yes, missing		✓	✓		✓
	nonreg	No, yes, missing		✓	✓		✓
	csw	No, yes, missing		✓	✓		✓
Age mixing	biggestgap	No partner, 0-4 years, 5-9 years, 10+ years	✓	✓	✓		✓
HIV testing	hiv_test_when	Never, <1 year, 1-2 years, 2+ years, missing		✓	✓		
	hiv_test_ever	No, yes, missing	✓	✓	✓		
Reason for HIV test	hiv_test_why		✓	✓	✓		
Forced sex in last year	forced_sex	No, yes, missing	✓	✓	✓		
Going without	gw_shelter	Shelter: Never, Rarely, Sometimes, Often		✓			
	gw_fuel	Fuel: Never, Rarely, Sometimes, Often		✓			
	gw_water	Water: Never, Rarely, Sometimes, Often		✓			
	gw_medicine	Medicines: Never, Rarely, Sometimes, Often		✓			

	gw_food	Food: Never, Rarely, Sometimes, Often		✓	
	gw_cash	Cash income: Never, Rarely, Sometimes, Often		✓	
Has disability	disability	No, yes, missing			✓
Has dependents	dependents	No, yes, missing		✓	✓
Mobility	mobileyear	Been away in last year		✓	
	mobileweek	Been away 1+ nights in last week		✓	
Male circumcision	circumcised	Men only: No, yes, missing	✓		✓
Circumcised before first sex	circbeforesex	Men only: No, yes, unclear, missing	✓		✓
Partners' fidelity in last month	punfaith	No, yes, don't know, no partner(s), missing			✓

Section 1C. Results from multivariate analysis

Data available for multivariate analysis

Table 1.3 describes the numbers of male and female respondents who were interviewed, interviewed and tested for HIV (HSRC only) and who had **sufficiently complete data for multivariate analysis** (i.e. who did not have missing responses on key variables). The low proportion of respondents from HSRC 2008 available for multivariate analysis was due largely to missing information on age at first sex and details of partners in the year prior to the survey. However, most variables had missing values for between 6% and 10% of respondents which HIV status, and many respondents were missing some information.

In HSRC 2008, information on sexual activity (sex ever or sex in the last year) was missing for 7% of the respondents who were both interviewed and tested for HIV. Age at first sex was missing for 14.5% of these respondents. Around a fifth of respondents were not tested for HIV and, as a result of excluding these respondents with missing values, multivariate analysis was conducted on just over half of the original sample. In HSRC 2005, a smaller proportion of respondents were missing information on sexual activity (3.5% and 4.5% missing sex ever and sex in the last year respectively), however, 16% of respondents were missing age at first sex. Thus just over 60% of respondents could be included in the multivariate analysis. For both HSRC 2005 and HSRC 2008 the HIV status of those excluded from analysis was compared with those included in the multivariate analysis. For both surveys there was no difference in HIV status between those without missing values and those excluded from the analysis due to missing data. The data from the HSRC 2002 survey was more complete: less than 1% of respondents were missing information on sexual activity and for only 5% was age at first sex not available. The NCS datasets were essentially complete and the few respondents with missing values were excluded from analysis.

Table 1.3: Number of respondents interviewed, tested for HIV (HSRC only) and available for multivariate analysis, by survey and sex

Survey		Number of respondents	Number interviewed & tested for HIV (% of total)	Number with complete data for analysis (% of total)	Number complete & aged 16-55 (% of total)
HSRC 2002	*Men*	2,704	2,591 (95.8)	2,016 (74.6)	1,731 (64.0)
	Women	3,667	3,497 (95.4)	2,666 (72.7)	2,194 (59.8)
HSRC 2005	*Men*	6,338	4,529 (71.5)	3,828 (60.4)	3,146 (49.2)
	Women	10,057	7, 503 (74.6)	6,404 (63.7)	5,140 (51.5)
NCS 2006	*Men*	3,505	n/a	3,411 (97.3)	3,137 (89.5)
	Women	3,501	n/a	3,382 (96.6)	3,104 (88.7)
HSRC 2008	*Men*	5,501	4,229 (76.9)	2,944 (53.5)	2,424 (44.1)
	Women	8,327	6,579 (79.0)	4,751 (57.1)	3,801 (45.6)
NCS 2009	*Men*	4,437	n/a	4,419 (99.6)	4,413 (99.5)
	Women	5,291	n/a	5,266 (99.5)	5,263 (99.5)

Characteristics of included respondents

Characteristics of respondents, by survey and sex, are shown in **Section 1F** using only those respondents available for the multivariate analysis and aged 16-55.

The sampling and survey instruments differed between the HSRC and NCS surveys, which might explain differences between the two types of survey. However, slightly different methods were used for each of the three HSRC surveys, and for the 2006 and 2009 NCS. Therefore comparisons were made across all five surveys, with the caveat that some differences may be due to survey design. At this stage, no formal statistical tests were conducted to see if differences between surveys were due to chance (see sections on trends over time).

Socio-demographic characteristics

Distribution by provinces has changed little over the three HSRC surveys and was broadly similar between the HSRC and NCS 2009 surveys. The HSRC 2008 sample has fewer respondents from rural/tribal areas and more from urban formal areas than the previous HSRC surveys. The NCS 2009 has more respondents from urban informal areas than the other surveys, and fewer from rural areas. At least three quarters of respondents in all surveys were African.

The surveys covered different age ranges but, once restricted to the range common to all surveys (16-55) the distribution did not change markedly between the surveys. Male respondents tended to be younger than female respondents (mean ages 34.5 and 36.8 respectively). The HSRC surveys had no upper age limit but the distribution of older respondents was similar across the surveys (not shown). The proportion reporting secondary education has increased between 2002 and 2009. The proportion of men and women reporting tertiary education in NCS 2009 (6% and 5% respectively) was around half of the level in the other surveys.

Comparing the five surveys, the proportion of respondents who were married had decreased over time and the proportion single had increased. The proportion of respondents cohabiting with a non-spousal partner had increased steadily; the proportion formerly married had not changed.

Table 1.4 gives the number of respondents with complete HIV test data and the proportion HIV positive in each HSRC survey, by sex.

Table 1.4: Respondents with complete HIV test data and HIV status (2002, 2005, 2008)

	MEN			WOMEN		
Variable	**2002**	**2005**	**2008**	**2002**	**2005**	**2008**
N respondents with complete data, age 15+	2016	3828	2944	2666	6404	4751
HIV Status						
Positive, ages 15+	11.3	10.7	10.1	13.9	16.8	17.0
Positive, ages 16-55 only	12.2	12.4	11.3	16.1	19.6	20.0

HIV Status Models (see tables in Section 1G)

Regression model for HIV status: Women 2008

After adjusting for other factors there was still a strong association between race and HIV status.

The geographical variables, province and geotype, remained important but only certain categories were significantly different from the others. Living in an urban informal area was associated with higher odds of HIV infection compared to other types of area. Respondents living in KwaZulu Natal and Mpumalanga were more likely to be HIV infected than others.

In the same way, education was only discriminatory for women with tertiary education compared to others.

Married women had lower odds of HIV infection than other women and showed an interaction with birth cohort so a combined variable was created. The baseline for the combined variable is single women born 1980-89.

Unmarried women in the youngest cohort were less likely to be HIV positive women that unmarried women born 1980-89. The odds of infection for single women born in the 1960s and 1970s were no different to those of women born in the 1980s. Single women born before 1960 had lower odds of infection than single women born in the 1980s.

Married women born before 1980 had lower odds of infection than single women born in the 1980s, the odds of infection declined steadily for older cohorts. Very few women born in the 1990s and 1980s were married, but their HIV status did not differ from that of single women born in the 1980s. Therefore marriage appears to be negatively associated with HIV infection in the middle age range, where HIV prevalence peaks. The reduced odds found for the older cohorts (born before 1960) is probably a selection effect: women from these cohorts who became infected probably acquired HIV infection in the 1980s and 1990s and, without access to ART would have died before these surveys were fielded. Older women (born before 1960) are less likely to be infected regardless of marital status- because when they were younger HIV prevalence was much lower and any women from that cohort who were infected probably died before their fifties. This assumes that the force of infection was greatest for these women when they were younger and has declined as the women have aged.

Reason for having an HIV test was associated with HIV, compared to those who had not had a test. By and large this shows what is expected- respondents who waited until they were ill to go and get a test are more likely to be positive.

HIV infection was overwhelming associated with sexual activity, and there was a slightly higher risk among those active in the last year, though this difference was not significant.

Regression model for HIV status: Men 2008

Most of these factors from the bivariate analysis were not significant once adjusted for the other variables.

As for women, race (African or not) was the most important predictor of HIV status. Geotype was not important for men but most provinces were different to Western Cape, reflecting the relatively low prevalence in that province. Three provinces were not different: Northern Cape, Free State and Limpopo.

Higher odds of infection were seen for men born between 1960 and 1979, compared to men born 1980-89. Marriage was not important and there was no interaction effect observed.

Men who used the internet regularly, compared to those who never did, were much less likely to be infected .

The only sexual behaviour variable to retain an effect once adjusted for other variables was sex with a CSW in the year before the survey, which trebled the odds of HIV infection, though the p-value was quite large.

Reason for having had an HIV test was important. Compared to respondents who had never had a test, men who had a test because they were feeling ill, were referred by a health worker or because a partner or child was ill, diagnosed with HIV or had died, had higher odds of infection. Men who cited curiousity as the main reason for their test were also more likely to be infected.

Regression model for HIV status: Women 2005

Geographic variables, province, geotype and race (African or other) all retained a large and significant effect in the adjusted model. Four provinces (Free State, KZN, Gauteng & Mpumalanga) were associated with higher HIV prevalence compared to Western Cape. Being African had an adjusted OR for HIV of 8.7 (95% CI 5.1-14.8) compared to other races.

Geotype showed some effect, with a borderline protective association for rural formal areas compared to urban formal areas.

Women born in the 1970s were at increased likelihood of being HIV positive compared to those born later. Women born before 1960 were less likely to be HIV positive. There was no interaction between birth cohort and marriage in this model. Married and cohabiting women were less likely to be HIV positive than single women.

Respondents who said they ever went without cash were more likely to be HIV infected. Respondents who said they rarely went without shelter were less likely to be infected.

Women who had ever had sex were much more likely to be HIV positive than virgins; the risk was only slightly higher in those who had had sex in the year before the survey than in those who had not had sex within the last year. Women with more than one partner at the time of the survey, those who reported a non-regular partner in the last year and those who had a partner more than 10 years older all had higher odds of infection.

Women who reported having had an HIV test because they were sick, they were advised by a health worker to take a test or because a partner or child was sick, diagnosed with HIV or died were more likely to be infected than women who had never taken a test. Other test reasons were not associated with infection.

Watching television was protective and there was a borderline protective association with internet use.

Regression model for HIV status: Men 2005

In 2005 province and race retained their strong effects. Men born in the 1960s and 1970s were much more likely to be HIV positive than men born in the 1980s. Men born in the 1990s were less likely to be infected in 2005. Tertiary education, compared to no education, was protective.

Men who reported at least one partner who was more than a 10 years younger (or older) than them were more likely to be infected. (NB. the age gap can go either way but the vast majority of men's partners were younger, only a handful were older than the respondents.) This suggests that men who choose much younger partners are more likely to be HIV positive than men whose partners are more similar in age, but which comes first the HIV infection or the younger partner.

Having had an HIV test prompted by feeling sick, referral by a health worker or because a partner or child was ill, diagnosed with HIV or died, was associated with increased odds of infection. Tests for other reasons showed no association.

Regression model for HIV status: Women 2002

Province was not important for women in 2002 but race and type of settlement were both associated with HIV. Women living in tribal areas were less likely to be infected than women in urban formal areas. In this model there was no significant difference between women in formal and informal urban areas but the OR was higher for informal urban areas, consistent with the models for 2005 and 2008.

The effect of age was also less marked in this model, only women born in the 1970s were at significantly higher odds of infection compared to those born in the 1980s. Marriage was protective compared to being single. However being sexually active was associated with much higher odds of infection, and having had sex in the last year was associated with even higher odds, which outweighed the effect of marriage. Therefore, as in all the models, sexually active respondents were much more likely to be HIV positive and this was only partially offset by marriage.

HIV test history was not significantly associated with HIV status, there was a borderline protective effect with taking a test for administrative purposes and the OR for the other reasons were in line with those in the 2005 and 2008 models.

Internet usage and reading newspapers appeared to be protective in 2002.

Regression model for HIV status: Men 2002

Effects of province and race were evident for men in 2002 but not as marked as in the later surveys. Men born in the 1960s and 1970s were more likely to be infected than men born in the 1980s.

Men who reported a partner 10 or more years younger or older were much more likely to be HIV infected than men whose partner was of a similar age.

Men who were circumcised before they first had sex were much less likely to be HIV infected.

Men who had had an HIV test for administrative purposes were less likely to be infected than men who had never had a test. Men who had been tested because of illness were also less likely to be infected than those who had never tested, but this effect was borderline. If true the OR has changed dramatically between 2002 and 2008 from 0.25 to 4.9.

HSRC 2008: Interactions by race and province

Race and province were strongly associated with HIV status. Both variables describe the local prevalence of HIV and, because there are such marked variations, may drown out the effects of individual level characteristics. Certain characteristics may be differently associated with HIV status depending on province of residence or race i.e. these variables may be effect modifiers. Interaction terms were added to the main models to explore these effects but the sample size was insufficient for the resultant models. Regression models with just two factors were suggestive of interactions between race & province, and province & birth cohort for men and between race and birth cohort for women.

Trend over time in HIV prevalence (see table in Section 1H)

Results of logistic regression models to compare the HIV status of respondents in the three HSRC surveys are given in **Section 1H**).

For men, there was little evidence of a trend over time in HIV prevalence. Compared to 2008, the crude odds ratio for HIV positivity was 1.1 for both 2002 and 2005 (95% CI 0.8-1.5 and 0.8-1.5 for 2002 and 2005 respectively). For women there was no evidence for a difference between 2005 and 2008 (crude OR 0.98, 95% CI 0.8-1.2) but some evidence for lower HIV prevalence in the 2002 survey compared to 2008 (crude OR 0.77, 95% CI 0.61-0.97).

Differences between the surveys may be amplified, or disguised by, differences in the characteristics of survey respondents in the different years. Therefore adjusted logistic regression models were fitted to examine this.

Models included age group, educational attainment, province, type of settlement, marital status and race. Once adjusted for these factors, there was still no trend over time for men and the p-value for the crude association observed for women increased from 0.03 to 0.07. This suggests that the lower prevalence for women in 2002 compared to 2008 could be due to chance alone.

Characteristics associated with reporting sex with a CSW in 2008 (see table in Section 1I, men only)

Since sex with a sex worker was the only sexual behaviour to show an association with HIV status in any of the models for men a separate model was constructed to look at the characteristics associated with this behaviour.

The adjusted OR for being HIV positive by whether or not the respondent had a CSW partner in the last year was 2.9 (95% CI 0.9-9.4). Although only 0.5% of men (24 respondents) reported this behaviour, HIV prevalence was 22% among those men. The population impact may be relatively small but this nonetheless suggests that around 15,000 HIV positive men visit sex workers each year.

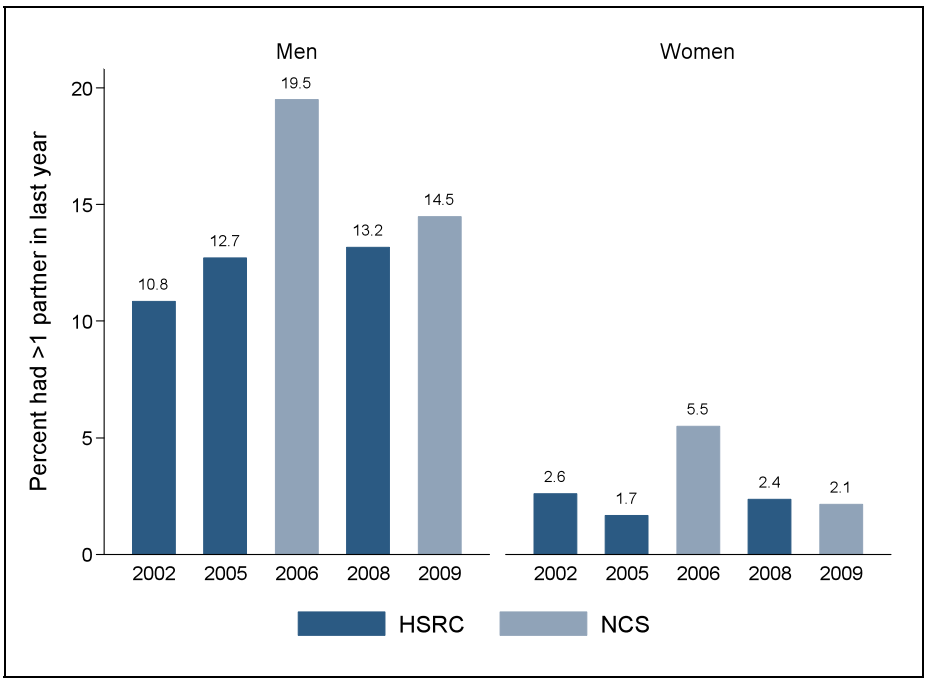
The logistic regression model is given in **Section 1I**). There was no association between CSW partners and place of residence, age, education or marital status. Men who had been sexually active recently were more likely to have had a CSW partner (adjusted OR 23.5), as were men who reported a non-regular partner in the last year (adjusted OR 10.1). HIV positive men were almost four times more likely to report CSW partners that HIV negative men (adjusted OR 3.8). Whilst the CSW partner may have been the source of HIV infection for some of the men, many will have been infected more than 12 months before the survey. Therefore HIV positive men continue to visit sex workers. Two factors were negatively associated with CSW partners: men who listened to the radio were less likely to have had a CSW partner than men who did not listen to the radio (adjusted OR 0.2) . Men who had ever been tested for HIV were also less likely to have had a CSW partner in the last year than men who had never been tested (adjusted OR 0.07).

Trend over time in proportion of men reporting multiple partners in the last year (see table in Section 1J)

As **Figure 1.2** shows, there was some indication of an increase over time in the proportion of 16-55 year old men who reported more than one partner in the year before the survey. No such trend was apparent for women. The 2006 NCS is an outlier for both men and women.

The crude OR for having had more than one partner in the year before the survey, comparing each year to 2008 were, or men, 0.8 (for 2002), 0.96 (for 2005), 1.6 (for 2006) and 1.1 (for 2009) . Only the OR for 2006 was significantly different from 2008, 95% CI: 1.3-2.0.

Figure 1.2: Proportion of 16-55 year olds reporting more than one partner in the year before the survey, by survey and sex.



A logistic regression model was fitted for men to see if changes in respondent characteristics might explain the differences over time. The model included age group, educational attainment, province, type of settlement, marital status and race. The results of this model are in **Section 1J**.

The difference between 2006 and 2008 remains once other factors are controlled for. Education was not important and was not retained in the model. All other factors showed an independent association with the outcome but none appeared to confound the association between year of survey and multiple partners in the last year.

Section 1D. Discussion

HIV status at survey

The logistic regression models for HIV status, fitted separately for men and women in each of the HSRC surveys showed that the macro level variables (such as province, race and birth cohort) were more important than individual level factors. These variables describe the "when" and the "where" of infection and reflect the marked geographical differences in HIV prevalence and the sharp contrasts over time. This finding echoes that of an analysis of cohort data from Zimbabwe[2].

Some behavioural factors were associated with HIV status, and these are discussed more fully below.

Women

In the HIV status models for women, in each year, women who had been sexually active were more likely to be HIV positive. This effect is due to the low prevalence among those who have never had sex, reflecting that fact that most infections are sexually transmitted and therefore complete abstinence is very protective. However, it raises the question of the extent to which HIV positive women continue to have active sex lives, and with whom. The OR for having had sex in the last year, comparing HIV positive women to HIV negative was 2.6 in 2002 (95% CI 1.7-3.8), 2.0 in 2005 (95% CI 1.6-2.5) and 1.9 in 2008 (95% CI 1.5-2.5). After controlling for age, this effect disappears for 2005 and 2008 and the adjusted OR for 2002 decreases to 1.8 (95% CI 1.1-2.7). The OR for having had sex in the month before the survey, again comparing HIV positive to HIV negative women, was 1.5 in 2005 (95% CI 1.2-1.9) and 1.8 in 2008 (95% CI 1.4-2.3). This information was not available in HSRC 2002. Again, this effect disappeared once controlled for age.

Marriage is associated with lower odds of infection in each year; this may be because women who married, and were HIV negative when they got married, were subsequently less likely to acquire infection, or because women who are HIV positive are less likely to remain married. It is unfortunate that it is not possible to distinguish first and subsequent marriages in these data.

In 2005, women who had had more than one partner in the year before the survey were more likely to be HIV positive. If HIV positive women are those most likely to have multiple partners, this would be a cause for concern regarding onwards transmission of infection. Comparing all women, including those who were not sexually active or who had never had sex, in 2002, there was no association between HIV status and multiple partners in the last year. In 2005, the crude OR for having had multiple partners, comparing HIV positive women to HIV negative was 3.9 (95% CI 2.2-6.9) and in 2008 the crude OR was 2.3 (95% CI 1.2-4.4). Once adjusted for age, the association disappeared in 2008 but was remained in 2005: adjusted OR 3.0 (95% CI 1.7-5.4).

In all three surveys, HIV positive women were significantly more likely to be single compared to HIV negative women. The proportion of HIV positive women who were single was 60%, 61% and 67% in 2002, 2005 and 2008, respectively, compared 42%, 41% and 47% of HIV negative women. This difference is not explained by the differences in age distribution between HIV positive and HIV negative.

Men

For men, few behavioural variables were associated with HIV status. In HSRC 2002 and HSRC 2005, having had an age gap of 10 years or more with a partner in the last year was associated with increased odds of infection. In 2008, having had sex with a CSW in the year before the survey was associated with increased odds of infection.

HIV status and sex with a sex worker: men

The logistic regression model, based on men in HSRC 2008, for sex with a CSW in the last year found that HIV status was associated with this outcome. Men who had had sex in the month before the survey, and men who had had a non-regular partner in the last year were also more likely to report sex with a CSW. In 2008, 74% of HIV positive men, versus 62% of HIV negative men (p-value=0.0001), had had

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Lopman B et al. (2008). HIV incidence in 3 years of follow-up of a Zimbabwe cohort—1998–2000 to 2001–03: contributions of proximate and underlying determinants to transmission. Intl J Epidem, 37(1):88-105

sex in the last year and 68% of HIV positive and 57% of HIV negative had had sex in the last month (p-value 0.03). These differences are explained by the difference in the age distribution of HIV positive and HIV negative men, and disappear once age is controlled for. However, this reinforces the point that HIV positive men are in the age group that reports the most sexual activity, and HIV infection does not appear to limit their activity. This is undoubtedly because most men are not aware of their status and because early infection is rarely symptomatic.

Having had an HIV test was negatively associated with having sex with a sex worker. This could be because men who are concerned about HIV infection avoid CSW partners and take HIV tests, or because the experience of HIV testing discourages men from visiting sex workers. There is not way to date the HIV test relative to the CSW partner, or to ascertain whether men who did not report CSW partners but did report HIV tests had ever visited CSW at some point in their lives.

Although, the number of men reporting sex with a CSW was small in 2008, and the proportion of the population equally small, the population impact could still be noticable.

In addition, the reversal of the proportions reporting non-regular partners and CSW partners between 2005 and 2008 suggests that there may have been some social desirability bias operating. If the lay person's definition of a CSW is quite fluid, or if it is undesirable to admit to having such a partner, perhaps men in 2008 were more inclined to report such partners as non-regular than the respondents in 2005. If so, the proportion of men with this behaviour might be higher than the 2008 survey suggests.

HIV trend over time

The logistic regression models for HIV status at survey, based on the data from the 2002, 2005 and 2008 HSRC surveys, show that the odds of being HIV positive among survey respondents have not changed over the surveys. This is also reflected in the age-specific prevalence graph (see section XXX main report) which shows an increase in the age of those infected over time, but also wide confidence intervals which show that any changes within individual age groups could be due to chance.

Multiple partners trend

Comparison of the results from the individual surveys suggests that the proportion of men reporting more than one partner in the year before the survey had been increasing between 2002 and 2009. However, results from logistic regression did not support this observation; no trend was evident over time when geographic variables (province, geotype & race) and age and marital status were controlled for. The 2006 NCS survey was different to the others; there is no obvious reason why this should be so.

In the report on the 2008 HSRC survey there was a trend apparent between 2002 and 2008 in the proportion of both men and women who reported more than one partner in the last year. There were some differences between that analysis and this; the analysis in the HSRC report was based only on the HSRC data whereas NCS data were included in this analysis. However, there was no trend evident when this analysis was restricted to HSRC surveys only. In the HSRC report, the analysis included only those aged 15-49 who had had sex in the year before the survey. They also included respondents who were not tested for HIV. The analysis presented here included all respondents aged 16-55, and, in the HSRC surveys, tested for HIV (with appropriate weights).

The increase over time, in the proportion of men reporting multiple partners, and the apparent sensitivity of the results to the analytical approach, suggest that no evidence for a trend should not be taken as evidence of no trend. The differences, and some deficiencies, in the behavioural data from the different surveys make rigorous analysis difficult. The only survey with a partner history is the NCS 2009. Partner histories permit a more detailed analysis of behaviour because, unlike direct questions on a behaviour of interest, they can be used to build up a profile of a respondent's behaviour during the period before the survey.

Section 1E. Recommendations

Comparison of behaviour between subsequent surveys and the existing data would be facilitated by the inclusion of a partner history. This would permit backwards compatible analysis since the measures used

to date could be derived from the partner history but it would also be possible to describe individual behaviour more fully.

Multi-level modelling of HIV status might better describe the processes operating at geographic and social levels: their relative importance and their influence on individual level factors.

To do this would require detailed information on the survey designs in order to disaggregate the survey weights and assign each component to the correct level in the model.

The information on partner acquisition and loss in the 2009 NCS could be analysed further. Further differentiating partner status by cohabitation would help explain the associations seen in this analysis. Loss rates, and concurrency start rates (partner acquisition by those who already have a partner) could be investigated. A multi-level model would permit comparison of the factors associated with acquiring a partner and those associated with acquiring an additional partner. It is important to understand whether these two processes are different in order to target HIV prevention efforts and to inform the debate on the importance of concurrent partnership in HIV transmission.

Macro level variables, such as race and location of residence, were more important than individual characteristics in describing HIV status of the survey respondents. There is some evidence that HIV positive men may be slightly more likely to report recent risky sexual behaviour than HIV negative men.

There was little statistical evidence for trends over time in either HIV status or multiple partnerships. However, the results of both analyses are sensitive to the analytical approach used. Changes are apparent in the crude results, and may become statistically significant as more data are collected. Comparisons over time were undermined by different survey methods in each year.

The importance of macro level variables such as province and race suggests that multi-level analysis of these data could elucidate some of the associations seen in this analysis.

Section 1F. Characteristics of respondents (all five surveys)

	MEN					WOMEN				
	2002	**2005**	**2006**	**2008**	**2009**	**2002**	**2005**	**2006**	**2008**	**2009**
N respondents aged 16-55 with complete data	*1731*	*3146*	*3137*	*2424*	*4410*	*2194*	*5140*	*3104*	*3801*	*5257*
Province										
Western Cape	12.9	12.1	10.4	13	12.1	13.4	8.8	10.1	11.4	11
Eastern Cape	15.3	11.3	14.1	13	10.7	16.5	15.3	14.1	13.5	13
Northern Cape	2.3	1.7	1.9	1.7	2.1	2.3	1.4	2	1.7	2.3
Free State	7.7	8.1	6.6	6.3	5.3	6.1	5.8	6.8	5.8	6.4
KwaZulu natal	18.4	19	19.2	15.2	22.5	17	25.5	20	21.5	18.7
North West	6.8	9.8	8.6	9.2	5.6	6.5	8.5	8.6	8.1	8.1
Gauteng	24	21	21.4	25.3	24.9	22.3	18.4	20.5	21.9	23.2
Mpumalanga	4.2	7.9	6.5	6.4	7.4	6.1	5.4	6.2	5.5	7.4
Limpopo	8.4	9.1	11.3	9.8	9.4	9.8	11	11.6	10.7	9.7
Type of settlement										
Rural	47.8	51.1	54.1	59.5	42.9	50.5	45.3	53.7	53.5	42.9
Urban	9.8	8.8	7.7	8	20.7	8.1	9.1	7.5	10.9	20.4
Informal	31.9	28.2	30.5	24.7	31.5	34.1	38.8	31.2	29.5	31.7
Formal	10.5	11.8	7.7	7.9	4.8	7.2	6.7	7.6	6	5
Respondent is African										
No	22.7	23.8	21.6	24.8	20.9	21.4	19.6	20.5	22.1	23.1
Yes	77.3	76.2	78.4	75.2	79.1	78.6	80.4	79.5	77.9	76.9
Age group										
16-19	19.8	19.9	17.8	23.2	19.1	12.9	12.3	13.2	14.9	13.8
20-24	18.6	19	20.9	18.7	16.4	17.5	16.7	17.1	18.4	15.9
25-29	12.1	15	16.4	15.2	18.6	15.4	13.7	17.1	15.5	17
30-34	11	11	11.8	11.5	13	12.1	16.2	14.9	13	12.6
35-39	11.7	12.3	11	12.4	10	12.2	16.8	11.6	14.5	12.2
40-44	8.9	8.2	7.9	6	8	11.5	8.5	9.2	8.9	11.6
45-49	9.5	6.6	8.1	6.6	7.4	10.1	8	9.1	7.4	8.1
50-55	8.5	8	6.1	6.3	7.3	8.3	7.7	7.7	7.5	8.8
55+	0	0	0	0	0	.	.	.	.	.
10-year birth cohort										
Pre-1950	4.1	0	0	0	0	3	.	.	.	.
1950-59	17.4	12.6	10.2	7.3	7.9	18.5	14.1	13.2	8.7	9.5
1960-69	21.3	19.8	17.4	13.8	15.8	25.3	24.1	19.2	17.2	20.3
1970-79	24.8	26.3	26.4	24.1	23.4	30	29.4	29.6	28.2	24.7
1980-89	32.4	41.4	43	38.2	35.5	23.2	32.4	35.7	35.1	33.3
1990-94	0	0	3	16.6	17.5	.	.	2.3	10.8	12.1
Highest level of education completed										
None	6.7	5	1.6	2.4	1.7	8	7.5	3.4	3.1	3
Primary	26.8	19.1	15.3	15.2	10	22.7	21.1	17.1	14.1	9.7
Secondary	57	63.7	74	70.3	82.3	60.6	62.7	71	71.9	82.6
Tertiary	9.5	12.2	9	12.1	5.9	8.8	8.7	8.4	10.9	4.7
Marital Status										
Single	59.8	57.3	66.8	65.6	68.6	51.6	48.5	56	56.2	58.1
Married	34.3	32.6	22.7	25.3	21	38.4	37.5	26.6	30.9	24.9
Unmarried cohabiting	1.5	5.3	6	4.9	5.9	1.9	4.5	7.9	5.2	6.7
Formerly married	4.4	4.8	4.5	4.2	4.5	8	9.4	9.5	7.7	10.3
HIV test result										
Negative	87.8	87.6	0	88.7	0	84	80.4	.	80	.
Positive	12.2	12.4	0	11.3	0	16	19.6	.	20	.
Ever had sex										
No	15.8	16.5	13.9	19.2	13.8	12.3	10.4	9.9	12.4	9
Yes	84.2	83.5	86.1	80.8	86.2	87.7	89.6	90.1	87.6	91

Continued next page

	MEN					WOMEN				
	2002	**2005**	**2006**	**2008**	**2009**	**2002**	**2005**	**2006**	**2008**	**2009**
Had sex in last year										
No	26.2	28.5	24.6	33.1	27.9	28.2	32.1	24.5	31.8	29.6
Yes	73.8	71.5	75.4	66.9	72.1	71.8	67.9	75.4	68.2	70.4
Sexual activity in last year										
Never had sex	15.8	16.5	14	19.2	13.8	12.3	10.4	10	12.4	9
Not in last year	10.4	12.1	10.7	14.1	14.2	15.9	21.7	14.6	19.4	20.6
In last year	73.8	71.5	75.4	66.7	72.1	71.8	67.9	75.4	68.1	70.4
>1 partner in life										
No	0	0	0	37.6	0	.	.	.	43.8	.
Yes	0	0	0	60.2	0	.	.	.	55	.
Missing	0	0	0	2.2	0	.	.	.	1.2	.
>1 partner in year										
No	89.2	87.3	80.5	86.8	85.5	97.4	98.3	94.5	97.6	97.9
Yes	10.8	12.7	19.5	13.2	14.5	2.6	1.7	5.5	2.4	2.1
>1 partner in month										
No			93.6	95	93.5			98.2	99.5	99.4
Yes			6.4	5	6.5			1.8	0.5	0.6
>1 partner now										
No	92.7	90			90.9	99	98.7			99.3
Yes	7.3	10			9.1	1	1.3			0.7
Age at first sex, grouped										
Never had sex	15.8	16.5	13.9	19.2	13.8	12.3	10.4	9.9	12.4	9
Early <16	10.8	11.6	19.8	15.9	19.4	11.4	10.1	10.2	10.4	11
Middle 16-20	57.2	48.7	54.2	52.2	55.7	61.2	54.4	63.6	60.7	64
Late 21+	16.2	12.5	10.7	12.8	10.3	15.1	14.8	14.3	16.5	15.3
Missing	0	10.7	1.4	0	0.8	.	10.4	2		0.6
HIV test result										
Negative	87.8	87.6		88.7		84	80.4		80	
Positive	12.2	12.4		11.3		16	19.6		20	
Time since last HIV test										
Never		69.6		53.9		.	60.5		34.5	
<1 year		12.8		25.4		.	14.9		31.1	
1-2 years		9.9		11.4		.	13.9		19.4	
2+ years		7.7		9.3		.	10.7		15	

Continued next page

	MEN				WOMEN			
	2002	2005	2008	2009	2002	2005	2008	2009
Had HIV test, by reason								
Never tested	75.3	69.6	53.9		75.2	60.5	34.5	
Curiosity	5.1	14.2	27.9		2	12.2	28.1	
New P/P request	0.6	0.6	0.7		0.4	0.7	0.8	
Insurance/Loan/Employment/Unrelated medical/blood donor	11.6	10.1	9.1		7.6	5.5	7.1	
Sick/HW referred/Partner or child sick/HIV+/died	3.8	3.8	4.1		2.3	3.8	6.2	
Pregnancy	0.2	0.1	0.3		9	15.3	21.2	
Campaign			2.2		.	.	1.1	
Exposure			0.4		.	.	0.6	
Reason missing	3.4		1.4		3.4	.	0.5	
HIV test history missing		1.7			.	2	.	
Biggest age gap in last year								
No partner	26.2	28.5	33.1	28	28.2	32.1	31.8	29.7
0-4 years	42.9	40.1	39.9	39.1	40.2	37.5	39.4	38.2
5-9 years	21.4	20.8	19.4	22.1	21.4	20.1	21	22.5
10+ years	9.5	10.5	7.7	10.5	10.1	10.4	7.7	9.2
Missing				0.3	.	.	.	0.4
Had sex in month before survey								
No		38.4	38.5	49.3	.	43.1	37.2	53.8
Yes		61.6	61.5	50.7	.	56.9	62.8	46.2
How often listens to radio								
Never				10	.	.	.	15.6
Less than once a week	7.4	8.3	14	13	11	13.7	18.4	14
1 to 3 days a week	7.2	7.5	8.7	14.6	6.7	8.5	10.9	14.2
4 to 6 days a week	19.9	11.5	17.7	14.2	17.1	10.4	15.7	8.9
Every day of the week	65.6	72.6	59.6	48.2	65.2	67.4	55	47.4
How often watches TV								
Never				13.2	.	.	.	13.4
Less than once a week	25.4	21.9	16.2	8.2	28	28.1	18.8	7.3
1 to 3 days a week	6.9	7.4	4.6	9.6	5.8	5.4	5.7	8.1
4 to 6 days a week	15.4	7.2	12.6	11.5	9.7	8.2	9.9	7
Every day of the week	52.3	63.5	66.6	57.6	56.6	58.2	65.5	64.2
How often reads a newspaper								
Never				27.9	.	.	.	37
Less than once a week	40.4	31.8	25.7	19.5	46.5	41.4	31.9	24.1
1 to 3 days a week	22.9	27.4	26.4	20.6	26.6	27.8	28.6	17.9
4 to 6 days a week	20.3	16.7	21.1	10.7	14.1	14	18.8	6.6
Every day of the week	16.4	24	26.9	21.3	12.8	16.8	20.7	14.4
How often reads a magazine								
Never				45				42.4
Less than once a week	42.3	35.5	35	26.6	45.3	41.4	34.1	26.7
1 to 3 days a week	28.5	32.7	29.7	18	29.2	28.9	32	18.3
4 to 6 days a week	20.1	18	21.8	4.7	16.1	15.9	19.9	5.8
Every day of the week	9.2	13.8	13.4	5.8	9.3	13.8	14	6.8
How often uses internet								
Never				79.4				83.8
Less than once a week	92.2	87.9	75.4	5.6	92.1	91	80.8	5
1 to 3 days a week	2.4	3.4	7.2	5.6	2.7	3.3	5.5	3.9
4 to 6 days a week	2	2.9	6.5	2.1	1.8	1.8	3.9	1.3
Every day of the week	3.3	5.7	10.9	7.3	3.5	3.8	9.8	6.1

Section 1G.
HIV status models (HSRC 2002, 2005, 2008)

MEN 2002

N=2012	N (% HIV+)	Adj OR	95% CI	p-value
Province				
Western Cape	328 (3.3)	1		
Eastern Cape	253 (5.8)	1	0.33-3.03	0.994
Northern Cape	143 (15.8)	4.63	1.67-12.87	0.003
Free State	133 (22.7)	4.83	1.67-14.02	0.004
KwaZulu natal	389 (12.0)	2.29	0.76-6.87	0.139
North West	175 (7.2)	0.98	0.29-3.29	0.978
Gauteng	373 (16.4)	3.06	1.12-8.34	0.029
Mpumalanga	85 (15.8)	2.84	0.81-10.02	0.104
Limpopo	137 (8.3)	1.63	0.50-5.31	0.420
Race: African or other				
Not African	854 (4.4)	1		
African	1162 (13.3)	2.57	1.33-4.99	0.005
10-year birth cohort				
Pre-1950	281 (5.4)	0.54	0.15-1.97	0.351
1950-59	298 (11.9)	1.58	0.61-4.11	0.347
1960-69	349 (17.9)	2.63	1.13-6.15	0.025
1970-79	425 (17.2)	2.84	1.28-6.27	0.010
1980-89	663 (6.5)	1		
Biggest age gap in last year				
No partner	609 (6.0)	0.75	0.35-1.60	0.452
0-4 years	816 (10.9)	1		
5-9 years	390 (11.8)	1.02	0.56-1.84	0.954
10+ years	201 (25.6)	3.58	1.72-7.48	0.001
Circumcised before first sex				
No	1664 (12.2)	1		
Yes	352 (7.0)	0.53	0.29-0.99	0.047
Had HIV test, by reason				
Never tested	1566 (11.8)	1		
Curiosity	62 (22.7)	1.52	0.60-3.87	0.377
New P/P request	6 (7.6)	0.33	0.02-5.63	0.447
Insurance/Loan/Employment/Unrelated medical/blood donor	262 (5.0)	0.36	0.16-0.83	0.017
Sick/HW referred/Partner or child sick/HIV+/died	42 (5.0)	0.25	0.06-1.13	0.072
Pregnancy	4 (0.0)			
Reason missing	74 (11.3)	1.39	0.46-4.22	0.564

MEN 2005

N=3828	N (% HIV+)	Adj OR	95% CI	p-value
Province				
Western Cape	606 (1.1)	1		
Eastern Cape	483 (10.3)	4.89	1.72-13.95	0.003
Northern Cape	239 (5.0)	4.37	1.37-13.97	0.013
Free State	267 (13.4)	3.72	1.18-11.70	0.025
KwaZulu natal	640 (15.0)	7.42	3.02-18.20	0.000
North West	293 (14.6)	4.78	1.87-12.26	0.001
Gauteng	642 (9.1)	3.4	1.38-8.42	0.008
Mpumalanga	304 (19.3)	7.78	3.15-19.23	0.000
Limpopo	354 (6.1)	2.43	0.88-6.71	0.086
Race: African or other				
Not African	1567 (1.4)	1		
African	2261 (13.8)	7.91	4.31-14.51	0.000
10-year birth cohort				
Pre-1950	495 (2.8)	0.52	0.20-1.38	0.191
1950-59	464 (13.3)	2.52	1.26-5.04	0.009
1960-69	648 (19.4)	4.27	2.26-8.06	0.000
1970-79	608 (18.6)	4.57	2.51-8.33	0.000
1980-89	1426 (4.9)	1		
1990-94	187 (1.9)	0.33	0.09-1.18	0.088
Biggest age gap in last year				
No partner	1397 (5.7)	1.02	0.60-1.74	0.949
0-4 years	1362 (9.9)	1		
5-9 years	658 (14.5)	1.15	0.70-1.91	0.582
10+ years	411 (21.2)	1.85	1.09-3.14	0.022
Education				
None	277 (9.3)	1		
Primary	790 (15.6)	1.77	0.93-3.39	0.082
Secondary	2378 (10.6)	1.48	0.78-2.81	0.226
Tertiary	383 (3.2)	0.4	0.17-0.97	0.043
Had HIV test, by reason				
Never tested	2765 (9.7)	1		
Curiosity	462 (12.1)	0.91	0.54-1.52	0.705
New P/P request	19 (9.8)	1.58	0.37-6.78	0.542
Insurance/Loan/Employment/Unrelated medical/blood donor	379 (7.5)	1.52	0.70-3.30	0.285
Sick/HW referred/Partner or child sick/HIV+/died	120 (37.8)	3.72	1.83-7.55	0.000
Pregnancy	4 (22.9)	5.21	0.46-58.55	0.181
HIV test history missing	79 (2.4)	0.65	0.12-3.61	0.622

MEN 2008

N=2944	N (% HIV+)	Adj OR	95% CI	p-value
Province				
Western Cape	518 (2.5)	1	1.00-1.00	.
Eastern Cape	427 (11.4)	2.49	0.99-6.27	0.052
Northern Cape	251 (5.9)	2.4	0.82-6.97	0.109
Free State	189 (7.6)	1.8	0.64-5.07	0.266
KwaZulu natal	443 (18.2)	5.05	2.08-12.25	0.000
North West	265 (11.7)	2.6	1.04-6.53	0.042
Gauteng	434 (9.5)	2.57	0.96-6.85	0.059
Mpumalanga	178 (15.7)	3.19	1.16-8.77	0.025
Limpopo	239 (4.9)	0.82	0.30-2.24	0.702
Race: African or other				
Not African	1309 (0.7)	1		
African	1635 (13.5)	14.32	6.14-33.39	0.000
10-year birth cohort				
Pre-1950	292 (4.8)	0.86	0.39-1.88	0.704
1950-59	299 (7.5)	1.21	0.58-2.49	0.614
1960-69	398 (15.4)	2.67	1.33-5.36	0.006
1970-79	427 (22.5)	4.84	2.83-8.30	0.000
1980-89	897 (6.5)	1	1.00-1.00	.
1990-94	631 (3.2)	0.55	0.14-2.19	0.398
Had a CSW partner in last year				
No	2931 (10.0)	1	1.00-1.00	.
Yes	13 (30.2)	2.89	0.89-9.42	0.078
Had HIV test, by reason				
Never tested	1736 (7.6)	1	1.00-1.00	.
Curiosity	635 (15.3)	1.9	1.20-3.01	0.006
New P/P request	19 (9.8)	1.07	0.24-4.74	0.932
Insurance/Loan/Employment/Unrelated medical/blood donor	292 (3.7)	1.09	0.34-3.47	0.879
Sick/HW referred/Partner or child sick/HIV+/died	147 (31.7)	4.92	2.59-9.35	0.000
Pregnancy	7 (7.7)	0.24	0.01-5.64	0.376
Campaign	76 (1.6)	0.31	0.05-1.87	0.201
Exposure	11 (27.0)	2.34	0.30-18.06	0.413
Reason missing	21 (3.2)	0.27	0.04-1.94	0.195
HIV test history missing	75 (0.0)			
How often respondent sees internet				
Never	2286 (12.6)	1	1.00-1.00	.
Once a week	185 (0.4)	0.03	0.01-0.10	0.000
2-6 days a week	176 (3.8)	0.53	0.14-2.03	0.351
Every day	297 (0.7)	0.08	0.01-0.45	0.004

WOMEN 2002

N=2666	N (% HIV+)	Adj OR	95% CI	p-value
Province				
Western Cape	441 (11.1)	1		
Eastern Cape	365 (9.4)	0.72	0.36-1.46	0.360
Northern Cape	214 (9.2)	0.71	0.33-1.51	0.369
Free State	180 (15.6)	1.1	0.44-2.74	0.841
KwaZulu natal	519 (12.4)	0.89	0.50-1.61	0.709
North West	180 (16.6)	1.09	0.52-2.26	0.827
Gauteng	413 (22.1)	1.19	0.65-2.19	0.569
Mpumalanga	162 (14.7)	1.54	0.68-3.48	0.295
Limpopo	192 (10.0)	0.92	0.40-2.10	0.839
Race: African or other				
Not African	1114 (5.9)	1		
African	1552 (16.1)	3.37	1.81-6.26	0.000
EA geotype				
Urban formal	1663 (16.2)	1		
Urban informal	260 (26.2)	1.23	0.80-1.89	0.355
Tribal area	580 (8.9)	0.49	0.29-0.83	0.008
Rural formal	163 (12.2)	0.89	0.34-2.32	0.816
10-year birth cohort				
Pre-1950	476 (6.1)	1	0.45-2.26	0.994
1950-59	398 (13.1)	1.45	0.69-3.06	0.328
1960-69	527 (14.7)	1.35	0.72-2.54	0.350
1970-79	622 (23.4)	1.85	1.04-3.30	0.036
1980-89	643 (10.6)	1		
1990-94	1286 (0.0)			
Marital status				
Single	1178 (18.8)	1		
Married	1084 (9.6)	0.44	0.28-0.69	0.000
Unmarried cohabiting	49 (13.6)	0.42	0.13-1.35	0.145
Formerly married	355 (10.8)	0.66	0.35-1.25	0.203
Sexual activity in last year				
Never had sex	382 (5.8)	1		
Not in last year	646 (8.8)	2.13	0.87-5.21	0.099
In last year	1638 (17.8)	4	1.99-8.04	0.000
Had HIV test, by reason				
Never tested	2009 (13.0)	1		
Curiosity	54 (29.0)	1.67	0.55-5.03	0.361
New P/P request	11 (6.2)	0.2	0.02-2.54	0.214
Insurance/Loan/Employment/Unrelated medical/blood donor	237 (6.7)	0.52	0.26-1.07	0.077
Sick/HW referred/Partner or child sick/HIV+/died	52 (44.9)	2.3	0.68-7.80	0.180
Pregnancy	209 (17.1)	0.76	0.40-1.45	0.402
Had HIV test, by reason	779 (0.0)			
Campaign	67 (0.0)			
Exposure	94 (20.9)			
Reason missing	28 (0.0)	1.13	0.37-3.45	0.831
HIV test history missing				
How often respondent sees internet				
Never	2456 (14.6)	1		
Once a week	84 (2.2)	0.12	0.02-0.81	0.030
2-6 days a week	57 (9.0)	0.53	0.10-2.76	0.450
Every day	69 (6.7)	0.72	0.17-3.07	0.655
How often respondent sees newspaper				
Never	1201 (11.5)	1		
Once a week	628 (18.1)	1.47	0.96-2.27	0.077
2-6 days a week	480 (20.0)	2.12	1.24-3.61	0.006
Every day	357 (9.5)	0.74	0.32-1.71	0.480

WOMEN 2005

N=6404	N (% HIV+)	Adj OR	95% CI	p-value
Province				
Western Cape	884 (4.1)	1		
Eastern Cape	1051 (14.0)	1.16	0.63-2.17	0.631
Northern Cape	375 (8.9)	1.93	0.86-4.30	0.110
Free State	439 (23.0)	2.53	1.23-5.21	0.011
KwaZulu natal	1171 (21.9)	2.34	1.31-4.18	0.004
North West	442 (17.1)	1.32	0.67-2.60	0.415
Gauteng	961 (17.4)	1.86	1.04-3.32	0.036
Mpumalanga	442 (22.6)	2.42	1.30-4.50	0.005
Limpopo	639 (12.7)	1.02	0.52-1.99	0.964
Race: African or other				
Not African	2319 (1.5)	1		
African	4085 (20.7)	8.7	5.12-14.78	0.000
EA geotype				
Urban formal	3445 (13.7)	1		
Urban informal	739 (27.7)	1.21	0.87-1.69	0.252
Tribal area	1677 (18.7)	0.93	0.69-1.25	0.616
Rural formal	543 (12.4)	0.63	0.38-1.06	0.082
10-year birth cohort				
Pre-1950	1042 (3.6)	0.19	0.09-0.41	0.000
1950-59	920 (7.9)	0.42	0.24-0.72	0.002
1960-69	1209 (16.3)	0.99	0.65-1.50	0.947
1970-79	1103 (26.8)	1.52	1.05-2.19	0.027
1980-89	1908 (20.6)	1		
1990-94	222 (6.5)	0.74	0.29-1.91	0.538
Education				
None	702 (12.2)	1		
Primary	1425 (16.8)	1.06	0.58-1.92	0.8594
Secondary	3799 (19.0)	1.17	0.69-1.98	0.5554
Tertiary	478 (7.5)	0.64	0.32-1.29	0.2134
Marital status				
Single	2831 (23.3)	1		
Married	2258 (10.4)	0.44	0.31-0.60	0.000
Unmarried cohabiting	244 (20.3)	0.58	0.32-1.06	0.076
Formerly married	1071 (12.4)	0.92	0.59-1.42	0.693
Sexual activity in last year				
Never had sex	924 (5.4)	1		
Not in last year	1993 (13.8)	4.54	2.34-8.80	0.000
In last year	3487 (20.6)	4.89	2.71-8.82	0.000
Biggest age gap in last year				
No partner	2917 (11.4)	DROPPED		
0-4 years	2014 (18.6)	1		
5-9 years	970 (20.9)	1.17	0.84-1.63	0.363
10+ years	503 (27.4)	1.58	1.06-2.35	0.024
Had a CSW partner in last year				
No	6285 (16.6)	1		
Yes	119 (25.4)	0.65	0.33-1.30	0.223
Had a non-regular partner in last year				
No	6385 (16.7)	1		
Yes	19 (42.5)	3.27	0.96-11.22	0.059
>1 partner currently				
No	6336 (16.4)	1		
Yes	67 (52.5)	4.29	2.10-8.76	0.000

Continued on next page

WOMEN 2005 N=6404	N (% HIV+)	Adj OR	95% CI	p-value
Had HIV test, by reason				
Never tested	4380 (15.5)	1		
Curiosity	668 (22.6)	0.98	0.69-1.39	0.904
New P/P request	30 (15.4)	0.47	0.11-2.02	0.312
Insurance/Loan/Employment/Unrelated medical/blood donor	296 (2.4)	0.69	0.26-1.84	0.456
Sick/HW referred/Partner or child sick/HIV+/died	242 (26.6)	1.79	1.07-2.99	0.027
Pregnancy	680 (23.4)	1.01	0.69-1.47	0.959
HIV test history missing	108 (4.2)	0.39	0.07-2.06	0.266
How often respondent sees internet				
Never	5862 (17.9)	1		
Once a week	207 (3.4)	0.43	0.17-1.07	0.071
2-6 days a week	117 (4.6)	1.21	0.38-3.89	0.748
Every day	218 (4.3)	0.42	0.15-1.18	0.100
How often respondent sees tv				
Never	1479 (20.2)	1		
Once a week	332 (12.8)	0.59		
2-6 days a week	545 (13.8)	0.77	0.48-1.25	0.292
Every day	4048 (15.7)	0.97	0.71-1.34	0.856
Gone without cash				
Never	3170 (11.9)	1		
Rarely	380 (17.0)	1.08	0.65-1.80	0.756
Sometimes	1864 (21.3)	1.45	1.11-1.91	0.007
Often	990 (21.7)	1.58	1.15-2.17	0.005
Gone without shelter				
Never	6266 (16.6)	1		
Rarely	38 (5.9)	0.19	0.04-0.80	0.024
Sometimes	47 (39.0)	1.85	0.73-4.69	0.192
Often	53 (25.0)	1.41	0.66-3.02	0.372

WOMEN 2008

N=4751	N (% HIV+)	Adj OR	95% CI	p-value
Province				
Western Cape	682 (6.5)	1		
Eastern Cape	694 (14.8)	1.18	0.65-2.17	0.582
Northern Cape	365 (6.2)	0.82	0.35-1.95	0.658
Free State	323 (17.4)	1.56	0.86-2.81	0.141
KwaZulu natal	854 (22.6)	2.03	1.17-3.55	0.012
North West	401 (16.1)	1.15	0.60-2.18	0.675
Gauteng	756 (16.5)	1.42	0.82-2.47	0.209
Mpumalanga	273 (26.9)	2.42	1.25-4.70	0.009
Limpopo	403 (16.8)	1.13	0.58-2.19	0.727
EA geotype				
Urban formal	2758 (13.0)	1		
Urban informal	626 (29.6)	1.57	1.10-2.24	0.014
Tribal area	1054 (19.4)	0.99	0.69-1.40	0.939
Rural formal	313 (18.1)	1.09	0.63-1.87	0.769
Race: African or other				
Not African	1816 (1.4)	1		
African	2935 (21.7)	9.08	5.27-15.63	0.000
Year of birth and whether married (yes/no)				
1990-94 No	640 (5.1)	0.37	0.21-0.65	0.001
1980-89 No	1106 (24.1)	1		
1970-79 No	441 (35.4)	1.12	0.69-1.81	0.656
1960-69 No	410 (28.5)	0.67	0.31-1.43	0.299
1950-59 No	288 (17.2)	0.23	0.08-0.65	0.006
Pre-1950 No	420 (1.8)	0.01	0.00-0.06	0.000
1990-94 Yes	7 (40.4)	2.36	0.37-15.18	0.366
1980-89 Yes	180 (16)	0.67	0.34-1.31	0.243
1970-79 Yes	329 (11.5)	0.36	0.19-0.67	0.001
1960-69 Yes	421 (9.6)	0.2	0.08-0.47	0.000
1950-59 Yes	289 (4.6)	0.07	0.02-0.23	0.000
Pre-1950 Yes	220 (1.6)	0.02	0.00-0.12	0.000
Education				
None	298 (14.5)	1		
Primary	911 (18.0)	0.88	0.53-1.47	0.628
Secondary	3129 (18.7)	0.9	0.54-1.51	0.690
Tertiary	413 (5.3)	0.4	0.18-0.89	0.025
Sexual activity in last year				
Never had sex	724 (3.7)	1		
Not in last year	1440 (15.6)	7.25	3.31-15.90	0.000
In last year	2587 (20.5)	8.84	4.20-18.64	0.000
Had HIV test, by reason				
Never tested	2195 (11.8)	1		
Curiosity	1055 (24.3)	1.3	0.95-1.79	0.101
New P/P request	22 (1.1)	0.06	0.01-0.47	0.008
Insurance/Loan/Employment/Unrelated medical/blood donor	301 (0.9)	0.23	0.08-0.72	0.011
Sick/HW referred/Partner or child sick/HIV+/died	272 (28.7)	2.02	1.19-3.43	0.009
Pregnancy	779 (21.5)	0.92	0.65-1.31	0.649
Campaign	67 (12.7)	2.29	0.59-8.87	0.231
Exposure	32 (2.8)	0.22	0.04-1.29	0.094
Reason missing	28 (40.1)	4.54	1.11-18.50	0.035
Years since first sex				
tfs	median 17	1.04	1.01-1.07	0.017
How often respondent sees internet				
Never	3985 (19.3)	1		
Once a week	216 (6.3)	0.47	0.19-1.14	0.095
2-6 days a week	182 (15.1)	1.75	0.77-3.99	0.184
Every day	368 (1.6)	0.26	0.10-0.67	0.006

Section 1H. Trends over time in HIV prevalence (HSRC 2002 – 2008)

MEN	2002			2005			2008		
	Adj OR	95% CI	p-value	Adj OR	95% CI	p-value	Adj OR	95% CI	p-value
Race: African or other									
Not African	1			1			1		
African	2.57	1.33-4.99	0.005	7.91	4.31-14.51	0.000	14.32	6.14-33.39	0.000
10-year birth cohort									
Pre-1950	0.54	0.15-1.97	0.351	0.52	0.20-1.38	0.191	0.86	0.39-1.88	0.704
1950-59	1.58	0.61-4.11	0.347	2.52	1.26-5.04	0.009	1.21	0.58-2.49	0.614
1960-69	2.63	1.13-6.15	0.025	4.27	2.26-8.06	0.000	2.67	1.33-5.36	0.006
1970-79	2.84	1.28-6.27	0.010	4.57	2.51-8.33	0.000	4.84	2.83-8.30	0.000
1980-89	1			1			1		
1990-94				0.33	0.09-1.18	0.088	0.55	0.14-2.19	0.398
Biggest age gap in last year									
No partner	0.75	0.35-1.60	0.452	1.02	0.60-1.74	0.949			
0-4 years	1			1					
5-9 years	1.02	0.56-1.84	0.954	1.15	0.70-1.91	0.582			
10+ years	3.58	1.72-7.48	0.001	1.85	1.09-3.14	0.022			
Circumcised before first sex									
No	1								
Yes	0.53	0.29-0.99	0.047						
Had CSW partner in last year									
No							1		
Yes							2.89	0.89-9.42	0.078
Education									
None				1	1.00-1.00	.			
Primary				1.77	0.93-3.39	0.082			
Secondary				1.48	0.78-2.81	0.226			
Tertiary				0.4	0.17-0.97	0.043			
Had HIV test, by reason									
Never tested	1			1			1		
Curiosity	1.52	0.60-3.87	0.377	0.91	0.54-1.52	0.705	1.9	1.20-3.01	0.006
New P/P request	0.33	0.02-5.63	0.447	1.58	0.37-6.78	0.542	1.07	0.24-4.74	0.932
Insurance/Loan/Employmt/Unrel. medical/blood donor	0.36	0.16-0.83	0.017	1.52	0.70-3.30	0.285	1.09	0.34-3.47	0.879
Sick/HW referred/Partner or child sick/HIV+/died	0.25	0.06-1.13	0.072	3.72	1.83-7.55	0.000	4.92	2.59-9.35	0.000
Pregnancy				5.21	0.46-58.55	0.181	0.24	0.01-5.64	0.376
Campaign							0.31	0.05-1.87	0.201
Exposure							2.34	0.30-18.06	0.413
Reason missing	1.39	0.46-4.22	0.564				0.27	0.04-1.94	0.195
HIV test history missing				0.65	0.12-3.61	0.622			
How often sees internet									
Never							1		
Once a week							0.03	0.01-0.10	0.000
2-6 days a week							0.53	0.14-2.03	0.351
Every day							0.08	0.01-0.45	0.004
Province									
Western Cape	1			1			1		
Eastern Cape	1	0.33-3.03	0.994	4.89	1.72-13.95	0.003	2.49	0.99-6.27	0.052
Northern Cape	4.63	1.67-12.87	0.003	4.37	1.37-13.97	0.013	2.4	0.82-6.97	0.109
Free State	4.83	1.67-14.02	0.004	3.72	1.18-11.70	0.025	1.8	0.64-5.07	0.266
KwaZulu Natal	2.29	0.76-6.87	0.139	7.42	3.02-18.20	0.000	5.05	2.08-12.25	0.000
North West	0.98	0.29-3.29	0.978	4.78	1.87-12.26	0.001	2.6	1.04-6.53	0.042
Gauteng	3.06	1.12-8.34	0.029	3.4	1.38-8.42	0.008	2.57	0.96-6.85	0.059
Mpumalanga	2.84	0.81-10.02	0.104	7.78	3.15-19.23	0.000	3.19	1.16-8.77	0.025
Limpopo	1.63	0.50-5.31	0.420	2.43	0.88-6.71	0.086	0.82	0.30-2.24	0.702

Section 1H. Trend over Time in HIV prevalence (HSRC 2002, 2005, 2008)

	Men crude			Men adjusted			Women crude			Women adjusted		
	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value
Year												
2002	1.09	0.79-1.50	0.5899	1.03	0.73-1.44	0.883	**0.77**	**0.61-0.97**	**0.0277**	0.8	0.62-1.02	0.069
2005	1.12	0.84-1.49	0.4418	1.03	0.76-1.38	0.855	0.98	0.82-1.17	0.8009	0.96	0.81-1.15	0.687
2008	1			1			1			1		
Province												
Western Cape				1						1		
Eastern Cape				**2.63**	**1.42-4.86**	**0.002**				0.89	0.61-1.31	0.559
Northern Cape				**3.49**	**1.81-6.74**	**0.000**				1.09	0.68-1.76	0.713
Free State				**2.87**	**1.53-5.39**	**0.001**				1.36	0.89-2.08	0.154
KwaZulu natal				**4.53**	**2.62-7.84**	**0.000**				**1.52**	**1.08-2.16**	**0.017**
North West				**2.68**	**1.52-4.72**	**0.001**				1.03	0.70-1.54	0.868
Gauteng				**2.24**	**1.31-3.83**	**0.003**				1.39	0.98-1.98	0.066
Mpumalanga				**4.1**	**2.33-7.22**	**0.000**				**1.68**	**1.14-2.48**	**0.009**
Limpopo				1.69	0.88-3.25	0.112				0.83	0.55-1.27	0.399
Type of settlement												
Urban formal				1						1		
Urban informal				1.13	0.81-1.57	0.480				**1.3**	**1.04-1.62**	**0.020**
Tribal area				0.87	0.61-1.25	0.459				0.92	0.74-1.14	0.427
Rural area				0.84	0.47-1.48	0.542				0.95	0.66-1.37	0.771
Respondent is African												
No				1						1		
Yes				**8.15**	**5.52-12.04**	**0.000**				**8.27**	**5.68-12.06**	**0.000**
Age group												
16-19				0.55	0.26-1.17	0.119				**0.33**	**0.24-0.45**	**0.000**
20-24				1						1		
25-29				**2.73**	**1.72-4.33**	**0.000**				**2.34**	**1.81-3.03**	**0.000**
30-34				**5.87**	**3.72-9.27**	**0.000**				**2**	**1.53-2.63**	**0.000**
35-39				**6.13**	**3.76-10.01**	**0.000**				**1.37**	**1.04-1.80**	**0.026**
40-44				**3.95**	**2.26-6.88**	**0.000**				1.15	0.83-1.59	0.413
45-49				**2.53**	**1.43-4.49**	**0.001**				0.88	0.59-1.30	0.506
50-55				**2.31**	**1.25-4.29**	**0.008**				**0.57**	**0.38-0.85**	**0.006**
Highest level of education completed												
None				1						1		
Primary				1.62	0.91-2.88	0.101				1.15	0.76-1.74	0.496
Secondary				1.5	0.85-2.64	0.163				1.12	0.75-1.68	0.575
Tertiary				0.62	0.28-1.41	0.258				**0.42**	**0.25-0.71**	**0.001**
Marital Status												
Single				1						1		
Married				0.88	0.62-1.26	0.495				**0.43**	**0.35-0.54**	**0.000**
Unmarried cohabiting				1.33	0.82-2.17	0.254				**0.66**	**0.45-0.95**	**0.025**
Formerly married				1.29	0.77-2.16	0.339				0.92	0.67-1.25	0.582

Section J. Trend over time in proportion of reporting multiple partners in last year (all five surveys, men only)

More than partner in the last year, men only

		OR	95% CI	p-value
Year				
	2002	0.86	0.64-1.17	0.345
	2005	1.02	0.79-1.32	0.870
	2006	**1.52**	**1.26-1.84**	**0.000**
	2008	1		
	2009	0.99	0.79-1.24	0.948
Province				
Western Cape		1		
Eastern Cape		**0.5**	**0.36-0.69**	**0.000**
Northern Cape		**0.53**	**0.41-0.69**	**0.000**
Free State		**0.44**	**0.32-0.61**	**0.000**
KwaZulu natal		**0.72**	**0.56-0.94**	**0.015**
North West		**0.55**	**0.40-0.75**	**0.000**
Gauteng		**0.54**	**0.42-0.70**	**0.000**
Mpumalanga		**0.53**	**0.37-0.76**	**0.001**
Limpopo		**0.72**	**0.50-1.03**	**0.071**
Type of settlement				
Rural		1		
Urban		1.03	0.76-1.40	0.865
Informal		**0.76**	**0.60-0.97**	**0.027**
Formal		**0.77**	**0.59-0.99**	**0.043**
Respondent is African				
No		1		
Yes		**2.74**	**2.14-3.51**	**0.000**
Age group				
15-19		1		
20-24		**2.23**	**1.77-2.80**	**0.000**
25-29		**2.41**	**1.87-3.09**	**0.000**
30-34		**1.67**	**1.17-2.38**	**0.005**
35-39		**1.98**	**1.41-2.78**	**0.000**
40-44		**1.92**	**1.33-2.78**	**0.001**
45-49		1.37	0.80-2.33	0.248
50-54		1.22	0.67-2.20	0.520
55-59		0.38	0.10-1.41	0.149
Marital Status				
Single		1		
Married		**0.33**	**0.25-0.44**	**0.000**
Unmarried cohabiting		0.78	0.55-1.12	0.178
Formerly married		1.01	0.67-1.52	0.979

Section 1H. Trend over Time in HIV prevalence (HSRC 2002, 2005, 2008)

	Men crude			Men adjusted			Women crude			Women adjusted		
	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value
Year												
2002	1.09	0.79-1.50	0.5899	1.03	0.73-1.44	0.883	**0.77**	**0.61-0.97**	**0.0277**	0.8	0.62-1.02	0.069
2005	1.12	0.84-1.49	0.4418	1.03	0.76-1.38	0.855	0.98	0.82-1.17	0.8009	0.96	0.81-1.15	0.687
2008	1			1			1			1		
Province												
Western Cape				1						1		
Eastern Cape				**2.63**	**1.42-4.86**	**0.002**				0.89	0.61-1.31	0.559
Northern Cape				**3.49**	**1.81-6.74**	**0.000**				1.09	0.68-1.76	0.713
Free State				**2.87**	**1.53-5.39**	**0.001**				1.36	0.89-2.08	0.154
KwaZulu natal				**4.53**	**2.62-7.84**	**0.000**				**1.52**	**1.08-2.16**	**0.017**
North West				**2.68**	**1.52-4.72**	**0.001**				1.03	0.70-1.54	0.868
Gauteng				**2.24**	**1.31-3.83**	**0.003**				1.39	0.98-1.98	0.066
Mpumalanga				**4.1**	**2.33-7.22**	**0.000**				**1.68**	**1.14-2.48**	**0.009**
Limpopo				1.69	0.88-3.25	0.112				0.83	0.55-1.27	0.399
Type of settlement												
Urban formal				1						1		
Urban informal				1.13	0.81-1.57	0.480				**1.3**	**1.04-1.62**	**0.020**
Tribal area				0.87	0.61-1.25	0.459				0.92	0.74-1.14	0.427
Rural area				0.84	0.47-1.48	0.542				0.95	0.66-1.37	0.771
Respondent is African												
No				1						1		
Yes				**8.15**	**5.52-12.04**	**0.000**				**8.27**	**5.68-12.06**	**0.000**
Age group												
16-19				0.55	0.26-1.17	0.119				**0.33**	**0.24-0.45**	**0.000**
20-24				1						1		
25-29				**2.73**	**1.72-4.33**	**0.000**				**2.34**	**1.81-3.03**	**0.000**
30-34				**5.87**	**3.72-9.27**	**0.000**				**2**	**1.53-2.63**	**0.000**
35-39				**6.13**	**3.76-10.01**	**0.000**				**1.37**	**1.04-1.80**	**0.026**
40-44				**3.95**	**2.26-6.88**	**0.000**				1.15	0.83-1.59	0.413
45-49				**2.53**	**1.43-4.49**	**0.001**				0.88	0.59-1.30	0.506
50-55				**2.31**	**1.25-4.29**	**0.008**				**0.57**	**0.38-0.85**	**0.006**
Highest level of education completed												
None				1						1		
Primary				1.62	0.91-2.88	0.101				1.15	0.76-1.74	0.496
Secondary				1.5	0.85-2.64	0.163				1.12	0.75-1.68	0.575
Tertiary				0.62	0.28-1.41	0.258				**0.42**	**0.25-0.71**	**0.001**
Marital Status												
Single				1						1		
Married				0.88	0.62-1.26	0.495				**0.43**	**0.35-0.54**	**0.000**
Unmarried cohabiting				1.33	0.82-2.17	0.254				**0.66**	**0.45-0.95**	**0.025**
Formerly married				1.29	0.77-2.16	0.339				0.92	0.67-1.25	0.582

Section I. Men CSW outcome model (HSRC 2008)

Men aged 15+ with complete data, HSRC 2008 (N=2944)

Logistic regression model, N 2,942*	Adj. OR	95% CI	p-value
Had sex in last month			
No	1		
Yes	23.51	2.49-221.63	0.0058
Ever listens to radio			
No	1		
Yes	0.2	0.06-0.65	0.0074
HIV test result			
Negative	1		
Positive	3.84	1.20-12.30	0.0233
Ever had an HIV test			
No	1		
Yes	0.07	0.02-0.29	0.0003
Had a non-regular partner in last year			
No	1		
Yes	10.1	2.46-41.45	0.0013

* Numbers differ because 2 respondents drop out of model because both were missing HIV test history and had not had sex with CSW

WOMEN	2002			2005			2008		
	Adj OR	95% CI	p-value	Adj OR	95% CI	p-value	Adj OR	95% CI	p-value
Sexual activity in last year									
Never had sex	1			1			1		
Not in last year	2.13	0.87-5.21	0.099	4.54	2.34-8.80	0.000	7.25	3.31-15.90	0.000
In last year	4	1.99-8.04	0.000	4.9	2.71-8.84	0.000	8.84	4.20-18.64	0.000
Race: African or other									
Not African	1			1			1		
African	3.37	1.81-6.26	0.000	8.73	5.14-14.83	0.000	9.08	5.27-15.63	0.000
10-year birth cohort									
Pre-1950	1	0.45-2.26	0.994	0.19	0.09-0.41	0.000			
1950-59	1.45	0.69-3.06	0.328	0.42	0.24-0.72	0.002			
1960-69	1.35	0.72-2.54	0.350	0.98	0.65-1.49	0.929			
1970-79	1.85	1.04-3.30	0.036	1.51	1.04-2.18	0.029			
1980-89	1			1					
1990-94				0.74	0.29-1.90	0.536			
group(bc10 married)									
1990-94 No							0.37	0.21-0.65	0.001
1980-89 No							1		
1970-79 No							1.12	0.69-1.81	0.656
1960-69 No							0.67	0.31-1.43	0.299
1950-59 No							0.23	0.08-0.65	0.006
Pre-1950 No							0.01	0.00-0.06	0.000
1990-94 Yes							2.36	0.37-15.18	0.366
1980-89 Yes							0.67	0.34-1.31	0.243
1970-79 Yes							0.36	0.19-0.67	0.001
1960-69 Yes							0.2	0.08-0.47	0.000
1950-59 Yes							0.07	0.02-0.23	0.000
Pre-1950 Yes							0.02	0.00-0.12	0.000
Biggest age gap in last year									
No partner				dropped					
0-4 years				1					
5-9 years				1.17	0.84-1.64	0.349			
10+ years				1.58	1.06-2.35	0.023			
Had CSW partner in last year									
No				1					
Yes				0.65	0.33-1.30	0.222			
Education									
None				1			1		
Primary				1.06	0.58-1.92	0.856	0.88	0.53-1.47	0.628
Secondary				1.17	0.69-1.97	0.567	0.9	0.54-1.51	0.690
Tertiary				0.64	0.32-1.28	0.207	0.4	0.18-0.89	0.025
EA geotype									
Urban formal	1			1			1		
Urban informal	1.23	0.80-1.89	0.355	1.21	0.87-1.68	0.257	1.57	1.10-2.24	0.014
Tribal area	0.49	0.29-0.83	0.008	0.92	0.68-1.24	0.593	0.99	0.69-1.40	0.939
Rural formal	0.89	0.34-2.32	0.816	0.63	0.38-1.05	0.078	1.09	0.63-1.87	0.769
Gone without cash									
Never				1					
Rarely				1.08	0.65-1.80	0.757			
Sometimes				1.46	1.11-1.92	0.007			
Often				1.58	1.15-2.17	0.005			

Continued on next page

WOMEN	2002			2005			2008		
	Adj OR	95% CI	p-value	Adj OR	95% CI	p-value	Adj OR	95% CI	p-value
Gone without shelter									
Never				1	1.00-1.00	.			
Rarely				0.19	0.04-0.80	0.024			
Sometimes				1.85	0.73-4.68	0.192			
Often				1.41	0.66-3.02	0.372			
Had HIV test, by reason									
Never tested	1			1			1		
Curiosity	1.67	0.55-5.03	0.361	0.98	0.69-1.39	0.905	1.3	0.95-1.79	0.101
New P/P request	0.2	0.02-2.54	0.214	0.47	0.11-2.02	0.310	0.06	0.01-0.47	0.008
Insurance/Loan/Employm/Unrel. medical/blood donor	0.52	0.26-1.07	0.077	0.69	0.26-1.84	0.459	0.23	0.08-0.72	0.011
Sick/HW referred/Partner or child sick/HIV+/died	2.3	0.68-7.80	0.180	1.79	1.07-2.99	0.027	2.02	1.19-3.43	0.009
Pregnancy	0.76	0.40-1.45	0.402	1.01	0.69-1.47	0.961	0.92	0.65-1.31	0.649
Campaign							2.29	0.59-8.87	0.231
Exposure							0.22	0.04-1.29	0.094
Reason missing	1.13	0.37-3.45	0.831				4.54	1.11-18.50	0.035
HIV test history missing				0.46	0.10-2.00	0.297			
How often sees internet									
Never	1			1			1		
Once a week	0.12	0.02-0.81	0.030	0.43	0.17-1.07	0.069	0.47	0.19-1.14	0.095
2-6 days a week	0.53	0.10-2.76	0.450	1.21	0.38-3.90	0.746	1.75	0.77-3.99	0.184
Every day	0.72	0.17-3.07	0.655	0.42	0.15-1.16	0.094	0.26	0.10-0.67	0.006
Marital status									
Single	1			1					
Married	0.44	0.28-0.69	0.000	0.43	0.31-0.60	0.000			
Unmarried cohabiting	0.42	0.13-1.35	0.145	0.58	0.32-1.05	0.074			
Formerly married	0.66	0.35-1.25	0.203	0.92	0.59-1.42	0.697			
>1 partner currently									
No				1					
Yes				4.28	2.10-8.73	0.000			
How often sees newspaper									
Never	1								
Once a week	1.47	0.96-2.27	0.077						
2-6 days a week	2.12	1.24-3.61	0.006						
Every day	0.74	0.32-1.71	0.480						
Had a non-regular partner in last year									
No				1					
Yes				3.27	0.96-11.21	0.059			
Province									
Western Cape	1			1			1		
Eastern Cape	0.72	0.36-1.46	0.360	1.17	0.63-2.18	0.621	1.18	0.65-2.17	0.582
Northern Cape	0.71	0.33-1.51	0.369	1.93	0.86-4.32	0.108	0.82	0.35-1.95	0.658
Free State	1.1	0.44-2.74	0.841	2.54	1.24-5.22	0.011	1.56	0.86-2.81	0.141
KwaZulu natal	0.89	0.50-1.61	0.709	2.35	1.32-4.21	0.004	2.03	1.17-3.55	0.012
North West	1.09	0.52-2.26	0.827	1.33	0.67-2.61	0.412	1.15	0.60-2.18	0.675
Gauteng	1.19	0.65-2.19	0.569	1.87	1.04-3.33	0.035	1.42	0.82-2.47	0.209
Mpumalanga	1.54	0.68-3.48	0.295	2.43	1.31-4.52	0.005	2.42	1.25-4.70	0.009
Limpopo	0.92	0.40-2.10	0.839	1.02	0.52-2.01	0.950	1.13	0.58-2.19	0.727
Years since first sex									
tfs							1.04	1.01-1.07	0.017
How often sees TV									
Never				1					
Once a week				0.59	0.36-0.98	0.040			
2-6 days a week				0.77	0.48-1.25	0.294			
Every day				0.97	0.71-1.34	0.868			

Annex 2. Analysis of age at first sex (all five surveys)

(E. Slaymaker)

This analysis included all five surveys (HSRC 2002, HSRC 2005, NCS 2006, HSCR 2009, NCS 2009). It addressed the following questions:

- Did the surveys yield different results?
- Has there been a change over time, assuming these surveys are representative

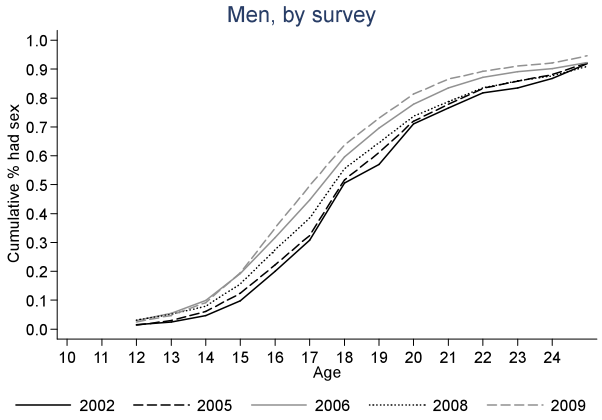
Methods

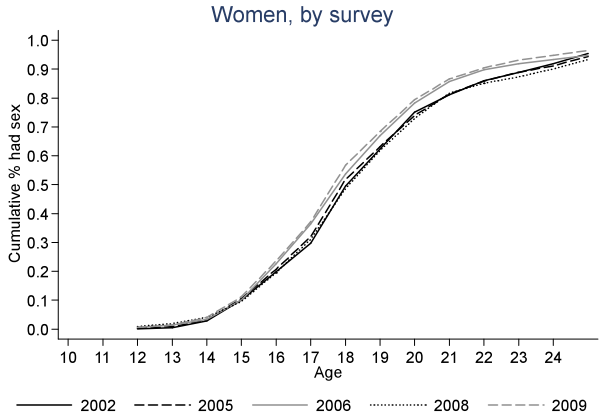
The analysis used the age at first sex (AFS) reported by each survey respondent. Respondents who had never had sex were included in the analysis at their current age and censored. Survival analysis used to estimate the cumulative proportion of respondents who reported having had sex by age.

Graphs show the failure functions (% had sex by age) for men and women for survey year (all ages combined) and for birth cohort (all surveys combined). The graphs by survey show whether the surveys yielded different results: some of this could be genuine changes as older people age out of the survey and younger people age in there may be some changes in AFS. However, given that the surveys cover seven years and that AFS remains constant over a lifetime we would not expect much change.

The graphs by birth cohort show whether there have been real changes in AFS over time. By pooling the data from the different surveys, any differences in response between surveys is minimised. On the graphs, a shift to the left indicates a younger age at first sex (a greater proportion have had sex at any given age).

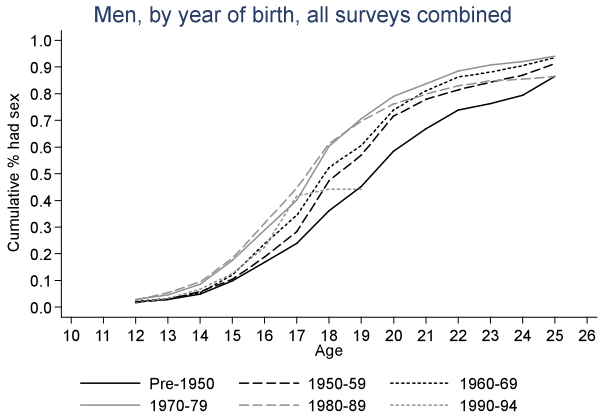
Results and Discussion

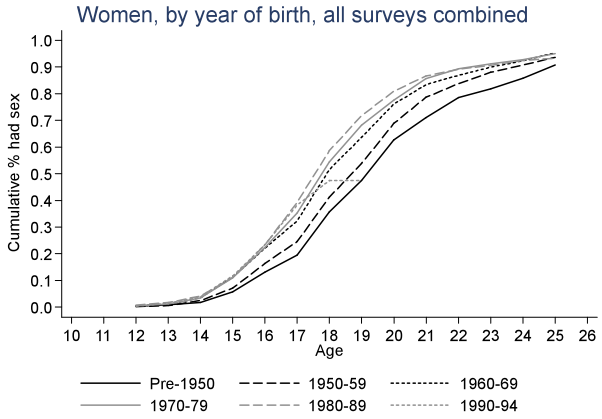




Men: Age at first sex reported in the NCS surveys was much younger than in the HSRC surveys. Survey seemed to have quite an impact on reported AFS.

Women: AFS reported in NCS slightly younger than in the HSRC but difference is less pronounced than for men.





Men: AFS was highest for men born before the 1950s and lowest for men born in the 1970s and 1980s. Men born in the 1990s might be starting sex later, but it is too early to tell as they are still very young.

Women: AFS has got steadily younger between those born before the 1950s and the cohort from the 1980s. Again, some evidence than those born in the 1990s may be starting sex later than those born in the 1980s.

Results from Cox regression models, controlling for year of survey and birth cohort, confirm that the differences apparent on the graph are unlikely to be due to chance.

For men, the NCS respondents reported a lower age at first sex - Hazard ratios (HR, describing the chance of having sex) are higher for NCS respondents in both 2006 and 2009 compared to the 2002 HSRC respondents. There is no difference between the three HSRC surveys.

For women respondents in the 2008 HSRC reported a higher age at first sex than 2002 respondents (HR is lower than 1) but there are no other differences.

For both men and women there has been a gradual decline in AFS over time for people born before 1950 up until the cohort born in the 1970s. Compared to men and women born in the 1980s (whose first sex occurred between the mid-1990s and the present), those born before 1950 were much less likely to have had sex at a given age (HR for men 0.69 (95% CI 0.62-0.76); HR for women 0.64 (95% CI 0.58-0.7).

Median AFS was 20 for men and women born before 1950 and 18 for those born in the 1980s. The decline in AFS continued until the 1980s for women, but not for men: the HR for women, comparing 1970s to 1980s, was 0.91 (p=0.02) whereas the HR for men showed no difference between these two groups - 1.01 (p=0.9).

For men, the cohort born the 1990-1994 appears to be starting sex later than the cohort born in the 1980s, the HR is 0.8, showing that the chance of starting sex has declined relative to the 1980s (p=0.02).

	Men			Women		
	HR	**95% CI**	**p-value**	**HR**	**95% CI**	**p-value**
2002	1			1		
2005	1.00	0.92-1.08	0.9810	0.95	0.88-1.03	0.1872
2006	**1.14**	**1.06-1.23**	**0.0005**	1.01	0.94-1.09	0.7532
2008	1.06	0.96-1.16	0.2415	**0.90**	**0.84-0.97**	**0.0056**
2009	**1.26**	**1.16-1.38**	**0.0000**	1.03	0.95-1.11	0.4892
pre 1950	**0.69**	**0.62-0.76**	**0.0000**	**0.64**	**0.58-0.70**	**0.0000**
1950-59	**0.80**	**0.72-0.89**	**0.0001**	**0.73**	**0.69-0.79**	**0.0000**
1960-69	**0.90**	**0.82-0.99**	**0.0242**	**0.87**	**0.78-0.97**	**0.0087**
1970-79	1.01	0.91-1.11	0.9111	**0.91**	**0.85-0.99**	**0.0213**
1980-89	1			1		
1990-94	**0.80**	**0.66-0.97**	**0.0231**	1.01	0.85-1.19	0.9344

Annex 3. Basic sexual concurrency analyses (NCS 2009)

(M. Morris & A. Leslie-Cook)

This report briefly explains how concurrency is measured using the variables in the NCS 2009 survey, and presents the descriptive findings for the estimates of cumulative and point prevalence. Results stratified by sex and race are weighted by the variable *fweight*. Results stratified by sex, race and province are not weighted, so that the small numbers in some cells are visible.

Measurement of Concurrency

Concurrency is typically measured at the individual level using a binary classification (1=yes, 0=no), and summarized at the population level using prevalence (the percent of persons classified as having a concurrent partner). The timeframe over which concurrency is measured gives rise to two general forms of concurrency, "point" and "cumulative", and a number of associated measures:

Time frame	**Individual level variables**	**Population level summaries**
Point in time	Point degree – *pdeg* Point concurrency – *pconc* Point concurrency time series – *pconc(t)*	Point prevalence – *pprev* Point prevalence time series – *pprev(t)*
Any time during the last 12 mos	Cumulative concurrency count – *ccount* Cumulative concurrency – *cconc*	Cumulative annual prevalence – *cprev*

The data from any specific survey may allow for additional measures, or require more detailed coding, depending on the survey instrument. From the NCS 2009 survey, four different measures of the point prevalence of concurrency and one measure of cumulative annual concurrency (we shorten this to "cumulative concurrency" below) can be constructed.

- The first measure of point prevalence is taken directly from question 3.10 – "How many sexual partners do you currently have?" The number of current partners is *pdegsum,* and any respondent answering 2 or more partners is classified as having a point concurrency in the variable *pconcsum*.

- The second measure of point prevalence is taken from questions 3.xx.16 – "Do you expect to have sex with him/her again?" The number of partnerships for which the respondent answers "yes" is *pdegnet,* and any respondents answering yes to more than one partners is classified as having a point concurrency in the variable *pconcnet*.

- The third measure of point prevalence, *pconcmax,* takes the maximum value of *pconcsum* and *pconcnet*, which codes cases that are inconsistent on these two measures as concurrent.

- The fourth point prevalence measure and the one cumulative prevalence measure are constructed using a combination of the active status questions (3.xx.16 from above), and the date questions: 3.xx.5 – "When was the first time you had sex with him/her?" and 3.xx.11 – "When was the last time you had sex with him/her?" These are used to construct the active interval for each partnership.

    - From these intervals, we estimate point concurrency time series, *pnum(t) and pconc(t)* (t = 0 to 12), that count the number of active partnerships at each month t

prior to the date of interview, and code respondents with 2 or more active partnerships at month *t* as concurrent for that month.

- The cumulative concurrency estimate is based on the overlap of all pairs of partnership intervals. There are five possible partners, so 10 possible pairs of partners. We count the number of interval pairs that are concurrent for each person, *ccount,* and respondents with at least one pair of overlapping partnership intervals are classified as having a cumulative concurrency in the variable *cconc*.

For all of the concurrency measures except those based on question 3.10, the potential for missing data, and for date ambiguity given the measurement scale (months), leads to some uncertainty in the classification of respondents. We track and label the level of certainty as follows:

0. No concurrency – the respondent has 2+ partners within the last year, but the dates for each partnership confirm that no relationships overlap

1. Dated concurrency – the date information from 2 or more partnerships confirm that at least one pair of partnerships overlap

2. Possible concurrency – the respondent has 2+ partners within the last year, but is either missing date information needed to establish interval overlap, or the start of the more recent partnership coincides with the end of the previous relationship.

96. Too few partners – the respondent had exactly 1 partner in the last year

97. No sex last year – the respondent has had sex, but not within the last year

98. Never had sex – the respondent has never had sex

Values 96-98 can be treated as 0, or as missing, depending on the denominator desired in the calculation of concurrency prevalence.

In this report, 96 and 97 were treated as 0 (no concurrency) and 98 as missing. The denominator for all percentages is the sexually active population.

Missing data: Throughout the point prevalence time series, less than 4% of the point concurrency variables for men had missing values, and for women, the missing percentage remained under 13% throughout. Missing cumulative concurrency values were assigned to less than 4% of men with 2+ partners in the last year, and almost 14% of women with multiple partners in the last year were assigned a missing cumulative concurrency value.

Data inconsistencies: Three types of data inconsistencies were analysed and it was generally found that inconsistent data were few.

Summary Results

Table 3.1 shows the concurrency estimates for the first three point prevalence measures, and for the cumulative annual prevalence measure, broken down by race and sex. The percents are based on the post-stratification population weights.

Table 3.1. Summary concurrency prevalence measures

		Point Prevalence				Cumulative Annual Prevalence	
		pconcsum	*pconcnet*		*pconcmax*		
			*min**	*max***		Min*	Max**
Men	African	**12.4**	**11.7**	**12.8**	**14.8**	**17.4**	**18.7**
	Coloured	**3.8**	**4.6**	**4.8**	**5.0**	**6.9**	**7.0**
	White	**1.9**	**1.9**	**1.9**	**2.7**	**2.7**	**2.9**
	Indian	**2.9**	**2.9**	**2.9**	**2.9**	**3.7**	**3.7**
Women	African	**0.9**	**0.9**	**1.2**	**1.5**	**1.7**	**2.2**
	Coloured	**0.4**	**0.2**	**0.2**	**0.6**	**1.4**	**2.1**
	White	**-**	**-**	**0.6**	**0.6**	**-**	**0.6**
	Indian	**-**	**-**		**-**	**-**	**-**

* Excludes "possible" category; ** Includes "possible" category

The results show large differences in the prevalence of reported concurrency by race, and by sex. **Rates are highest for African men by a substantial margin** – 3 to 4 times higher than the rates observed for Colored, and 5 to 6 times higher than the rates observed for Whites and Indians. **Rates for African women are higher than for other women, but the difference is much less dramatic, and the rates for all women are about 10 times lower than for men.**

Methodologically, the results show that there is some difference between the minimum and maximum estimates for both the point and cumulative measures. The range of uncertainty in the cumulative concurrency prevalence measure is relatively low. There is no uncertainty in the estimates for Indian men, because there was no missing data or ambiguous dating for the 146 men in the sample.

The detailed weighted numbers and percents for all of these variables are shown on the last pages of this annex in **tables 3.4 to 3.7**.

Figures 3.1 and 3.2 show the minimal and maximal point prevalence estimates at each month prior to the date of interview by sex. **Table 3.7** provides the minimum, maximum and mean summary statistics for each time series shown below.

Figure 3.1: Men's minimal and maximal point prevalence at each month prior to interview

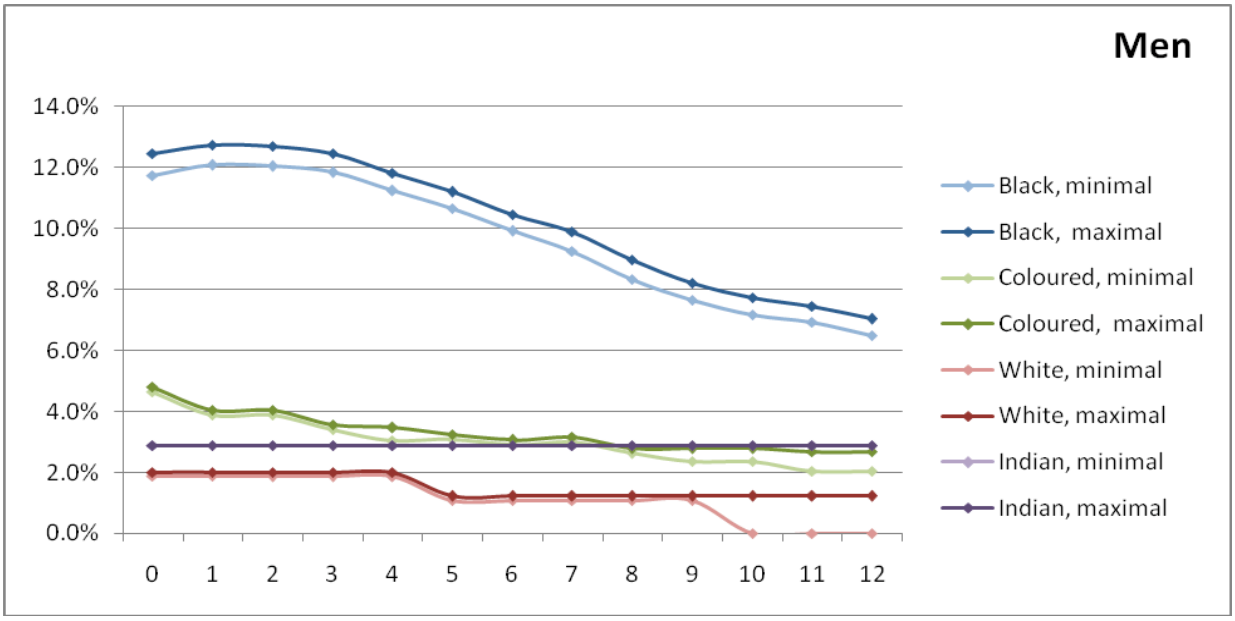


Figure 3.2: Women's minimal and maximal point prevalence at each month prior to interview

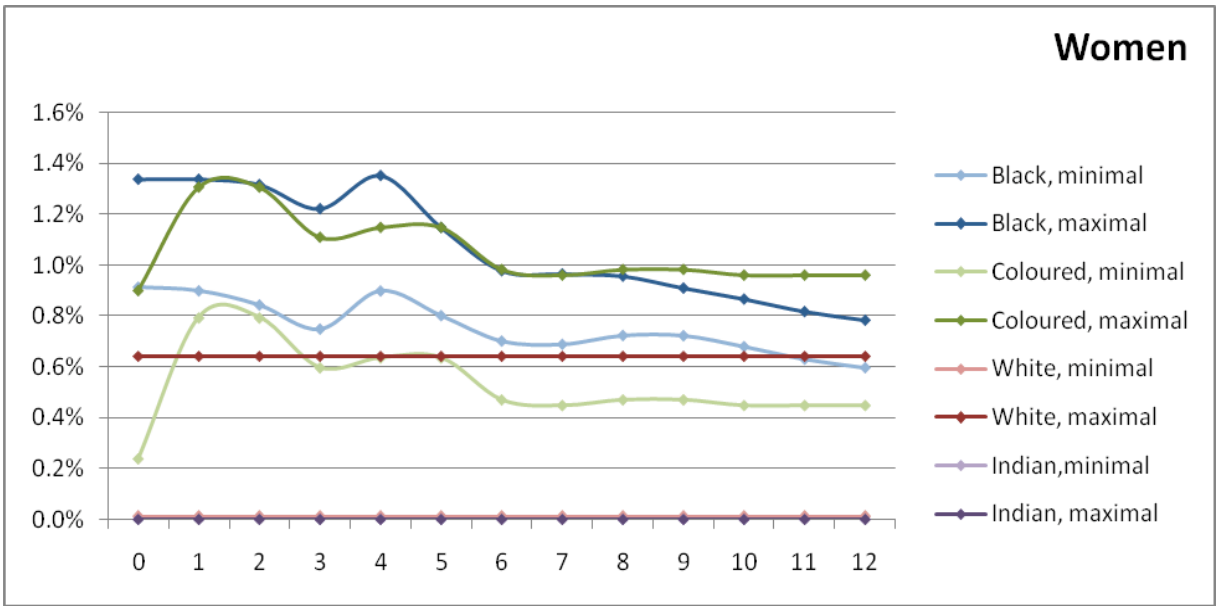


Table 3.2. Cumulative concurrency broken down by race, sex and province.

Note: unweighted data shown to identify cells with small N. Cells with less than 15 cases shown in grey type

Report

race Q1.2 Race of respondent	province A. Province	Mean						N		
		sex Sex of Respondent						sex Sex of Respondent		
		0 Female		1 Male		Total		0 Female	1 Male	Total
		cprev min	cprev max	cprev min	cprev max	cprev min	cprev max			
1 African	1 Eastern Cape	1.8	1.8	16.0	16.3	6.8	6.9	567	306	873
	2 Free State	1.2	1.2	13.0	13.4	5.7	5.8	423	261	684
	3 Gauteng	2.4	3.0	19.1	20.1	11.2	12.0	623	692	1315
	4 KwaZulu-Natal	1.5	1.9	23.6	24.3	12.2	12.7	591	551	1142
	5 Limpopo	.5	.9	16.2	17.0	7.8	8.3	573	495	1068
	6 Mpumalanga	.2	.4	17.3	17.3	8.2	8.4	482	428	910
	7 North West	1.6	2.4	16.6	17.7	7.8	8.8	253	181	434
	8 Northern Cape	1.5	2.9	8.2	9.8	4.6	6.2	137	122	259
	9 Western Cape	4.8	5.4	9.2	10.6	6.9	8.0	147	142	289
	Total	1.5	1.8	17.4	18.1	8.7	9.2	3796	3178	6974
2 Coloured	1 Eastern Cape	1.3	1.3	5.4	7.1	3.0	3.8	76	56	132
	2 Free State	.0	.0	20.0	20.0	13.6	13.6	7	15	22
	3 Gauteng	.0	.0	16.0	16.0	5.4	5.4	49	25	74
	4 KwaZulu-Natal	.0	.0	12.5	12.5	6.3	6.3	8	8	16
	5 Limpopo	.0	.0	.0	.0	.0	.0	2	5	7
	6 Mpumalanga	.0	.0	.0	.0	.0	.0		3	3
	7 North West	.0	.0	.0	.0	.0	.0	8		8
	8 Northern Cape	1.8	1.8	6.6	6.6	3.6	3.6	273	166	439
	9 Western Cape	1.4	2.3	7.5	7.5	3.9	4.4	217	146	363

	Total	1.4	1.7	7.8	8.0	3.9	4.2	640	424	1064
3 White	1 Eastern Cape	.0	.0	.0	.0	.0	.0	7	6	13
	2 Free State	.0	.0	.0	.0	.0	.0	38	29	67
	3 Gauteng	.0	.0	3.2	3.2	1.1	1.1	60	31	91
	4 KwaZulu-Natal	.0	.0	.0	.0	.0	.0	6	9	15
	5 Limpopo	.0	.0	.0	.0	.0	.0	52	24	76
	6 Mpumalanga	3.6	3.6	11.1	11.1	5.4	5.4	28	9	37
	7 North West	.0	.0	50.0	50.0	14.3	14.3	5	2	7
	8 Northern Cape	.0	.0	.0	7.1	.0	2.7	23	14	37
	9 Western Cape	.0	5.3	5.0	5.0	2.6	5.1	19	20	39
	Total	.4	.8	2.8	3.5	1.3	1.8	238	144	382
4 Indian	1 Eastern Cape	.0	.0	100.0	100.0	100.0	100.0		1	1
	3 Gauteng	.0	.0	.0	.0	.0	.0	25	14	39
	4 KwaZulu-Natal	.0	.0	.0	.0	.0	.0	53	29	82
	7 North West	.0	.0	.0	.0	.0	.0		1	1
	9 Western Cape	.0	.0	50.0	50.0	50.0	50.0		2	2
	Total	.0	.0	4.3	4.3	1.6	1.6	78	47	125
Total	1 Eastern Cape	1.7	1.7	14.4	14.9	6.3	6.5	650	369	1019
	2 Free State	1.1	1.1	12.1	12.5	5.4	5.6	468	305	773
	3 Gauteng	2.0	2.5	18.0	18.9	10.0	10.7	757	762	1519
	4 KwaZulu-Natal	1.4	1.7	21.9	22.6	11.2	11.6	658	597	1255
	5 Limpopo	.5	.8	15.3	16.0	7.2	7.7	627	524	1151
	6 Mpumalanga	.4	.6	17.0	17.0	8.1	8.2	510	440	950
	7 North West	1.5	2.3	16.8	17.9	7.8	8.7	266	184	450
	8 Northern Cape	1.6	2.1	7.0	7.9	3.8	4.5	433	302	735
	9 Western Cape	2.6	3.7	8.4	9.0	5.2	6.1	383	310	693
	Total	1.4	1.7	15.6	16.2	7.7	8.2	4752	3793	8545

Table 3.3. Point prevalence of concurrency (based on pconcnet) by race, sex and province.

Note: unweighted data shown to identify cells with small N. Cells with less than 15 cases shown in grey type.

Report

race Q1.2 Race of respondent	province A. Province	Mean						N		
		sex Sex of Respondent						sex Sex of Respondent		
		0 Female		1 Male		Total		0 Female	1 Male	Total
		pprev min	pprev max	pprev min	pprev max	pprev min	pprev max			
1 African	1 Eastern Cape	.9	.9	11.4	12.4	4.6	4.9	567	306	873
	2 Free State	.5	.7	5.4	5.7	2.3	2.6	423	261	684
	3 Gauteng	1.0	1.6	11.0	13.6	6.2	7.9	623	692	1315
	4 KwaZulu-Natal	1.2	1.5	17.8	19.2	9.2	10.1	591	551	1142
	5 Limpopo	.3	.5	10.9	11.5	5.2	5.6	573	495	1068
	6 Mpumalanga	.2	.4	14.3	14.3	6.8	6.9	482	428	910
	7 North West	.8	.8	6.6	8.3	3.2	3.9	253	181	434
	8 Northern Cape	.7	2.2	4.1	4.9	2.3	3.5	137	122	259
	9 Western Cape	2.0	2.0	7.0	7.7	4.5	4.8	147	142	289
	Total	.8	1.1	11.5	12.7	5.6	6.4	3796	3178	6974
2 Coloured	1 Eastern Cape	1.3	1.3	1.8	3.6	1.5	2.3	76	56	132
	2 Free State	.0	.0	13.3	20.0	9.1	13.6	7	15	22
	3 Gauteng	.0	.0	12.0	12.0	4.1	4.1	49	25	74
	4 KwaZulu-Natal	.0	.0	12.5	12.5	6.3	6.3	8	8	16
	5 Limpopo	.0	.0	.0	.0	.0	.0	2	5	7
	6 Mpumalanga	.0	.0	.0	.0	.0	.0		3	3
	7 North West	.0	.0	.0	.0	.0	.0	8		8
	8 Northern Cape	.7	.7	4.2	4.2	2.1	2.1	273	166	439
	9 Western Cape	.0	.0	5.5	5.5	2.2	2.2	217	146	363
	Total	.5	.5	5.2	5.7	2.3	2.5	640	424	1064
3 White	1 Eastern Cape	.0	.0	.0	.0	.0	.0	7	6	13

	2 Free State	.0	.0	.0	.0	.0	.0	38	29	67
	3 Gauteng	.0	.0	3.2	3.2	1.1	1.1	60	31	91
	4 KwaZulu-Natal	.0	.0	.0	.0	.0	.0	6	9	15
	5 Limpopo	.0	.0	.0	.0	.0	.0	52	24	76
	6 Mpumalanga	3.6	3.6	11.1	11.1	5.4	5.4	28	9	37
	7 North West	.0	.0	50.0	50.0	14.3	14.3	5	2	7
	8 Northern Cape	.0	.0	.0	.0	.0	.0	23	14	37
	9 Western Cape	.0	5.3	.0	.0	.0	2.6	19	20	39
	Total	.4	.8	2.1	2.1	1.0	1.3	238	144	382
4 Indian	1 Eastern Cape	.0	.0	.0	.0	.0	.0		1	1
	3 Gauteng	.0	.0	.0	.0	.0	.0	25	14	39
	4 KwaZulu-Natal	.0	.0	.0	.0	.0	.0	53	29	82
	7 North West	.0	.0	.0	.0	.0	.0		1	1
	9 Western Cape	.0	.0	50.0	50.0	50.0	50.0		2	2
	Total	.0	.0	2.1	2.1	.8	.8	78	47	125
Total	1 Eastern Cape	.9	.9	9.8	10.8	4.1	4.5	650	369	1019
	2 Free State	.4	.6	5.2	5.9	2.3	2.7	468	305	773
	3 Gauteng	.8	1.3	10.5	12.9	5.7	7.1	757	762	1519
	4 KwaZulu-Natal	1.1	1.4	16.6	17.9	8.4	9.2	658	597	1255
	5 Limpopo	.3	.5	10.3	10.9	4.9	5.2	627	524	1151
	6 Mpumalanga	.4	.6	14.1	14.1	6.7	6.8	510	440	950
	7 North West	.8	.8	7.1	8.7	3.3	4.0	266	184	450
	8 Northern Cape	.7	1.2	4.0	4.3	2.0	2.4	433	302	735
	9 Western Cape	.8	1.0	6.1	6.5	3.2	3.5	383	310	693
	Total	.7	.9	10.3	11.4	5.0	5.6	4752	3793	8545

Table 3.4: Minimal and Maximal Estimates of Cumulative Concurrency by sex and race*

		Minimum Estimate		Maximum Estimate	
		Not concurrent	Concurrent	Not concurrent	Concurrent
Men	African	7,494,368 82.1%	1,638,004 **17.4%**	7,425,257 81.3%	1,707,115 **18.7%**
	Coloured	1,009,127 93.1%	75,063 **6.9%**	1,008,441 93.0%	75,749 **7.0%**
	White	941,017 97.3%	26,284 **2.7%**	939,730 97.1%	27,571 **2.9%**
	Indian	270,822 96.3%	10,421 **3.7%**	270,822 96.3%	10,421 **3.7%**
Women	African	9,634,426 98.3%	170,658 **1.7%**	9,589,074 97.8%	216,010 **2.2%**
	Coloured	1,163,072 98.6%	16,650 **1.4%**	1,155,247 97.9%	24,475 **2.1%**
	White	1,378,112 100.0%	175 **0.0%**	1,369,451 99.4%	8,836 **0.6%**
	Indian	381,500 100.0%	0 **0.0%**	381,500 100.0%	0 **0.0%**

*restricted to the sexually active population who reported race

Table 3.5: Minimal point prevalence estimates of concurrency on the day of interview by sex and race*

		Pconcsum		*Pconcnet*		*Pconcmax*	
		Not concurrent	Concurrent	Not concurrent	Concurrent	Not concurrent	Concurrent
Men	African	8,004,452 87.6%	1,127,920 **12.4%**	8,060,898 88.3%	1,071,474 **11.7%**	7,838,918 85.8%	1,293,454 **14.2%**
	Coloured	1,043,247 96.2%	40,943 **3.8%**	1,033,849 95.4%	50,341 **4.6%**	1,030,637 95.1%	53,553 **4.9%**
	White	1,948,521 98.1%	18,780 **1.9%**	949,116 98.1%	18,185 **1.9%**	941,017 97.3%	26,284 **2.7%**
	Indian	273,166 97.1%	8,077 **2.9%**	273,166 97.1%	8,077 **2.9%**	273,166 97.1%	8,077 **2.9%**
Women	African	9,717,631 99.1%	87,453 **0.9%**	9,715,549 99.1%	89,535 **0.9%**	9,677,389 98.7%	127,695 **1.3%**
	Coloured	1,174,630 99.6%	5,092 **0.4%**	1,176,924 99.8%	2,798 **0.2%**	1,172,417 99.4%	7,305 **0.6%**
	White	1,378,287 100.0%	0 **0.0%**	1,378,112 100.0%	175 **0.0%**	1,378,112 1000%	175 **0.0%**
	Indian	381,500 100.0%	0 **0.0%**	381,500 100.0%	0 **0.0%**	381,500 100.0%	0 **0.0%**

*restricted to the sexually active population who reported race

Table 3.6: Maximal point prevalence estimates of concurrency on the day of interview by sex and race*

	Pconcsum		*Pconcnet*		*Pconcmax*	
	Not	Concurrent	Not	Concurrent	Not	Concurrent

		concurrent		concurrent		concurrent	
Men	African	8,004,452 87.6%	1,127,920 **12.4%**	7,962,449 87.2%	1,169,923 **12.8%**	7,778,416 85.2%	1353956 **14.8%**
	Coloured	1,043,247 96.2%	40,943 **3.8%**	1,032,119 95.2%	52,071 **4.8%**	1,029,593 95.0%	54597 **5.0%**
	White	948,521 98.1%	18,780 **1.9%**	949,116 98.1%	18,185 **1.9%**	941,017 97.3%	26284 **2.7%**
	Indian	273,166 97.1%	8,077 **2.9%**	273,166 97.1%	8,077 **2.9%**	273,166 97.1%	8,077 **2.9%**
Women	African	9,717,631 99.1%	87,453 **0.9%**	9,682,775 98.8%	122,309 **1.2%**	9,656,791 98.5%	148,293 **1.5%**
	Coloured	1,174,630 99.6%	5,092 **0.4%**	1,176,924 99.8%	2,798 **0.2%**	1,172,417 99.4%	7,305 **0.6%**
	White	1,378,287 100.0%	0 **0.0%**	1,369,451 99.4%	8,836 **0.6%**	1,369,451 99.4%	8,836 **0.4%**
	Indian	381,500 100.0%	0 **0.0%**	381,500 100.0%	0 **0.0%**	381,500 100.0%	0 **0.0%**

*restricted to the sexually active population who reported race

Table 3.7: Summary statistics of the point prevalence time series by sex and race

		minimal estimates			*maximal estimates*		
		Minimum	Maximum	Mean	Minimum	Maximum	Mean
Men	African	6.5%	12.1%	9.6%	7.0%	12.7%	10.2%
	Coloured	2.0%	4.6%	3.0%	2.7%	4.8%	3.3%
	White	0.0%	1.9%	1.1%	1.2%	2.0%	1.5%
	Indian	2.9%	2.9%	2.9%	2.9%	2.9%	2.9%
Women	African	0.6%	0.9%	.08%	0.8%	1.3%	1.1%
	Coloured	0.2%	0.8%	0.5%	0.9%	1.3%	1.1%
	White	0.0%	0.0%	0.0%	0.6%	0.6%	0.6%
	Indian	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Annex 4. Partner Acquisition Rates (NCS 2009) E. Slaymaker

The analysis of partner acquisition rates (PAR) was done through piecewise exponential models and includes NCS 2009 data only. The models for men and women are show on the last two pages of this annex.

The partner acquisition rates by type of partner are given in Error! Reference source not found. for men and women. Overall, **men have a much higher rate than women** (0.28 per person year compared to 0.09 per person year). Acquisition of a spouse is a rare event for both sexes. Women's PAR for boyfriends is higher than for casual partners, but the reverse is true for men.

Table 4.1: Partner Acquisition Rates by sex and type of partner

Type of partner	PAR (per person-year)	
	MEN	WOMEN
Spouse	0.010	0.007
Boy/girlfriend	0.112	0.065
Casual	0.153	0.022
All	0.276	0.094

Results for men

The crude hazard ratio (HR) by partner status confirmed the differences apparent in the PAR by partner status (see **Figure 4.1**). Compared to men with no partner, the hazard of acquiring a new partner is lower in men who have a non-spousal partner (0.76, p=0.008) and substantially reduced among men who have a spouse (0.01, p<0.001). The adjusted HR changes little for men with a spouse, but reduces further (to 0.54, p<0.001) for men with a non-spousal partner. Marital status retained an independent effect in the adjusted model, even after partner status was controlled for. Compared to single men, men who were unmarried but cohabiting were almost twice as likely to acquire a new partner. African men had almost twice the hazards of other men (HR 1.85, p=0.001). Men aged 20-24 had the highest rates of partner acquisition, the rate declined steadily from that age onwards. Education status and frequency of reading a newspaper were both associated with partner acquisition. Men with only primary education had lower hazards than men with secondary education. Men who reported reading newspapers had higher hazards.

Compared to the rest of the country, men resident in Western Cape had lower hazards of acquiring a partner (see **Figure 4.2**). Once adjusted for other variables, this was also true of men living in Free State and KwaZulu Natal. Compared to men living in formal urban settlements, men living in tribal areas had lower hazards of partner acquisition.

Age at first sex retained the effect seen in the crude rates (see **Figure 4.3**): compared to men who first had sex in the middle of the range, those who had first sex early had higher HR (1.65, p<0.001) and men who had late first sex had lower HR (0.36, p<0.001). HIV test history also remained important, but the effects changed slightly from the pattern seen in the crude rates. In the adjusted model, the HR for men who had recently had an HIV test, compared to men who had never had an HIV test, was 1.24 (p=0.03). There was no difference between men who had never had a test and those who had had a test more than a year before the survey.

Results for women

Compared to single women, the crude HR was substantially lower for women with any type of partner (see **Figure 4.1**). There was still a difference between women with a non-spousal partner and those with a spouse. The HR for women with a non-spousal partner was 0.16 (p<0.001) and for women with a spousal partner the HR was 0.01 (p<0.001). These HR changed little once adjusted for other factors; the HR for women with a non-spousal partner fell to 0.10 and the HR for women with a spousal partner

remained at 0.01. Marital status remained associated with partner acquisition; the effect was the same as for men and unmarried cohabiting women had much higher hazards of acquiring a new partner than single women (HR 4.21, p<0.001). Age remained important in the multivariate model but, once other factors were controlled for, the patterns by age changed slightly. The youngest women (aged less than 20) had lower rates of partner acquisition than women in their early 20s (the baseline). The hazards were similar for women in their late 20s and early thirties. Women aged 35 and over had statistically significantly lower hazards than women aged 20-24. African women had higher rates of partner acquisition than other women (HR 1.47, p=0.052) but the difference was not as pronounced as for men.

Province was not important for women but type of settlement was and women living in tribal areas had lower rates of partner acquisition than women living in formal urban areas (HR 0.64, p=0.001) - see **Figure 4.2**.

Women who had a recent HIV test, or had one more than two years before the survey, had higher hazards of partner acquisition than women who had never been tested (see **Figure 4.3**). Women who had first sex before age 16 had higher rates of partner acquisition than women whose first sex was between ages 16 and 20. Women whose first sex was after age 20 had lower rates.

There was a clear decline by age for both men and women; for women the highest rate was observed in those aged less than 20, whereas for men the peak rate is among 20-24 year olds. **The peak rate was higher for men and the decline with age steeper** so that, by the late 40s, men and women were more similar than at younger ages. **The greatest difference between the sexes was seen in the early 20s.**

Marital status had a marked effect on PAR. Married men and women had the lowest rates, and single men and women the highest. Unmarried cohabitees had higher PAR than formerly married men and women.

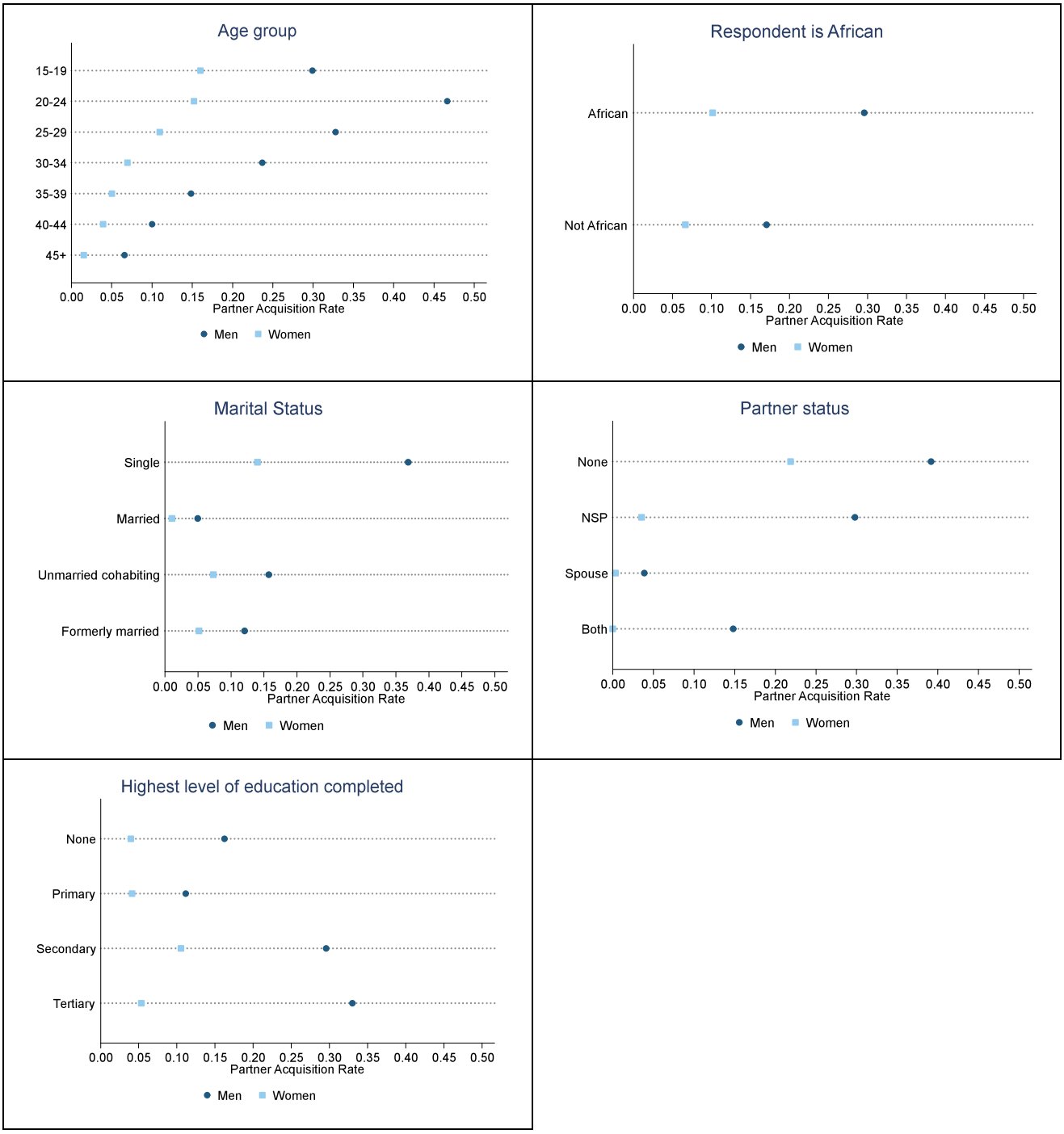
Educational level showed a different pattern for men and women. **Women with secondary education had the highest PAR**, and there was little difference between the other educational categories. **Men with tertiary education had the highest PAR**, and the rate for those with secondary or tertiary education was much higher than that for men with only primary education.

Rates also varied by social and geographic variables: African men had higher rates than non-African men; there was a less noticeable difference for women. Men's rates differed by province; there was less variation between the provinces for women. The PAR for men in Western Cape was much lower than elsewhere.

PAR differed by reported age at first sex (grouped into <16, 16-20 and 21 and over). Respondents who had not yet had sex were included in the category for their current age. Rates were highest for men and women whose first sex was before 16, and lowest for those whose first sex was after age 20.

PAR varied by HIV test history: men who had had an HIV test 1-2 years before the survey, i.e. prior to the period covered by the partner history, had lower PAR than other men.

Figure 1.1: Partner acquisition rates for South African men and women, by demographic characteristics (NCS 2009)



There were marked differences between men and women in PAR but, despite this, there were some similarities in the effects of background characteristics on acquisition rates: PAR were highest among those who have no partner, and who were in their early twenties. The relationship between age and partner acquisition, for women, was confounded by marital/partner status. Once this was controlled for, women under 20 no longer had higher rates of partner acquisition than older women. African men and women were more likely to acquire a new partner than non-Africans.

Men and women who, at the time of the survey, were not married but cohabiting with a partner had a higher chance of acquiring a new partner than single people. This may be because that group is composed of newer relationships, and may be identifying people who recently got a partner. The increased hazards for unmarried cohabitees does not actually mean their rates of partner acquisition are

higher than those of single people. Having a partner (a pre-requisite for an unmarried cohabitee) greatly reduces the chance of acquiring a new partner. This suggests that people who have a partner that they live with have a higher chance of acquiring a partner than people who have a partner that they do not live with. It would be possible to amend the partner status variable to include whether or not the current partner(s) were cohabiting. This might remove the effect of marital status. Men and women living in tribal areas were the least likely to acquire a new partner.

Figure 2.2: Partner acquisition rates for South African men and women, by geographic characteristics (NCS 2009)

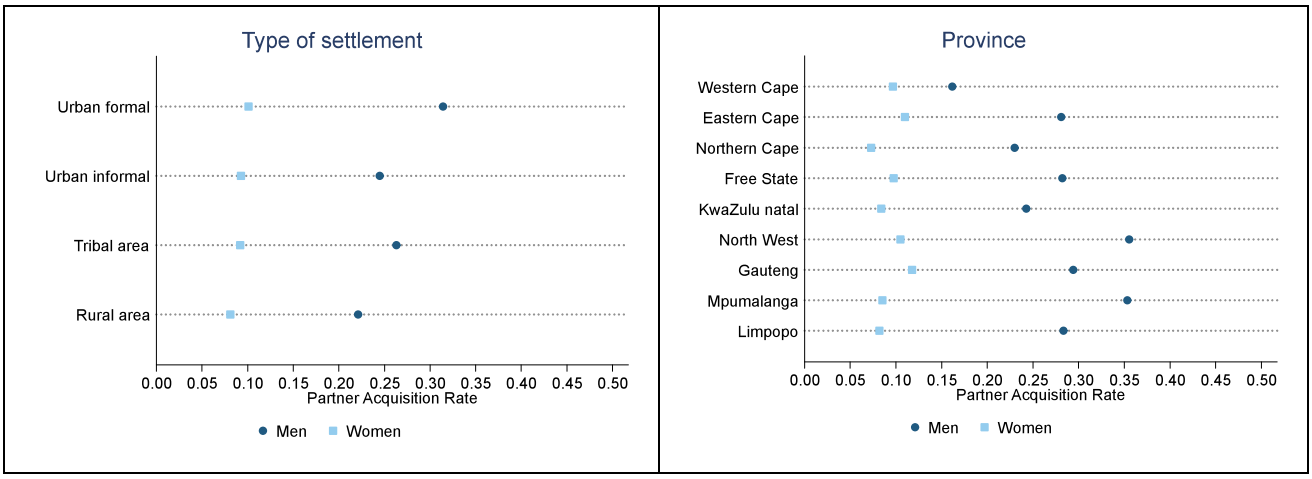
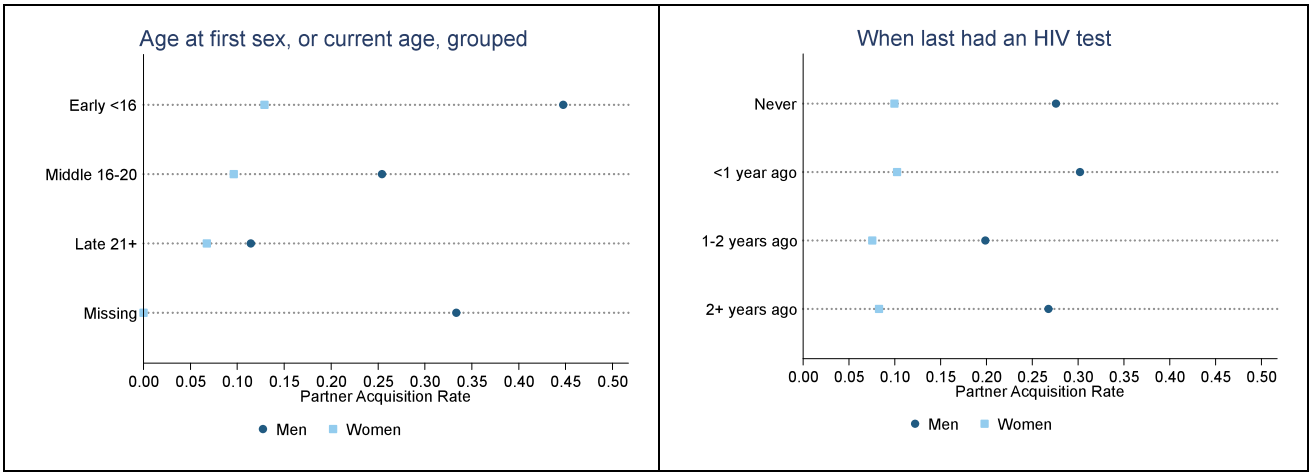


Figure 3.3: Partner acquisition rates for South African men and women, by behavioural characteristics (NCS 2009)



The effect of having had an HIV test remained for both men and women after other variables were controlled for. People who had an HIV test in the 12 months before the survey had higher acquisition rates in the same period. People who get a new partner might be getting tested as they enter the new relationship; alternatively, people who are aware that new partners present an HIV risk may get tested in response to their exposure. Age at first sex is associated with partner acquisition in later life. This association has been shown for prevalent partners (for example, White, Richard; Cleland, John; Caraël, Michel (2000) "Links between premarital sexual behaviour and extramarital intercourse: a multi-site analysis" *AIDS* 14(15) 2323-2331). This analysis shows that the incidence of new partnerships is associated with age at first sex; prevalent partners may be higher in those who had sex at an early age simply because they have had more time to acquire them. That incident partnerships are higher suggests that age at first sex is related to other characteristics which in turn influence partnership behaviour later in life.

Model: MEN

	Crude PAR model			Adj. PAR model		
	HR	95% CI	p-value	HR	95% CI	p-value
Partner status						
None	1			1		
NSP	**0.76**	**0.63-0.93**	**0.008**	**0.54**	**0.43-0.68**	**0.000**
Spouse	**0.10**	**0.06-0.16**	**0.000**	**0.11**	**0.06-0.20**	**0.000**
Both	**0.29**	**0.13-0.63**	**0.002**	**0.27**	**0.12-0.64**	**0.003**
Province						
Western Cape				**0.45**	**0.26-0.78**	**0.005**
Eastern Cape				0.95	0.66-1.36	0.781
Northern Cape				0.84	0.57-1.26	0.399
Free State				**0.64**	**0.41-1.00**	**0.048**
KwaZulu Natal				**0.69**	**0.52-0.91**	**0.009**
North West				1.09	0.70-1.68	0.704
Gauteng				0.87	0.62-1.22	0.426
Mpumalanga				0.81	0.60-1.10	0.176
Limpopo				Omitted		
Type of settlement						
Urban formal				1		
Urban informal				0.91	0.69-1.20	0.509
Tribal area				**0.73**	**0.58-0.93**	**0.010**
Rural area				0.95	0.65-1.38	0.783
Respondent is African						
Not African				1		
African				**1.85**	**1.28-2.67**	**0.001**
Age group						
15-19				**0.48**	**0.38-0.61**	**0.000**
20-24				1		
25-29				**0.82**	**0.67-1.00**	**0.054**
30-34				**0.63**	**0.50-0.80**	**0.000**
35-39				**0.56**	**0.40-0.80**	**0.002**
40-44				**0.44**	**0.26-0.74**	**0.002**
45+				**0.26**	**0.14-0.46**	**0.000**
When last had an HIV test						
Never				1		
<1 year ago				**1.24**	**1.02-1.50**	**0.030**
1-2 years ago				0.88	0.63-1.22	0.443
2+ years ago				1.36	0.96-1.92	0.082
Marital Status						
Single				1		
Married				0.82	0.47-1.44	0.493
Unmarried cohabiting				**1.81**	**1.09-3.00**	**0.021**
Formerly married				1.06	0.55-2.03	0.862
Age at first sex, or current age, grouped						
Early <16				**1.65**	**1.38-1.96**	**0.000**
Middle 16-20				1		
Late 21+				**0.36**	**0.25-0.52**	**0.000**
How often reads a newspaper						
Never				1		
Less than once a week				1.17	0.89-1.54	0.268
1 to 3 days a week				**1.37**	**1.06-1.78**	**0.015**
4 to 6 days a week				0.87	0.64-1.18	0.368
Every day of the week				1.25	0.96-1.64	0.096
How often watches TV						
Never						
Less than once a week						
1 to 3 days a week						
4 to 6 days a week						
Every day of the week						
Highest level of education completed						
None				0.95	0.43-2.08	0.896
Primary				**0.59**	**0.38-0.89**	**0.013**
Secondary				1		
Tertiary				1.06	0.78-1.44	0.691

Model: WOMEN

	Crude PAR model			Adj. PAR model		
	HR	**95% CI**	**p-value**	**HR**	**95% CI**	**p-value**
Partner status						
None	1			1		
NSP	**0.16**	**0.12-0.22**	**0.000**	**0.10**	**0.07-0.15**	**0.000**
Spouse	**0.01**	**0.00-0.03**	**0.000**	**0.01**	**0.00-0.02**	**0.000**
Both	**0.00000**	**0.00-0.00**	**0.000**	**0.00000**	**0.00-0.00**	**0.000**
Type of settlement						
Urban formal				1		
Urban informal				1.01	0.76-1.36	0.922
Tribal area				**0.64**	**0.49-0.83**	**0.001**
Rural area				1.03	0.55-1.93	0.931
Respondent is African						
Not African				1		
African				**1.47**	**1.00-2.18**	**0.052**
Age group						
15-19				**0.64**	**0.46-0.89**	**0.009**
20-24				1		
25-29				0.92	0.67-1.28	0.633
30-34				0.87	0.55-1.37	0.544
35-39				**0.43**	**0.24-0.76**	**0.004**
40-44				**0.25**	**0.14-0.42**	**0.000**
45+				**0.06**	**0.03-0.14**	**0.000**
When last had an HIV test						
Never				1		
<1 year ago				**1.46**	**1.09-1.94**	**0.010**
1-2 years ago				1.03	0.64-1.64	0.905
2+ years ago				**1.52**	**1.00-2.32**	**0.051**
Marital Status						
Single				1		
Married				0.73	0.32-1.65	0.444
Unmarried cohabiting				**4.21**	**2.65-6.68**	**0.000**
Formerly married				0.64	0.34-1.21	0.171
Age at first sex, or current age, grouped						
Early <16				**1.77**	**1.25-2.50**	**0.001**
Middle 16-20				1		
Late 21+				**0.63**	**0.43-0.92**	**0.017**
Missing				**0.0000**	**0.00-0.00**	**0.000**