# The Natural History of HIV/AIDS in South Africa

## A biomedical and social survey in Carletonville

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Cover photograph by Brian Williams shows some of those involved in the project.

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# Contents

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Most importantly of all we thank the men and women of Carletonville and the mineworkers who have made this survey possible and on whose shoulders rests the task of turning the tide of the epidemic in their community.

# Abbreviations and acronyms

| | |
|---|---|
| 3TC | Lamivudine, Epivir (antiretroviral) |
| AIDS | Acquired immunodeficiency syndrome |
| ANC | Ante-natal clinics |
| AZT | Zidovudine, retrovir (antiretroviral therapy) |
| CSW | Commercial sex worker |
| DFID | Department for International Development |
| HIV | Human immunodeficiency virus |
| HIV+ | HIV test results positive |
| PPT | Periodic presumptive treatment |
| R | South African Rand |
| RPR | Rapid plasma reagent |
| STD | Sexually transmitted disease |
| TPHA | *Treponema pallidum* haemagglutination |
| CAC | Carletonville AIDS Committee |
| CSIR | Council for Scientific and Industrial Research |
| ERU | Epidemiology Research Unit, Johannesburg |
| NUM | National Union of Mineworkers of South Africa |
| SAIMR | South African Institute for Medical Research |
| SFH | Society for Family Health |
| USAID | United States Agency for International Development |
| $\chi^2$ | Chi-squared |
| CI | Confidence interval |
| *n* | Sample size |
| n.s. | Non-significant |
| OR | Odds Ratio |
| *p* | Significance level |

# Preface

The Carletonville project was given the name Mothusimpilo by people in the Carletonville community. Mothusimpilo, which means 'working together for health' captures the essence of what we are trying to do and it has been the involvement and commitment of all the players and stakeholders in Carletonville that has made the project possible.

The project was conceived by Brian Williams and Catherine Campbell in 1994 after discussions with Julian Lambert. The intention from the start was to find ways to manage and control the spread of HIV infection in a community at high risk. But it was also clear that we needed to evaluate the project carefully and fully so that we should know if the project was succeeding and so that we could learn lessons from the project which could be applied throughout the country and indeed the region. A great deal of time was spent thinking about how the evaluation should and could be done. Ideally one would like to carry out randomised controlled trials, and these were considered, but the ethical constraints, the pressure of time and the need to act immediately meant that this was not possible.

We decided to do an 'ecological study' and the survey described in the following pages is one of the results. The notion was that the best that we could do would be to carry out regular surveys, covering as many biomedical, psychological, behavioural and social aspects of the epidemic as possible and to back these up with detailed and extensive social studies, using focus group discussions and in-depth interviews, to explore and elucidate the findings of the quantitative studies. Eventually we will use these data and the understandings that we manage to develop to build mathematical models which we hope will enable us to synthesize and explore the implications of these studies and the impact of the intervention in a convincing way. While more formally designed studies give us much more reliable information about a very narrow range of factors, studies such as this give us less reliable information but about a much broader range of factors. The measures of our success will be in convincing others firstly of the validity of our interpretation of the factors driving the

epidemic and secondly of the validity of our interpretations of the extent to which the intervention has changed the course of the epidemic.

In the following pages three surveys are described. In 1997 we carried out a demographic survey to get an overall picture of the community in which we were to work. A pilot survey was then done in January 1998 and this provided initial data on the nature and size of the epidemic. From this we learned many valuable lessons, particularly in relation to working with the local communities. The heart of this report, however, is the discussion of the baseline survey, carried out in August 1998 for this provides us with hard and good evidence concerning the nature and extent of the problem. The first follow up survey was done in August 1999 and a second follow up survey will be done in August 2000. These will enable us to assess the extent to which we have succeeded in our aims although the full impact on the intervention will almost certainly take several more years to become evident.

Chapter 1 provides the salient background information and the rationale for the present study. A brief discussion is provided of gold mining and the migrant labour system in South Africa and how these relate to the spread of HIV infection.

In Chapter 2 the history of the project is outlined with a discussion of the funding, organization and management structure. The procedures used for carrying out the three surveys, the collection, management and analysis of the data, and the laboratory procedures used to analyse the blood and urine samples, are described in detail.

In Chapter 3 the results of the statistical analyses are presented. Separate sections deal with biomedical, demographic, behavioural and social aspects of the epidemic and with particular issues such as male circumcision, alcohol consumption, migrancy and social capital. But perhaps the most important single finding to come out of this study is the extraordinarily high rate of infection amongst adolescent girls reaching nearly 60% at 25 years of age. Finding ways to protect young girls from infection must be given the highest possible priority.

In Chapter 4 the results obtained in Chapter 3 are used as the basis for a formal univariate and multivariate analysis of risk factors for infection. In an ecological study such as this it is inevitably difficult to untangle cause and effect in the multiplicity of factors that bear on each other and on the spread of infection. Eventually we have to bring as many lines of argument to bear as possible in developing a convincing narrative that explains the natural history of the epidemic.

Chapter 5 is an overview of the findings of this survey and some of the more important and immediate conclusions are as follows. First of all, the rates of infection in Carletonville are extremely high, not only amongst commercial sex workers and mineworkers but also amongst people in the general population. It should be borne in mind that this is still the only extensive, population based study, covering an entire community and there are undoubtedly other communities in South Africa with equally high rates of infection. The next most important observation is that rates of sexually transmitted diseases (STDs) are also very high among all sectors of the society, even for easily curable diseases such as syphilis. There can be no doubt that effective control of curable STDs would have a major impact on the course of the epidemic and could even reverse the upward trend. A third critical finding is the fact that people did not perceive themselves to be at risk of infection; even amongst those who thought that they were at no risk of infection very many were already infected. While knowledge is not a sufficient condition to bring about changes in behaviour it is a necessary condition because if people really do not believe that they are at risk of infection there is no reason for them to change their behaviour. Another important finding is that condom use is very low with regular and with casual partners. One of the reasons for this may well be the very high proportion of women who use injectable contraceptives which protect them against pregnancy but not against HIV infection. In countries such as India, where condoms are the preferred method of preventing pregnancy, rates of infection are correspondingly low.

Several, more particular, risk factors are also important. Several of the measures of social capital are associated with an increase or a decrease in the likelihood of infection. Belonging to a church or a sports club tends to be associated with lower rates of infection; belonging to a stokvel (a rotating credit scheme) with higher rates of infection. While stokvels play a supportive role in the community it may be that their social context is such that they provide an important opportunity for targeting interventions. The consumption of alcohol is also associated with higher rates of infection, and as with the group memberships, this needs to be explored in more detail. This study confirms the increasing body of evidence showing that male circumcision reduces the risk of infection substantially and confirms the findings in a wide range of publications that migrancy contributes to both the level and spread of HIV infection. Dealing with migrancy is complex and difficult but clearly it is an issue that must be faced.

Finally, Chapter 6 gives an overview of the intervention including ways in which the project is attempting to improve the management of sexually transmitted diseases, how it is mobilising and training community based peer educators, the extent to which condom distribution has been successfully undertaken and the ways that have been found to mobilise all of the stakeholders in the area from the government, industry and the trades unions to community organizations and structures. Even during the six months between the completion of the pilot survey and the baseline survey there has been evidence of significant changes in attitudes and behaviour. The two subsequent surveys will reveal just how much progress we are making in our attempts to manage the epidemic of HIV/AIDS.

At the end of this book, in Appendix 9, is a list of publications arising from the project as well as some other relevant papers by project staff. Many of them are referred to in this publication and they provide a considerable amount of detail and background information to supplement the discussion in this book.

# 1 Introduction

South Africa faces one of the most rapidly growing HIV epidemics in the world. A survey carried out by the Department of Health indicated that in 1990 the prevalence of infection among women attending antenatal clinics was less than 1%. At the end of 1998, 23% of such women were infected with HIV (Department of Health, 1999). The prevalence of HIV varies significantly among provinces ranging from a high of 33% in KwaZulu Natal and a low of 7% in the Western Cape (Department of Health, 1999). The prevalence amongst women increases up to 20 to 25 years, and declines with age amongst older women (Williams, Gouws, Abdool Karim & Wilkinson, 2000). In October 1998, about 27% of women, attending ante-natal clinics in South Africa were HIV positive at the age of 25 years (Department of Health, 1999).

Because these data reflect the prevalence of infection among pregnant women who attended public health clinics, extrapolation to other women and particularly to men can only be done with caution. The conventional wisdom is that analyses based on antenatal clinic data overestimate prevalence among young women who, since they are pregnant, are clearly sexually active. On the other hand these data may underestimate prevalence among older women, since women who are very active sexually are likely to be infected with sexually transmitted diseases (STDs) that render them infertile, so that they are under-represented at antenatal clinics.[1]

1 Bos (1998) used HIV-prevalence data for adult women, from ten different surveys conducted in Africa to show that the biases in the antenatal clinic data (the over-estimation in younger women and under-estimation in older women), largely offset each other, giving a reasonable estimate of overall prevalence in adult females. In a study carried out in Hlabisa, it was found that the incidence of HIV was about three times the incidence of pregnancy, and that the age distributions of these two incidence measures were similar (Williams, Gouws, Abdool Karim and Wilkinson, 2000).

Projecting the HIV-prevalence data beyond 1998 suggests that the overall prevalence will reach almost 30% in the adult population by the year 2010 and life expectancy will be reduced to 48 years compared to the 68 years anticipated without HIV/AIDS. By the year 2010, it is estimated South Africa will have to cope with some 750,000 orphans from households affected by HIV/AIDS (Taylor, 1998; Williams, Gouws and Abdool Karim, 2000).

The epidemic of HIV/AIDS must surely be the greatest challenge facing South Africa. While some countries, notably Thailand, Uganda and Senegal, have succeeded in stemming or turning the tide of infections, the response to the epidemic in most sub-Saharan African countries has been inadequate at best. The Mothusimpilo-Carletonville Project was developed by Brian Williams and Catherine Campbell in order to identify ways to control the spread of HIV in a community at high risk. From the beginning the project included a substantial evaluation component, both biomedical and social, so that the effectiveness of the various interventions could properly be understood.

The Mothusimpilo-Carletonville Project is unique in South Africa in that it attempts to deal with HIV/AIDS in an entire community and one that includes migrant gold mine workers, men and women from all social strata, and commercial sex workers (CSWs). The project addresses many of the social issues that confront South Africa and which fuel the epidemic, such as migrancy, sex work, poverty, unemployment and high rates of sexually transmitted diseases.

This report describes a cross-sectional baseline survey conducted as part of the overall evaluation of the project. It provides information on the prevalence of HIV and other sexually transmitted diseases (STDs), stratified by gender, age and type of housing, which was used as a measure of socio-economic status. In addition, correlations between HIV and other variables, such as STDs, alcohol use, lifetime partners and circumcision are explored, to shed light on factors that may be driving the epidemic in Carletonville. Finally, the concept of ‘social capital’ is

explored in relation to a range of measures of sexual health and high-risk behaviour.

## 1.1 Gold mining in South Africa

The first gold mines began operations on the Witwatersrand near Johannesburg in 1886 and by 1890 approximately 60,000 Africans were working in these mines (Packard, 1989). The number of mineworkers employed on gold mines peaked at about 500,000 in 1985 (Moodie and Ndatshe, 1994) but the last five years have seen large-scale retrenchments and they now employ approximately 350,000 men (Crush, 1995; Meekers, 1999). Most mineworkers are migrant labourers either from rural areas of South Africa or from neighbouring countries including Lesotho, Zambia, Mozambique, Zimbabwe and Botswana. In 1960, 80% of the workforce came from countries other than South Africa but this figure has fallen to between 40% and 50% (Fages, 1999).

Gold production peaked at about 1 million kilograms in the late 1960s and has declined since then due to the liberalisation of the gold market in the early 1970s and increased production costs. Mining, particularly gold mining, still plays an important role in the economy of South Africa. In 1994 mining contributed 8.7% directly to the gross domestic product but the total contribution, based on direct and indirect multipliers, was close to 18%. (Baxter, 1996). Carletonville remains the biggest gold mining complex in the world.

## 1.2 The Carletonville district

The district of Carletonville covers approximately 400 square kilometres. To the north-west of Carletonville town is Khutsong township, to the south are the goldmines. Carletonville is just under 100 kilometres from Johannesburg, and about half that distance from Soweto, so that there is a significant movement of people into and out of the district.

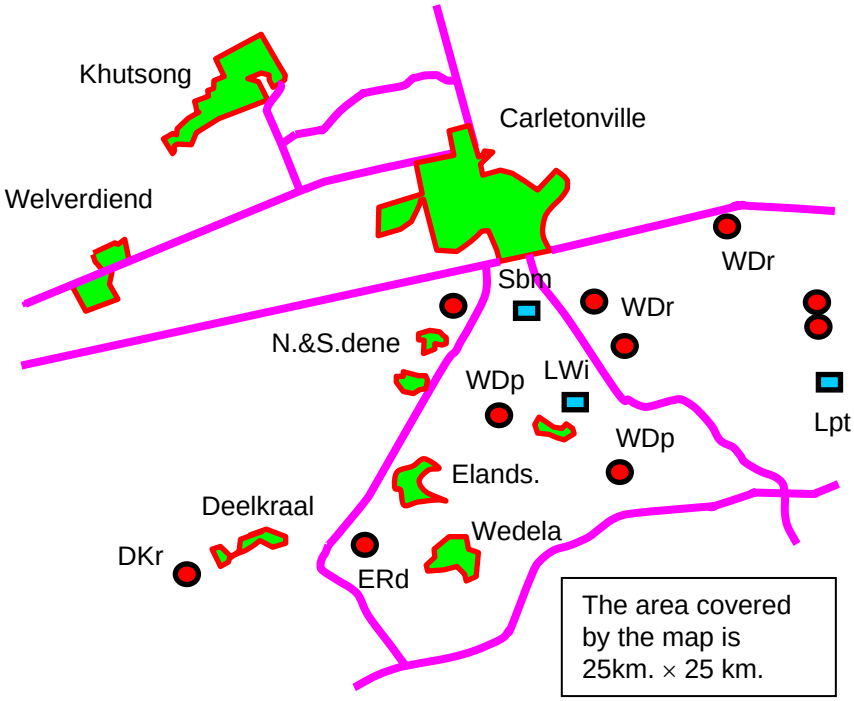


Figure 1.1 Map of the Carletonville district. Irregular shapes are residential areas, circles are mine shafts and squares are hotspots. The shafts are WDr: West Driefontein; EDr: East Driefontein; WDp: Western Deep Levels; ERd: Elandsrand; DKr: Deelkraal. The hotspots are Sbm: Sibomvu; LWi: Leslie Williams; Lpt: Leeupoort.

Two mining houses, AngloGold and Gold Fields,[2] operate ten shafts between them while RandGold operates one shaft. The population of Carletonville town is about 20,000 while that of Khutsong is estimated

2 Now called: GFL Mining Services

to be 150,000. The mines house an additional 60,000 to 80,000 migrant mine workers. (Municipal Authority, 1996). Most mine workers live in ten single sex hostels close to the mine shafts (Figure 1.1). Living conditions are basic and between four and fifteen workers share a room where each man has a bed and a locker or cupboard space.

Close to the mine hostels there are shebeens (informal bars) and hotspots where commercial sex workers meet clients (Figure 1.1). Some hotspots are informal settlements, others are simply open areas in the veld. Several of the hotspots are close to concession stores where private traders are given a concession by the mine to run a trading store at which miners can buy some of their basic living essentials. Most people who live in hotspots are illegal squatters and live in fear of eviction. From early morning the first customers, miners returning from the night shift, come and go, buying alcohol and sex. The shacks are generally owned by older women, often former sex workers, who sell liquor and provide accommodation to three or four sex workers in order to attract men to the premises (Campbell, 2000). Sex workers who work permanently in the hotspots are joined on weekends by women from Khutsong or from other places such as Soweto. Sex work is the only source of income for most of the women. Miners who see their wives and families between once a month and once a year are ready clients, and often form casual relationships with sex workers.

## 1.3 HIV/AIDS in the mines

In 1986–87, three patterns of HIV transmission were described in South Africa. Pattern One, which was found in the early stages of the epidemic in developed countries, included epidemics where transmission was mainly among homosexual and bisexual men. Pattern Two, which rapidly established itself as the dominant pattern in Sub-Saharan Africa, included epidemics where HIV is spread mainly through heterosexual contact. Pattern Three included transmission to haemophiliacs through contaminated blood products (Mann, Tarantola and Netter, 1992; Campbell and Williams, 1996).

The first diagnosed cases of AIDS in sub-Saharan Africa were reported to the World Health Organisation in 1985, and it is thought that HIV entered South Africa in the late 1970s. In 1992 sub-Saharan Africa was the only region in the world where men and women were infected in roughly equal proportions: in North America the ratio of infected men to women was then 8:1, in Latin America 4:1, in Western Europe 5:1, in Eastern Europe 10:1, in Southeast Asia 2:1 and in the Caribbean 1.5:1 (Mann, Tarantola and Netter, 1992).

The large population of migrant mineworkers in Carletonville attracts many commercial sex workers. Both groups are at high risk of contracting HIV, sex workers because of their many sexual partners and mineworkers because they have few opportunities for relaxation or entertainment apart from alcohol and sex. In a study carried out among hostel dwellers in South Africa approximately one third of the respondents admitted to having had sex with sex workers and casual partners but only 15% said that they consistently use condoms (Webb, 1997). Moreover, South Africa's well-developed transport infrastructure facilitates the movement of people and hence the spread of infection to other parts of the country and to the home countries of the migrant workers. Mineworkers are employed on a contract basis and must leave the mines every year after termination of their contract. They are usually re-employed when they return, if they pass a medical and fitness examination, although this is not guaranteed. A study conducted in Hlabisa in 1995 suggested that women whose husbands were migrant workers were at higher risk of HIV infection than women whose husbands were not migrant workers. In particular, among women whose husbands spent ten or fewer nights at home each month, the prevalence of HIV was 14% while none of the women whose partners spent more than ten nights per month at home were infected (Taylor, 1998).

## 1.4 Aims and objectives

The survey reported on here provides the baseline data for the Mothusimpilo-Carletonville intervention, a project set up in order to

explore and develop ways of managing HIV and STDs in a mining town near Johannesburg. The three main components of the intervention include:

1. Ensuring that all health service providers[3] carry out state-of-the art syndromic management of STDs, provide partner notification services, engage in the systematic collection of routine clinic data, and help to educate people in the community.
2. Developing community-based peer education and condom distribution programmes among women at high risk in the hotspots, in Khutsong and in Carletonville, among mine workers and among adolescents.
3. Encouraging and facilitating the involvement of the community and other stakeholders in Carletonville to ensure that the project receives maximum support, is well co-ordinated and ultimately sustainable.

The aims and objectives of the cross sectional baseline survey are:

1. To assess the prevalence of HIV and STDs among miners, women at high risk and people in the general population.
2. To explore associations between HIV infection and other variables such as age, gender, socio-economic status, knowledge of HIV, condom use, multiple sexual partners, STD infections, male circumcision, and so on and thus to generate detailed explanations as to the natural history of HIV transmission in the Carletonville area and to identify risk factors for HIV transmission.
3. To provide a sound basis for evaluating the impact of the intervention on rates of STDs, including HIV, as well as on behaviour, knowledge, attitudes and practices.
4. Ultimately to develop mathematical models of the course of the epidemic and the impact of the interventions.

As well as the baseline survey, a pilot survey was conducted in January 1998m and, where appropriate, comparisons will be made with the results obtained in that survey.

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3 Including the mine and provincial health services, and traditional healers.

# 2 Designing the surveys

Three surveys have been carried out by Progressus, a local survey company, in the gold mining area of Carletonville: a demographic survey in September 1997, a pilot survey in January 1998, and the baseline survey in July and August 1998. This chapter describes the design of the surveys, including the sampling and stratification, the recruitment and training of field assistants, recruitment of study participants, ethical considerations, and the collection and management of the biomedical and social data. Details of the laboratory analyses and of STDs are also provided.

## 2.1 History of the project

In 1994 Brian Williams and Catherine Campbell, realising the impact that HIV/AIDS would have on South Africa and the mining industry in particular, decided to raise money for an intervention to develop and test ways to reduce the transmission of HIV/AIDS. In this they were joined by Solly Moema and Zodwa Mzaidume (now the Project Manager and the Community Outreach Co-ordinator, respectively) who, with the help of the Carletonville AIDS Action Committee, had been trying to garner support for the development of an HIV intervention in the Carletonville area. The Carletonville AIDS Action Committee had been established by local community groups in Carletonville in response to the realization that HIV/AIDS was beginning to threaten the community.

Developing the protocol and raising donor funding for the project took three years (1994 to 1997) during which time negotiations took place with the gold mines, the trade unions, the state health services, local community organisations and other interested parties. Initial funding for the project was provided by the Department for International Development, United Kingdom, (DFID, UK), which committed £650,000 to the project. Work on the ground started in earnest in January 1997. The central aim of the project is to develop ways to reduce the spread of HIV in a community at high risk. At the same time the project includes an

extensive evaluation component partly to ascertain the present state and nature of the epidemic, but also to fully evaluate the impact of the intervention. .

## 2.2 Stake-holders and funding bodies

Initially the project was directed by Brian Williams then of the Epidemiological Research Unit (ERU), Johannesburg. At the beginning of 1999 Williams moved to the Council for Scientific and Industrial Research (CSIR), Johannesburg who took over responsibility for the project. Williams convened a committee of stakeholders to oversee the project and this included representatives of:

1. Anglo-American Corporation (now Anglo-Gold);
2. Gold Fields of South Africa (now GFL Mining Services);
3. RandGold;
4. The Carletonville AIDS Committee (CAC);
5. The Carletonville Local Health Authority;
6. The Epidemiology Research Unit (ERU; succeeded by the Council for Scientific and Industrial Research, CSIR)
7. The Gauteng Provincial Department of Health;
8. The National Department of Health;
9. The National Union of Mineworkers;
10. The North-West Provincial Department of Health;
11. The Society for Family Health (SFH);
12. The South African Institute of Medical Research (SAIMR).

Funding for the project during its development stage was provided by the ERU until more substantial funding was obtained from the Department for International Development (UK) in 1997. The Population Council (USA), the Provincial Department of Health (SA), and the Old Mutual Assurance Company (SA) have subsequently provided further financial assistance.[4]

4 The amounts of money contributed by the various organisations since the start of the project are given in Appendix 2.

## 2.3 Ethical approval

The protocol for the project was submitted to the committee for Research on Human Subjects (Medical), of the University of Witwatersrand, Johannesburg, and was approved on 10 March 1997 (Protocol M 970235).

## 2.4 The demographic survey

It is likely that the risk of HIV infection depends, in part, on socio-economic status, and research in Soweto has shown that peoples' housing provides a good measure of their socio-economic status (Owen Crankshaw, personal communication). Khutsong township, from which the general population sample was drawn, can be divided into a number of sections, corresponding to those living in private houses, council houses, site-and-service accommodation, and informal settlements or squatter camps. A demographic survey was therefore conducted to estimate the number of people living in each housing type, while collecting data on age, gender, socio-economic status, income, employment, education, and other demographic parameters. (The questionnaire for the demographic survey is given in Appendix 1.) The results of this survey determined the stratification sample of all subsequent surveys and ensured that the sample population was representative of the total population of Khutsong.

### 2.4.1 The study site

Carletonville district, shown in Figure 1.1, includes four distinct populations which needed to be considered separately in relation to the risk of acquiring HIV infection: people living in Carletonville town, people living in Khutsong township, mine workers living in mine hostels, and men and women living in hotspots (i.e. informal settlements) in close proximity to the mine hostels. Within Khutsong there are five main types of housing. Private houses are generally occupied by professional people. Council houses, which are rented from the local authority, are older, smaller and of lower quality than private houses. Most council houses in Khutsong are now being sold to their inhabitants. Both of these types of house may have backyard shacks that are rented out or occupied by other

family members. People living in backyard shacks usually have access to facilities in the main house for which they pay if they do not belong to the family. Poorer people live in site-and-service accommodation, council hostels and informal settlements (squatter camps). In 'site-and-service' areas people are allocated a plot of land that has already been provided with electricity, an outdoor toilet and a tap providing clean and safe drinking water. The inhabitants pay for these services and build their own houses which may be anything from a brick structure with a roof and windows to a shack made of corrugated iron. When a shack is first erected on the land, there is the understanding that the residents themselves will gradually upgrade these shacks into formal housing units. As many as ten people, usually of the same sex, share a room in a council hostel. Basic cooking and sanitation facilities are provided but shared between the inhabitants of more than one room. Khutsong is a growing community, and informal settlements comprising shacks constructed largely of corrugated iron, cardboard and sheets of plastic are constantly added at the edges of the town. There is no electricity, running water or sewerage system in these parts of Khutsong. The inhabitants, including many immigrants from neighbouring countries, live in crowded conditions, buy fresh water at outlets provided by the local council, and dig their own pit latrines.

### 2.4.2 Estimating the population

The demographic survey was carried out in 1997.[5] Table 2.1 gives estimates of the number of housing units in each sector obtained from aerial and the number of people per unit (obtained from the sample) from which the total number of people living in that sector can be estimated. The results of the survey suggest that there were 56,459 people living in Khutsong in 18,000 dwellings.[6] In addition, a total of 70,566 migrant mine workers were living in single-sex mine hostels.

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5 The questionnaire used in the demographic survey is included in Appendix 1.

6 In a census carried out by the municipal authorities a similar estimate was made for the number of dwellings but they estimated the population as being

Table 2.1 Estimated number of people living in each housing type in Khutsong. Priv.: private housing; Coun.: Council housing; S & S: Site and service; Inf.: Informal settlements; Mines: Mine hostels.

| | Priv. | Coun. | S & S | Inf. | Mines |
|---|---|---|---|---|---|
| Units | 805 | 3,151 | 1501 | 12,000 | |
| People/unit | 3.7 | 3.4 | 2.7 | 2.7 | |
| *People* | *2,962* | *10,713* | *4,023* | *32,160* | *70,566* |
| Shacks/house | 1.53 | 0.19 | 0.83 | | |
| Shacks | 1,232 | 599 | 1246 | | |
| People/shack | 2.01 | 2.77 | 1.98 | | |
| *People* | *2,476* | *1,658* | *2,467* | | |
| **Total people** | **5,438** | **12,372** | **6,489** | **32,160** | **70,566** |

## 2.5 The pilot survey

Field work for the pilot survey was carried out in January 1998 among 1,597 residents of the Carletonville mining region, and consisted of a biomedical component including tests for HIV, syphilis, gonorrhoea and chlamydia, and a social science component. The latter was a modified version of the UNAIDS multi-site HIV survey, with sections on background characteristics, demographic and socio-economic issues, measures of social capital, sexual relationships and sexual networking with both regular and casual partners, knowledge and perceptions of HIV/AIDS, attitudes to people who are HIV positive, condom use and reported behaviour change, and experience of STDs.

### 2.5.1 Sampling

Table 2.2 shows the number of men and women sampled in each housing type. For the main housing area the last two columns list the proportion of people living there and the proportion of people sampled in order to

approximately 150,000 inhabitants which would imply almost three times as many people per dwelling (Municipal Authority, 1996).

ensure that the sampling was reasonably close to the actual distribution of people among different housing types.

Table 2.2 Number of men and women sampled in the pilot survey by housing type. The two last columns give the percentage of the total population in each housing type in Khutsong, estimated from the demographic survey and sampled in the survey.

| | Male | Female | Percent of population | Percent of sample |
|---|---|---|---|---|
| Private | 69 | 126 | 10 | 16 |
| Council | 114 | 193 | 22 | 25 |
| Informal | 185 | 417 | 57 | 49 |
| Site & Service | 66 | 52 | 11 | 10 |
| Mine hostels | 229 | • | | |
| Council hostels | 30 | 56 | | |
| Hotspots | • | 47 | | |
| Unknown | 8 | 5 | | |
| Total | 701 | 896 | | |

### 2.5.2 Lessons and problems

The pilot survey provided useful information about the state of the epidemic as well as a number of important lessons concerning the logistics of the survey. (Williams, Campbell and MacPhail, 1999). The pilot survey revealed two problems concerning language and participation.

The questionnaire was translated from English into Zulu, Xhosa, Tswana, Sotho and Shangaan, but the interviewers experienced problems because while the translations were formally correct they sometimes differed significantly from the language used by people in Khutsong. It was clear that the questionnaires would have to be translated into the local versions of the various languages.

The second and more important problem was to get people to participate, particularly in the higher socio-economic sections of Khutsong. In the private house areas it was estimated that 90% of the people were there when visited but of these only about 10% agreed to participate. Reasons given for not wanting to participate included the fact that people already had medical aid and would go to their own doctor if they had a problem; that they were not at risk of HIV; the belief that their blood would be taken and then sold; a perception that the study was only concerned with black and not white people; and a lack of understanding that this was a research project designed to understand the scale and nature of the problem. The people who had been recruiting respondents felt that there would be little point in organising a community meeting in the private housing sector for future surveys as the people living there do not have a strong sense of community. It seemed that older people were also reluctant to be interviewed by younger people. It was decided that when the full surveys were conducted extensive leafleting of the area would be done in advance of the survey and that older people would be used to do the interviews where possible.

Among people living in council houses the response rate was better, and it was estimated that 80% of the people were at home when visited and of these 80% agreed to participate. The most common reason given for not participating was because the father was not present and he would have to decide if the family should participate. In two adjacent sections, visited on consecutive days, there was very poor response on day one in the first section, and a very good response on day two in the second section. The recruiters felt that this was partly due to the fact that once word got around that the process was perfectly acceptable, the news was passed to peoples neighbours who were then happy to participate. It was also clear that to reach the mothers recruiters should go before 11:00 a.m. but to reach the fathers they needed to go in the late afternoon. It was decided that in future surveys, council houses should be visited on the first night between 16:00 and 18:00 hours and arrangements made for

participants to attend on the following day. This would give families time to discuss it with fathers.

In the site-and-service areas it was estimated that 80% of the people were there when visited, but in about 20% of households no one was eligible because of age. For example, many families consisted of grandparents living with grandchildren. Among those who were eligible but refused to participate the main reason given was a reluctance to give blood.

In the squatter settlements people were far more likely to be at home and it was estimated that over 95% of the people were there when visited. However, in Shangaan-speaking areas almost everyone refused to participate, while in the sections known as 'Chris Hani', 'Joe Slovo' and 'New Mandela' the refusal rate was about 30%. In the remaining areas about 10% refused to participate. The reason given by Shangaan speakers was that it was 'against their religion' to give blood although this may have been compounded by the fact that many of them may be illegal immigrants. In the three named areas there are also many illegal immigrants and this would account for the high refusal rate in those areas. Specifically it seemed that people were afraid that the mini-bus that came to bring them to the central point was in fact going to take them away and deport them. This situation was aggravated by the fact that the police use unmarked cars to round up illegal immigrants. There was a significant problem in explaining the difference between HIV and STDs, plus a fear of the results. For future surveys it was decided that interviewers and selectors should receive explicit training in this regard. A decision was also made to work closely with the street committees, at least one month prior to the survey, to help to educate the community about the reasons for and the importance of the survey.

The participation rates among mine workers varied substantially among the various shafts. Except where the union provided people, men were approached while they were eating in the dining hall and as they were leaving the dining hall, and at some shafts miners approached the selectors asking to be included in the study.

At the Elandsrand shaft the refusal rate was estimated at 70%, at Western Deep Levels Number 1 Shaft 40% refused, at the Number 2 Shaft no-one refused, and at the Number 4 Shaft 50% refused. At Deelkraal and at East and West Driefontein no one refused to participate. The problems on the mines were varied. The union was suspicious of the process and was concerned that management would get access to the results. Furthermore the mine management was not overly supportive in some instances. Little or no information about the research had been given to the hostel residents, making them suspicious of the research despite negotiations with their union and management representatives which took place well in advance. On the day of the field work the members of the hostel committees were very uncooperative. At Elandsrand there was an ongoing dispute between management and the union which led to difficulties there. At Western Deep Levels No. 1 Shaft the management had been informed but did not convey the information to those below them. At Western Deep Levels No. 2 Shaft the project worked through the social worker and there were no problems. At both East and West Driefontein the union made a list of people who were approached and all of them agreed to participate (bearing in mind the danger of introducing bias in the selection).

It was clear that future surveys would have to ensure much higher levels of support from management, much closer co-operation with the local union representatives and much greater involvement of the hostel resident's committees. If all of these things are done then persuading mineworkers to participate should not be a problem.

## 2.6 The baseline survey

As noted in chapter one, the main aim of the baseline survey was to assess the prevalence of HIV and STDs in an industrial centre where a large proportion of the population is made up of migrant labourers. From this and subsequent surveys the intention is to generate detailed explanations as to the natural history of HIV transmission and ultimately to evaluate the impact of the interventions that are put in place.

### 2.6.1 Budget

The budget for the baseline survey has three parts: the budget for the behavioural survey, the budget for the laboratory analyses and the budget for data entry (details given in Appendix 2). The average cost per study participant was R450 (approximately US$70) excluding the cost of the data analysis.

### 2.6.2 Recruitment and training of field assistants

Advertisements were placed in churches, local clinics and community buildings in Carletonville, Khutsong and the neighbouring township of Wedela, offering positions in a community project to young people over the age of 23 years, with some tertiary education and fluency in English. Suitable applicants were interviewed and a total of 42 field assistants (twenty selectors for the recruitment of study participants and 22 to conduct interviews). All selected assistants were fluent in at least one local language and were familiar with the Carletonville area.

The twenty selectors met the trainers from Progressus, the company contracted to do the survey, for a three-day training session where they were taught how to find the selected households, visit them one by one, inform household members about the study, motivate them to participate, and collect basic demographic data.

Training the 22 interviewers took one week. Trainee interviewers were given the opportunity to look through the questionnaire and discuss each section in depth. Discussions focused on the structure of the questionnaire and on words and concepts that were difficult to understand. Trainees used role-plays to practice interviewing techniques. Practice interview sessions with both a friend or family member and a stranger were followed by further in-depth discussion of problems and difficulties encountered. Questions on sexual behaviour and the vocabulary used by interviewees generated the most discussion. Question-and-answer sessions, exercises and role-plays were used until all trainees felt comfortable administering the questionnaire to a stranger. The training also provided information on HIV transmission, symptoms of AIDS and places to which to refer people who were in need of counselling.

### 2.6.3 Sampling and stratification

Mine workers, sex workers and the general population of Khutsong were sampled separately. Within Khutsong the population was stratified according to housing type. Given the substantial differences in socio-economic status and also in place of origin of people living in the various housing sectors, it was important to ensure that all were represented approximately in proportion to their numbers in the overall community.

The original sample size calculations are outlined in Appendix 3 from which it was decided to include approximately 1,000 mineworkers, 1,500 people from Khutsong and a further 100 women at high risk, living in the hotspots, to complement the qualitative, in-depth studies that were planned as part of the project.

Different sampling strategies and ways of preparing communities for recruitment were used for the Khutsong community, the mineworkers, and the women at high risk. A full-time person was recruited locally to work with the mines as well as with the community in Khutsong. His job was to promote and market the project, and to provide information to organisations and individuals. Street associations, churches and other community organisations in Khutsong were contacted to gain support for the project. In addition, pamphlets were distributed in the private housing sector to facilitate communication with people living in this area.

The sample was stratified using the results of the demographic survey (Table 2.1). For the cross-sectional survey, individual dwellings on aerial photographs were counted, the aerial photograph was ‘ground-truthed’ to estimate the degree to which the settlements had increased in size since the photographs were taken, and the number of inhabitants per housing type estimated. The number of people sampled per housing type included those living in the backyard shacks. The number of respondents needed from each housing type was calculated in proportion to the total sample size and the number of clusters chosen to give 25 to 30 people per cluster (Table 2.3).

Table 2.3 The number of people required per housing type for the baseline survey.

| | People per housing type | Number of clusters | People per cluster |
|---|---|---|---|
| Private houses | 100 | 4 | 25 |
| Council houses | 200 | 4 | 50 |
| Site and service | 300 | 8 | 38 |
| Council hostels | 50 | 2 | 25 |
| Informal sector | 400 | 14 | 29 |
| Khutsong South | 100 | 3 | 34 |
| Mine hostels | 900 | 9 | 100 |
| Hotspots | 150 | 25 | 6 |

The large number of people per cluster in the council houses was due to the high number of backyard shacks in this area. The index houses were chosen randomly from 1:50,000 maps of the area, geo-coded and identified on the ground. Other houses in each cluster were identified by moving to the right of the index house, taking every third house including its backyard shack. If the third plot did not have a house then the sampling continued with the next house three to the right. The same applied if the plot had a church, shop or any building other than a house. In council hostels, an index room was chosen at random, and all inhabitants of every third room to the right of this room were sampled. Once the dwelling units within a cluster had been identified, all people aged 13 to 59 years were invited to participate. Every effort was made to ensure that all members of the selected households took part in the survey.

### 2.6.4 Recruitment of study participants

Recruitment in Khutsong began each day in the late afternoon, when people finished work and were most likely to be at home. The selectors covered a specified area of the town according to a prearranged sampling plan. They approached the household heads in the specified houses and

provided information on the study. The whole family, including those living in backyard shacks were then invited to participate. Once the family had agreed to participate the selectors completed a form, recording the number of people in the house, their first names (family names were not recorded), gender and age. Selectors returned twice more to a selected house if there was no-one present or some household members had not presented themselves to be interviewed. If people were not present or still refused to participate after three visits, the house or the person was dropped and another chosen.

From the experience of the pilot survey it was considered important to involve both the mine management and the National Union of Mine Workers in the selection of miners. Before the recruitment of miners commenced, all mines in the area were visited and at each one all hostel supervisors were informed about the project, and were asked to give their support. There are ten hostels in the Carletonville area (Figure 1.1) which are occupied by migrant mine workers and from these 900 miners were recruited. In each hostel all the occupants of the third room to the right of a randomly-selected index room were invited to participate. Sampling was continued in this way until a total of 90 men had been recruited in each hostel. Recruitment began at one o'clock in the afternoon, when the men from the evening shift were available, and continued throughout the afternoon with the men from the other shifts.

### 2.6.5 Refusal rates

In Khutsong, 173 people refused to participate and a further 135 apparently lived in the selected houses but could not be found.[7] Neither the sex ratio nor the age distribution of those who refused to participate differed from those who did participate, so that the refusals are unlikely to bias the results significantly. It should be pointed out, however, that the refusal rate did vary by housing type with higher refusal rates among those living in private houses.

7 Of these 308 people 42% were men and 58% were women.

### 2.6.6 Ethical considerations

A consent form (Appendix 4) was available in English and translated into the respondents language of choice so that all participants were informed in their own language that they would be interviewed about issues relating to their health and their sexual behaviour and that they would be asked to provide a sample of blood and urine for HIV and STD testing.

Participants were told that they would be given their STD test results and provided with treatment if they so wished. All STD tests were therefore done, and the results made available to the study participants who were treated in local community clinics or mine clinics, before the HIV tests were carried out. All individual identifiers were then destroyed and the blood samples tested for HIV. Study participants were all offered a separate, free HIV test with pre- and post-test counselling but no-one took up the offer.

The first name, age, sex and identifying number of each study participant as well as the identification number of the house were recorded when people were recruited. All information that could lead to the identification of an individual participant was destroyed after data collection had been completed. The behavioural and biomedical data were connected by an individual identification number only so that no survey information could be traced to a particular person. For those who returned for the results of their STD tests, the project kept only the identification number and the participants had to produce their identification number on the basis of which their STD test results could be ascertained and treatment given.

## 2.7 Data collection

The baseline survey was carried out during four weeks in July and August 1998. The recruiters gave each household member a card which stated the time and place at which to attend for the interview and for giving samples. The participants were accompanied by selectors to a specified street corner from where they were transported to their interview venues at local schools. The total number of participants was 2231.

### 2.7.1 Questionnaire

The questionnaire was based on the one used in the UNAIDS Multi-centre Study which was carried out in two West African cities (Cotonou and Yaounde) and two East African cities (Kisumu and Ndola) (UNAIDS, 1998). Some of the questions in the UNAIDS questions were changed to make them relevant to the situation in Carletonville and other questions were added to cover issues of migrancy (which is central to the social structure of Carletonville) and social capital. The questionnaire was translated into Sotho, Tswana, Zulu and Xhosa, and then translated back into English to check the accuracy of the translation. The English version of the questionnaire is given in Appendix 5, versions in other languages are available from the authors. Final adjustments to the questionnaire were made during the process of training the interviewers in order to ensure that the languages were as spoken by local people.

### 2.7.2 Interviews

At the interview venues, the interviewers introduced themselves and then explained again what was expected of the study participant. The consent form was read out in the language of the respondent, who was asked if they would consent to be part of the study and, if they agreed to participate, they signed the consent form. The interviewers completed the questionnaire during a one-to-one discussion in the language of the interviewee and, whenever possible, by an interviewer of the same sex as the respondent, to obtain data on socio-economic characteristics, medical and sexual history, knowledge and attitudes about HIV/AIDS. It was made clear to the interviewees that their names were not being recorded on the questionnaire to maintain confidentiality, and that they had the right not to answer questions if they so wished. Two teams of ten selectors and eleven interviewers each worked simultaneously and were supervised by two language supervisors and four project supervisors.

### 2.7.3 Blood and urine collection

The interviewee took the completed questionnaire to an assistant nurse who explained the procedures for collecting blood and urine. The assistant

nurse labelled the questionnaire, the household card, two tubes for blood collection, and a urine container. All of these were labelled with a common identification number. A fully-qualified nursing sister then drew venous blood, and the subject was asked to deliver approximately ten millilitres of first stream urine. The blood tubes, urine container, questionnaire and household card were then presented to the assistant nurse who checked that everything had been done. Each participant was given a card with his or her identification number, to be presented when collecting STD results. Once the whole process had been completed the participants were given R10 (approximately US$1.50) as a token of appreciation and to cover the transport costs for the collection of their STD results. While the interviewee was still present and blood and urine samples were being taken the completed questionnaire was checked by the supervisors for completeness and for internal consistencies. A taxi service was organised to transport participants home again, because data collection finished after nightfall.

### 2.7.4 Policy on needle-stick injuries

All nurses and nursing assistants involved in taking blood were vaccinated against Hepatitis B at the start of the project and asked to read and sign the form given in Appendix 6, a copy of which was given to them to keep. This procedure ensured that if anyone did receive a needle-stick from an infected person they would immediately be put on anti-retroviral therapy for two months. This policy on needle-stick injuries (Appendix 6) was discussed in detail with all health workers at the time of their employment. In the event there was one needle-stick injury but the person from whom blood was being taken tested negative.

## 2.8 Laboratory tests

Once the blood and urine samples had been collected they were stored overnight at a temperature of $4^{o}$C. The following morning they were transported to Johannesburg. Staff at the Reference Centre for STDs at the South African Institute for Medical Research were responsible for the

processing and analysing of the samples. Both tubes of blood samples were spun down and the serum collected in two separate sterile tubes; one was refrigerated for use in syphilis serology and the other stored at -20 $^{o}$C. All tests were performed once and the results recorded on pre-prepared record sheets. The laboratory tests are described fully in Appendix 7.

### 2.8.1 HIV

The serum samples were defrosted and a Capillus® HIV-1/HIV-2 Latex Aggregation Test was performed according to the instruction manual (Cambridge Diagnostics, Galway, Ireland Ltd). Only a single test was done because the sensitivity and the specificity of the test are both greater than 99%, and the results of the test were strictly anonymous. All participants were offered a separate HIV test with full counselling, but none took up the offer.

Table 2.4 Interpretation of syphilis serology with the percentage found in each category in the baseline survey ($n$ = 2176)

| Non-treponemal | Treponemal | Interpretation |
|---|---|---|
| Negative | Negative | No syphilis or incubating syphilis: 61.8% |
| Positive | Negative | Probably a non-specific reaction: 0.2% |
| Negative | Positive | Successfully treated syphilis or untreated very early syphilis: 30.2% |
| Positive | Positive | Untreated or unsuccessfully treated syphilis, or late syphilis: 7.8% |

### 2.8.2 Syphilis

Serological tests are the most frequently-used method for the diagnosis of syphilis. Non-treponemal tests are very sensitive but not absolutely specific and are known to yield false positive reactions. However, they are easy to perform, cheap, and suitable for large-scale screening. Moreover, they can be used to monitor responses to treatment. In contrast, while treponemal tests are highly specific, people continue to test positive once they have been infected, even if they are subsequently treated and cured.

The interpretation of syphilis serology is complex (Ballard and Fehler, 1996) and is summarised in Table 2.4.

Two different tests for the detection of syphilis antibodies were performed on each serum sample: a non-treponemal carbon antigen test,[8] and a specific treponemal antigen test.[9] Both tests were performed according to the manufacturers' instructions.

### 2.8.3 Gonorrhoea

The LCx® *Neisseria gonorrhoeae* assay uses the nucleic acid amplification method (Ligase Chain Reaction) to detect a specific target nucleic acid sequence in the Opa gene of *Neisseria gonorrhoeae* in urine specimens from symptomatic and asymptomatic men and women. All tests for the presence of *Neisseria gonorrhoeae* DNA were performed according to the instruction manual of the *Neisseria gonorrhoeae* assay.[10] The specificity of the assay is greater than 99% in all cases, the sensitivity varies from 85.7% in asymptomatic men to 99.4% in symptomatic men with the sensitivity for women falling in between (Appendix 7).

### 2.8.4 Chlamydia

All tests for the presence of *C. trachomatis* plasmid DNA were performed according to the instruction manual of the LCx® *Chlamydia trachomatis* assay.[11] The specificity of the test is in excess of 96% all cases while the sensitivity varies from 92% in asymptomatic men to 97% in symptomatic women (Appendix 7).

### 2.8.5 Collection of STD results

Khutsong community members were told that they could collect their STD results from the clinic closest to their home. No names were recorded. Upon presentation of the blue card with an identification number that could be matched to the test results, each person was either

8 Immutrep-Carbon Antigen, Omega Diagnostics, Ltd., Alloa, Scottland, UK
9 Cellognost Syphilis H, Dade Behring, Marburg, Germany
10 Abbott Laboratories, Illinois, USA
11 Abbott Laboratories, Illinois, USA

told that he or she was free of STDs or given a referral letter and asked to present at a municipal clinic for free treatment. Miners who participated in the survey were given their STD results and treatment, if necessary, at mine clinics. Altogether 481 people (196 men and women in Khutsong, 249 mine workers and 36 sex workers) returned to get their STD results.

## 2.9 Data management

All information collected was recorded on standard forms and checked daily. Laboratory results and all data from the behavioural survey were entered twice by different people into a database (Microsoft Access). The two entries were then compared and any differences noted and corrected. The data were then extensively checked for inconsistencies (ages in the correct range, men only answering questions relating to men, etc.). The files were then imported into the Statistical Package for Social Sciences (SPSS 9.0 for Windows) and prepared for statistical analysis.

## 2.10 Statistical analysis

All continuous variables were first checked for normality and those that were significantly skew were normalised using a logarithmic transformation or converted into discrete variables.[12] Statistical tests used included $\chi^2$, Fisher's exact test, Cramer's V, Median test, Mann-Whitney test, Pearson's and Spearman correlation coefficients, univariate and multivariate logistic regression, and the Kolmogorov-Smirnov test. Test statistics were regarded as significant when $p \leq 0.05$ although variables from the univariate analyses were subsequently included in the multivariate analyses when $p \leq 0.2$. The number of independent variables was always less than $(N-50)/8$ which is generally regarded as an upper limit to avoid over fitting the data.

12 These included age, number of days on trips out of Carletonville, wages, age difference between person and regular or casual partner, age at first sex and time from first sex to current marriage.

# 3 Results

In this chapter the results of the biomedical and behavioural surveys carried out in August 1998 are presented. Following a general description of the study population, the relationships between HIV prevalence and biomedical and social data are explored. The biomedical data include the prevalence of various STDs while the social data include circumcision, multiple partnerships, condom use, knowledge and perception of HIV/AIDS, and social capital. A statistical model, based on the results of multivariate risk factor analysis is then presented. Results for men and women are reported separately because of the significant difference in HIV prevalence between the two genders. The results for miners and sex workers are generally analysed separately for the same reason.

## 3.1 The study population

Table 3.1 shows the composition of the sample which comprised 2,231 people: 1,396 men and 833 women. Of the men, 475 were living in Khutsong, 24 in hotspots, and 899 in single-sex mine hostels. Of the women, 712 were living in Khutsong and 121 in hotspots. The hotspots are places close to the mine hostels and shafts where commercial sex takes place and where alcohol is informally sold and consumed.

Table 3.1 Numbers of men and women from Khutsong, mine hostels, and hotspots

| | Men | Women | Total |
|---|---|---|---|
| Khutsong | 475 | 712 | 1185 |
| Mine hostels | 899 | 0 | 899 |
| Hotspots | 24 | 121 | 145 |
| Total | 1398 | 833 | 2231 |

Table 3.2 shows the number of people we planned to sample and the actual number sampled. Khutsong South has been created since the demographic survey was conducted and the population of that area has still to be estimated. We therefore decided to sample 100 people from this area.

Table 3.2 The number of people sampled per housing type: 'Planned' gives the intended number to sample; 'Sampled' gives the number actually sampled, by housing type. These are followed by 'Sam. %' the percentage in the sample from each housing type and 'Pop. %' the population percentage and the estimated number of people in the general population living in each housing type.

| Housing type | Planned | Sampled | Sam. % | Pop. % |
|---|---|---|---|---|
| Private | 100 | 98 | 10 | 10 |
| Khutsong South[13] | 100 | 106 | • | • |
| Council | 200 | 195 | 19 | 22 |
| Site-and-service | 300 | 311 | 31 | 11 |
| Informal | 400 | 415 | 41 | 57 |
| Council Hostel | 50 | 49 | • | • |
| Total | 1,150 | 1,174 | 100 | 100 |

The population is broken down by housing type and gender in Table 3.3 where the number of people living in backyard shacks is also indicated. There were more men than women living in private houses but more women than men living in council houses, site-and-service areas and informal settlements.

13 The houses in Khutsong South are all private houses.

Table 3.3 Number of men and women sampled in Khutsong by housing type.

| | Men | | Women | |
|---|---|---|---|---|
| | Number | % | Number | % |
| Private | 63 | 14 | 35 | 5 |
| Khutsong South | 45 | 10 | 61 | 9 |
| Council | 59 | 13 | 136 | 19 |
| Site-and-service | 109 | 23 | 202 | 29 |
| Informal | 162 | 35 | 253 | 36 |
| Council Hostel | 28 | 6 | 21 | 3 |
| Total | 466 | 100 | 708 | 100 |

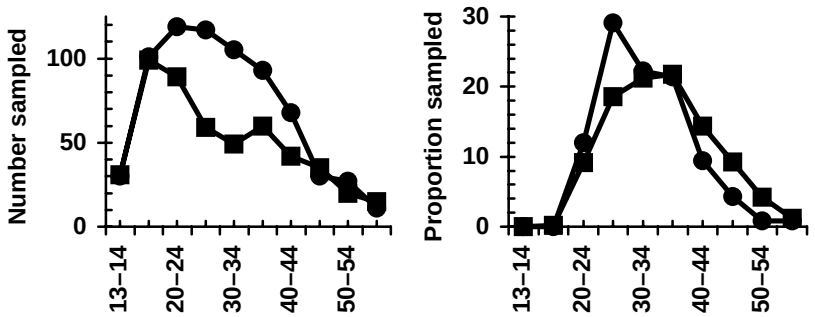


Figure 3.1. (a) The *number* of men (squares) and women (circles) living in Khutsong, and (b) the *proportion* of miners (squares) and women living in hotspots (circles), who were included in the survey, plotted against age. All age ranges except the first cover five years.

In Table 3.4 and Figure 3.1 the population is further broken down by age and gender. The age distributions of men and women in Khutsong differ significantly (Kolmogorov-Smirnov test; $p = 0.021$). Although the mean age of the men (29.4 years) is very close to the mean age of the women (30.0 years), there were more women than men between the ages of 20 and 44 years. The age distributions of men in Khutsong and

mineworkers, on the other hand, are very different (Kolmogorov-Smirnov test; $p \leq 10^{-6}$) with 26% of men in Khutsong but only 0.8% of mineworkers being below the age of 20 years. Interestingly, as shown in Figure 3.1, the age distribution of mineworkers is quite close to that of the women living in the hotspots (Kolmogorov-Smirnov test; $p = 0.018$) although the mineworkers were slightly older (mean age of mineworkers = 35.2 years, of women in hotspots = 32.5 years).

Table 3.4 Age distribution of men and women in Khutsong, mineworkers and women living in hotspots. Numbers in brackets give mean ages.

| | Khutsong men (29.4 yr.) | | Mine-workers (35.2 yr.) | | Khutsong women (30.0 yr.) | | Women in hotspots (32.5 yr.) | |
|---|---|---|---|---|---|---|---|---|
| Age (yr) | *n* | % | *n* | % | *n* | % | *n* | % |
| 13–14 | 31 | 6.2 | 0 | 0.0 | 30 | 4.2 | 0 | 0.0 |
| 15–19 | 99 | 19.8 | 2 | 0.2 | 104 | 14.5 | 1 | 0.8 |
| 20–24 | 89 | 17.8 | 82 | 9.1 | 121 | 17.0 | 14 | 11.6 |
| 25–29 | 59 | 11.8 | 167 | 18.6 | 117 | 16.5 | 35 | 28.9 |
| 30–34 | 49 | 9.8 | 191 | 21.2 | 107 | 15.1 | 26 | 21.5 |
| 35–39 | 60 | 12.0 | 196 | 21.8 | 93 | 13.1 | 25 | 20.7 |
| 40–44 | 42 | 8.4 | 129 | 14.3 | 69 | 9.7 | 11 | 9.1 |
| 45–49 | 35 | 7.0 | 83 | 9.2 | 30 | 4.1 | 5 | 4.1 |
| 50–54 | 20 | 4.0 | 38 | 4.2 | 28 | 3.9 | 2 | 1.7 |
| 55–59 | 15 | 3.0 | 11 | 1.2 | 11 | 1.5 | 2 | 1.7 |
| Unknown | 0 | 0.0 | 0 | 0.0 | 2 | 0.3 | 0 | 0.0 |
| Total | 499 | 100.0 | 899 | 100.0 | 712 | 100.0 | 121 | 100.0 |

## 3.2 Age-prevalence of HIV infection

The men and women from Khutsong were a random sample of 13 to 59 year-old people living in the township. The women living in hotspots

generally worked as commercial sex workers. The mineworkers were all migrants either from rural areas within South Africa or from rural areas in neighbouring countries. Susceptibility to HIV infection varies according to age, gender and migrancy status, and was particularly high among commercial sex workers (CSWs). Most statistical analyses were therefore carried out separately for the men in Khutsong, miners, women in Khutsong, and women in hotspots. As expected, the highest HIV prevalence was found among women in hotspots where nearly 70% were HIV-positive as compared to 37% of the general female population of Khutsong. The mean prevalence among men in Khutsong was 22%, while that among miners was 29% (Table 3.5).

Table 3.5 The number of men and women living in Khutsong, and the number of mineworkers and women living in hotspots by age and the percentage that are HIV-positive by age.

| | Khutsong men | | Khutsong women | | Mine-workers | | Women in hotspots | |
|---|---|---|---|---|---|---|---|---|
| Age (yr) | *n* | HIV+ | *n* | HIV+ | *n* | HIV+ | *n* | HIV+ |
| 13–14 | 31 | 0.0 | 30 | 0.0 | 0 | • | 0 | • |
| 15–19 | 99 | 2.0 | 101 | 20.8 | 2 | 0.0 | 1 | 0.0 |
| 20–24 | 89 | 17.0 | 119 | 53.8 | 82 | 29.3 | 14 | 92.9 |
| 25–29 | 59 | 43.1 | 117 | 58.1 | 167 | 28.1 | 34 | 67.6 |
| 30–34 | 49 | 42.9 | 105 | 46.7 | 191 | 28.4 | 26 | 69.2 |
| 35–39 | 60 | 36.2 | 93 | 33.3 | 196 | 31.6 | 25 | 52.0 |
| 40–44 | 42 | 31.0 | 68 | 23.5 | 129 | 27.9 | 11 | 81.8 |
| 45–49 | 35 | 15.2 | 30 | 20.0 | 83 | 28.9 | 5 | 60.0 |
| 50–54 | 20 | 10.0 | 27 | 14.8 | 38 | 23.7 | 1 | 100.0 |
| 55–59 | 15 | 13.3 | 11 | 27.3 | 11 | 9.1 | 1 | 100.0 |
| Total | 499 | 21.5 | 701 | 37.4 | 899 | 28.5 | 118 | 68.6 |

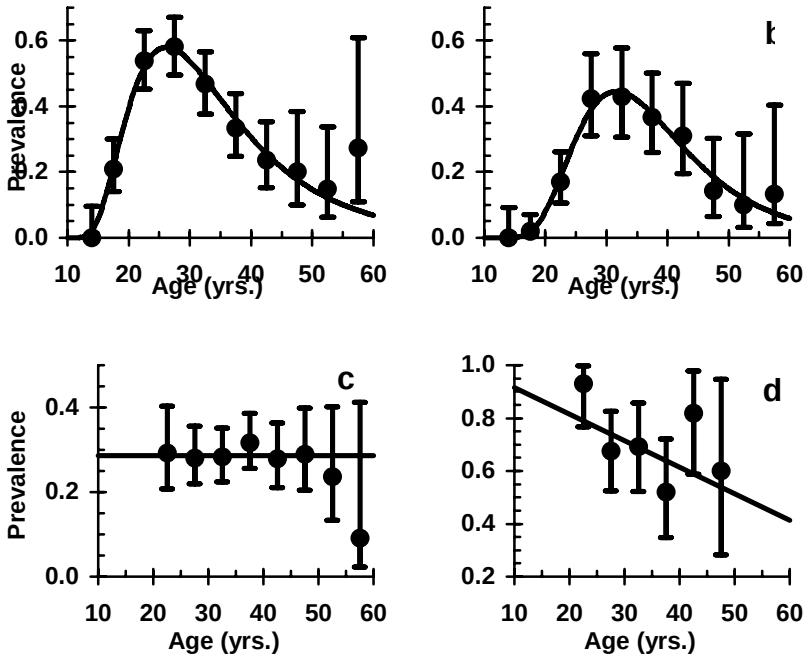


Figure 3.2. The age prevalence of HIV-infection among a) women in Khutsong; b) men in Khutsong; c) mineworkers; and d) women in hotspots. (Details of the fitted curves are given in Appendix 8.)

It is important, however to examine the variation in the prevalence with age since this is quite different in the different populations (Table 3.5 and Figure 3.2). Considering first the age prevalence of HIV infection for men and women in Khutsong, we note that among 13 and 14 year-old men and women the prevalence was zero (≤ 4.9%; 95% CL, men and women combined). At 20 years of age the prevalence of infection among women had reached 39% while among men it was still only 8% (Fitted curves in Figure 3.2). The prevalence peaks at 58% among 26 year old women and at 45% among 32 year old men. The decline with age beyond the peak is due to the fact that older men and women in this community are

presumably now at lower risk than are younger people and when they were younger there was little or no HIV infection in the population.

The pattern of infection among mineworkers and sex workers is quite different from the pattern of infection in the community as can be seen in Figure 3.2 (but note the changes of scale). For mineworkers the age prevalence does not differ significantly from a constant ($p$ = 0.506; test of deviance). For women living in hotspots the age-prevalence declines significantly with age ($p$ = 0.028; test of deviance) from an estimated high of about 80% among 20 year old women to 50% among 50 year old women.

The most parsimonious explanation for these differences starts from the observation that in a rapidly spreading epidemic the age prevalence is proportional to the age incidence, to a first approximation, because any infections will have been acquired recently (Williams, Gouws, Abdool Karim and Wilkinson, 2000). Young women and men in Khutsong become sexually active in their teen-age years but sexual activity declines in older people. The differences between men and women in Khutsong can be partly attributed to differences in the age of sexual partners and in women's susceptibility to infection and these issues are discussed below. The implication is, however, that for mineworkers the risk of infection is independent of age which could well be a consequence of the conditions under which they are obliged to live (Williams, Gouws, Colvin, Sitas et al. 2000). For women living in the hotspots it is not surprising that the prevalence of infection is very high and it may well be that younger women in the hotspots have more sexual partners than older women so that the incidence is highest amongst younger women.

## 3.3 HIV and partnerships

Figure 3.3 and Table 3.6 give the prevalence of infection plotted against the reported number of sexual partners. Among people who said that they had never had sex, two of 82 men and two of 68 women were infected. One of these individuals, a sixteen-year-old man, had a fourteen-year-old girlfriend in Khutsong. The others, a twenty-year-old man and two women

aged eighteen and 42, said that they were single. Among people who reported having had at least one sexual partner in their life, the HIV prevalence increased to 25% among men in Khutsong to 29% among mine workers and to 41% among women in Khutsong.

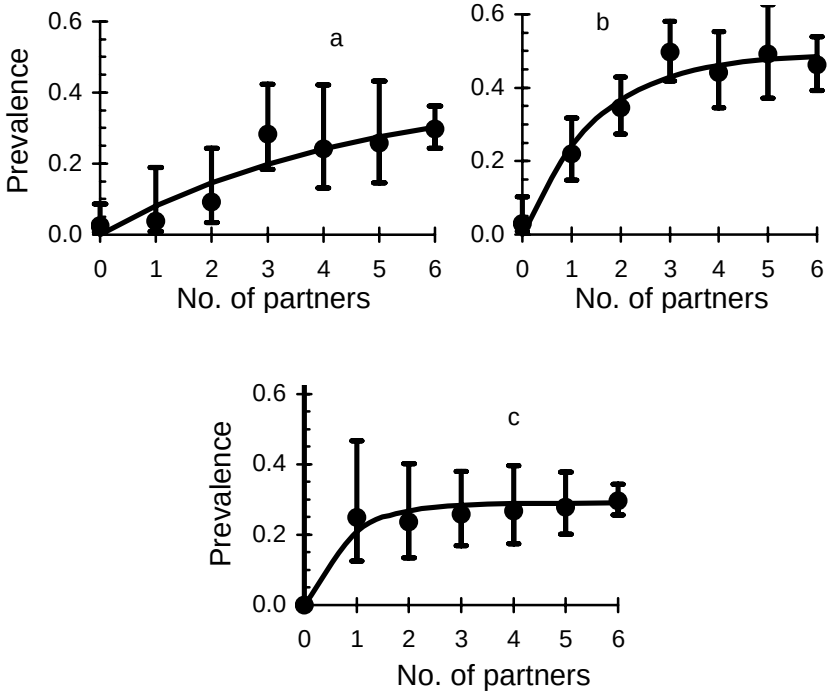


Figure 3.3 The prevalence of HIV-infection plotted against the reported number of sexual partners for a) women in Khutsong; b) men in Khutsong; and c) mineworkers. (Details of the fitted curves are given in Appendix 8.)

The patterns of infection are again quite different among the four groups. Among men living in Khutsong the rate of infection increases much more slowly than among women living in Khutsong and levels off

at a substantially lower prevalence. Among mineworkers the prevalence of infection increases almost as quickly as among women but then shows no further increase after the second partner.

Table 3.6 The number sampled and the percentage that are HIV-positive by age for Khutsong men and women and mineworkers.[14]

| No. of | Khutsong men | | Mineworkers | | Khutsong women | |
|---|---|---|---|---|---|---|
| partners | *n* | HIV+ | *n* | HIV+ | *n* | HIV+ |
| 0 | 81 | 2.5 | 1 | 0.0 | 67 | 3.0 |
| 1 | 27 | 3.7 | 24 | 25.0 | 91 | 22.0 |
| 2 | 33 | 9.1 | 38 | 23.7 | 142 | 34.5 |
| 3 | 53 | 28.3 | 66 | 25.8 | 143 | 49.7 |
| 4 | 33 | 24.2 | 60 | 26.7 | 86 | 44.2 |
| 5 | 35 | 25.0 | 97 | 27.8 | 57 | 49.1 |
| 6+ | 228 | 29.8 | 612 | 29.7 | 177 | 46.2 |
| Total | 492 | 21.5 | 899 | 28.6 | 703 | 37.4 |

Table 3.7 Best fit values for the asymptotic prevalence and the risk of HIV-infection after having had one partner for men and women in Khutsong and for mineworkers.

| Parameter | Khutsong men | Khutsong women | Mineworkers |
|---|---|---|---|
| Asymptote (%) | 42 | 49 | 29 |
| Risk after one partner (%) | 8 | 27 | 21 |

Fitting these data to functions that increase exponentially to an asymptote (as described in Appendix 8) gives the parameter values shown in Table 3.7. The eventual risk of infection in men is about 80% of that for

14 Appendix 5, question 326.

women as judged by the asymptotes while the eventual risk for mineworkers is about 75% of that of men. However, the risk of infection for women after one partner is roughly three times that for men, while the risk of infection for mineworkers who report having had only one sexual partner is not that much less than for women. The reasons why mineworkers become infected so rapidly after only one partnership and by the age of 25 years but then appear to show no further increase with either age or the number of partners is not clear.

Table 3.8 Percentage of people belonging to various ethnic groups in Carletonville. 'Others' includes Pedi, Shangaan, Swazi, Ndebele, Malawian and Tsonga.[15]

| | Khutsong men ($n$ = 499) | Khutsong women ($n$ = 712) | Mine-workers ($n$ = 899) | Women in hotspots ($n$ = 121) |
|---|---|---|---|---|
| Tswana | 32.7 | 29.2 | 12.3 | 3.3 |
| Xhosa | 26.3 | 32.5 | 29.8 | 35.8 |
| Sotho | 19.8 | 25.1 | 26.5 | 42.3 |
| Zulu | 8.6 | 6.6 | 9.1 | 11.4 |
| Others | 12.6 | 6.6 | 22.2 | 7.3 |

## 3.4 Demographic and behavioural characteristics

### 3.4.1 Ethnic groups

A number of ethnic groups including Tswana, Xhosa, Sotho, Zulu, Pedi, Shangaan, and Swazi were represented in the sample (Table 3.8). Among those living in Khutsong the most important groups were Tswana, Xhosa and Sotho, followed by Zulu; among both mineworkers and women living in hotspots the dominant groups were Xhosa and Sotho followed by Tswana and Zulu.

15 Appendix 5, question 206.

### 3.4.2 Education

Education levels were uniformly high amongst all groups (Table 3.9). Close to 60% of all groups had completed primary education and more than 25% of people living in Khutsong as well as mineworkers had completed secondary education. There was no significant difference between the educational levels reached by men and women living in Khutsong but relatively few women living in hotspots had completed secondary school.

Table 3.9 Percentage of men in Khutsong, mineworkers, women in Khutsong and women in hotspots who had reached various educational levels. The table only refers to people over the age of 20 years.[16]

| | Khutsong men ($n$ = 499) | Mine-workers ($n$ = 895) | Khutsong women ($n$ = 707) | Women in hotspots ($n$ = 123) |
|---|---|---|---|---|
| Not completed primary school | 16.8 | 20.6 | 14.9 | 23.6 |
| Completed primary school | 57.7 | 56.8 | 61.7 | 63.4 |
| Completed secondary school | 23.4 | 21.7 | 23.6 | 13.0 |
| Post matriculation | 2.0 | 1.0 | 0.6 | 0.0 |

### 3.4.3 Employment

Unemployment was high among people living in Khutsong but especially so amongst women (Table 3.10); mineworkers were necessarily all in full-time employment. Working women in Khutsong were mainly engaged in domestic services or selling goods; among women living in hotspots 37% gave ‘sex worker’ as their usual occupation but a further 13% said that they had accepted money in exchange for sex.

16 Appendix 5, question 203.

Table 3.10 Proportion of people in different categories of employment. Employed includes full-time, part-time and self; unemployed includes house-wives, looking for work, not looking for work. Retired includes pensioners and disabled.[17]

| | Khutsong men *n* = 499 | Khutsong women *n* = 642 |
|---|---|---|
| Employed | 36.4 | 17.9 |
| Unemployed | 32.8 | 58.7 |
| Student | 28.2 | 22.0 |
| Retired | 2.6 | 1.4 |

Table 3.11 Lower quartile, median and upper quartile monthly incomes in Rands for those who are employed (full-time, part-time or self). At the time of the survey 1US$ ≈ R6.[18]

| | Khutsong men *n* = 231 | Khutsong women *n* = 229 | Mine-workers *n* = 886 | Women in hotspots *n* = 72 |
|---|---|---|---|---|
| Lower quart. | 400 | 180 | 1000 | 200 |
| Median | 1000 | 300 | 1300 | 345 |
| Upper quart. | 1500 | 500 | 1500 | 600 |

The median income of mineworkers was R1,300 per month and the median income of men in employment in Khutsong slightly less at R1,000 per month (Table 3.11). However, the income at the lower quartile for men in Khutsong was considerably less than for mineworkers showing that a substantial proportion of men who do work earn very little.

17 Appendix 5, question 215.
18 Appendix 5, question 215A.

Working women living in Khutsong and women living in hotspots had very similar earnings but these were only about one-third of the earnings of men.

### 3.4.4 Alcohol consumption

A substantial proportion of people said that they never drink alcohol ranging from 41% of women living in hotspots to 66% of women living in Khutsong. But many said that they drink every day ranging from about 10% of men and women living in Khutsong to 27% of women living in hotspots (Table 3.12). There were no significant differences among the prevalence of HIV infection in those who said that they drank daily, weekly or monthly in any of the four groups but those who said they never drank alcohol were significantly less likely to be HIV positive than those that did drink alcohol in all four groups.

Table 3.12 The proportion of Khutsong men and women, mineworkers and women living in hotspots who drink alcohol daily, weekly, monthly or never (as a percentage) and the prevalence of HIV infection among each group (as a percentage). Significance levels are for comparisons between those who drink (daily, weekly or monthly) and those who never drink.[19]

| | Khutsong men *n* = 499 | | Khutsong women *n* = 711 | | Mine-workers *n* = 899 | | Women in hotspots *n* = 123 | |
|---|---|---|---|---|---|---|---|---|
| | Prop. | HIV | Prop. | HIV | Prop. | HIV | Prop. | HIV |
| Daily | 11.0 | 29.1 | 10.3 | 48.6 | 15.9 | 33.3 | 27.0 | 72.7 |
| Weekly | 22.5 | 37.3 | 12.7 | 37.8 | 21.3 | 30.9 | 23.8 | 75.9 |
| Monthly | 17.5 | 24.4 | 11.5 | 50.6 | 15.6 | 37.1 | 8.2 | 80.0 |
| Never | 49.0 | 11.7 | 65.5 | 33.2 | 47.2 | 23.2 | 41.0 | 57.5 |
| *p* | < 0.00001 | | 0.0016 | | 0.0006 | | 0.048 | |

19 Appendix 5, question 217.

### 3.4.5 Marital status

Table 3.13 gives the proportion of people who are married, single, separated or widowed. Mineworkers and women living in hotspots were more likely to be married than were people living in Khutsong, while men living in Khutsong were more likely than people in the other groups to be single.

Table 3.13 The marital status of people in the survey. 'Married' includes living as married; 'committed' means not living together; 'separated' includes 'divorced'.[20]

| | Khutsong men *n* = 499 | Khutsong women *n* = 711 | Mine-workers *n* = 899 | Women in hotspots *n* = 123 |
|---|---|---|---|---|
| Married | 36.5 | 49.9 | 66.6 | 64.2 |
| Committed | 33.7 | 25.7 | 26.7 | 12.2 |
| Single | 25.3 | 15.9 | 4.3 | 16.3 |
| Separated | 2.4 | 5.5 | 1.7 | 3.3 |
| Widowed | 2.0 | 3.1 | 0.7 | 4.1 |

## 3.5 Demographics of young people

The infection rates amongst young people, especially young women, are alarmingly high (Figure 3.2). It is clear that a critical target group for interventions is people aged fifteen to twenty years. In this section we consider people aged fifteen to 29 only, in order to highlight risk factors and behaviours that are specific to young people.

### 3.5.1 Ethnic groups

The ethnic groups represented among young people are not very different from those represented amongst everyone included in the survey (compare Table 3.8 and Table 3.14). Thus the dominant groups are again Tswana, Xhosa and Sotho, followed by Zulu, amongst people living in Khutsong,

20 Appendix 5, question 303.

and Xhosa and Sotho, followed by Tswana and Zulu, amongst mineworkers and women living in Khutsong. .

Table 3.14 Ethnic groups for young people aged 15 to 29 years. 'Others' include Pedi, Shangaan, Swazi, Ndebele, Malawian, Tsonga and any others.[21]

| | Khutsong men *n* = 241 | Khutsong women *n* = 343 | Mine-workers *n* =273 | Women in hotspots *n* = 53 |
|---|---|---|---|---|
| Tswana | 37.3 | 29.7 | 7.0 | 3.8 |
| Xhosa | 24.9 | 32.7 | 33.3 | 41.5 |
| Sotho | 21.2 | 25.1 | 29.3 | 30.2 |
| Zulu | 6.6 | 8.5 | 9.9 | 11.3 |
| Others | 10.0 | 6.6 | 20.5 | 13.2 |

Table 3.15 Percentage of men and women attending a school or a college for different ages.[22]

| Age (yr.) | Khutsong men | | Khutsong women | |
|---|---|---|---|---|
| | *n* | % | *N* | % |
| 13–14 | 31 | 97.4 | 31 | 96.8 |
| 15–16 | 56 | 96.4 | 44 | 90.9 |
| 17–18 | 26 | 84.6 | 43 | 72.1 |
| 19–20 | 31 | 45.2 | 51 | 49.0 |
| 21–22 | 40 | 17.5 | 42 | 7.1 |
| 23–24 | 33 | 0.0 | 50 | 6.0 |
| 25–26 | 21 | 0.0 | 42 | 4.8 |

21 Appendix 5, question 206
22 Appendix 5, question 215.

### 3.5.2 Education

School attendance is very high as shown in Table 3.15. Over 90% of both men and women living in Khutsong were still at school at sixteen years of age and about half were still at school or attending a college at 20 years of age. Women started to leave school in significant numbers between the ages of fifteen and sixteen but more women than men stayed on at school or at college until the age of 26. Men in this age group (15 to 29 years) who were not at school were mainly engaged in manual labour, some were employed by the mining industry, and some sold goods. Women who were not at school were either employed in domestic services, or sold goods.

### 3.5.3 Alcohol consumption

Table 3.16 shows how alcohol consumption varies with age for young men and women. A significant number of both men and women started drinking between the ages of 15 and 19 years, by their early twenties half the boys and about one third of the girls were drinking alcohol and this increased to 71% among 25 to 29 year old men but only to 38% among women of that age.

Table 3.16 Percentage of men and women who say that they drink alcohol for different ages.[23]

| Age (yr.) | Khutsong men | | Khutsong women | |
|---|---|---|---|---|
| | *n* | % | *n* | % |
| 13–14 | 31 | 2.6 | 31 | 3.2 |
| 15–19 | 99 | 15.8 | 104 | 12.4 |
| 20–24 | 89 | 52.8 | 121 | 31.8 |
| 25–29 | 59 | 70.9 | 117 | 38.4 |

23 Appendix 5, question 217.

### 3.5.4 Age at sexual debut

Respondents were asked if they had ever had sex.[24] Plotting the proportion who answered 'yes' as a function of age gives the dots in Figures 3.4a and b. Respondents were also asked the age at first sex.[25] This gives a probability density function (*p.d.f.*) for the age at sexual debut from which the corresponding cumulative distribution is readily obtained as indicated by the diamonds in Figures 3.4a and b. The lines are the cumulative distributions obtained from the maximum likelihood fit to the *p.d.f.s* (Williams and Dye, 1994). Since there are two independent estimates of the same function they should give the same values, unless of course there has been a shift in the age at first sex over the last five to ten years (since the former gives the current state of affairs and the latter the state of affairs a variable amount of time before the present). It is important to note however, that the curves based on the first question are less likely to be biased than the curves based on the second question, since the second set of curves relies on recall. However, the number of people indicating that they first had sex at an early age will be greater than the number of young people of that age in the sample, so that the curves based on the second question will be statistically more precise than the first. Comparing the two curves for men (Figure 3.4a) we find that they differ significantly (Kolmogorov-Smirnov test; $p < 0.001$) but the difference in the median age at first sex is only nine months, so that if the men exaggerate downward when asked how old they were when they first had sex, they only exaggerate slightly.

Figure 3.4b presents the same analysis for women. For women we see that there is much closer agreement between the two estimates and indeed there is no evidence that they exaggerate in either direction (Kolmogorov-Smirnov test; $p > 0.05$).

From the fits to the cumulative distribution functions in answer to the question "have you had sex?",[24] the mean age at first sex is 16.5 years

24 Appendix 5, question 324.
25 Appendix 5, question 325.

for men and 16.4 years for women. The standard deviations of the probability density functions are 1.88 years for men and 1.91 years for women so that 95% of men first have sex between 12.8 and 20.1 years, while the corresponding ages for women are 12.6 and 20.1 years. There is therefore no evidence that men and women in Khutsong differ significantly in the age at first sex.

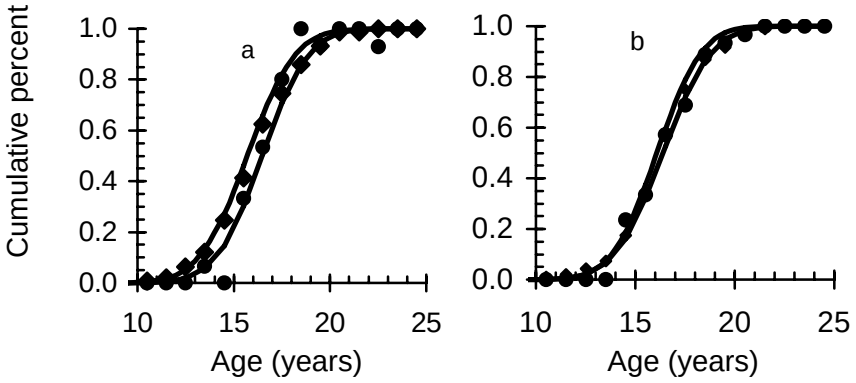


Figure 3.4. Cumulative distributions of reported age at first sex for (a) men and (b) women. The dots (and curves to the left) are based on those who said that they have had sex;[24] the triangles (and the curves to the right) are based on the reported age at first sex.[25] The fitted curves are cumulative normal distributions.

### 3.5.5 Marital status and partners

Almost 13% of young men and 40% of the young women were married or living as married. More than 2% of the men but no women reported more than one concurrent regular partner. The median number of life-time sexual partners among fifteen- to nineteen-year-olds, excluding those who had never had sex, was three for men and one for women. In this age group, 51% of the men and 34% of the women had not yet had sex. Men aged 25 to 29 years had a median of five partners, and women the same age group had three, again considering only those who had had sex. The mean number of life-time number of sexual partners among 25 to 29 year

old men and women was eight and three respectively and everyone in this age group had had sex.

### 3.5.6 HIV prevalence

The incidence of HIV among young people, but especially women, is very high as can be seen from the rate of increase of prevalence with age in Figure 3.5. At fourteen years of age no men or women were HIV positive. By eighteen years of age the prevalence amongst young men had only reached 1% (as estimated from the fit in Figure 3.5a), while the prevalence amongst young women had already reached 19% and continued to increase to almost 60% at age 25 years. Even more striking is the observation that at age sixteen years the prevalence in young women is about 6% but only half of them report having had sexual intercourse so that the prevalence amongst those who have had sexual intercourse must be about 12% at age sixteen.

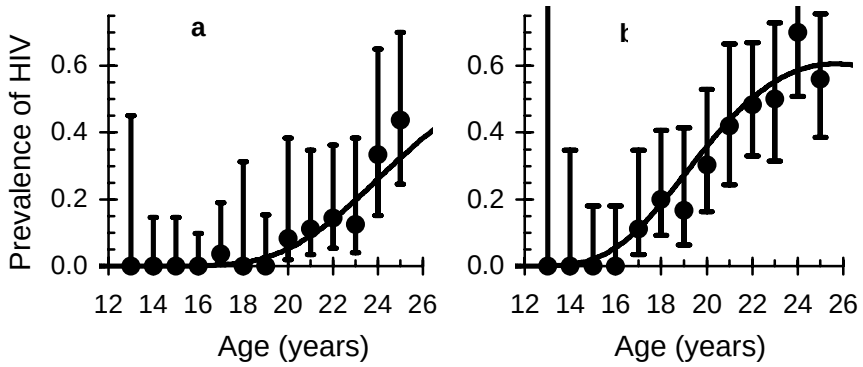


Figure 3.5 Age prevalence of HIV infection among (a) young men and (b) young women in Khutsong.

It is clear that effective interventions must be developed to protect young women, aged fifteen to twenty years, as a matter of urgency. To do this it will be necessary to include their sexual partners which are mainly young men up to age 25 years. Figure 3.6 shows the age of sexual partners from which it is seen that partners of fifteen-year old women are, on

average, having sex with men who are seventeen years of age, while twenty-year old women are having sex with men who are over 23 years of age. In itself this is unlikely to explain the very dramatic differences in the rate of increase of infection with age among women and men; an important contributing factor is that male-to-female transmission is almost certainly more likely (per sex act) than female-to-male transmission and this is supported by the data in Table 3.7 where the risk of infection after having one partner is three times greater for women than for men. Clearly this is a matter which needs further detailed study and analysis.


Figure 3.6 Reported ages of respondents and their most recent casual male or female sexual partners (*n* = 104). Circles give the ages of men and their female partners, diamonds the ages of women and their male partners. The upper line corresponds to equal ages, the lower line is the best fit to the data using principle axis regression. Age of female partner = 2.56 + 0.7425× Age of male partner (ages in years).[26]

26 Appendix 5, question 405

## 3.6 Selected topics

In this section, the factors that were most strongly associated with the transmission of HIV in univariate analysis are discussed. These are male circumcision, incidence of STDs, migrancy, knowledge, perceived risk of HIV and behaviour, and social capital. All of these factors were important, but no single factor was overwhelmingly so. The overall profile of a person most at risk includes demographic, biomedical and behavioural factors. In addition, HIV/AIDS is relatively new in southern Africa and although the antenatal clinic prevalence is now about 25% the increase has been rapid (Figure 3.7) and most current infections have been acquired in the last two to three years (Williams, Gouws, Wilkinson and Abdool Karim, 2000).

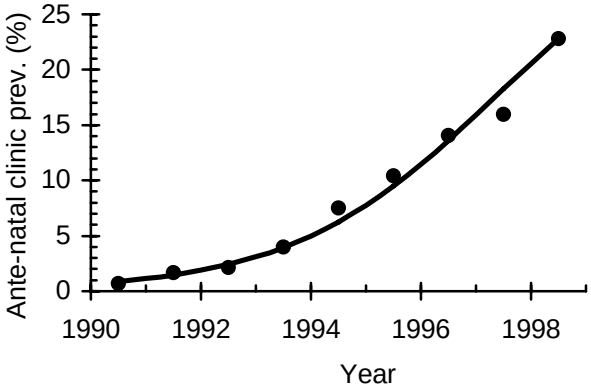


Figure 3.7 Prevalence of HIV infection among women attending antenatal clinics in South Africa. (Department of Health, 1999)

### 3.6.1 Male circumcision

Table 3.18 shows the proportion of men over the age of 20 years who were circumcised by ethnic group and the prevalence of infection amongst those who were and were not circumcised. In this study we treat ethnic group as a surrogate for place of origin since we know that HIV infection varies widely among the provinces of South Africa and also among the

countries from which migrant mineworkers come. For this reason one might expect to find bigger differences among the ethnic groups on the mines (since the mineworkers are all migrants) but not among the ethnic groups in Khutsong (since most of them have lived in Khutsong for many years).

Circumcision practices vary widely in the region. A previous study (Williams, Campbell and MacPhail, 1997) showed that the mean age at circumcision was between sixteen and eighteen years for all ethnic groups except the Shangaan amongst whom it was nine years. For this reason only men over the age of twenty years are included in Table 3.17.

Table 3.17 The prevalence of HIV infection among men who are and are not circumcised. For Zulu men the number circumcised was too small to provide a significant proportion.[27]

| | Men | | | | Mineworkers | | | |
|---|---|---|---|---|---|---|---|---|
| | | | HIV prev. (%) | | | | HIV prev. (%) | |
| | *n* | Prop. circ. | Circ. | Not circ. | *n* | Prop. circ. | Circ. | Not circ. |
| Tswana | 136 | 11.0 | 20.0 | 24.8 | 111 | 21.6 | 20.8 | 22.1 |
| Xhosa | 120 | 53.3 | 22.2 | 21.4 | 268 | 74.6 | 20.5 | 32.4 |
| Sotho | 85 | 40.0 | 26.5 | 26.0 | 237 | 53.6 | 28.4 | 33.6 |
| Zulu | 42 | 11.9 | • | • | 80 | 22.5 | 27.8 | 43.6 |
| Other | 58 | 44.8 | 23.1 | 35.5 | 200 | 40.0 | 28.8 | 35.0 |

Fitting the probability of circumcision to ethnic group and whether people are mineworkers or live in Khutsong, a multiplicative model without interactions gives a satisfactory fit ($\chi^2$ test of deviance, $p = 0.65$). Xhosa and Sotho men are significantly more likely to be circumcised than Tswana men(OR = 8.8 and 4.3, respectively, $p < 0.00001$), but Zulu men are not more likely to be circumcised than Tswana men (OR = 1.16, $p$ =

27 Appendix 5, question 519.

0.58). Miners are significantly more likely to be circumcised than men living in Khutsong (OR = 1.65, $p = 0.00001$).

The highest rates of circumcision are among the Xhosa, followed by Sotho and then Tswana and Zulu. Rates of circumcision within ethnic groups are consistently higher among mineworkers than among men living in Khutsong. Table 3.17 shows that amongst some groups circumcision appears to be protective, more so for mineworkers than for men living in Khutsong, and especially in the case of Xhosa and Zulu mineworkers.

Because of the strong association of HIV infection with age it is important to allow for age in this analysis. The highest HIV-infection rates occurred among 25 to 29 year-old uncircumcised men and for men in this age group, circumcision was strongly protective, with an odds ratio of 0.33 ($p < 0.0001$, 95% CL 0.20–0.60). The odds ratio was not significant among 30 to 34 year-old men (OR = 0.6, $p \geq 0.1$) or among 35 to 40 year-old men (OR = 0.6, $p = 0.07$). Young men were probably infected in the previous few years, during which HIV prevalence in South Africa began to increase. Older, uncircumcised men were probably more sexually active several years ago when HIV prevalence was still very low. The comparison was thus less powerful for older men.

A multivariate logistic regression was carried out to examine the effect of circumcision for men between the ages of 20 and 59 only while allowing for ethnic groups and age in five year age bands. For men in Khutsong there is a protective effect with an odds ratio of 0.62 (CI 0.38–1.01; $p = 0.054$) for mineworkers the protective effect is highly significant with an odds ratio of 0.65 (CI 0.48–0.87; $p = 0.004$).

### 3.6.2 Sexually transmitted diseases

In this section, the laboratory results of blood and urine STD tests were correlated with reported symptoms and perceptions of STDs, and with reported treatment-seeking behaviour.[28] Table 3.18 shows the prevalence of syphilis, gonorrhoea and chlamydia infections among mineworkers,

28 See Section 2.8 for a description of the various tests.

men and women living in Khutsong, and women living in hotspots separately. For each of the STDs, prevalences among women in Khutsong were approximately twice as high as those among men while prevalences among women in hotspots were twice as high as among women in Khutsong. For example, almost 28% of the men in Khutsong and 30% of miners had had a syphilis infection at least once in their life (positive TPHA-test) compared to more than 48% of the women in Khutsong and 77% of the women in hotspots. When the TPHA and the RPR test are both positive this is taken as an indicator of current or recent syphilis and 6.1% of the men in Khutsong, 5.2% of miners, 10% of the women in Khutsong, and 23% of women in hotspots (Table 3.18) were both TPHA and RPR positive.

Table 3.18 STD prevalences (percentages) among Khutsong men, mine workers, women in Khutsong, and women in hotspots

| STD | Mine-workers | Khutsong men | Khutsong women | Women in hotspots |
|---|---|---|---|---|
| Life-time syphilis | 30.3 | 27.7 | 48.4 | 76.9 |
| Syphilis | 5.2 | 6.1 | 9.7 | 23.3 |
| Gonorrhoea | 3.0 | 3.4 | 6.9 | 15.7 |
| Chlamydia | 3.8 | 5.2 | 8.1 | 9.1 |
| One or more STD | 11.4 | 13.7 | 21.5 | 36.4 |

Since the TPHA test indicates lifetime exposure to syphilis it is interesting to examine the age-prevalence of lifetime exposure to syphilis. The data are given in Figure 3.8 (but not for women living in hotspots where the number tested was too small) and the fitted curves are maximum likelihood fits to logistic curves with variable asymptotes (Appendix 8).

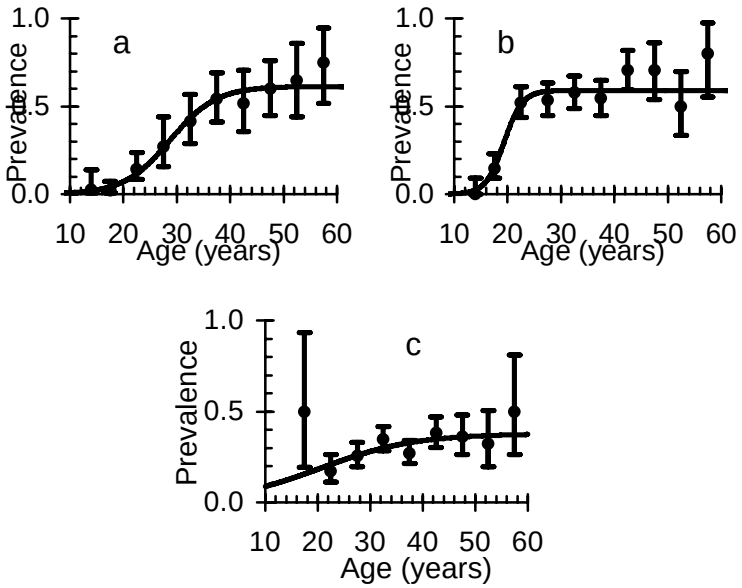


Figure 3.8 Life-time exposure to syphilis for a) men and b) women living in Khutsong and c) mineworkers.

The asymptotic values of the prevalences for men and women living in Khutsong (*N* in Table 3.19 and see Appendix 8), which gives the expected lifetime risk of contracting syphilis are both about 60%; a remarkably high figure. Furthermore, the patterns of infection are similar to those for HIV with the rate of increase amongst young women about 2.5 times that of men (ratio of the coefficients $\beta$ in Table 3.19). For mineworkers the curve is much flatter (the intrinsic rate of increase is only about half that of men living in Khutsong) and the asymptotic prevalence is about two thirds of that for men and women living in Khutsong. The former probably reflects better access to treatment and antibiotics among miners.

Table 3.19 Parameters for the fits to the data shown in Figure 3.8. $N$ gives the asymptotic prevalence and $\beta$ the intrinsic rate of increase.

| | Khutsong men | Khutsong women | Mineworkers |
|---|---|---|---|
| $N$ | 0.613 | 0.590 | 0.379 |
| $\beta$ | 0.233 | 0.584 | 0.111 |

*Symptoms of STDs* It is of interest to investigate the relationships, if any, between self-reported symptoms and laboratory diagnoses of STDs. Recent and current symptoms were common at the time of the survey (Table 3.20).

Table 3.20: Percentage of people reporting various symptoms of STDs when asked.[29]

| | Mine-workers | Khutsong men | Khutsong women | Women in hotspots |
|---|---|---|---|---|
| Discharge or pain during last 12 months | 28.4 | 21.6 | 45.8 | 48.8 |
| Discharge during the last 24 hours | 4.8 | 1.9 | 17.1 | 22.8 |
| Genital sores during the last 12 months | 11.9 | 12.26 | 14.4 | 15.6 |
| Current sores in the genital area | 2.7 | 2.4 | 4.7 | 3.3 |

More than one in four men reported at least one episode of pain or urethral discharge in the previous 12 months, and 12% reported genital sores. At the time of the survey, 7.2% of the men complained of pain, 4% had experienced a urethral discharge in the last 24 hours, and 3.3% had genital sores.

29 Appendix 5, questions 502 to 509 (men) and 530 to 538 (women).

More women than men reported STD-related symptoms, as may be expected from their higher STD prevalences (Table 3.18). In Khutsong, 45% of women reported at least one episode of pain or discharge within the last year, and 16% had had genital sores in the same period. Corresponding values for hotspots were nearly 50% and 14%, respectively. A very high proportion of women reported current symptoms when interviewed. Among Khutsong women, 17% had a discharge, 50% complained of a vaginal itch, and 5.3% had genital sores. Among women in the hotspots, 23% had a discharge, 50% a vaginal itch and 7.5% genital sores.

*Symptoms and laboratory tests* . The only significant correlation between reported STD symptoms and the results of the laboratory tests was for men among who there was a significant correlation between chlamydial infection and urethral discharge: among those with chlamydia 12% said that they were suffering from a discharge; among those without chlamydia the figure was 4.1% ($p = 0.01$).

*Treatment-seeking behaviour* People in all four groups were more likely to seek advice from a clinic, hospital or from a general practitioner than from a traditional healer although the latter are also important (Table 3.21). Women living in Khutsong were less likely than others to seek advice from a traditional healer and mineworkers were less likely than others to wait for the symptoms to pass. Most people said that they had told their partner about their last episode of an STD and more than half were willing to do something to protect their partner. This is encouraging in relation to partner notification schemes. It is curious that more people said that they did something to protect their partners than thought that the infection could be passed on to their partners.

Only one in five men who did seek advice or treatment waited longer than one week before seeking treatment. Sixty percent of men with STDs informed their partners and approximately half thought they might have infected their partners. One third took measures to prevent passing the infection on, such as abstinence from sex (one in six) or condom use

(one in fifteen). More than four out of five men who experienced pain, urethral discharge and genital ulcers knew that these might be symptoms of STDs.

Table 3.21 Understanding of symptoms and treatment. Health seeking behaviour of those participants who had symptoms of STD's (sores/discharge/pain).[30]

| | Khutsong men *n* = 127 | Khutsong women *n* = 331 | Mine-workers *n* = 299 | Women in hotspots *n* = 64 |
|---|---|---|---|---|
| Sores/discharge/pain are symptoms of STDs | 70.4 | 65.1 | 87.2 | 76.6 |
| For last symptom did you: | | | | |
| Seek advice from a friend/relative? | 28.4 | 24.2 | 9.7 | 23.4 |
| Seek advice from a traditional healer? | 16.7 | 9.1 | 16.1 | 14.1 |
| Seek advice from a clinic/hospital? | 46.5 | 48.3 | 40.1 | 50.0 |
| Seek advice from GP? | 25.2 | 23.6 | 44.8 | 31.3 |
| Wait for symptoms to pass? | 17.3 | 22.7 | 8.0 | 14.3 |
| Tell your partner about last episode? | 60.6 | 75.5 | 59.7 | 76.6 |
| Think that infection can be passed on? | 47.7 | 36.7 | 49.8 | 54.7 |
| Do something to protect partner? | 63.5 (*n* = 63) | 54.8 (*n* = 126) | 61.2 (*n* = 152) | 55.6 (*n* = 36) |

30 Appendix 5, questions 511 to 518 (men) and 540 to 547 (women).

Only one in five women waited longer than one week before seeking treatment, and just over 28% did not seek either advice or treatment. Three out of four informed their partners, and 40% thought it possible that they had transmitted the infection. A total of 23% said that they had taken measures to prevent infections from being passed on, 10% abstained from sex, and 8.9% used condoms. Two thirds of the women with abdominal pain, vaginal itch, vaginal discharge or genital ulcers recognised these as possible symptoms of STDs. Roughly the same proportion of people obtained medication from each type of facility as sought help at each type of facility (Tables 3.21 and 3.22).

Table 3.22 Ways of accessing medication for the last symptomatic episode of STDs by those participants who had symptoms of STD's including sores, discharge or pain. (More than one answer could be given).[31]

| Knowledge and behaviour | Khutsong men *n* = 127 | Khutsong women *n* = 331 | Mine-workers *n* = 299 | Women in hotspots *n* = 64 |
|---|---|---|---|---|
| Self-treatment | 22.1 | 14.2 | 9.0 | 18.8 |
| Medicine from traditional healer | 17.3 | 9.4 | 16.6 | 18.8 |
| Drugs from clinic/hospital | 44.9 | 48.8 | 41.5 | 46.9 |
| Medicines from pharmacy | 10.2 | 4.5 | 5.0 | 1.6 |
| Drugs from mobile clinics | 1.6 | 0.3 | 1.4 | 4.8 |
| Drugs from GP | 28.4 | 26.4 | 45.8 | 31.7 |
| Waited for symptoms to pass | 17.3 | 22.7 | 8.0 | 14.3 |

31 Appendix 5, questions 512 (men) and 541 (women).

Table 3.23 Percentage of respondents who used condoms with regular and last casual partners.[32]

| | Khutsong men | Khutsong women | Mine-workers | Women in hotspots |
|---|---|---|---|---|
| **Regular partner** | *n* = 352 | *n = 538* | *n* = 838 | *n* = 94 |
| Never | 76.7 | 83.1 | 82.8 | 58.5 |
| Sometimes | 14.2 | 10.6 | 11.5 | 15.9 |
| Always | 9.1 | 6.3 | 5.7 | 25.5 |
| **Last casual partner** | *n* = 158 | *n* = 158 | *n* = 471 | *n* = 78 |
| Never | 62.7 | 72.8 | 70.7 | 26.9 |
| Sometimes | 9.5 | 5.7 | 10.6 | 14.0 |
| Always | 27.8 | 21.5 | 18.7 | 58.9 |

*Condom use* Although condom use was higher with casual than with regular partners amongst all groups, the rates are still disappointingly low (Table 3.23). Furthermore, among the nearly 14% of the men in Khutsong and 11% of the miners who were diagnosed as having one or more of syphilis, gonorrhoea or chlamydia, 85% said that they never used condoms with their regular partner, 12% said that they used condoms sometimes, and only 3.2% said that they always used condoms. Approximately half these men reported a relationship with a casual partner. One in three STD-infected men never used condoms with the casual partner at the time of the symptoms, one in ten sometimes did, and one in eight never did. No correlation was found between infection with at least one STD and the number of casual sexual partners in the previous week or in the previous month.

Among the women in Khutsong with a regular partner, 24% were diagnosed with at least one of the above three STDs. Of these women, 80% never used condoms with their regular partner, 13% sometimes did,

32 Appendix 5, questions 317 (men) and 418A (women).

and 7% always did. Of the women who reported a casual partner, 29% were infected with at least one STD and of these 60% never used condoms, 4% sometimes did and 36% reported that they always used condoms with their casual partners.

Table 3.24 Prevalence of HIV infection amongst those with and without STDs.

| | Khutsong men | | Mine-workers | | Khutsong women | | Women in hotspots | |
|---|---|---|---|---|---|---|---|---|
| | *n* | HIV pos. | *n* | HIV pos. | *n* | HIV pos. | *n* | HIV pos. |
| Syphilis | 30 | 33.3 | 49 | 34.7 | 69 | 55.1 | 31 | 67.7 |
| No syphilis | 467 | 20.9 | 849 | 28.3 | 636 | 35.2 | 91 | 68.5 |
| Rel. risk | | 1.6 | | 1.2 | | 1.6* | | 0.9 |
| Gonorrhoea | 17 | 35.3 | 27 | 44.4 | 49 | 60.9 | 19 | 83.3 |
| No gonorr. | 481 | 21.3 | 870 | 28.1 | 658 | 35.5 | 104 | 65.7 |
| Rel. risk | | 1.7 | | 1.6 | | 1.7** | | 1.3 |
| Chlamydia | 26 | 20.0 | 34 | 14.7 | 58 | 44.8 | 11 | 63.6 |
| No chlam. | 472 | 21.8 | 863 | 29.1 | 649 | 36.5 | 112 | 68.8 |
| Rel. risk | | 0.9 | | 0.5 | | 1.2 | | 0.9 |

More than one in three women in the hotspots was infected with at least one STD. Of these, 61% never used condoms with their regular partner, 16% sometimes did and 23% always did. Of women with an STD, 20% never used condoms with their casual partner, 17% sometimes did and 63% always did. As among men, there was no significant correlation between current infection with at least one STD and the number of casual sexual partners in the previous week or month, either among women in Khutsong or in hotspots. Among those with one or more STD, 65% the men in Khutsong, 64% of the miners, and 84% of Khutsong women believed that their casual partner had other concurrent sexual partners.

*Association with HIV* There were significant correlations between the prevalence of HIV and the prevalence of STDs diagnosed at the time of the survey. Among all men the relative risk of HIV infection for those with gonorrhoea was 1.6 ($p = 0.02$) but this was not significant for men in Khutsong and miners taken separately (Table 3.24). Among women in Khutsong the relative risk of HIV infection for those with gonorrhoea was 1.7 ($p = 0.001$) and for those with syphilis was 1.6 ($p = 0.002$). Furthermore, the relative risk of HIV infection for women who reported genital sores in the year prior to the survey was 1.62 ($p < 0.0001$).

### 3.6.3 Knowledge, perceived risk and behaviour

Information about HIV knowledge and perceptions was gained from participants' answers to multiple choice questions. Some of the questions, mainly those concerning behaviour, provided opportunities for additional remarks which were included in the analyses.

Table 3.25 Male participants' answers to questions about prevention of HIV infection, expressed as percentages. Correct answers indicated in bold type.[33]

| | Khutsong men | | | Mineworkers | | |
|---|---|---|---|---|---|---|
| | True | Not true | Don't know | True | Not true | Don't know |
| Remain faithful | **82.2** | 14.0 | 3.8 | **83.5** | 10.1 | 6.3 |
| Use condoms | **87.8** | 6.8 | 5.4 | **83.3** | 9.9 | 6.8 |
| Use clean needles | **86.6** | 5.6 | 7.8 | **86.9** | 4.1 | 8.9 |
| Avoid public toilets | 29.7 | **56.5** | 13.8 | 37.4 | **48.7** | 13.9 |
| Avoid touching | 28.5 | **60.8** | 10.6 | 37.4 | **48.3** | 14.4 |
| Avoid sharing food | 31.2 | **57.8** | 11.0 | 38.2 | **46.6** | 15.3 |
| Avoid mosquito bites | 54.3 | **28.9** | 16.8 | 52.8 | **28.8** | 18.4 |
| HIV+ show symptoms | 29.1 | **50.1** | 20.8 | 37.5 | **36.9** | 25.6 |

33 Appendix 5, questions 602 and 603.

*Knowledge of risk factors* Respondents knowledge of the most important risk factors for infection and ways of preventing transmission was good and is summarised in Tables 3.25 and 3.26 where correct answers are given in bold. Between 83% and 87% of participants correctly answered questions about the importance of faithfulness, condom use and use of clean needles in the prevention of HIV transmission. However, 35% of the men and 31% of the women expected that HIV-positive people would always show symptoms of the infection. The answers given by men and women were remarkably similar (men in Table 3.25, women in Table 3.26). These percentages were compared with HIV prevalence among men in Khutsong, mine workers, women in Khutsong, and women in hotspots separately. No statistically-significant correlations were found between HIV sero-prevalence and peoples' perceptions of how transmission of HIV is prevented.

Table 3.26 Female participants' answers to questions about prevention of HIV infection, expressed as percentages. Correct answers indicated in bold type.[33]

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | True | Not true | Don't know | True | Not true | Don't know |
| Remain faithful | **84.2** | 9.9 | 5.9 | **84.6** | 10.6 | 4.9 |
| Use condoms | **85.6** | 7.2 | 7.3 | **88.6** | 3.3 | 8.1 |
| Use clean needles | **85.3** | 6.0 | 8.7 | **85.4** | 4.9 | 9.8 |
| Avoid public toilets | 37.6 | **45.7** | 16.7 | 47.2 | **38.2** | 14.6 |
| Avoid touching | 28.4 | **57.3** | 14.3 | 35.8 | **49.6** | 14.6 |
| Avoid sharing food | 29.3 | **56.5** | 14.2 | 35.8 | **47.2** | 17.1 |
| Avoid mosquito bites | 54.1 | **27.8** | 18.1 | 51.2 | **29.3** | 19.5 |
| HIV+ show symptoms | 29.5 | **44.9** | 25.6 | 35.8 | **37.4** | 26.8 |

Most men and women knew that it is very important to remain faithful and to use condoms. Yet 32% of the men in Khutsong, 53% of the

miners, and 22% of the women in Khutsong reported sexual intercourse with at least one casual partner during the year prior to the survey. Furthermore, 60% of the men in Khutsong, 68% of the miners, and 74% of the women believed that their casual partner had had other sexual partners at the time.

Few people said that they knew anyone with HIV. Only 8.0% of the men in Khutsong and 9.1% of the miners knew of a friend or relative who was HIV-positive. Among women living in Khutsong, 8.5% knew a friend or relative who was HIV positive.

*Perceived risk* Respondents were asked if they thought they were at risk of being infected with HIV (Table 3.27). Only 20% of men and 17% of women living in Khutsong thought that they had a 'good chance' of being infected. Among miners and women in hotspots, the corresponding figures were 30% and 38%, respectively.

Table 3.27 Proportion of men in each category of perceived risk and the prevalence of HIV infection amongst each risk group.[34]

| | Khutsong men | | Mine-workers | | Khutsong women | | Women in hotspots | |
|---|---|---|---|---|---|---|---|---|
| | % | HIV pos. | % | HIV pos. | % | HIV pos. | % | HIV pos. |
| No chance | 33.3 | 15.3 | 22.0 | 28.3 | 26.3 | 27.6 | 16.5 | 70.0 |
| Moderate chance | 15.8 | 24.1 | 12.1 | 23.9 | 13.5 | 46.3 | 7.4 | 75.0 |
| Good chance | 19.4 | 27.1 | 23.0 | 30.4 | 16.7 | 37.8 | 36.4 | 75.0 |
| Don't know | 31.5 | 23.4 | 42.8 | 29.2 | 43.7 | 40.1 | 39.7 | 69.0 |
| Already infected | 0.0 | • | 0.0 | • | 0.0 | • | 0.0 | • |

34 Appendix 5, question 702.

There is clearly a strong mismatch between perceived and actual risk among both men and women. A substantial proportion of respondents thought that they were at no risk (Table 3.27). Yet among those people infection rates varied from 15% among men in Khutsong to 28% among mineworkers. None of the respondents said they knew their HIV status.

Table 3.28 The proportion of respondents who reported making various behavioural changes to avoid HIV infection, and the prevalence of HIV amongst those who made changes.[35] (Note: Figures in the bottom four rows are expressed as a percentage of those who made any changes.)

| | Khutsong Men *n* = 499 | | Mine-workers *n* = 899 | | Khutsong women *n* = 712 | | Women in hotspots *n* = 122 | |
|---|---|---|---|---|---|---|---|---|
| | % | HIV pos. | % | HIV pos. | % | HIV pos. | % | HIV pos. |
| Any change | 44.3 | 26.7 | 36.6 | 27.9 | 33.0 | 42.7 | 43.9 | 70.4 |
| No change | 55.7 | 17.6 | 63.4 | 29.0 | 67.0 | 34.5 | 56.1 | 66.7 |
| Change | *n* = 222 | | *n* = 329 | | *n* = 235 | | *n* = 54 | |
| Always use condoms | 29.0 | 27.0 | 19.4 | 27.0 | 29.2 | 30.9 | 70.4 | 73.7 |
| Sometimes use conds. | 11.9 | 38.5 | 12.9 | 26.2 | 10.3 | 58.3 | 11.1 | 66.7 |
| Have fewer partners | 33.2 | 22.5 | 42.6 | 26.1 | 27.0 | 48.4 | 14.8 | 50.0 |
| Other | 25.8 | 25.0 | 25.0 | 33.3 | 33.5 | 43.6 | 3.7 | • |

*Behaviour change* Almost 40% of all men said that they had changed their behaviour to avoid HIV infection. Men living in Khutsong who had not changed their behaviour were *less* likely to be HIV positive than men who had changed their behaviour ($p = 0.015$). Forty percent had done so within the last 12 months (of these, 30% were HIV-positive), whereas 60% had

35 Appendix 5, questions 703, 704 and 704B.

done so more than 12 months ago (of these, 26% were infected). Twenty-five percent of the men who had not changed their behaviour were HIV-positive. Table 3.28 shows behavioural changes made by men and women, and the prevalence of HIV in each group.

One third of the women living in Khutsong had changed their sexual behaviour to avoid HIV infection. As with the men, the prevalence of HIV among women who had not changed their behaviour was lower than that among those who had done so ($p = 0.033$). Forty-six percent had done so in the past 12 months (of these, 55% were already infected) and 54% more than 12 months ago (of these, 42% were infected). Table 3.28 lists the proportion of women who made particular changes in relation to the prevalence of HIV among these women.

*Care*[36] Seventy five percent of all women and of all men interviewed were prepared to take care of a family member with AIDS, and the majority said that they would tell someone if they had an HIV infection themselves (66% of women and 75% of men). Sixty percent of women would first tell a relative, whereas 28% said that they would first tell their regular sexual partner. Among men, 55% said that they preferred to tell their regular partner first and 37% preferred to tell a relative first. Similar proportions of HIV-positive and HIV-negative men and women said that they would keep their HIV status secret.

*Other practices*[37] One in four women in Khutsong and one in three women in hotspots reported having had sexual intercourse during menstruation in the last 12 months, but there was no statistically significant correlation between this and the womens' HIV status. A small number of women (3.2%) often or always used drying agents, mainly dry cloth or towels, water and soap, or *umuthi* (remedy prescribed by a traditional healer). Other substances such as ointment, snuff, coca cola, perfumes or detergent were used by a few women. Overall, 67% of

36 Appendix 5, questions 705, 706A and 706B.
37 Appendix 5, questions 521 and 528.

women who used drying agents were HIV-positive, compared to 44% of those who did not ($p$ = 0.02). In Khutsong, 50% of the women who used drying agents were HIV-positive, compared to 41% of those who did not. Only eleven women (9.1%) in hotspots used drying agents. However, 91% of those who used drying agents were HIV-positive, compared to 66% of those who did not ($p$ = 0.09). These results were not confounded by age.

*Commercial sex*[38] Relatively few men stated that their last casual partner was a commercial sex worker (3.2% of men in Khutsong and 8.2% of mine workers). On the other hand, 92 women (11% of the total sample) identified themselves as commercial sex workers (50% of the women in hotspots and 4.4% of the women in Khutsong). Among men whose last casual partner was a sex worker, HIV prevalence was slightly higher than among men whose last casual partner was not a sex worker (36% compared to 31%) but the difference was not significant.

*Contraception*[39] Among the 359 women who said that they were doing something to avoid pregnancy, 79% said that they were using an injectable contraceptive, 9% that they were taking contraceptive pills, 8% had been sterilized and only 3% were using condoms. The common use of non-barrier methods of contraception may be one of the most important reasons for the high rates of HIV transmission in South Africa.

*Use of condoms*[40] More than 94% of the men and 86% of the women knew where to buy condoms and approximately 85% of both men and women knew that condoms would prevent infection. However, 61% of men and 66% of women had never used a condom, and only 8.7% of men and 4.6% of women had ever bought condoms.

Of the men in Khutsong and the mine workers who had a regular partner, 81% never used condoms with this partner, 12% sometimes did

38 Appendix 5, question 426.
39 Appendix 5, questions 522 and 523.
40 Appendix 5, questions 802 to 808.

and 6.7% always did. The main reasons given for using condoms were avoidance of infection with a disease (31%), avoidance of pregnancy (29%) and avoidance of passing a disease on to a spouse (14%). Men did not use condoms with their regular partner because they did not feel the need to or had decided not to (60%) and because they disliked condoms (21%).

Condom use with casual partners was slightly higher than with regular partners: 69% of men never used condoms with casual partners, 10% sometimes did, and 21% always did. The main reason for condom use with casual partners was fear of infection (70%) and of passing on infections (12%). Men who did not use condoms with their casual partners said that they disliked condoms (37%), they had decided not to do so (20%), their partner objected (19%), or they had no access to condoms or they were too expensive (15%).

Of the women who had a regular partner, more than 79% never used condoms with this partner, 11% sometimes did and 9.2% always did. The main reasons given for using condoms, among those who did so, were avoidance of disease (43%), avoidance of passing a disease on to a spouse (22%) and avoidance of pregnancy (17%). The main reasons given by women for not using condoms with their regular partner were that they did not feel the need to use them or had decided not to use them (41%), because their partner objected (30%), or because they disliked condoms (13%).

Women were more likely to use condoms with casual partners: 58% never did, 8.5% sometimes did and 34% always did. The main reason given for using condoms with casual sexual partners was prevention of disease transmission (64% because of being infected themselves and 19% because they might infect their partner). The main reasons given for not using condoms with casual partners was because their partner objected (46%), they disliked condoms (22%), they had decided not to use condoms (15%), or because they had no access to condoms or thought they were too expensive (10%).

*Thoughts regarding condom use* One of the questions concerned thoughts and opinions concerning condom use. Participants had to choose one of five possible answers to the questions listed in Table 3.29.

Table 3.29 Percentage of people giving various answers regarding their thoughts on condom use with regular (Reg.) and casual (Cas.) partners for the prevention of HIV infection.[41]

| | Khutsong men | | Khutsong Women | | Mine-workers | | Women in hotspots | |
|---|---|---|---|---|---|---|---|---|
| | Reg. | Cas. | Reg. | Cas. | Reg. | Cas. | Reg. | Cas. |
| Not made a decision | 39.7 | 27.2 | 40.8 | 14.5 | 36.4 | 28.7 | 30.9 | 17.9 |
| Decided not to use condoms | 11.9 | 5.4 | 15.8 | 4.2 | 8.7 | 4.7 | 3.3 | 0.0 |
| Decided to use but not yet | 15.4 | 10.6 | 19.2 | 17.4 | 26.2 | 14.4 | 15.5 | 6.5 |
| Use condoms sometimes | 14.6 | 11.6 | 11.8 | 11.1 | 11.9 | 10.4 | 18.7 | 9.7 |
| Use condoms always | 18.4 | 45.2 | 12.4 | 52.8 | 16.7 | 41.8 | 31.7 | 65.8 |

Of the men who said that they always ought to use condoms with their regular partner to prevent HIV infection, 30% of them had earlier said that they never did, 15% that they sometimes did, 29% that they always did and 27% that they had no regular partner. Similar responses were given to questions related to condom use with casual partners. Of the men who said that they always ought to use condoms with their casual partner, only 16% actually did so, 4.6% sometimes did and 23% never did, while 57% did not have a casual partner. It is clear that peoples' practices in this regard fall behind their understanding of what they should be doing.

41 Appendix 5, questions 812 and 814.

For women, as for men, their practice in regard to the use of condoms falls behind their understanding. Of those who said that they ought always to use condoms with their regular partner to prevent HIV transmission, 26% indicated in an earlier question that they never used condoms with their regular partner, 10% that they sometimes did, and only 30% that they always did. The remaining 34% had no regular partner. A similar situation is observed with women's casual partners. Of those who said that they ought to use condoms all of the time only 17% actually said that they did so, 3.4% that they sometimes did, and 12.7% that they never did. The remaining 67% said that they did not have a casual partner.

### 3.6.4 Migrancy

Amongst miners, 97% described themselves as migrant workers, as expected. Of the men in Khutsong, 33% said they were migrants, and of these men 28% worked on the mines. The median income of the migrant mine workers was R1300 per month, and of migrant men not employed in the mining industry R500 per month. Of the non-migrant men in Khutsong, 49% reported they had no regular income. These men either were at school or college or were unemployed. The median income of the other 51% of non-migrant men in Khutsong who were not working as miners, was R350.

Migrant men were more likely than non-migrants to have a regular partner (13% v. 64%, respectively) but their partners were much less likely to live in Carletonville (5.4% v. 75% of partners, respectively.) More than half the migrants said they had had sexual intercourse with at least one casual partner in the last twelve months. Of these, 70% said that they never used condoms with their casual partners and 10% that they sometimes did. A total of 83% of the migrant men never used condoms with their spouse. Only 2.2% of the non-migrant men and 7.8% of the migrants stated that their last casual partner was a commercial sex worker.

The prevalence of HIV was significantly higher among migrant mineworkers living in mine hostels than among non-migrant men living in

Khutsong (29% v. 19%) ($p < 0.0001$) but this was confounded by age (Figure 3.2). Considering men living in Khutsong only, the prevalence of HIV among non-migrants was not significantly different from the prevalence among migrant men. Furthermore, the prevalence of syphilis, gonorrhoea and chlamydia was similar in migrant and non-migrant men between twenty and 59 years old: 12% of migrants and 15% of non-migrants had at least one of these STDs at the time of the survey.

Twenty five percent of all women declared themselves to be migrant workers; 47% of the women in hotspots and 21% of the women living in Khutsong. Of the migrant women who had casual sexual relationships in the year prior to the survey, 53% had taken money for sex from their casual partners compared to 30% of non-migrant women with a casual partner. The median monthly income of migrant women was R300, that of non-migrant women R150.

Table 3.30 Percent prevalence of HIV among migrant and non-migrant women of different ages living in Khutsong. The *p* values are for $\chi^2$ tests with 1 degree of freedom

| | HIV positive | | |
|---|---|---|---|
| Age | Migrants | Non-migrants | *p* |
| 15–19 | 50.0 | 18.8 | 0.07 |
| 20–24 | 82.4 | 54.3 | < 0.03 |
| 25–29 | 65.9 | 58.5 | *n.s.* |
| 30–34 | 51.1 | 51.2 | *n.s.* |
| 35–39 | 43.2 | 33.9 | *n.s.* |
| 40–44 | 32.1 | 31.4 | *n.s.* |
| 45–49 | 50.0 | 9.5 | 0.007 |
| 50–54 | 16.7 | 18.2 | *n.s.* |
| 55–59 | 20.0 | 42.9 | *n.s.* |
| Total | 51.1 | 38.7 | 0.002 |

Migrant women in Khutsong were more likely than non-migrant women to have had a casual partner in the last twelve months (37% vs. 18%). Condom use was similar for both groups of women: more than 80% never used condoms with their regular partner and 73% of non-migrant and migrant workers never used condoms with their casual partners. Migrant women were more likely to be HIV positive than were non-migrant women (51% vs. 39%; $p < 0.002$). Table 3.30 lists HIV prevalence among migrant and non-migrant women by age group, excluding women in hotspots.

Table 3.31 The number and the percentage of men and women in Khutsong with an income and the median income of those people.[42]

| | Men | | | Women | | |
|---|---|---|---|---|---|---|
| Housing type | *n* | % with income | Median income | *n* | % with income | Median income |
| Private houses | 110 | 51 | 1000 | 93 | 59 | 350 |
| Council houses | 75 | 54 | 380 | 146 | 58 | 300 |
| Site and Service | 100 | 66 | 490 | 170 | 64 | 250 |
| Council hostel | 32 | 91 | 1150 | 18 | 89 | 400 |
| Informal settlement | 146 | 70 | 600 | 204 | 77 | 300 |
| Hotspots | 24 | 96 | 400 | • | • | • |

### 3.6.5 Housing type

The population of Khutsong was stratified by housing type because this was thought to be the most reliable marker of socio-economic status. People living in private houses were assumed to have the highest socio-

42 Appendix 5, question 215A.

economic status, followed by those living in council houses, site-and-service areas and in council hostels, and finally those in informal settlements or squatter camps**.** Because so many people say that they have no income, Table 3.31 gives the proportion of people and the median income of people who say that they do have an income.

Men living in private houses earn substantially more than men living in council houses, site-and-service areas and informal settlements. However, the median income of the men living in council hostels was higher still and it turns out that 10 of these 32 men work on the mines which explains their relatively high income. It is also interesting to note that the income earned by people living in informal settlements was higher than that earned by people living in council houses and site-and-service areas. Women earned consistently less than men except in the council houses where the difference was small.

Table 3.32 Percent prevalence of HIV infection for men and women living in different housing types in Khutsong.

| Housing type | Men | Women |
|---|---|---|
| Council houses | 19.0 | 28.7 |
| Private houses | 17.1 | 36.7 |
| Informal settlement | 25.0 | 38.9 |
| Site-and-service | 17.5 | 42.0 |
| Mine hostels | 28.6 | • |
| Council hostels | 20.0 | 42.1 |
| Hotspots | 52.4 | 68.8 |

Table 3.32 shows HIV prevalence for men and women by housing type. More than half of the men in hotspots were HIV-positive and 29% of the men in mine hostels. The lowest prevalence was found among people from private houses (17%) ($p$ = 0.001). As expected, the highest HIV prevalence in women was found in hotspots (69%), followed by council

hostels (42%) and then site and service accommodation. Women living in council houses showed the lowest HIV prevalence (29%) ($p$ = 0.0001). These results will be confounded by age and this is examined further below.

More than half of the men in mine hostels said they had had a non-spousal relationship in the last 12 months, as did 30% of those living in council hostels, 23% of those in private houses, 38% of those in site and service, 47% of those in council hostels, 36% of those in squatter settlements, and 42% of those in hotspots. More than 64% of the women in hotspots reported at least one casual partner in the last year, as did 19% of those living in council hostels, 15% of those in private houses, 19% of those in site and service, 21% of those in council hostels and 30% of those living in squatter settlements.

Of the men, those living in hotspots reported the most consistent condom use and 60% always used condoms with a casual partner. This was followed by men living in site and service accommodation (38%) and in council houses (30%). Approximately one in four men living in all other housing types always used condoms with a casual partner. Nearly 60% of the women in hotspots consistently used condoms with a casual partner, compared to a corresponding value of approximately 28% for all other housing types combined.

### 3.6.6 Education

The prevalence of HIV did not vary significantly among people with different educational levels.[43] Of the men with no education, 30% were HIV-positive, as were 24% of those with primary education, 28% of those with secondary education, and 37% of those with post matriculation education. Among women, corresponding values were 37%, 43%, 41% and 33% respectively.

43 Appendix 5, question 203.

### 3.6.7 Social capital and sexual health

It is now widely accepted that sexual health can only be fully understood by considering the social context of peoples behaviour. However, it is not clear what constitutes a health-enabling community or how this can be quantified. Some studies have found a correlation between levels of social support as measured by community networks and relationships of trust, and the likelihood of people engaging in health-promoting behaviour. Membership of an association and the feeling of belonging to a group of people or an organisation usually involves acceptance of the ideology and value system of that association. Health-promoting behaviours such as faithfulness or condom use are more likely to be practised when the value system of the organisation promotes them and when the beliefs relating to such behaviours are shared with peers.

Table 3.33 lists the proportion of men and women who belonged to various associations. One in three men and more than half of all women belonged to a religious organisation. More women (12%) than men (5.4%) belonged to a stokvel or rotating credit association. (Stokvel members meet on a monthly basis and contribute a small fixed amount of money. Each month, a different member of the association receives the whole monthly collection). Half of the men were members of a union, as were 18% of the men living in Khutsong and 71% of all miners. Almost one third of all men and one third of all women belonged to a burial society which helps people to save money for burial expenses. For traditional and religious reasons, the body of the deceased should be buried at the persons home and the family may incur considerable expenses in transporting the body home. Nearly one third of the men and one sixth of the women were members of sports clubs. Most members of youth clubs (6.9% of all men and 13% of all women) were between 13 and 29 years old.

When asked whether or not people can be trusted, 19% of the men and 12% of the women responded that they felt people could be trusted, all others thought one had to be careful with trusting others. A total of 54% of the men and 46% of the women perceived other people generally as helpful. Three quarters of all men and women found their

neighbourhood a pleasant place to live in. Three in four men and 72% of the women thought they had much in common with their neighbours.

Table 3.33 Percentage of men and women belonging to various associations and reporting various feelings about their communities.[44]

| | Khutsong men | Mine-workers | Khutsong women | Women in hotspots |
|---|---|---|---|---|
| Women's group | • | • | 12.0 | 1.7 |
| Church | 50.2 | 27.3 | 60.8 | 28.9 |
| Stokvel (rotating credit) | 10.4 | 2.7 | 11.2 | 16.5 |
| Political party | 16.8 | 11.2 | 7.2 | 4.1 |
| Union | 17.5 | 70.7 | 4.1 | 0.0 |
| Burial society | 21.6 | 37.2 | 31.5 | 25.4 |
| Residents association | 9.3 | 1.1 | 8.8 | 2.5 |
| Sports club | 39.3 | 23.0 | 16.3 | 4.1 |
| Youth club | 17.0 | 1.1 | 14.7 | 4.1 |
| At least one group | 79.8 | 87.2 | 77.9 | 52.9 |
| Can people be trusted | 14.3 | 22.2 | 11.4 | 12.4 |
| Are people helpful | 54.4 | 53.7 | 46.1 | 44.6 |
| Is neighbourhood pleasant | 82.6 | 73.2 | 80.0 | 56.2 |
| In common with neighbours | 74.5 | 74.0 | 71.5 | 71.7 |

Men and women's HIV sero-status was cross tabulated with indicators of social capital to investigate correlations between membership of a particular association and HIV status. Because the prevalence of HIV among men less than 20 years old was only 2%, and membership of organisations other than youth and sports clubs among men in this group was very low, this age group was excluded from the analysis. The only

44 Appendix 5, questions 218 to 222.

statistically significant difference among miners was found between members and non-members of burial societies. HIV prevalence of members was 25%, whereas that of non-members was 32%. ($p$ = 0.04). Among men in Khutsong, 16% of sports club members were HIV-positive, compared to 25% of non-members ($p$ = 0.02). Nearly 20% of the miners who found the neighbourhood pleasant were HIV positive, compared to 31% who did not find the neighbourhood pleasant ($p$ = 0.02).

For women in Khutsong the prevalence of infection was much lower among those who belonged to a sports club (21%) than among those who did not (40%) ($p$ = 0.0001). Because the prevalence of HIV was high among young women while few young women belonged to burial associations, stokvels or women's groups, only women older than 20 years were considered in relation to these three associations. Thirty-seven percent of burial society members were HIV-positive, compared to 46% of the non-members ($p$ = 0.04). The other associations were not significantly associated with HIV infection. In the hotspots, 95% of the women belonging to a stokvel organisation were HIV-positive whereas 64% of those who did not were infected ($p$ = 0.008). HIV prevalence among church members in hotspots was 50%, compared to 77% for non-church members ($p$ = 0.004).

For the association between HIV and youth club membership only women below the age of 30 and men below 34 were considered as this included 94% of all female and 89% of all male youth club members. Among these young women, 29% of those who belonged to a youth club were HIV-positive as compared to 46% of women who did not ($p$ = 0.003). Youth club membership was not associated with HIV prevalence among young men.

Of all miners who found their neighbourhood a pleasant place, 20% were HIV-positive compared to 31% of those who did not ($p$ = 0.02). Among women in Khutsong, 28% of those who trusted most people, but 39% of those who did not, were HIV-positive ($p$ = 0.053).

Alcohol consumption, the number of casual sexual partners and condom use all influence HIV transmission and these may mediate the

link between social capital and sexual health. Alcohol consumption was strongly associated with group membership among Khutsong men more than 20 years old, and was higher among members than non-members of stokvels (77% vs. 64%, $p = 0.007$), political parties (77% vs. 63%, $p = 0.001$) and trade unions (75% vs. 63%, $p = 0.04$). Fewer church members than non-church members drank alcohol (58% vs. 72%, $p = 0.004$). Among men younger than 30, those who belonged to a youth club were less likely to drink alcohol than those who did not (25% vs. 38%, $p = 0.08$).

Among miners, only church and trade union membership was significantly associated with alcohol consumption. Church members were less likely to drink than were non-members (42% vs. 57%, $p = 0.0001$) while members of trade unions were more likely to drink than non-members (55% vs. 48%, $p = 0.04$).

Alcohol consumption of the women in Khutsong was also associated with club membership. Women were more likely to drink if they belonged to a burial societie (42% vs. 31%, $p = 0.004$), a women's club (49% vs. 33%, $p = 0.02$), or a residents association (50% vs. 33%, $p = 0.008$), and less likely to drink alcohol if they belonged to a church (32% vs. 39%, $p = 0.04$), or a sports club (21% vs. 37%, $p = 0.001$). Women below the age of 30 were less likely to drink alcohol if they belonged to a youth club (26% vs. 38%, $p = 0.07$). Women in hotspots were more likely to drink alcohol if they belonged to a burial society than if they did not (81% vs. 52%, $p = 0.005$).

Membership of certain groups was also associated with casual sexual relationships. Among men in Khutsong, those who belonged to a church were less likely to have a casual partner (32% vs. 41%, $p = 0.05$). Those who found their neighbourhood a pleasant place to live or felt that they had much in common with their neighbours were less likely to have a casual partner (33% vs. 51%, $p = 0.004$ and 34% vs. 45%, $p = 0.04$, respectively) than those who did not.

Among miners, belonging to certain organisations increased the likelihood of having a casual partner. These included political parties

(79% vs. 52%, $p = 0.008$), stokvels (71% vs. 47%, $p = 0.02$), sports clubs (60% vs. 50%, $p = 0.01$) and burial societies (60% vs. 48%, $p = 0.001$).

Among women in Khutsong, those who belonged to a stokvel were more likely to have had a casual sexual relationship in the last year (43% vs. 22%, $p = 0.0001$). No relationship between indicators of social capital and casual sexual relationships was established among women in hotspots.

There was no correlation between consistent condom use with a casual partner and associational membership among men in Khutsong, nor among mine workers.

Women in Khutsong were more likely to use condoms consistently with a casual partner if they belong to a sports club (42% vs. 19%, $p = 0.02$) or a burial association (30% vs. 18%, $p = 0.08$), but were less likely to use condoms consistently if they feel that they had a lot in common with their neighbours (17% vs. 30%, $p = 0.07$), or if they found their neighbourhood pleasant (17% vs. 37%, $p = 0.008$).

In some cases associational membership act to reduce the risk of HIV infection as expected. On the other hand, women who regard others as trustworthy or the neighbourhood as pleasant are less likely to protect themselves with condoms. Clearly the interpretation of the impact of social capital on behaviour is complex and sometimes counter intuitive and more detailed qualitative research is needed to develop a better understanding of these interactions.

# 4. Risk factor analysis

In the previous chapter the risk of HIV infection is considered in relation to a range of demographic, social and behavioural factors in order to identify some of the determinants of infection. In addition, some of the potentially mediating factors, such as alcohol use and condom use, are explored in the same way. In this chapter we proceed to carry out a more formal risk factor analysis in which we first present a formal description of the population based on the findings of the previous chapter, carry out a series of univariate analyses to identify a subset of variables that may be used to predict HIV-status and to include in a multi-variate analysis.

In this chapter only those people who reported having had sexual intercourse are included in the analyses as the rest are not at risk of infection. This subset of the data included 417 men living in Khutsong, 898 mine workers, 644 women living in Khutsong and 121 women living in hotspots. Among these men in Khutsong, 25% were HIV positive. Among the mine workers 29% were HIV positive. Among these women in Khutsong the prevalence was 41% and among women in hotspots 69% were HIV positive.

## 4.1 Description of the population

Tables 4.1 and 4.2 summarise the most important differences between men from Khutsong and migrant mine workers. Miners were older, drank less alcohol, travelled more often and were less well educated than men in Khutsong. Miners were more likely to be Basotho and less likely to be Tswana than were men living in Khutsong. Miners all lived in single sex mine hostels, were in full-time employment and had a higher income than men in Khutsong.

The overall prevalence of HIV was not significantly different between miners and men from the general population in Khutsong, although the age-prevalence was significantly different, as shown in Figure 3.2. Compared to men in Khutsong, mine workers were less likely to use condoms consistently, were on average older at first sex, reported

more lifetime partners and were more likely to have had a casual relationship in the last twelve months. Miners were also more likely to have been clients of commercial sex workers. There was no difference in prevalence of STDs (gonorrhoea, syphilis and chlamydia) although more miners reported pain or urethral discharge in the previous twelve months. Significantly more miners than men in Khutsong were treated by medical professionals for STD episodes.

More than half of the women in hotspots said that they were commercial sex workers and they had significantly more life-time partners, as well as non- spousal partners and short-term partners in the previous year than had Khutsong women. Women in hotspots were more likely to have sex during menstruation and to practise dry sex, they drank significantly more alcohol, were less educated and travelled less frequently than women in Khutsong, but were more likely to be in full time employment and had a higher average monthly income. More women in hotspots reported two or more concurrent spouses. Three quarters of all women with a casual partner assumed he had one other sexual partner at the time of the relationship. However, significantly more women in hotspots thought that their casual partner had at least three other partners simultaneously.

Table 4.1. Summary of abbreviations used in the risk factor analyses given in Tables 4.2 to 4.5.

| Abbreviation | Meaning |
|---|---|
| 2+ spouses | Two or more spouses (polygamous) |
| ADS | Age difference from spouse |
| AD CP | Age difference from casual partner |
| Alcohol | Drink alcohol daily, weekly or monthly |
| AM | Age at current marriage |
| Condoms | Always use condoms |
| CP | Casual partner |
| CP > 1 other | Casual partner had more than one other partner |

| Abbreviation | Meaning |
|---|---|
| CP > 3 other | Casual partner had more than three other partners |
| CP in last yr. | Had a casual partner in the last year |
| CSW client | Client of commercial sex worker |
| Dry sex | Always or often |
| Education | Completed at least secondary school |
| Employed | In full time employment |
| First sex | Median age at first sex |
| First sex 18+ | First sex after 18 years of age |
| Helpful | Most people are helpful |
| Last CP CSW | Last casual partner was commercial sex worker |
| LP | Life-time partners |
| Neighbourhd. | Neighbourhood is a pleasant place to live |
| Neighbours | Having a lot in common with one's neighbours |
| P/D in last year | Experienced genital pain/discharge in previous yr. |
| PBM > *n* | More than *n* partners before marriage |
| Res. assoc. | Residents association |
| S to M > *n* | More than *n* years between first sex and marriage |
| S to M | Time between first sex and current marriage |
| Sex week >1 | One or more sex acts in the last week |
| Sex mens. | Sex during menstruation |
| Sores | Reported sores |
| Syphilis life-time | Life time syphilis (RPR and TPHA positive) |
| Syphilis recent | RPR positive |
| Trust | Most people are regarded as trustworthy |
| Two trips | Two or more trips out of Carletonville in last year |

Table 4.2 Characteristics of 417 men and 644 women living in Khutsong, 898 mine workers and 121 women living in hotspots who had had at least one sexual partner. Some of the questions were based on subsets of these samples. See Table 4.1 for explanation of categories.

**a) Background characteristics**

| | Khutsong men | Mine workers | Khutsong women | Women in hotspots |
|---|---|---|---|---|
| **General** | | | | |
| Mean age (yr.) | 32.1 | 35.2 | 31.5 | 32.5 |
| Alcohol (%) | 60.7 | 52.9 | 37.7 | 59.2 |
| Education (%) | 27.9 | 22.7 | 25.0 | 13.2 |
| Employed (%) | 31.9 | 98.1 | 8.1 | 16.7 |
| Income/month (R) | 350 | 1300 | 200 | 300 |
| Two trips (%) | 22.2 | 26.1 | 14.9 | 11.6 |
| **Ethnic group (%)** | | | | |
| Basotho | 19.7 | 26.5 | 25.2 | 42.1 |
| Zulu | 9.6 | 9.1 | 7.0 | 11.6 |
| Pedi | 2.4 | 1.6 | 1.4 | 4.6 |
| Shangaan | 5.5 | 12.1 | 3.0 | 1.7 |
| Xhosa | 27.4 | 30.0 | 33.1 | 35.5 |
| Tswana | 30.0 | 12.2 | 28.0 | 3.3 |
| Swazi | 1.9 | 6.5 | 1.2 | 0.0 |
| Other | 3.4 | 2.0 | 1.2 | 1.7 |
| **Housing (%)** | | | | |
| Private | 22.4 | | 13.7 | |
| Council | 15.8 | | 22.3 | |
| Site-and-serv. | 29.9 | | 26.0 | |
| Informal | 20.6 | | 35.0 | |
| Council hostels | 6.4 | | 3.0 | |

**b) Sexual behaviour**

| | Khutsong men | Mine workers | Khutsong women | Women in hotspots |
|---|---|---|---|---|
| Ever married (%) | 48.7 | 69.1 | 64.5 | 63.6 |
| First sex (median yrs.) | 16.0 | 16.0 | 17.0 | 17.9 |
| First sex 18+ (%) | 36.5 | 47.6 | 44.6 | 41.3 |
| Last CP CSW (%) | 3.8 | 8.2 | 4.8 | 50.4 |
| CP in last year (%) | 37.9 | 52.6 | 24.4 | 64.5 |
| Median no. LPs | 6.0 | 9.0 | 3.0 | 9.0 |
| Circumcised (%) | 35.0 | 50.1 | • | • |
| Dry sex (%) | • | • | 2.5 | 9.1 |

**c) Health**

| | Khutsong men | Mine workers | Khutsong women | Women in hotspots |
|---|---|---|---|---|
| HIV-positive (%) | 25.3 | 28.6 | 40.4 | 68.6 |
| Syphilis recent (%) | 7.0 | 5.2 | 10.7 | 23.3 |
| Syphilis life-time (%) | 32.8 | 30.3 | 53.0 | 76.9 |
| Gonorrhoea (%) | 3.6 | 3.0 | 7.5 | 15.7 |
| Chlamydia (%) | 6.0 | 3.8 | 8.5 | 9.1 |
| Sores in last year (%) | 12.5 | 11.9 | 14.3 | 15.9 |
| P/D in last year (%) | 22.1 | 28.4 | 45.5 | 49.6 |

**d) Partners**

| | Khutsong men | Mine workers | Khutsong women | Women in hotspots |
|---|---|---|---|---|
| **Married individuals**[45] | | | | |
| AD S (yr.) | 6.0 | 6.9 | 6.4 | 7.0 |
| AD S > 11 yr (%) | 18.3 | 13.7 | 19.6 | 33.8 |
| S to M (yr.)[46] | 13.0 | 12.0 | 6.0 | 9.0 |
| S to M > 9 yr. (%) | 74.0 | 70.5 | 84.7 | 84.4 |
| Median AM yr.[47] | 27.0 | 27.0 | 27.0 | 28.0 |
| AM > 27 yrs. (%) | 74.6 | 70.8 | 85.8 | 88.3 |
| 2+ curr. spouses% | 6.3 | 7.8 | 2.3 | 6.6 |
| **Those with CP in last yr.**[48] | | | | |
| AD CP (yr.) | 7.0 | 8.6 | 4.7 | 6.4 |
| AD CP > 11 yrs (%) | 23.6 | 26.6 | 10.2 | 29.0 |
| Condoms (%) | 27.8 | 18.7 | 21.5 | 59.0 |
| CP > 1 other (%) | 62.9 | 68.1 | 73.7 | 74.7 |
| CP > 3 other (%) | 13.9 | 9.9 | 13.5 | 37.2 |
| Sex week > 1 (%)[49] | 42.6 | 48.4 | 47.3 | 69.9 |

As expected, the prevalence of HIV as well as the prevalence of syphilis and gonorrhoea were significantly higher among women living in

45 181 men and 535 women living in Khutsong, 599 mineworkers and 77 women living in hotspots.

46 Aged 30–39 years only. 65 men and 79 women living in Khutsong, 280 mineworkers and 25 women living in hotspots.

47 Aged 30–34 years only. 25 men and 77 women living in Khutsong, 126 mineworkers and 18 women living in hotspots.

48 158 men and 158 women living in Khutsong, 471 mineworkers and 78 women living in hotspots.

49 101 men and 112 women living in Khutsong, 345 mineworkers and 56 women living in hotspots.

hotspots than among women living in Khutsong, although the number who reported STD symptoms (genitals sores, vaginal or urethral discharge or pain) in the previous year did not differ significantly. Women in hotspots were more likely to have had more than one sexual act with a casual partner in the previous week. A much larger proportion of women in hotspots reported consistent use of condoms with a casual partner than did women in Khutsong.

## 4.2 Univariate analysis

Univariate logistic regressions were done to identify risk factors for men and women in Khutsong, mineworkers and women in hotspots (Table 4.3). Risk factors for men in Khutsong were drinking alcohol (OR 2.3), to have been married (OR 1.6), to have had non-spousal sexual relationships (OR 1.8), to have had genital sores in the last year (OR 3.6) and to have a casual partner who is thought to have other partners at the same time (OR 2.7). Risk factors for mine workers in the univariate analysis were drinking alcohol (OR 1.7), and reported STD symptoms such as genital sores (OR 1.7) and urethral discharge or pain in the last year (OR 1.4). Circumcision reduced the risk of HIV infection (OR 0.7), so did at least two trips out of Carletonville (OR 0.7) and to be a member of a burial association (OR 0.7).

Risk factors identified for women in Khutsong in the univariate analyses (Table 4.3) were age, informal housing (living in squatter camps and council hostels (OR 1.4), and having non-spousal relationships in the last year (OR 1.6). Women were also at increased risk for HIV infection if they had active syphilis or gonococcal infections (odds ratios: 1.9 and 2.5, respectively) or if they reported genital sores (OR 2.5) or had experienced a pain or a discharge in the previous year (OR 1.6). Membership of a church or a sports club were both protective (odds ratios: 0.8 and 0.3, respectively).

Risk factors for women living in hotspots were having non-spousal sexual partners and belonging to a stokvel (odds ratios: 2.2 and 10.3, respectively). Church membership had a protective effect (OR 0.3).

Table 4.3. Univariate analysis of risk factors for HIV infection among people who have had at least one sexual partner. The table gives the odds ratio, the 95% confidence interval, and the significance level, *p* (if $p < 0.2$). Where a factor was not included in the analysis this is indicated by a bullet. Where a factor was included but the significance level was greater than 0.2 the cells is left blank. See Table 4.1 for an explanation of the abbreviations.

**a) Background**

| | Khutsong men | | | Mine-workers | | |
|---|---|---|---|---|---|---|
| | *n* = 415; HIV+ = 25.3% | | | *n* = 898; HIV+ = 28.7% | | |
| | OR | CI | *p* | OR | CI | *p* |
| **Age** | | | | | | |
| 15–19 | | 1 | | | | |
| 20–24 | 9.4 | 1.2–74 | 0.03 | | | |
| 25–29 | 36.3 | 4.7–281 | 0.001 | | | |
| 30–34 | 36.0 | 4.6–282 | 0.001 | | | |
| 35–39 | 27.2 | 3.5–212 | 0.002 | | | |
| 40–49 | 15.1 | 1.9–118 | 0.009 | | | |
| Alcohol | 2.3 | 1.4–3.8 | 0.001 | 1.7 | 1.2–2.3 | < 0.001 |
| Education | | | | | | |
| Employed | | | | | | |
| Two trips | | | | 0.7 | 0.5–1.0 | 0.05 |
| **Ethnic group** | | | | | | |
| Others | | 1 | | | | |
| Swazi | 7.5 | 1.0–54 | 0.05 | | | |
| Housing | | | | | | |
| Formal | | 1 | | | | |
| Informal | | | | • | | |

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | *n* = 644; HIV+ = 40.9% | | | *n* = 121; HIV+ = 68.6% | | |
| | OR | CI | *p* | OR | CI | *p* |
| **Age** | | | | | | |
| 15–19 | | 1 | | | | |
| 20–24 | 2.8 | 1.5-5.4 | 0.001 | | | |
| 25–29 | 3.3 | 1.7-6.2 | 0.0003 | | | |
| 30–34 | 2.1 | 1.1-3.9 | 0.03 | | | |
| 35–39 | | | | | | |
| 40–49 | | | | | | |
| Alcohol | | | | | | |
| Education | | | | | | |
| Employed | | | | | | |
| Two trips | | | | | | |
| **Ethnic group** | | | | | | |
| Others | | | | | | |
| Swazi | | | | | | |
| **Housing** | | | | | | |
| Formal | | 1 | | | | |
| Informal | 1.4 | 1.0–2.0 | 0.05 | | • | |

**b) Sexual behaviour**

| | Khutsong men | | | Mineworkers | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Ever married | 1.6 | 1.0–2.6 | < 0.03 | | | |
| First sex 18+ | | | | | | |
| CP last yr. | 1.8 | 1.1–2.8 | < 0.02 | | | |
| Median LPs | 1.1 | 1.0–1.2 | 0.003 | | | |
| Circumcised | | | | 0.7 | 0.5–0.9 | 0.006 |
| Sex mens. | | • | | | • | |
| Dry sex | | • | | | • | |
| CSW client | | | | | | |

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Ever married | | | | | | |
| First sex 18+ | | | | | | |
| CP last yr. | 1.6 | 1.1–2.3 | 0.01 | 2.2 | 1.0–4.9 | 0.05 |
| Median LPs | 1.1 | 1.0–1.2 | 0.006 | | | |
| Circumcised | | • | | | • | |
| Sex mens. | | | | | | |
| Dry sex | | | | | | |
| CSW client | | | | | • | |

**c) Health**

| | Khutsong men | | | Mineworkers | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Syph. recent. | | | | | | |
| Gonorrhoea | | | | | | |
| Chlamydia | | | | | | |
| Sores last yr. | 3.6 | 2.0–6.5 | < 0.001 | 1.7 | 1.1–2.6 | 0.01 |
| P/D last year | | | | 1.4 | 1.0–1.9 | 0.05 |
| Health serv. | | | | | | |

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Syph. recent. | 1.9 | 1.1–3.2 | 0.01 | | | |
| Gonorrhoea | 2.5 | 1.4–4.8 | 0.003 | | | |
| Chlamydia | | | | | | |
| Sores last yr. | 2.5 | 1.6–4.0 | 0.0001 | | | |
| P/D last year | 1.6 | 1.2–2.2 | 0.003 | | | |

**d) Partners**

| | Khutsong men | | | Mineworkers | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| **Married only** | | | | | | |
| ADS (yr.) | | | | | | |
| PBM > 5 | | | | | | |
| PBM > 1 | | • | | | • | |
| S to M > 9 | | | | | | |
| S to M > 3 | | • | | | • | |
| 2+ spouses | | | | | | |
| **CP last year** | | | | | | |
| ADCP | | | | | | |
| ADCP>11 | | | | | | |
| Condoms | | | | | | |
| CP > 3 | 2.7 | 1.0–7.1 | 0.05 | | | |

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| **Married only** | | | | | | |
| ADS (yr.) | | | | | | |
| PBM > 5 | | • | | | • | |
| PBM > 1 | | | | | | |
| S to M > 9 | | • | | | • | |
| S to M > 3 | | | | | | |
| 2+ spouses | | | | | | |
| **CP last year** | | | | | | |
| ADCP | | | | | | |
| ADCP>11 | | | | | | |
| Condoms | | | | | | |
| CP > 3 | 2.7 | 1.0–7.1 | 0.05 | | | |

**e) Social capital**

| | Khutsong men | | | Mineworkers | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Church | | | | | | |
| Stokvel | | | | | | |
| Trade union | | | | | | |
| Political party | | | | | | |
| Res. assoc. | | | | | | |
| Burial society | | | | 0.7 | 0.5–1.0 | 0.04 |
| Sports club | | | | | | |
| Trust | | | | | | |
| Neighbourhd. | | | | | | |
| Neighbours | | | | | | |
| Helpful | | | | | | |

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Church | 0.8 | 0.6–1.1 | 0.02 | 0.3 | 0.1–0.7 | 0.007 |
| Stokvel | | | | 10.3 | 1.3–80 | 0.03 |
| Trade union | | | | | | |
| Political party | | | | | | |
| Res. ass. | | | | | | |
| Burial society | | | | | | |
| Sports club | 0.3 | 0.2–0.6 | 0.0004 | | | |
| Trust | | | | | | |
| Neighbourhd. | | | | | | |
| Neighbours | | | | | | |
| Helpful | | | | | | |

## 4.3 Multivariate analysis

Possible risk factors identified in univariate analysis were entered into a multivariate logistic regression model to determine which ones were independently associated with HIV infection. Multivariate logistic regression performed on men living in Khutsong showed that, in addition to age, genital sores (OR 4.2) remained statistically significant (Table 4.4).

For mine workers, drinking alcohol (OR 1.7) and reported genital sores (OR 1.7) remained significant risk factors in multiple logistic regression. Circumcision and membership of burial association retained their protective effect (OR 0.7 and 0.7, respectively) (Table 4.4).

Multivariate analysis performed on women living in Khutsong showed that in addition to age having active syphilis or gonococcal infections (OR 1.9 and 2.0, respectively) as well as reported genital sores (OR 2.4) were significantly associated with HIV. Members of a sports club were less at risk than non-members (OR 0.4). However, the results on STDs have to be interpreted with caution as it was not possible to establish which infection was first, the STD (gonorrhoea, syphilis) or HIV (Table 4.4).

Current STDs, syphilis and gonorrhoea were entered into the multivariate analysis for women in Khutsong only because only in this group were *p*-values of less than 0.2 obtained in the univariate analyses. Age and genital sores experienced in the previous year (OR 2.4) were risk factors and sports club membership was protective (OR 0.4). In addition, drinking alcohol was a significant risk factor (OR 1.4) as was living in informal housing (OR 1.4).

For women living in hotspots, alcohol consumption (OR 2.7) and stokvel membership (OR 7.6) were risk factors, church membership was protective (OR 0.2).

Table 4.4 Multivariate analysis of risk factors for HIV infection among people who have had at least one sexual partner. Although these tables are split the multivariate analysis included all factors simultaneously. Where a factor was not included in the analysis this is indicated by a bullet. Where a factor was included but the significance level was greater than 0.2 the cells is left blank. See Table 4.1 for explanations of the abbreviations.

**a) Background**

| | Khutsong men | | | Mineworkers | | |
|---|---|---|---|---|---|---|
| | *n* = 417; HIV+ = 25.3% | | | *n* = 898; HIV+ = 28.7% | | |
| | OR | CI | *p* | OR | CI | *p* |
| **Age** | | | | | | |
| 15–19 | | 1 | | | | |
| 20–24 | 8.8 | 1.1–70 | 0.04 | | | |
| 25–29 | 35.7 | 4.5–281 | 0.001 | | | |
| 30–34 | 36.2 | 4.5–289 | 0.001 | | | |
| 35–39 | 28.8 | 2.6–228 | 0.001 | | | |
| 40–49 | 16.7 | 2.1–132 | 0.07 | | | |
| Alcohol | | | | 1.7 | 1.2–2.3 | 0.0007 |
| Education | | • | | | • | |
| Employed | | • | | | • | |
| Two trips | | • | | | | |
| Ethnic group | | • | | | | |
| Housing | | • | | | | |

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | *n* = 644; HIV+ = 240.9% | | | *n* = 121; HIV+ = 68.6% | | |
| | OR | CI | *p* | OR | CI | *p* |
| **Age** | | | | | | |
| 15–19 | | 1 | | | 1 | |
| 20–24 | 2.3 | 1.2–4.6 | 0.01 | | | |
| 25–29 | 2.6 | 1.3–5.2 | 0.005 | | | |
| 30–34 | | | | | | |
| 35–39 | | | | | | |
| 40–49 | | | | | | |
| Alcohol | | | | 2.7 | 1.1–6.2 | 0.02 |
| Education | | • | | | • | |
| Employed | | • | | | • | |
| Two trips | | • | | | • | |
| Ethnic group | | • | | | • | |
| Housing | | | | | • | |

**b) Sexual behaviour**

| | Khutsong men | | | Mineworkers | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Ever married | | | | | • | |
| First sex 18+ | | | | | • | |
| CP last yr. | | | | | • | |
| Median LPs | | | | | | |
| Circumcised | | • | | 0.7 | 0.5–0.9 | 0.008 |
| Sex mens. | | • | | | • | |
| Dry sex | | • | | | • | |
| CSW client | | • | | | • | |

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Ever married | | | | | • | |
| First sex 18+ | | • | | | • | |
| CP last yr. | | | | | | |
| Median LPs | | | | | • | |
| Circumcised | | • | | | • | |
| Sex mens. | | • | | | | |
| Dry sex | | • | | | | |
| CSW client | | • | | | • | |

**c) Health**

| | Khutsong men | | | Mineworkers | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Syph. recent. | | • | | | • | |
| Gonorrhoea | | • | | | • | |
| Chlamydia | | • | | | • | |
| Sores last yr. | 4.2 | 2.2–8.2 | 0.0001 | 1.7 | 1.1–2.5 | 0.02 |
| P/D last year | | • | | | | |
| Health serv. | | • | | | • | |
| | Khutsong women | | | Women in hotspots | | |
| | OR | CI | *p* | OR | CI | *p* |
| Syph. recent. | 1.9 | 1.1–3.4 | 0.02 | | • | |
| Gonorrhoea | 2.0 | 1.1–3.9 | 0.03 | | • | |
| Chlamydia | | • | | | • | |
| Sores last yr. | 2.4 | 1.5–4.0 | 0.0003 | | • | |
| P/D last year | | | | | • | |
| Health serv. | | • | | | • | |

**d) Partners**

| | Khutsong men | | | Mineworkers | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| **Married only** | | | | | | |
| ADS (yr.) | | • | | | • | |
| PBM > 5 | | • | | | • | |
| PBM > 1 | | • | | | • | |
| S to M > 9 | | • | | | • | |
| S to M > 3 | | • | | | • | |
| 2+ spouses | | • | | | • | |
| **CP last year** | | | | | | |
| ADCP | | • | | | • | |
| ADCP>11 | | • | | | • | |
| Condoms | | • | | | • | |
| CP > 3 | | • | | | • | |

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| **Married only** | | | | | | |
| ADS (yr.) | | • | | | • | |
| PBM > 5 | | • | | | • | |
| PBM > 1 | | • | | | • | |
| S to M > 9 | | • | | | • | |
| S to M > 3 | | • | | | | |
| 2+ spouses | | • | | | • | |
| **CP last year** | | | | | | |
| ADCP | | • | | | • | |
| ADCP>11 | | • | | | • | |
| Condoms | | • | | | • | |
| CP > 3 | | • | | | • | |

**e) Social capital**

| | Khutsong men | | | Mineworkers | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Church | | • | | | • | |
| Stokvel | | • | | | • | |
| Trade union | | | | | • | |
| Political party | | | | | • | |
| Res. assoc. | | • | | | • | |
| Burial society | | • | | 0.7 | 0.5–1.0 | 0.05 |
| Sports club | | • | | | • | |
| Trust | | • | | | • | |
| Neighbourhd. | | | | | • | |
| Neighbours | | • | | | • | |
| Helpful | | • | | | • | |

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Church | | • | | 0.2 | 0.1–0.6 | 0.002 |
| Stokvel | | • | | 7.6 | 1.5–39 | 0.01 |
| Trade union | | • | | | • | |
| Political party | | • | | | • | |
| Res. assoc. | | • | | | • | |
| Burial society | | • | | | • | |
| Sports club | 0.4 | 0.3–0.8 | 0.004 | | | |
| Trust | | | | | • | |
| Neighbourhd. | | • | | | • | |
| Neighbours | | • | | | • | |
| Helpful | | • | | | • | |

## 4.4 Young people

HIV prevalence was zero in young people below 15 years old, 2% in young men (15–19 years old) and 20.6% in young women of that age group. In the age group 20–24, almost 23% of the men and 58% of the women were infected. Because of the very high incidence among young people the risk factors for people aged 15 to 29 years were analysed separately and are presented in Tables 4.5 and 4.6. Individual risk factors for HIV infection in the univariate analysis for young men in Khutsong were age, drinking alcohol (OR 2.8), being in full-time employment (OR 3.4), having been married (OR 2.8), a higher number of lifetime partners (OR 1.3), having been a client of a commercial sex worker (OR 8.5) and genital sores in the previous year (OR 3.5). Of the social capital indicators, members of stokvels or trade unions were at increased risk (OR 2.5 and 3.2) and members of sports clubs and those who find the neighbourhood a pleasant place to live in were at decreased risk of infection (OR 0.3 and 0.4, respectively) (Table 4.5). However, in the multivariate risk factor analysis only four risk factors remained significant. The most significant risk factor was age followed by having been a client of a commercial sex worker (OR 7.1), having a higher number of life-time partners, and having had genital sores in the previous 12 months (OR 1.1 and 3.1, respectively) (Table 4.6).

Among young mineworkers, three individual risk factors were significant, having had non-spousal relationships, a higher number of life-time partners and gonococcal infection (OR 2.0, 1.1 and 3.3 respectively). Circumcision was protective (OR 0.4) (Table 4.5). In the multivariate analysis, non-spousal partner(s) was the only significant risk factor (OR 2.1) and circumcision remained a protective factor (OR 0.4) (Table 4.6).

Table 4.5. Univariate analysis of risk factors for HIV infection among young people (aged 15 to 29 years) who had at least one sexual partner. The table gives the odds ratio with its confidence interval and the significance level where the latter is less than 0.2. See Table 4.1 for explanations of abbreviations.

**a) Background**

| | Khutsong men | | | Mine-workers | | |
|---|---|---|---|---|---|---|
| | *n* = 194; HIV+ = 20.6% | | | *n* = 251; HIV+ = 28.3% | | |
| | OR | CI | *P* | OR | CI | *p* |
| **Age** | | | | | • | |
| 15–19 | | 1 | | | | |
| 20–24 | 9.4 | 1.2–74 | < 0.03 | | | |
| 25–29 | 36.3 | 4.7–281 | < 0.001 | | | |
| Alcohol | 2.8 | 1.3–6.0 | 0.006 | 1.7 | 1.2–2.3 | < 0.001 |
| Education | | | | | | |
| Employed | 3.4 | 1.5–7.6 | 0.002 | | | |
| Two trips | | | | 0.7 | 0.5–1.0 | 0.05 |
| **Ethnic group** | | | | | | |
| Others | | | | | | |
| Swazi | | | | | | |
| Housing | | | | | | |
| Formal | | | | | | |
| Informal | | | | | • | |

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | *n* = 301; HIV+ = 50.5% | | | *n* = 49; HIV+ = 73.5% | | |
| | OR | CI | *P* | OR | CI | *p* |
| **Age** | | | | | • | |
| 15–19 | | 1 | | | | |
| 20–24 | 2.8 | 1.5-5.4 | 0.001 | | | |
| 25–29 | 3.3 | 1.7-6.2 | 0.0003 | | | |
| 30–34 | 2.1 | 1.1-3.9 | < 0.03 | | | |
| Alcohol | 2.3 | 1.4–3.8 | 0.0002 | | | |
| Education | 0.5 | 0.3–0.9 | 0.01 | | | |
| Employed | | | | | | |
| Two trips | | | | | | |
| **Ethnic group** | | | | | | |
| Others | | | | | | |
| Swazi | | | | | | |
| **Housing** | | | | | | |
| Formal | | 1 | | | | |
| Informal | 2.3 | 1.4–3.8 | 0.0005 | | • | |

**b) Sexual behaviour**

| | Khutsong men | | | Mineworkers | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Ever married | 2.8 | 1.3–6.5 | 0.01 | | | |
| First sex 18+ | | | | | | |
| CP last yr. | | | | 2.0 | 1.2–3.6 | 0.01 |
| Median LPs | 1.3 | 1.2–1.4 | < 0.0001 | 1.1 | 1.0–1.2 | 0.04 |
| Circumcised | | | | 0.4 | 0.2–0.8 | 0.005 |
| Sex mens. | | • | | | • | |
| Dry sex | | • | | | • | |
| CSW client | 8.5 | 1.5–48 | 0.01 | | | |

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Ever married | | | | | | |
| First sex 18+ | | | | 5.4 | 1.0–28 | 0.04 |
| CP last yr. | 1.8 | 1.1–3.2 | 0.02 | | | |
| Median LPs | 1.2 | 1.1–1.3 | 0.001 | | | |
| Circumcised | | • | | | • | |
| Sex mens. | | | | | | |
| Dry sex | | | | | | |
| CSW client | | | | | • | |

**c) Health**

| | Khutsong men | | | Mineworkers | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Syph. recent. | | | | | | |
| Gonorrhoea | | | | 3.3 | 1.0–11 | 0.05 |
| Chlamydia | | | | | | |
| Sores last yr. | 3.5 | 1.4–8.4 | 0.005 | | | |
| P/D last year | | | | | | |
| Health serv. | | | | | | |

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Syph. recent. | | | | | | |
| Gonorrhoea | | | | | | |
| Chlamydia | | | | | | |
| Sores last yr. | 2.9 | 1.5–5.4 | 0.001 | | | |
| P/D last year | 1.8 | 1.1–2.9 | 0.01 | | | |

**d) Partners**

| | Khutsong men | | | Mineworkers | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| **Married only** | | | | | | |
| ADS (yr.) | | | | | | |
| PBM > 5 | | | | | | |
| PBM > 1 | | | | | | |
| S to M > 9 | | | | | | |
| S to M > 3 | | | | | | |
| 2+ spouses | | | | | | |
| **CP last year** | | | | | | |
| ADCP | | | | | | |
| ADCP>11 | | | | | | |
| Condoms | | | | | | |
| CP > 3 | | | | | | |

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| **Married only** | | | | | | |
| ADS (yr.) | | | | | | |
| PBM > 5 | | | | | | |
| PBM > 1 | | | | | | |
| S to M > 9 | | | | | | |
| S to M > 3 | | | | | | |
| 2+ spouses | | | | | | |
| **CP last year** | | | | | | |
| ADCP | | | | | | |
| ADCP >11 | | | | | | |
| Condoms | | | | | | |
| CP > 3 | 2.7 | 1.0–7.1 | 0.05 | | | |

**e) Social capital**

| | Khutsong men | | | Mineworkers | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Church | | | | | | |
| Stokvel | 2.5 | 1.0–6.5 | 0.056 | | | |
| Trade union | 3.2 | 1.2–8.8 | 0.02 | | | |
| Political party | | | | | | |
| Res. assoc. | | | | | | |
| Burial society | | | | | | |
| Youth club | | | | | | |
| Sports club | 0.3 | 0.2–0.7 | 0.007 | | | |
| Trust | | | | | | |
| Neighbourhd. | 0.4 | 0.2–0.8 | 0.01 | | | |
| Neighbours | | | | | | |
| Helpful | | | | | | |

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | OR | CI | *P* | OR | CI | *p* |
| Church | | | | 0.2 | 0.06–0.9 | < 0.04 |
| Stokvel | | | | | | |
| Trade union | | | | | | |
| Political party | | | | | | |
| Res. ass. | | | | | | |
| Burial society | | | | | | |
| Youth club | 0.6 | 0.4–1.0 | 0.03 | | | |
| Sports club | 0.3 | 0.2–0.6 | 0.0004 | | | |
| Trust | | | | | | |
| Neighbourhd. | 0.4 | 0.2–0.8 | 0.01 | | | |
| Neighbours | | | | | | |
| Helpful | | | | | | |

For 15 to 29 year old women living in Khutsong a list of individual risk factors that were statistically significant in the univariate regression analyses: age, drinking alcohol (OR 2.3), living in the informal housing sector (OR 2.3), non-spousal relationships (OR 1.8), a higher number of life-time partners (1.2) and genital sores and pain in the previous 12 months (OR 2.9 and 1.8). Three protective factors were identified: attending secondary school or being in higher education, and belonging to a youth club or a sports club (OR 0.5, 0.6 and 0.3 respectively) (Table 4.5). The remaining protective factor in the multivariate regression analysis was membership of a sports club; the remaining risk factors were: consumption of alcohol, living in informal housing and having had genital sores in the previous year (OR 2.1, 2.3 and 2.7) (Table 4.6).

A significant risk factor for young women in hotspots was having first had sex after the age of 18 years (OR 5.4), while church membership was protective (OR 0.2) (Table 4.5). In the multivariate analysis drinking alcohol (OR 4.4) and having first had sex after the age of 18 years (OR 9.0) were both significant. Church membership remained protective (OR 0.1) (Table 4.6).

Gonorrhoea was a significant risk factor for mine workers in the univariate analysis but not in the multivariate analysis and none of the other STD's were significant in any group.

Table 4.6. Multivariate analysis of risk factors for HIV infection among young people (aged 15–29 years) who had had at least one sexual partner. The analysis included all factors simultaneously. See Table 4.1 for explanations of the abbreviations.

**a) Background**

| | Khutsong men | | | Mineworkers | | |
|---|---|---|---|---|---|---|
| | *n* = 196; HIV+ = 20.6% | | | *n* = 251; HIV+ = 28.3% | | |
| | OR | CI | *p* | OR | CI | *p* |
| **Age** | | | | | • | |
| 15–19 | | 1 | | | | |
| 20–24 | 8.2 | 0.8–82 | 0.07 | | | |
| 25–29 | 29.2 | 2.9–293 | 0.004 | | | |
| Alcohol | | | | | • | |
| Education | | • | | | • | |
| Employed | | | | | | |
| Two trips | | • | | | • | |
| **Ethnic group** | | • | | | • | |
| **Housing** | | | | | • | |

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | *n* = 305; HIV+ = 50.5% | | | *n* = 50; HIV+ = 73.5% | | |
| | OR | CI | *p* | OR | CI | *p* |
| **Age** | | | | | • | |
| 15–19 | | | | | 1 | |
| 20–24 | | | | | | |
| 25–29 | | | | | | |
| Alcohol | 2.1 | 1.2–3.5 | 0.007 | 4.4 | 1.0–20 | 0.057 |
| Education | | | | | • | |
| Employed | | • | | | • | |
| Two trips | | • | | | • | |
| **Ethnic group** | | • | | | • | |
| **Housing** | | | | | • | |
| Formal | | 1 | | | | |
| Informal | 2.3 | 1.3–4.0 | 0.002 | | | |

**b) Sexual behaviour**

| | Khutsong men | | | Mineworkers | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Ever married | | | | | • | |
| First sex 18+ | | • | | | • | |
| CP last yr. | | | | 2.1 | 1.2–3.7 | 0.01 |
| Median LPs | 1.1 | 1.0–1.3 | 0.02 | | | |
| Circumcised | | • | | 0.4 | 0.2–0.8 | 0.004 |
| Sex mens. | | • | | | • | |
| Dry sex | | • | | | • | |
| CSW client | 7.1 | 1.1–46 | 0.04 | | • | |

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Ever married | | | | | • | |
| First sex 18+ | | • | | 9.0 | 1.3–61 | 0.02 |
| CP last yr. | | | | | • | |
| Median LPs | | | | | • | |
| Circumcised | | • | | | • | |
| Sex mens. | | • | | | • | |
| Dry sex | | • | | | • | |
| CSW client | | • | | | • | |

**c) Health**

| | Khutsong men | | | Mineworkers | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Syph. recent. | | • | | | • | |
| Gonorrhoea | | | | | | |
| Chlamydia | | | | | • | |
| Sores last yr. | 3.1 | 1.1–8.8 | 0.03 | | | |
| P/D last year | | • | | | | |
| Health serv. | | • | | | | |

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Syph. recent. | | | | | • | |
| Gonorrhoea | | | | | • | |
| Chlamydia | | | | | | |
| Sores last yr. | 2.7 | 1.4–5.3 | 0.003 | | | |
| P/D last year | | | | | • | |
| Health serv. | | • | | | • | |

**d) Partners**

| | Khutsong men | | | Mineworkers | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| **Married only** | | | | | | |
| ADS (yr.) | | • | | | • | |
| PBM > 5 | | • | | | • | |
| PBM > 1 | | • | | | • | |
| S to M > 9 | | • | | | • | |
| S to M > 3 | | • | | | • | |
| 2+ spouses | | • | | | • | |
| **CP last year** | | | | | | |
| ADCP | | • | | | • | |
| ADCP>11 | | • | | | • | |
| Condoms | | • | | | | |
| CP > 3 | | | | | • | |

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| **Married only** | | | | | | |
| ADS (yr.) | | • | | | • | |
| PBM > 5 | | • | | | • | |
| PBM > 1 | | • | | | • | |
| S to M > 9 | | • | | | • | |
| S to M > 3 | | • | | | | |
| 2+ spouses | | • | | | • | |
| **CP last year** | | | | | | |
| ADCP | | • | | | • | |
| ADCP>11 | | • | | | • | |
| Condoms | | • | | | • | |
| CP > 3 | | • | | | • | |

**e) Social capital**

| | Khutsong men | | | Mineworkers | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *p* |
| Church | | • | | | • | |
| Stokvel | | | | | • | |
| Trade union | | | | | • | |
| Political party | | • | | | • | |
| Res. assoc. | | • | | | • | |
| Burial society | | | | | • | |
| Youth club | | | | | | |
| Sports club | | | | 0.4 | 0.2–0.7 | 0.002 |
| Trust | | • | | | • | |
| Neighbourhd. | | | | | • | |
| Neighbours | | • | | | • | |
| Helpful | | • | | | • | |

| | Khutsong women | | | Women in hotspots | | |
|---|---|---|---|---|---|---|
| | OR | CI | *p* | OR | CI | *P* |
| Church | | • | | 0.1 | 0.02–0.7 | 0.02 |
| Stokvel | | • | | | • | |
| Trade union | | • | | | • | |
| Political party | | • | | | | |
| Res. assoc. | | • | | | • | |
| Burial society | | • | | | | |
| Youth club | | | | | • | |
| Sports club | 0.4 | 0.3–0.8 | 0.004 | | • | |
| Trust | | | | | • | |
| Neighbourhd. | | • | | | | |
| Neighbours | | • | | | • | |
| Helpful | | • | | | • | |

## 4.5 Summary

The prevalence of HIV infection in Khutsong was effectively zero below the age of 15 years, rose very rapidly but especially among young women, peaked and then fell. In contrast to the situation in the community, the age specific prevalence of the mine workers was almost flat. Fifty year old mine workers seem to be at the same risk as those aged 20 years.

A little less than half of the men in the study were circumcised. This varied from three quarters of the Pedi to two thirds of the Xhosa and less than half of the Basotho and Shangaan men. Zulus, Tswana and Swazi do not traditionally circumcise their men and only about 15% of these men were circumcised. Even allowing for ethnic group and age, there was a protective effect of male circumcision with circumcised mine workers being about 30% less likely to be infected than uncircumcised men.

The prevalence of other sexually transmitted diseases, such as syphilis, gonorrhoea and chlamydia was very high among all four groups of people. About 30% of all men, nearly 50% of the women in Khutsong and 77% of women in the hotspots had contracted syphilis at some time in their life. About 5% of all men, 10% of women in Khutsong and 23% of the women in hotspots had evidence of recently acquired syphilis. Current gonorrhoea and chlamydia infections were less prevalent, ranging from about 3% of men to 23% of women in hotspots for gonorrhoea and about 5% of men to 9% of women in hotspots for chlamydia.

Knowledge of transmission modes and prevention of infection with HIV very high among all four groups. Yet, 32% of the men in Khutsong, 53% of the mine workers and 22% of the women in Khutsong reported casual sexual intercourse with at least one partner in the previous year. Consistent condom use was very low with 7% of the men saying that they always use condoms with their regular partner and 21% saying that they did so with a casual partner. Of the women, 9% always used condoms with their regular partner and 34% used condoms with a casual partner.

Essentially all mineworkers were migrants and 93% had a wife or girlfriend to whom they were committed. However, only 4.5% of these wives and girlfriends lived in Carletonville, the others either lived elsewhere in South Africa or in another country. In contrast to this, 75% of the regular partners of men in Khutsong lived in Khutsong. Twenty-five percent of women declared themselves to be migrants, 21% in Khutsong and 47% in hotspots. Of the women who reported a casual sexual partner in the previous year, 53% of the migrants and 30% of the non-migrants had received money in exchange for sex.

After adjusting for age, the most significant identified risk factors for HIV infection were age and genital sores in the previous year for men in Khutsong, alcohol consumption and genital sores in the previous year for mine workers. For mine workers circumcision and belonging to a burial society were protective. Risk factors for women in Khutsong were age, gonococcal or syphilis infections. When STDs at the time of the survey were excluded from the model, drinking alcohol and living in the informal squatter areas were risk factors. Membership of sports clubs was protective. Alcohol consumption and membership of stokvels were associated with a higher risk of HIV infection among women in hotspots, while belonging to a church was protective.

# 5 Discussion

A cross-sectional survey was conducted in the Carletonville gold mining area to a) assess the prevalence of HIV and STD infections, b) to identify risk factors for infection with HIV, c) to provide a baseline against which to evaluate the impact of the intervention programme and d) to develop an understanding of the natural history of the HIV epidemic in a gold mining town in South Africa. In this chapter we discuss the results of the study with reference to previous field studies and other literature. The first section focuses on the study population and the methods used while the following sections discuss the relationship between HIV infection and other factors such as circumcision, STDs, knowledge about HIV transmission, perceived risk and behaviour, migrancy, and social capital.

## 5.1 The survey

The survey had two main aims. First, to provide a descriptive account of the HIV/AIDS epidemic in the Carletonville area and to develop explanations for the course that the epidemic has taken in this region. Secondly, to provide sound baseline data to ensure that the impact of the interventions can be fully assessed. The survey was repeated in August 1999 when the mine workers and sex workers were sampled in the same way as in this survey but in the general community only people aged 15–29 were included so that more precise data could be obtained on young people. The survey will be repeated again in August 2000. The prevalence of HIV and other STDs (syphilis, gonorrhoea and chlamydia) among mine workers, commercial sex workers and men and women from Khutsong township will be compared between the two surveys. Significant changes in behaviour are expected, especially in the use of condoms, number of casual sexual partners, perceived risk of infection and in attitudes towards people with HIV/AIDS. Major changes in HIV prevalence are not expected over the course of the next one or two years, given that the epidemic takes several decades to reach a peak and that life expectancy of people with HIV is between five and seven years.

However, a substantial drop in STD infections would indicate successful treatment of infected persons as well as reduced rates of reinfection.

For HIV/AIDS intervention programmes to succeed it is important to understand the social context in which the intervention efforts take place. Patterns of sexual behaviours are embedded in social organisations and culturally determined norms and an understanding of these is important in the evaluation of a programme (Mertens *et al*., 1994). The structured questionnaire used for interviews included sections concerned with general demographic characteristics and migrancy status as well as information about sexual history, regular and casual partners, condom use and perceptions of HIV/AIDS. In addition, information was collected on STD symptoms and treatment, as well as on social capital and health promoting behaviour.

Konings *et al*. (1995) compared various interview strategies and concluded that in-depth interviews may lead to a better understanding of particular situations than can be obtained from the use of questionnaires. However, such interviews are never completely standardised or objective and are also time consuming and expensive. In this survey all the interviews were conducted on a one-to-one basis in the respondent's own language and whenever possible with an interviewer of the same sex. Interviews lasted 45 minutes, on average, allowing time to build a rapport while questions on sensitive topics were asked in the second half of the interview. Nevertheless, using a structured questionnaire with limited time may mean that some information, concerning extra marital sexual partners, and commercial sex work, for example, is underreported (Konings *et al*., 1995). Furthermore, observed differences between the reported sexual behaviour of men and women may be explained by differences in perceptions of what constitutes a casual partner and differences in the expected behaviour of men and women (Mertens *et al*., 1994).

## 5.2 The study population

In the 1980s a considerable amount of research was carried out among people thought to be at high risk of HIV, including commercial sex workers and injecting drug users, but relatively few studies were done on people thought to be at low risk of HIV infection. One of the first studies of people assumed to be at low risk of infection was carried out by Caraël *et al*. (1995). At about the same time Williams and Campbell (1996) suggested that interventions should be aimed at whole communities and not only at particular groups with the overall population, even if this was a high risk group such as the mine workers. In the initial stages of designing the Carletonville project Campbell and Williams were concerned to include not only migrant gold mine workers but also the commercial sex workers with whom they interact as well as the men and women living in the neighbouring township of Khutsong (Figure 1.1).

Of the 1398 men included in this survey, 899 were gold mine workers and 499 were members of the Khutsong community. Of the 833 women studied, 121 were from hotspots and 712 from Khutsong. Mine workers were recruited from 10 mine shafts and represented approximately one percent of all gold-mine workers in the area. The people recruited in Khutsong were stratified according to housing type (private houses, council houses, site and service, council hostels and informal settlements or squatter camps) to ensure that the sample was representative of the Khutsong community.

In the analysis presented above the data for miners and for men living in Khutsong were analysed separately. The miners are all migrant workers from rural areas within or without South Africa and almost all will return to their places of origin when they stop working. The men living in Khutsong, on the other hand, are living a settled urban life although there is probably a considerable amount of in-migration from other urban areas. The data for women living in the hotspots and for the women living in Khutsong were also analysed separately. The former were included partly for comparative reasons and also to provide

quantitative data to complement the detailed qualitative studies carried out amongst these women (Campbell, Mzaidume and Williams, 1998; Campbell, 2000).

## 5.3 HIV prevalence

The prevalence of HIV infection among men in Khutsong increased slowly with age up to about 18 years when it had reached 2.5%. The prevalence then increased rapidly to a peak of 45% among men at 32 years of age, after which it declined to about 15% in 50 year old men (Figure 3.2). This pattern of infection shows that the risk of infection is greatest for men between 20 and 35 years of age and declines among older men.

The age-prevalence of infection amongst mineworkers is substantially different from that for men living in Khutsong. There are few mineworkers who are less than 20 years old or more than 50 years old but for men between these two ages the prevalence of infection is constant. This implies either that 50 year old mineworkers are at the same risk of infection as 20 year old mineworkers or that men infected with HIV are significantly more likely to leave the mines than men who are not infected with HIV. Some combination of these two hypotheses is probably needed to explain the observed prevalences but the latter hypothesis might explain the fact that in men aged 30 to 40 years the infection rates in mineworkers are substantially less than among men living in Khutsong. It is interesting to note that very similar patterns of infection are found amongst truck drivers who are also migrants, although of a different kind (Williams, Gouws, Colvin, Sitas, *et al.* 2000).

The prevalence amongst women in the community also started from close to zero at 15 years of age but then increased much more rapidly than among men reaching 25% amongst 18 year old women and peaking at nearly 60% amongst 25 year old women. As discussed above women aged 15 to 20 years had partners who were several years older than themselves and it is generally believed that women are three times

more likely than men to be infected by having sex with an infected partner (Carpenter *et al.,* 1999).

As expected, the highest overall prevalence was among women in hotspots where 67% were infected with HIV but the numbers were too small to determine whether or not there was a significant age-dependence.

## 5.4 Sexually transmitted diseases

Almost 14% of the men in Khutsong, 11% of the miners, 22% of the women in Khutsong and 36% of the women in hotspots had at least one diagnosed STD at the time of the survey in August 1998. A total of 30% of all men, almost half of the women in Khutsong and more than 77% of the women in hotspots had a syphilis infection at some time in their life. Interestingly, the only significant association between STD infections diagnosed in urine and blood and reported STD related symptoms (pain, urethral or vaginal discharge, and genital ulcers), was between urethral discharge and chlamydia infections in men. The presence of vaginal discharge was significantly associated with syphilis infections among women in Khutsong and with gonococcal infections among women in hotspots. However, there was no association between gonorrhoea or syphilis infections and the severity of the symptom reported or whether it was considered as normal or not. Similar discrepancies between reported STD syndromes and diagnosed STDs were recognised in a large study in Tanzania (Mosha *et al.,*1993) and could explain the relative high rate of STD infections in the Carletonville population. Men and women with asymptomatic infections would not seek treatment but might nonetheless pass on the infection to their sexual partner.

Significant correlations were found in the Carletonville study between the prevalences of HIV and of gonococcal infection in both men and women, and between HIV prevalence and recently acquired syphilis infection in women. Furthermore, HIV prevalence among women who reported genital sores in the year prior to the survey was nearly double than that among women who did not experience sores during this period. Correlations between STD and HIV infections have been reported by

studies conducted all over the world. (Baganizi *et al.*, 1997; Buvé *et al.*, in press; Ghys *et al.*, 1997; Kilmarx *et al.*,1998; Rakwar *et al.*, 1998; Taha *et al.*,1998; Torian *et al.*, 1995; De Vincenzi, 1994).

The relationship between STD and HIV infection is difficult to interpret because HIV and other STDs share a common dominant mode of transmission (sexual contact) and common behavioural factors (inconsistent condom use). It is not possible to establish a causal link in cross-sectional studies because people at risk of contracting HIV are simultaneously at risk of contracting other STDs and it is often impossible to ascertain which infection was first. However, it has been demonstrated that gonococcal and chlamydial cervicitis are associated with loss of surface columnar cells and necrotic ulcers. These clinical signs may cause increased shedding of HIV in sero-positive women or they may facilitate HIV entry in sero-negative women. Ghys *et al.* (1997) found that cervico-vaginal HIV shedding was significantly more frequent in women with gonorrhoea and chlamydia infections, and with cervical or vaginal ulcers. HIV shedding decreased when the STD was cured. Farber and Ballard (1996) estimated an eight-fold increase in the risk of heterosexual HIV transmission when one partner has genital ulcers, and a five-fold increase in the risk of non-ulcerative STD transmission.

In this study, no correlation was found between STD related symptoms experienced at the time of the survey and HIV sero-prevalence. HIV infection almost certainly predated STD episodes experienced during the survey, detection of HIV antibodies may take up to three months and most men and women interviewed reported that they visited a general practitioner, clinic, or hospital within one week of the occurrence of their STD symptoms. However, there were significant correlations between HIV status and STD symptoms experienced during the 12 months before the survey. At least one episode of pain or discharge was reported by 32% HIV positive men, whereas 26% such men reported no pain or discharge in the previous year ($p < 0.03$). Almost 43% of the HIV positive men reported genital sores in the previous year, whereas 26% did not ($p < 0.001$). The results for women were very similar. Among HIV positive

women, 51% reported at least one episode of pain or vaginal discharge in the previous 12 months, whereas 41% had no such episodes ($p$ = 0.005). Of all HIV positive women, 20% reported at least one genital sore in the year before the survey, compared with 10% of HIV negative women. These STD related symptoms may have enhanced the risk of HIV infection. Torian *et al.* (1995) reported that although overall HIV sero-prevalence and genital ulcer diseases declined in New York City between 1990 and 1992, sero-prevalence in patients with genital ulcer diseases increased from 10% to almost 16%. In their mathematical model, Chesson *et al.* (1999) estimated that almost 50% of HIV cases of the heterosexual population in the USA were attributable to syphilis.

The association between symptomatic STDs, bacterial vaginosis and HIV sero-prevalence may reflect a high risk of HIV transmission in the presence of clinically detectable inflammations related to these diseases. Alternatively, the presence of an HIV infection might change the clinical course of STDs, rendering them more aggressive and symptomatic (Baganizi *et al*., 1997).

Various prospective studies recruited HIV negative people to assess the possible role of STDs in HIV sero-conversion. Among Kenyan truck company workers univariate analysis showed that HIV acquisition was associated with the presence of *Treponema pallidum*, *Haemophilus ducreyi*, and *Herpes simplex* virus type 2 antibodies and that all three of these STDs were associated with genital ulcers (Rakwar *et al.*, 1999). The HIV sero-conversion of commercial sex workers in Thailand was found to be significantly associated with *Chlamydia trichomatis* (Kilmarx *et al.*, 1998). Among 1196 pregnant, HIV negative women in Malawi, 27 sero-converted by the time of delivery, 97 postnatally. Bacterial vaginosis was significantly associated with both antenatal and postnatal HIV sero-conversion (Taha *et al.*, 1998). These authors concluded that depletion of lactobacilli in bacterial vaginosis may limit the production of hydrogen peroxide, a possible protective agent against pathogenic organisms which cause STDs and HIV. Furthermore, low vaginal pH due to the reduced

production of hydrogen peroxide, may inhibit CD4 lymphocyte activation and reduce HIV target cells in the vagina.

Men and women in Khutsong and women in hotspots who suspected they had an STD infection, attended the local clinic or visited a general practitioner in the area where they received treatment and counselling. Mineworkers visited their medical station for treatment and were then referred to the hostel social worker for counselling. Partners of infected people were not routinely notified and treated.

## 5.5 Circumcision

Circumcision is a cultural tradition and is practised by some religious or ethnic groups in Africa. However, the tradition is flexible, some men belonging to non-circumcising groups are circumcised whereas some belonging to circumcising groups are not. Of all men in this study, 43% reported being circumcised. The lowest circumcision rate (15%) was found in Swazi men, the highest (76%) in Pedi men. Urassa *et al.* (1997) analysed data from five population-based studies in north-western Tanzania and concluded that self-reported circumcision status data are fairly accurate although they found a tendency to over-report circumcision.

Urassa *et al.* (1997) observed that HIV prevalence in Africa appeared to be higher among non-circumcising ethnic groups. In the Mothusimpilo-Carletonville study HIV prevalence was found to be highest among Swazi (38%) and Zulu men (34%), two non-circumcising groups. Furthermore, across all ethnic groups, HIV positive men constituted a higher proportion (28%) of the uncircumcised group than of the circumcised group (24%). The same was true within ethnic groups, except the Pedi, where all HIV positive individuals were circumcised. The largest difference was found among Zulu men, 23% of circumcised Zulus were HIV positive compared to 37% of those who were uncircumcised. Univariate risk factor analysis in this study revealed that circumcision was protective. After correcting for confounding factors, this protective effect was still significant for mine workers but not for men in Khutsong.

However, only one third of the men in Khutsong were circumcised compared to one half of the mine workers. Studies in north-western Tanzania (Urassa *et al.,* 1997), the Rakai district in Uganda (Kelly *et al.,* 1999), the Masaka district in Uganda (Carpenter *et al.,* 1999) and in Kisumu in Kenya (Buvé *et al.,* in press) also reported a protective effect of circumcision.

Slightly fewer than half of the Basotho and Shangaan men reported to be circumcised in the baseline survey. HIV prevalence differed little between circumcised and uncircumcised Basotho men (28% and 30% respectively). Among Shangaan men, 26% of circumcised individuals and 37% of uncircumcised individuals were HIV positive. Circumcision thus seemed to have a greater protective effect among the Shangaan than among the Basotho. This might be attributable to the age at circumcision. More than half of all circumcised Shangaan were circumcised by the age of 15, before their sexual debut, and 85% had been circumcised by the age of 20. In contrast only one in four of the circumcised Basotho had been circumcised by the age of 15. In those ethnic groups where there was a smaller difference in HIV prevalence between circumcised and non-circumcised men, circumcision was generally performed later in life, between 15 and 20 years or even later. (The age of circumcision for each ethnic group was established in the pilot survey; Williams, Campbell and MacPhail, 1997).

The protective effect of circumcision may be due to the decreased risk of preputial lesions, as the glans of the penis is less vulnerable in circumcised individuals. Circumcision may also be associated with better penile hygiene, which may reduce the risk of HIV and penile cancer (Urassa *et al.*, 1997). However, the reduced risk of HIV infection may be less pronounced when circumcision is partial or is performed after the onset of sexual activity. (For a recent review of this issue see Szabo and Short, 2000.)

## 5.6 Migrancy

For over a century, South Africa's economy has been dominated by the gold-mining industry, and the migrant labour system has operated since the first mines on the Witwatersrand were established. Men migrate from other areas of South Africa and from neighbouring countries to work as mine workers in the gold mines. The Carletonville area is the largest gold mining area in the world and currently employs about 70 000 migrant workers. The link between migrancy and the spread of HIV is self-evident and many studies have confirmed this (Brewer *et al.*, 1998; Nunn *et al.*, 1995; Rakwar *et al.*, 1999; Webb, 1997) because they may be more involved in sexual activities with multiple partners, particularly when away from their home environment (Lydié and Robinson, 1998). More than half of all mine workers reported at least one casual sexual partner in the 12 months prior to the survey compared to 32% of the men in Khutsong. Reports of visits to commercial sex workers were very infrequent. Only 10% of the men in Khutsong and 16% of the mineworkers stated that their last casual partner was a CSW.

The highest regional HIV prevalence in South Africa is in KwaZulu/Natal, followed by Mpumalanga, the Free State and Gauteng. The lowest prevalence is in the Western Cape, suggesting that the epidemic started in KwaZulu/Natal and spread from there along the routes taken by migrant workers. The main highway from Malawi (Webb, 1997), enters South Africa in KwaZulu/Natal and most of the trucking routes from Zambia end in Durban, the major port in KwaZulu/Natal. Among truck drivers in Kenya HIV infection is high particularly among those who travel for more than two weeks per month (Rakwar, *et al.*, 1999). Nunn (*et al.*, 1995) reported from Uganda that men who lived on the same compound for less than five years were at least three times more likely to be HIV infected than those who had been there for ten years or more.

Carletonville is 30 minutes from Soweto and one hour from Johannesburg by car. Although nearly two thirds of all mineworkers had worked in the area for six years or more, 8.4% reported that they had

arrived within the previous year and all the migrant mineworkers return home at least once a year for their leave. Among the mineworkers only 4.5% had a regular partner who lived in the Carletonville district and 79% had a wife or girlfriend in another city, in a rural area in South Africa or abroad. The living space of a mineworker in a single sex mine hostel is confined to a bed in a dormitory and space to keep a few belongings. Some of the hostels are some distance from town and recreational activities centre on drinking beer and meeting women in hotspots. Compared to other men in the community mineworkers are relatively well paid and earn between three and ten times than that of the average man in Khutsong.

More than half of the women in this survey who declared that they were migrants had taken money in exchange for sex from a casual partner in the previous year. HIV prevalence among migrant women was 51% compared to 39% among non-migrant women. This difference in HIV prevalence was particularly marked in women younger than 29 years old. A study of sugar cane cutters showed that women who came to the Dominican Republic without a partner were at a significantly higher risk of HIV infection than were women who came with a partner (Brewer *et al.*, 1998). The former were also significantly younger and reported that they exchanged sex for money. The women did not regard this behaviour as commercial sex work, but as the only way for a single woman to survive. To exchange sex for money is often regarded as commercial sex work but in southern Africa, a man demonstrates his commitment to a women by giving her a proportion of his wages at the end of the month.

## 5.7 Knowledge, perceived risk and behaviour

Knowledge concerning risk factors for HIV transmission was very high among both men and women and about 85% knew HIV transmission could be reduced by being faithful and using condoms. However, approximately one third of all men and women believed wrongly that infected people always show symptoms of illness and more than 43% that following a good diet protects you from becoming infected with HIV.

This was probably due to the educational message that infected people remain healthier longer when maintaining a healthy life style, including a good diet. In contrast, those who considered the statement untrue referred to the fact that a good diet is not effective in preventing infection. Approximately half of the study population knew that using public toilets, sharing food and touching an HIV positive person do not facilitate HIV infection.

Despite the high and rapidly rising prevalence of HIV in South Africa, very few infected people are open about their HIV status and, at the time of the survey, many people are still reluctant to believe that AIDS was common in the population (Taylor, 1998). Of all men and women interviewed in August 1998, only 9% said that they knew someone with HIV/AIDS in a population where one in four men and more than one in three women were HIV positive. However, 75% of all men and women said they were prepared to care for a family member with AIDS.

Most people know how HIV is transmitted and how to prevent infection. However, in the January pilot survey as many as one in three people still thought there was no chance of them contracting HIV, by the August baseline survey this proportion had decreased to one in four. In January 1998, 17% thought that there was a good chance of them getting infected, by August 1998 this proportion had risen to nearly 21%. The most dramatic changes in awareness were found among women in hotspots and in mine workers. Five percent more mine workers and 10% more women in hotspots thought they were really at risk of being infected with HIV.

For interventions to be effective, the consideration of the cultural explanations and people's perceptions of illness, disease and well-being are as important as knowledge of biomedical facts. For example, mine workers believe that high blood pressure is likely to develop in individuals who do not engage in sexual intercourse (Molapo, 1995). In mining communities, sexually inactive people of both genders were labelled as abnormal, weird and childish, and abstinence was considered unhealthy (Nielsen, 1999). In in-depth interviews with mine workers, some

informants commented that regular sex was necessary for good health, and played a key role in the regulation of a balanced supply of blood and sperm in a man's body. Sex was also linked to the notion of masculinity as was a manly desire for 'flesh-to flesh' contact (sex without condom), beliefs that put people at risk of HIV (Campbell, 1998a). The work underground is arduous and dangerous. Mineworkers live in fear of accidents and many have seen co-workers being killed or injured. a context where illness, death and injury are routine, people are unlikely to be motivated to avoid a disease that might affect them in five years time (Campbell and Williams, 1998a). The mining industry responded relatively quickly with awareness campaigns including posters, leaflets and free condom distribution after the first cases of HIV were identified among mine workers in 1986 (Crisp, 1998). Mineworkers know that HIV/AIDS exists but they have yet to see its impact. Unless the impact is visible, people cannot be expected to alter their life style (Plimmer, 1998). Fewer miners reported casual sexual partners in the year prior to the January survey (40%) than did those surveyed in August (53%). Although the mineworkers reported a ten-fold increase in condom use with their spouse in August (5.7%) compared to January (0.6%), condom use with casual partners was unchanged (19%).

Between the pilot survey in January 1998 and the baseline survey in August 1998, there were changes in Khutsong peoples' behaviour concerning casual sexual encounters and use of condoms. Approximately 40% of the men reported casual partners in January and 32% in August. In January, 29% of the women in Khutsong had a casual sexual partner compared to 22% in August. This decrease seems to be even more important considering that casual partners in the months of September to December 1997 were reported in both surveys as all partners 12 months prior to the survey were recorded.

From January to August, there was an overall increase in reported consistent condom use with the regular partner of men and women in Khutsong. Among men with a regular partner, 0.8% said that they used condoms in January and 9.1% in August. Among women with a regular

partner, 1.5% used condoms consistently in January and 6.3% in August. In January, none of the women in hotspots used condoms with their regular partners, but 26% did so in August. Consistent condom use with casual partners of men and women in Khutsong and women in hotspots nearly doubled in the eight months from January to August, from 16% to 28% for men, from 12% to 22% for women in Khutsong and from 24% to 59% for women in hotspots. These changes were almost certainly the result of peer education implemented by the project, in hotspots around the mine hostels from March 1998 and among commercial sex workers in Khutsong from July 1998.

However, the high incidence of casual sexual relationships and the very low condom use with the spouse reported by the study participants shows that the situation at the time of the baseline survey was still very grave. Nearly 60% of the women in hotspots use condoms with casual partners and clients. Surveys conducted among commercial sex workers in South Africa (Karim *et al.,* 1995; Campbell, Mzaidume and Williams, 1998) and the Honduras (Fox *et al.,* 1993) found that condom use led to client loss and physical abuse by clients. Clients also insisted on paying less for sex when a condom was used. Greater knowledge of HIV transmission was not associated with increased condom use by CSWs in Honduras.

Focus group interviews of young people, men and women in three townships in South Africa, conducted in 1999, found that their main reason for not using condoms was that condoms impair the physical sensation during sex and may burst. Young women also said that if they insisted on condom use they may be accused of already being infected with HIV or of not trusting their boyfriends. Some young men and women were aware of AIDS and were willing to take responsibility for their health whereas others stated they were not scared or that they had to die anyway (Nielsen, 1999). In this survey, 39% of all men and 34% of all women had used a condom at some time. The reason most frequently given by men for not using condoms was a dislike of condoms and by women the fact that their partner objected.

More than a third of the men in Khutsong, half of the mineworkers and one quarter of the women in Khutsong reported having had at least one casual sexual partner in the 12 months prior to the survey. Only approximately one in four men or women reported using condoms with this casual partner. Nonetheless, more than 85% understood the importance of being faithful and using condoms consistently for prevention of HIV infection.

Univariate risk factor analysis showed that casual sexual relationships were associated with increased risk of HIV infection for men and women in Khutsong and for women in hotspots. Men in Khutsong who thought their casual partner had had three or more other partners simultaneously, were also at increased risk of being HIV-positive. Having had sex with commercial sex workers was also a risk factor for young men. Although education based programmes provide information and increase knowledge, they play a limited role in changing people's behaviour (Campbell, 1998a; Crisp, 1998; Lowndes, *et al.*, 1998; Nielsen, 1999). In interviews, young South Africans and Nigerians considered 'real infected people' and 'famous people', who openly talked in public to be the most persuasive educators (Nielsen, 1999; Uwakwe *et al.*, 1998).

Some studies reported sex during menstruation as higher risk for HIV infection (Buvé *et al.*, in press; Kilmarx *et al.*, 1998). These findings were not confirmed in this study. Sex during menstruation seemed to have a protective effect among women in hotspots. However, this result, is confounded by the fact that menstruating sex workers use condoms to hide their menstruation and it is likely that the condom use rather than sex during menstruation was the protective factor. The use of a drying agent was found to increase the risk of HIV infection, particularly among commercial sex workers. Nearly 10% of the women in hotspots used drying agents, including cloth, soap, *umuthi* (traditional medicines) and detergents, to tighten or dry their vagina. The HIV prevalence among women in hotspots who often or always used drying agents was 91%, whereas that among those who used them rarely or never, was 66%. Only one in 40 women in Khutsong used drying agents, and 50% of this group

was HIV positive compared to 41% who did rarely or never use drying agents.

Drinking alcohol was associated with a higher HIV prevalence among men and women in Khutsong, mine workers and women in hotspots. Alcohol consumption by mine workers has caused serious behavioural and medical problems in the past (Molapo, 1995; Packard, 1989). In the 1920s and 1930s, beer was brewed by women for their husbands and friends and was also sold to single men. This provided women with a separate income, a welcome addition to the family budget (Packard, 1989). Today, women sell commercially produced beer around the mine hostels, and this is closely associated with commercial sex work. Sex work is often done around shebeens and is preceded by alcohol consumption (Chirwa, 1997). Alcohol use, particularly among adolescents has been shown in other studies to be associated with inconsistent condom use (Di Clemente, 1992). Although the effect of alcohol on sexual behaviour is unclear and varies between individuals, alcohol is often used to facilitate sexual contacts, to increase courage, to relax social inhibitions and to increase desire and sexual performance. It is clear that alcohol is often associated with unsafe sex (Weatherburn, 1992).

## 5.8 Social capital and health behaviour

Putnam defines social capital as consisting of the existence of community networks, civic engagement (participation in these community networks), local identity and a sense of solidarity and equality with other community members and finally, norms of trust and reciprocal help and support (Campbell, Wood and Kelly, 1999). It has been argued that social capital might be associated with positive health outcomes. However, certain aspects of social capital might be more health enhancing than others.

Sexual behaviour such as condom use is not only determined by knowledge of the importance of safer sex practices but also by a range of psycho-social and social factors such as collectively negotiated and accepted social norms (Campbell, 1998b). People are more likely to change their behaviour if they see that liked peers and trusted role models

change theirs and if they feel in control of their lives and supported by their social environment (Campbell, 1998b). Indicators of social capital which in this study, were linked to sexual health, were trust, the feeling of having a lot in common with one's neighbours, finding the neighbourhood a pleasant place to live in, perceiving people as helpful and belonging to formal or informal groups and associations. Among young men aged 15 to 29 years the fact that they found their neighbourhood pleasant had a protective effect. Research in both Europe and America revealed a correlation between social support and safer sex. For example, Prieur found that gay men in Norway were less like to engage in unprotected sex when they lived in a supportive social environment (Campbell, 1997).

Membership of some associations was found to be protective, whereas membership of others seemed to increase the risk of HIV infection. The latter groups were associated with either a higher number of casual partners, less condom use, increased alcohol consumption or a combination of these mediating behavioural factors. Membership of churches, sports clubs and youth clubs had a generally but not always significantly protective influence from HIV for men and women in Khutsong, miners and women in hotspots. Members of *stokvel* associations (rotating credit schemes) were at increased risk of HIV infection. HIV prevalence was generally lower in men and women who trusted others. Among women in Khutsong, HIV prevalence was lower in those who found neighbours helpful but higher in women in hotspots. This factor had no influence of HIV infection in men. HIV prevalence was lower in mineworkers and in women in hotspots who found their environment pleasant whereas it was higher in such men in Khutsong. Fewer men in Khutsong, mineworkers and women in Khutsong who felt they had much in common with their neighbours were HIV positive. The opposite was the case in hotspots where HIV prevalence was higher among such women respondents.

Most associations were associated with alcohol consumption apart from sports clubs, youth clubs and churches for all men and women. Membership of trade unions was associated with alcohol consumption

among miners. Slightly less than half of the mine workers did not have an alcoholic drink in the month prior to the survey compared to one third of the men in Khutsong. In the hotspots, 40% of the women reported they had not had an alcoholic drink in the previous month compared to 60% of the women in Khutsong.

Women who belonged to *stokvels* were more likely to have had a casual partner in the 12 months prior to the survey. Women belonging to sports clubs or burial associations were more likely to use condoms always as were women who felt they had little in common with their neighbours and who found the neighbourhood unpleasant. Different group memberships are associated with different sets of behavioural norms, values and ideologies with which members identify and which may shape their behaviour (Campbell, 1997). Beer is sold at stokvel meetings as a means of making money and members take turns receiving the profits. The availability of beer may attract people and also increase the likelihood of people having unprotected sex with a casual partner. On the other hand, churches emphasis the importance of family life and may warn of the dangers of alcohol and the immorality of casual sexual relationships. A healthy life style, including abstinence from drinking alcohol, is often a theme in sports clubs and conversely, it is fit and healthy people who join spots clubs in the first place.

The pilot study suggested that perceived levels of self-efficacy were low among mine workers. Low levels of self-efficacy are associated with the reduced likelihood of health-promoting behaviours (Campbell and Williams, 1996). In the baseline survey, associational membership was much lower in mineworkers than among men in the general community with the exception of trade union and burial societies. In-depth interviews showed that miners felt they had little control over their lives and were at the mercy of the mine authorities who could, for example, keep the miners waiting for long hours underground for transport to the surface after they had finished work (Campbell, 1997; Molapo, 1995). Moreover, mine work is dangerous and physically and psychologically demanding. The mine shafts in Carletonville, some of

which go more than three kilometres underground, are the deepest in the world. The working environment is extremely hot and humid as well as dangerous. In a twenty year working life a mineworkers has a 2.9% chance of being killed in a work-related accident and a 42% chance of suffering a reportable injury (Chamber of Mines, 1993). Many mine workers had witnessed accidents in which their friends and co-workers were killed or injured, and the distress this caused cannot be underestimated. New mine workers are often encouraged by their older colleagues, urging them to remember they were men. A man is regarded as someone with the responsibility of supporting his family, who is brave and able to withstand the rigours of the job. Linked with this ethos of masculinity, bravery, fearlessness and persistence in facing the demands underground is the notion of a macho sexuality, insatiable manly desire for multiple sexual partners and flesh-to-flesh sexual contact (Campbell, 1997). Off duty life is difficult in regimented, company owned, single sex hostels away from home and families. The only way miners are able to experience some degree of comfort and intimacy is in their relations with women in the hotspots and shebeens around their hostels. Although knowledge of HIV transmission was high among the mine workers, they were more concerned with the dangers and stresses at work which seemed to them much more real than an invisible disease which might affect them in a few years time.

Campbell conducted extensive in-depth interviews with commercial sex workers in the hotspots. Women negotiate directly with their clients without the involvement of a middle-man and are thus able to keep all the money they earn (R20). Negotiations and sexual encounters often take place in the open field. It is important for survival to wait for clients in groups of three or four and to give the money to a colleague for safekeeping as a man might pull out a knife after the encounter and demand his money back. Also, unemployed men might lie in wait to attack and rob a couple during intercourse. An extensive literature on HIV/AIDS in Africa highlights the powerlessness of women to negotiate safe sex in the face of male reluctance to use condoms (Campbell, 2000).

Commercial sex workers in the hotspots were aware of the dangers of unprotected sex but the principle of selling sex was that 'the customer is always right'. If a woman insisted on condom use, the client may either take business elsewhere or demanded a reduced price. In addition, in taking on the identity of a sex worker, the women were separated from many of the markers of conventional dignity and respectability, which are associated with the roles of wife, mother and home maker, and which form the cornerstone of African social relations (Campbell, 2000). In this study, apart from church membership, no indicator of social capital was identified as significant risk factors for HIV in the hotspots. Almost 30% of the women in hotspots belonged to a church and church membership was associated with a decrease risk of HIV infection. Membership of formal and informal associations was generally below four percent among the women in hotspots apart from burial societies (25%) and stokvel, (16%). Only 12% of the women felt they could trust others whereas about half thought that people were helpful and the neighbourhood was pleasant. More than 70% felt they had much in common with their neighbours.

Social capital may be defined as 'those specific processes among people and organisations, working collaboratively and in an atmosphere of trust, that lead to the accomplishment of goals of mutual social benefit' (Campbell and Williams, 1999b). These authors suggested that health programmes such as intervention to manage the HIV/AIDS epidemic in the Carletonville area will succeed to the extent that the target community has organisational systems that support the intervention. They concluded by suggesting that where they were such systems were lacking, one arm of the project's interventions must seek to provide a context in which people can collectively work towards new norms of sexual behaviour through discussion, argument and debate with each other and with peer educators with whom they may form a close or trusting relationship.

## 5.9 Risk factor analysis

The risk factor analysis was done separately for men in Khutsong, mine workers, women in Khutsong and women in hotspots and using data for

only those only who reported at least one sexual partner in their life. The most important behavioural risk factors included having many sexual partners, at least one casual partner in the preceding year, believing that ones casual partner had other casual partners simultaneously, and being marriage. Married people may have an increased risk of HIV infection because of the long-term sexual relationship with a spouse in an area with high HIV prevalence. In relation to STDs the most important risk factors were having experienced symptoms in the preceding year, particularly genital sores and discharge or pain. STD infections at the time of the survey were also associated with higher HIV prevalence.

Behaviours that were associated with an increased risk of HIV infection included the consumption of alcohol consumption and belonging to a stokvel while those who belonged to a church, a sports clubs or a youth club were less likely to be infected with HIV.

Circumcision was protective for men but there was not a significant association with consistent condom use probably because the numbers were too small and the power of the test correspondingly low.

Risk factor analyses were performed separately for young people, between the age of 15 and 29 years old who reported at least one sexual partner in their life. This was done to identify the most important factors responsible for HIV infection in this very high incidence age group and because these young people had had most of their sexual experience in a population and during a period with high HIV prevalence. However, these analyses established no new risk factors, at the individual, or at the population level. After correcting for confounding effects, the highest risk factor for young men in Khutsong was to have been a client of a commercial sex workers, and for young mine workers to have had casual sexual relationships in the last year. Among young women in Khutsong, genital sores occurring in the 12 month period before the survey was the highest risk factor. The most important risk factor for young women in hotspots was to have been 18 years old or older at first sex, indicating that all sexual experience happened in the last few years, a time when HIV prevalence was rising steeply in the Carletonville area.

# 6 The intervention

The baseline survey described in the preceding pages has provided detailed information on the prevalence of both HIV and STDs as well as information on factors influencing the expansion of the HIV epidemic in the Carletonville district at the start of the intervention. Furthermore, this survey provided data against which the effects of present and future intervention programmes may be compared. In this chapter we describe briefly the intervention that is being carried out in Carletonville. The intervention has been funded by the Department of International Development, UK; the Horizon of the Population Council, USA; the Provincial Department of Health, SA; and the Old Mutual Assurance Company, SA, and the Council for Scientific and Industrial Research, SA. This chapter provides information on these intervention programmes and suggests strategies for evaluation of these interventions.

## 6.1 Background

The gold mining industry in South Africa responded to the HIV crisis in the late 1980s when they set up compulsory health education programmes which every mineworker had to attend as part of his induction training and when he returned from leave each year. However, such programmes did not bring about the hoped-for changes in sexual behaviour (Crisp, 1998). This survey has shown that mineworkers had more sexual partners than had men in Khutsong, and that fewer miners were using condoms consistently with their casual sexual partners than were men in Khutsong.

Campbell and Williams (1999b) have consistently stressed the need to treat HIV/AIDS as a bio-psycho-social problem and to understand both the disease and the intervention at all three levels: biomedical, psychological and social. For intervention programmes to succeed, they must expand the traditional educational programme approach and put intervention attempts into a broader context. The wider context proposed by the Mothusimpilo-Carletonville intervention includes:

1. Involving not only high risk groups such as commercial sex workers and mineworkers but also members of the broader Khutsong community with whom commercial sex workers and mine workers interact regularly, both socially and sexually, and young people between the ages of 15 and 20 years.
2. Using community-based outreach and peer education strategies to supplement traditional information-based health education measures..
3. Expanding project management to incorporate an alliance of organisations such as trade unions, grassroots community organisations, and representatives of the provincial and national health services, rather than restricting this management to mining companies as is usually the case.
4. Incorporating a strong evaluation component to assess the impact of the intervention on the course of the HIV/AIDS epidemic in the area. A follow up survey was carried out in August 1999, focussing on young people aged 15 to 25 in the community, and the final survey will be carried out in August 2000.

The overall objective of the Mothusimpilo-Carletonville Project is to achieve a sustained reduction of the prevalence and incidence of HIV and STD infections based on a targeted three-pronged approach that includes:

1. Monitoring of the quality of STDs services provided to mine workers by the mines and to the population of Khutsong by provincial and private health services, and provision of STD treatment for commercial sex workers.
2. Developing and maintaining community-based peer education and condom distribution programmes.
3. Involving various grassroots community organizations and other stakeholders in the Carletonville area to generate maximum support for the project and preparing these organisations to ultimately assume responsibility for a sustained long-term intervention programme.

An intervention team consisting of a Project Manager, a Community Outreach Coordinator, and an STD Coordinator were recruited for the project.

## 6.2 Sexually transmitted disease management

Management of conventional sexually transmitted diseases (STDs) is widely regarded as critical for the control of HIV, and syndromic management of STDs has been advocated by the World Health Organisation since 1991 (Ballard, 1999). In the developed countries STDs are diagnosed with the aid of specialised and expensive laboratory tests which are not widely available in developing countries. Syndromic management of STDs entails symptom- or syndrome-based treatment to eradicate the pathogenic micro-organisms most common to a particular geographic region. Infections which cause similar symptoms are grouped together, e.g.: the 'genital ulcer' and 'vaginal discharge' syndromes, and simple flow charts help with diagnosis and the selection of correct treatment.[50]

Because up to half of the sexually transmitted infections in women may be asymptomatic, some studies have suggested complementing syndromic management of STDs with periodic presumptive treatment (PPT) for women at high risk. By treating such women at regular intervals, whether or not they show symptoms of infection, it is hoped that the infection rates can be brought down very rapidly; once they have been brought down, syndromic management should then be able to keep the rates low.

In this project all the formal (public and private) STD care providers were identified and visited by the STD Coordinator. Doctors, nurses and traditional healers were informed about the project and invited to attend training. By January 2000 36 general practitioners and

50 Copies of the complete range of flowcharts can be obtained from the Reference Centre for Sexually Transmitted Diseases, South African Institute for Medical Research, PO Box 1038, Johannesburg, 2000.

physicians of local hospitals, 21 mine doctors and 145 nurses had received training (as of January 2000). After an initial three-day course each nurse was paired with a mentor, a senior nursing sister experienced in syndromic management of STDs, for a two-week practical. All nurses must pass an examination before they take full responsibility for the syndromic treatment of STDs in their clinic. Traditional healers are encouraged to refer patients with possible STDs to a primary health care centre for syndromic treatment. All health professionals are invited to attend evening sessions which are accredited to the nationally-required continuing medical education (CME) programme.

Syndromic management of STDs for the general population in Khutsong and for the mineworkers started in mid-1999 after most physicians and nurses had been trained. Additionally, a partner notification system has been in place since January 2000 so that people diagnosed with an STD receive cards which they are asked to pass on to their partners who can then visit any clinic or general practitioner to receive free treatment. Two mobile clinics, paid for by USAID through the Population Council began to provide a service for women living in the hotspots in March 2000. Each mobile clinic is staffed by a nurse and a trained counsellor, who provide periodic presumptive STD treatment to women at high. The drugs for the periodic presumptive treatment of the sex workers were donated by Pfizer.

The quality and success of the STD services will be evaluated both by direct observation of the care delivered, and by the project's annual biomedical and behavioural survey. The project has developed and implemented a program of accreditation and project-based financial reimbursement to ensure some degree of control over the quality of care provided by private practitioners. Adequate treatment standards, assessed through exit interviews and mystery patients, are a condition for accreditation and thus for eligibility for reimbursement.

## 6.3 Peer education and condom distribution

Community-based peer education programmes are designed to do more than simply provide information and promote condom use. They seek to provide space for discussions, debates and arguments with liked and respected peers, hereby creating a context in which people can question and challenge existing social norms and even collectively work towards new norms of sexual attitudes and behaviours (Campbell and Williams, 1999b). This contrasts with traditional health education programmes in which people are lectured by a nurse, doctor or health educator, and are expected to absorb the information provided. Such traditional health education often improves peoples' knowledge about HIV/AIDS and their understanding of how to prevent its transmission without inducing them to change their behaviour, because they do not perceive themselves to be at risk. Moreover, in-depth interviews among mine workers (Campbell, 1997) have shown that their notion of health is more holistic than the bio-medical information framework of the western world. For HIV/AIDS education programmes to be effective, they must take account of local knowledge and beliefs of the target population.

Sex worker's experiences of gender and respectability were closely linked to issues relating to their lack of power and control over their lives. The success of peer education lies in its transfer of health-related knowledge from 'outside experts' to the target population of 'ordinary people', thereby improving that latter's perceived control over their health, and hence the likelihood that they will engage in health-enhancing behaviours (Campbell, Mzaidume and Williams, 1998).

Peer educators were recruited and trained from among commercial sex workers (99), mine workers (60), adolescents in the local high schools (51) and young people who have left (17). During their initial 10-day training, they received information about HIV/AIDS and other STDs and about safer sex behaviour, and instructions about condom distribution. Peer education training also includes training in community outreach, in life skills and in communications skills. Community based

peer education began in April 1998 in hotspots and in September 1998 among sex workers in Khutsong. The first youth peer educators started their work in December 1998. Training in the mines began in August 1999 and peer education in AngloGold mines began in September 1999. Peer educators were recruited in mines owned by Gold Fields in December 1999, and were trained early in 2000.

Peer educators raise awareness about HIV/AIDS and other STDs and about methods of protecting oneself from infection. Teaching negotiating skills for condom use, particularly among women, is an important component of their work. The peer educators facilitate discussions with approximately 5000 men and women per month, challenging social norms of sexual behaviour and attitudes; they organise road shows and appear at pop concerts and other community functions in the region using flip charts, songs and role plays to educate the community on all aspects of HIV/AIDS and STDs.

A container which originally functioned as a local satellite clinic in Khutsong has been transformed into a 'Youth User Friendly Service' following the clinic's move into new premises. The Youth User Friendly Service is staffed by volunteers from the Khutsong community ranging in age from 13 to 30 years. These volunteers were trained as peer educators by the project's Outreach Coordinator, and provide information to young people visiting the clinic on tuberculosis, HIV, STDs, alcohol use and various other topics, under the supervision of the clinic nurses. The service also acts as condom distribution point.

An estimated 400,000 condoms, provided free by the National Department of Health, are distributed each month, 250,000 by peer educators among the sex workers alone. The Project Manager is responsible for supplying condoms to fixed distribution points such as beer halls, taverns, taxi ranks, and the local police station, while the STD Coordinator supplies condoms to local hospitals and general practitioners.

The quality of community-based peer education is monitored in regular meetings and weekly follow-up training sessions with the Outreach Coordinator. In addition, each peer educator uses a quality check

list to properly conduct and evaluate his or her outreach activities. Peer educators also keep weekly diaries, which are checked by the Outreach Coordinator. Peer educators are already seen as important persons in the community, and some now actively participate in local community governance structures. The project has instilled a culture of civil responsibility in the Carletonville area, particularly among commercial sex workers who had previously competed for clients and often fought amongst themselves. Under their own initiative, hotspot communities decided to make the use of condoms mandatory in sex work. Each new sex worker receives an induction training and has to agree to obey the rules of the community.

One of the tools for the evaluation of peer education involves monitoring condom distribution, because changes in condom distribution and use reflect behavioural changes. There are indications that the next survey, to be carried out in August 2000, will show a significant effect of the peer education on the wider community, manifested by both improved knowledge about HIV/AIDS and by marked changes in peoples' attitudes and perceptions of their risk of HIV infection. Most of all, we expect to see behavioural changes, including increased and consistent condom use, particularly with casual sexual partners.

The project plans face-to-face in-depth interviews and focus groups, mainly with adolescents in and out of school, and with women at high risk. These will provide both information on the impact of the interventions and detailed information about the project's success in permanently changing peoples' attitudes, perceptions of risk, and ultimately their behaviour.

## 6.4 Stakeholder mobilisation

Projects such as this must involve the community if they are to succeed. Incorporation of the community's understanding and perception of the HIV/AIDS problem into the design of the intervention is essential (Mzaidume, 1999). In the conceptualisation and design of the project every effort was made to ensure that HIV was seen as a community

problem rather than an individual problem, and to maximise co-operation between its local initiative and representatives of the provincial and national health departments.

The fundamental premise underlying the project is that health-enabling communities can only be created through alliances between a wide range of stakeholders such as grassroots community groupings, mine management, trade unions, provincial and national health representatives (Campbell and Williams, 1999b). Such stakeholder mobilisation promotes the development and optimal use of local networks, and the sharing of responsibility for the HIV/AIDS problem. HIV/AIDS thus becomes a community problem rather than an individual problem. This approach has borne fruit, and a range of organisations and stakeholders are now contributing to the success of the project by actively participating, either by leading parts of the intervention or helping evaluate the intervention programmes.

The Regional Health Authority increased their activity in response to a request from the project, and a mobile clinic is now providing primary health care services on a fortnightly basis in residential hotspots where people previously had no access to primary health care facilities.

The Transitional Local Council made their nurses available to the project for training in the provision of syndromic treatment of STDs. These nurses are also involved in STD surveillance by compiling monthly statistics on STDs among their clinic attendees and making these available to the project.

Local general practitioners and physicians in local clinics and hospitals agreed to participate in the project, and received training in the delivery of syndromic management of STDs to all their patients. To date, 14 doctors have volunteered to compile statistics on STDs and report them to the project on a monthly basis, to evaluate the effectiveness of both STD treatment and condom promotion in reducing HIV infection rates.

The National Mine Union facilitated the involvement of the mine workers in the project, and encouraged their health and safety officer to volunteer for training as a peer educator to work in the hostels.

Mining companies provide free training facilities to the project, and nurses employed by these companies provide monthly STD statistics for the mine workers to the project.

The Society for Family Health is involved in 'Lover's Plus' condom social marketing. Traditional healers, in addition to performing their healing rituals, are now also referring STD patients to peer educators and local clinics for treatment and advice.

The support of the Carletonville AIDS Action Committee is critical in ensuring that information about the project reaches all sections of the community. Most formal and informal local organisations are represented on this committee, the meetings of which provide ideal platforms for discussions during which all member organisations are able to reach consensus and deliver the same message about prevention of HIV/AIDS to the community. Thanks to the above concerted effort, the community in the Carletonville area has willingly participated in the project. To date, approximately 7000 people have participated either in one of the annual surveys, in focus group discussions, or in-depth interviews conducted by the project. The name *Mothusimpilo* which means 'working together for health' was given by the members of the Carletonville AIDS Action Committee.

One of the keys to the sustainability of projects such as this is the successful mobilisation of the community. The community-based outreach and peer education strategies of the project were designed to maximise the participation of the target population. Such participation during the implementation of the project's intervention strategies increases people's sense of self-efficacy in relation to their health (Campbell and Williams, 1999a). Moreover, the project ultimately aims for full participation of target communities in project management, so that community leaders will be able to eventually assume responsibility for the project and ensure its sustainability.

A stakeholder analysis is conducted annually by an independent person to evaluate the effects and progress of stakeholder involvement. The ultimate test will be whether or not the stakeholders are able to carry

the project beyond the planned time frame, and to sustain an intervention programme which may be duplicated in other parts of the country .

## 6.5 Summary

HIV infection rates are extremely high among all groups of study participants in the Carletonville area, particularly among young women between 15 and 30 years old. The baseline survey revealed that knowledge about HIV transmission was good, yet perceptions of risk of HIV infection and understanding of behaviours which prevent HIV transmission were very poor. In the light of these results, a comprehensive intervention programme was proposed, including a combination of strategies. Traditional approaches which proved successful in other settings and novel ideas of community involvement and community empowerment are combined with state-of-the-art management of sexually transmitted diseases.

The evaluation of any HIV intervention programmes has several important facets, one of which is an understanding of the context in which the intervention is occurring. Patterns of sexual behaviour are deeply embedded in social organisation and culturally determined norms of behaviour. Local notions of masculinity, femininity and socially-acceptable sexual behaviours must be understood, as they may constrain or facilitate achievement of the desired effect of the intervention. A second facet is the adherence to planned timetables and budgets, and a third the assessment of intervention outcomes against their stated objectives (Mertens, *et al.*, 1994). The Mothusimpilo-Carletonville Project has a strong evaluation component, designed to determine the biomedical and the behavioural impact of the intervention. First, there is annual assessment of biomedical and psychosocial outcome measures such as prevalence rates of HIV and conventional STDs among CSWs, mine workers and the general population. The social component of the survey assesses changes in level of knowledge, risk perception, attitudes and changes in behaviour of the target community. Second, the extent to which the programme contributes to the development of social and

community processes which enable and support these changes is also assessed annually (Campbell and Williams 1999a). The third part of the evaluation is concerned with measures of processes. All intervention staff keep weekly diaries in which they note activities carried out, difficulties and obstacles encountered, and the week's most important achievements. Combined assessment of outcomes and of process enables the project's principal investigators to assess not only the project's impact on the progression of the HIV epidemic in the target area, but also to ascertain which processes succeeded and which obstacles could not be overcome, and why. Such information should be an invaluable tool for the design of further HIV intervention programmes in South Africa and the rest of the world.

# Appendix 1. Demographic survey questionnaire

1. Questionnaire Number **[DO NOT FILL IN]** [ ]
   Name of respondent _____
   Number of shack/address of stand _____
   Name of substitute respondent _____
   Number of shack/address of substitute stand _____
2. [Interviewer: Sample domain] Council house [1]
   Private sector house [2]
   Backyard structure [3]
   Informal Settlement [4]
   Hostel [5]
3. [Interviewer: Establish how many separate rooms there are in this house/shack (excluding bathroom and kitchen)] [ ]

**Household Characteristics and Tenure Relationships**

4. How many people live in this house/shack/room? [ ]
5. Do ALL the residents of this house/shack/room eat together? Yes [1] No [2]
6. [Interviewer: Work out how many separate households live in this house/shack/room. Remember: a household includes only those who eat together] [ ]
7. Does your 'spouse' **[READ OUT]** live at your other home? [1]
   live here with you permanently? [2]
   live here with you some of the time, at your other home the rest of the time? [3]
   live elsewhere? [4]
   (two 'spouses') one lives here and one lives at your other home? [5]
   **NOT APPLICABLE**: Respondent is single/divorced/widowed [0]
8. Do any of your children who are under 18 (or who are over 18 and still attend school) live at your other home? Yes [1] No [2]
   **NOT APPLICABLE**: Respondent does not have children under 18/still at school [0]
   **NOT APPLICABLE**: Respondent has only one home [0]
9. [Interviewer: Establish how many backyard shacks and formal outbuildings are on this stand] [ ]
   **NOT APPLICABLE** Respondent lives in a hostel [99]
10. [Interviewer: Establish how many people live on this stand (include all backyard tenants)] [ ]
    **NOT APPLICABLE** Respondent lives in a shack in a hostel [99]

Now go to the following table and fill in the details for:[51]

1) Each person who stays in the house **and**
2) All the respondent's children (under 20) **and**
3) Any spouse who stays elsewhere

Checklist of questions for probing:

1) How many adults stay in this house/shack?
2) How many children stay in this house/shack?
3) Is there anyone else, apart from the people you have told me about, who also stays here?
4) Do you have any children?
5) If so, where do they stay?
6) Are you married?
7) If so, where does your spouse stay?

| | Member 1 | Member 2 |
|---|---|---|
| Member's Name | | |
| What is respondent's relationship to the key decision maker?<br>Key decision maker 1; Spouse 2; Child 3Grandchild 4; Sibling 5; Sibling-in-law 6; Parent 7; Other relative 8; Not related 9 | 111 | 211 |
| What is respondent's marital status?<br>Never married 1; Married 2; Living together 3; Widow/widower 4; Divorced/separated 5 | 1112 | 212 |
| Sex Male 1 Female 2 | 113 | 213 |
| What is respondent's age in years? | 114 | 214 |
| What is respondent's highest school qualification?<br>None 0; Pre-school A; Grade 1 B; Std *n* = *n* (*n* = 1 to 10); NTC *n* = *n* + 10 (*n* = 1 to 3) | 115 | 215 |

51 The columns in these tables were repeated to allow for up to 10 members.

| | | |
|---|---|---|
| Post-Matric or post-NTC 3 qualification<br>None 0; NTC 4 1 ; NTC 5 2; NTC 6 3; T1 4; T2 5; T3 6; Commercial Diploma 7; Nursing Diploma 8; Teaching Diploma 9; Bachelor Degree 10; Post-Graduate Degree 11 | 116 | 216 |
| Is respondent [Read Out]<br>Employed full-time 1; Employed part-time 2; Self-employed 3; Unemployed seeking work 4; Unemployed not seeking work 5; Student/scholar 6; Child (not at school) 7; Disabled and unemployed 8; Retired? 9 | 1127 | 217 |
| What is (or was) respondents job? [If unemployed, ask for **LAST JOB**] **Codes: Never worked 0** | 1138 | 218 |
| Where does respondents work **OR** attend school? (township/suburb) **Codes: NOT APPLICABLE 0** | 1149 | 219 |
| What is respondents monthly income? (after deductions for tax and pension, but including BOND payments) | 120 | 220 |
| Does respondent own a house elsewhere? Yes 1 No 2 | 121 | 221 |
| Does respondent have a rural home which they consider their family home? (The home may be their own house, or his/her parents' house or their spouse's house or even their spouse's parents' house.) Yes 1; No 2 | 1152 | 222 |
| Does respondent [Read Out]<br>live permanently in this dwelling 1; live at the family's other home 2; live in this dwelling some of the time and at your other home for the rest of the time 3; live elsewhere 4 | 1163 | 223 |
| How often does respondent visit their other home?<br>Never 1; Once every two weeks 2 Once a month 3; Once every two months 4 Once every three months 5; Three times a year 6; Twice a year 7; Once a year 8;<br>Less than once a year 9; **NOT APPLICABLE**: Respondent does not own another home or has a family home 0 | 1174 | 224 |
| Where was respondent born?<br>If a rural district or a farm, state name of nearest town.<br>If outside South Africa, state the name of the country | 1185 | 225 |
| In what type of place was respondent born?<br>Urban area 1; Rural district 2; White-owned farm 3 | 1196 | 226 |
| In what year did respondent first move to stay in a town?<br>**NOT APPLICABLE** (born in a town) 0 | 1207 | 227 |

| | | |
|---|---|---|
| What is the name of the first township that respondent moved to stay in? **NOT APPLICABLE** (born in a town) 0 | 1218 | 228 |
| When respondent first moved to live in a town, did he/she **[READ OUT]**<br>Live in a formal house 1; Live in a house shared by another family 2; Live in a backyard room 3; live in a backyard shack 4; Live in a shack in a shack settlement 5; Live in a domestic servant's room 6; Stay in a hostel 7; Stay in a room on employer's premises 8; Stay in a hut on a construction site 9; **NOT APPLICABLE**: Born in an urban area =10? | 1229 | 229 |
| In what year did respondent first move to live in Carletonville? | 130 | 230 |
| What is the last type of place that respondent lived in before they moved to stay in this house/shack/room?<br>a formal house 1; a shared house 2; a backyard room 3; a backyard shack 4; a shack settlement 5; a domestic servant's room 6; a hostel 7; a room on employer's premises 8; a hut on a construction site 9; Not applicable: born in this dwelling 10 | 131 | 231 |
| What is the name of the last place that respondent stayed in before they came to stay in this house/shack/room? | 1232 | 232 |
| In what year did respondent move to live in this house/shack/room? | 1243 | 233 |

VARIABLES FOR POST-CODING

25.Stage in the life-cycle of the household

Unmarried youngster/s (younger than 25) without children [1]
Recently married/living together couple without children [2]
Parent/s with first child of pre-school age [3]
Parent/s with first child of school-going age [4]
Parent/s with first child of student/working age[5]
Household head retired [6]
Other (Specify) [ ]

26.Household structure

Nuclear family (Parents and their own children) [1]
Nuclear family plus parent/s of household head or spouse [2]
Nuclear family plus unmarried relative/s or friend/s [3]

One person living alone [4]
More than one unmarried person living together [5]
Single-parent (mother) household [6]
Single-parent (father) household [7]
Other (specify) [ ]

27.Urban/Rural household strategies

Rural-born breadwinner here with rest of family at rural home [1]
Rural-born breadwinner with some of immediate family here
and the rest at rural home [2]
Rural-born breadwinner with whole of immediate family living here [3]
Rural-born breadwinner without rural home [4]
Urban-born breadwinner; whole of immediate family living here [5]
Urban-born breadwinner; some immediate family at another urban home [6]
Farm-born breadwinner without rural home [7]
Other (specify)[ ]

# Appendix 2. Survey costs

**Field work**

| (US$1 ≈ R6) | No. | Rate | Rand |
|---|---|---|---|
| **1. Consultation** | | | |
| Meetings: 1 hour × 9 mines | 9 | 275 | 2,475 |
| Transport, 160 km | 5 | 1.62 | 1,296 |
| Travelling time, hours | 10 | 110 | 1,100 |
| **Total** | | | **4,871** |
| **2. Selection of field workers** | | | |
| Time, hours | 12 | 275 | 3,300 |
| Transport, 160 km | 1 | 1.62 | 259 |
| Travelling time, hours | 4 | 110 | 440 |
| **Total** | | | **3,999** |
| **3. Training of selectors** | | | |
| 17 people, 3 days, venue | 0 | 00 | 00 |
| Training, hours | 16 | 275 | 4,400 |
| **Total** | | | **4,400** |
| **4. Training of interviewers** | | | |
| 23 people, 5 days, venue | 00 | 00 | 00 |
| Training, hours | 80 | 275 | 22,000 |
| **Total** | | | **22,000** |
| **5. Training of monitors** | | | |
| 5 people, 2 days, venue | 00 | 00 | 00 |
| Training, hours | 16 | 275 | 4,400 |
| **Total** | | | **4,400** |

| | | | |
|---|---|---|---|
| **6. Data gathering** | | | |
| Sampling | 17 | 275 | 4,675 |
| Remuneration, 15 selectors | 225 | 100 | 22,500 |
| Remuneration, 1 coordinator | 90 | 100 | 9,000 |
| Remuneration, 2 monitors | 180 | 60 | 10,800 |
| Remuneration, 4 nurses | 100 | 120 | 12,000 |
| Remuneration, 4 ass. nurses | 100 | 80 | 8,000 |
| Transport, 4 vehicles, 25 days | 100 | 450 | 45,000 |
| Daily allowance, 28 people | 700 | 15 | 10,500 |
| Daily allowance, 15 people | 225 | 15 | 3,375 |
| Remuneration per interview | 2200 | 32 | 70,400 |
| Remuneration, 1 coordinator | 150 | 100 | 15,000 |
| Remuneration, 2 monitors | 300 | 60 | 18,000 |
| Meals, Accommodation | 125 | 50 | 6,250 |
| **Total** | | | **235,500** |
| | | | |
| **7. Administration** | | | |
| Coding of questionnaires | 2200 | 3.50 | 7,700 |
| Copying questionnaires, pages | 44000 | 0.20 | 8,800 |
| Fax., tel., stationary, etc. | | | 2,000 |
| Rewards for study participants | 2200 | 10 | 22,000 |
| **Total** | | | **40,500** |
| | | | |
| **Grand total** | | | **315,670** |

| | |
|---|---|
| **Laboratory tests** | |
| (Each times 2240) | |
| *Chlamydia trachomatis* urine LCR tests @ R 92.16: | R206,438 |
| *Neisseria gonorrhoea* urine LCR tests @ R 92.16 | R206,438 |
| Syphilis serology RPR and TPHA tests@ R 30.57 | R68,476 |
| HIV serology Capillus tests @ R 24.96 | R55,910 |
| **Total** | **R537,264** |
| | |
| **Training** | |
| Materials | R11,027 |
| **Total** | **R11,027** |
| | |
| **Data entry** | |
| Two persons for entry of all the biomedical and behavioural data | |
| **Total** | **R17,422** |

| | |
|---|---|
| Field work | R315,670 |
| Laboratory tests | R537,264 |
| Training | R11,027 |
| Data entry | R17,422 |
| **Grand total** | **R881,383** |

# Appendix 3. Sample size calculations

For biomedical and behavioural surveys in communities such as Carletonville UNAIDS recommends a sample size of 2,000, half men and half women. However, it is essential to stratify on mineworkers and others since the former are all men. Since close to half of the adult population consisted of mineworkers it was decided to sample approximately 1,000 mineworkers, about 1,500 people from the community and in addition 100 women at high risk to complement the qualitative studies that were being done in the hot-spots. Stratifying into five age classes it was estimated that there would be approximately 200 men and women in the largest age class making it possible to measure binary responses with a precision of the order of 7% or less (95% CL).

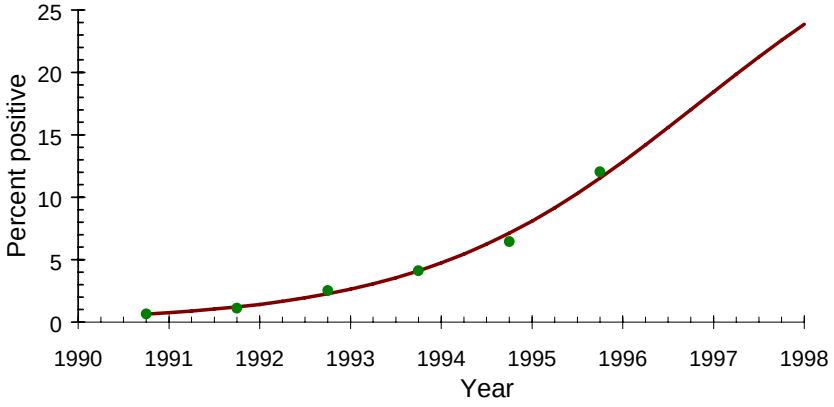


Figure A3.1 Prevalence of HIV amongst women in Gauteng based on the National HIV surveillance data and fitted to a logistic model

**HIV prevalence**

Ultimately, the purpose of the intervention is to reduce the incidence of HIV infection in Carletonville. Since no data were available on current or past levels of HIV infection in Carletonville the best possible starting point was provided by the data from the National Ante-Natal Clinic

surveys. The prevalence of HIV infection in Gauteng from these surveys is given in Figure A3.1.

The solid line is a logistic curve fitted to the data with an asymptote of 35%. The prevalence at the end of 1995 was 13% and the incidence about 5% p.a. Extrapolating for one year the 1997 prevalence was estimate to be about 18% and the incidence about 6% p.a. Assuming that in Carletonville the incidence was then 6% per year, then a sample size of 2,000 would give about 120 sero-conversions per year and it would then be possible to detect the difference between the expected value and a prevalence of 27.3% with 5% significance and 90% power. In other words, it will be possible to detect a 30% reduction in the expected increase in prevalence with reasonable statistical confidence.

If the incidence is currently about 6% per year amongst adults, there will be of the order of 48,600 new infections over the next year in the whole community. If the project achieves its goal, it would avert approximately 16,000 incident case of HIV.

**STD prevalence**

If the intervention is effective there should be a marked change in the prevalence of STDs which is important both in its own right and as a marker for HIV infection. Ballard recommended testing for syphilis, gonorrhoea and chlamydia as well as HIV and this was in agreement with the recommendations of the Global Programme on AIDS of the WHO.

No accurate data were available concerning the prevalence of STDs but Ballard believed that the prevalences of the three STDs of interest were probably in the range of 5 to 15%. If the prevalence of each STD was of the order of 10%, then with a sample size of 2,000 it would be possible to detect a reduction to 7% or less at a significance level of 5% and with 90% power. In order to detect reductions in the STD prevalence after stratifying on age, gender and migrancy status each stratum will contain approximately 200 people. It will then be possible to detect a reduction to 2% or less at a significance level of 5% and with 90% power and, depending on the success of the project, it was felt that this could be achieved.

# Appendix 4. Consent form

Hello, I am ..... and I am working for Progressus CC. We are doing a project which we hope will help to reduce the spread of HIV in this community. The project has the support of the Carletonville AIDS Action Group, the National Union of Mineworkers, the Mining Houses and the Department of Health. The project will include improving the treatment of sexually transmitted diseases, running education programmes concerning HIV and making condoms more easily available to those who wish to use them.

If we are to know if the project is successful we need to find out about the levels of sexually transmitted diseases as well as HIV and about peoples knowledge of sexually transmitted disease and about their partners. We will ask you to give a sample of blood and urine and to answer some questions. If you want to find out if you have a sexually transmitted disease we will give you the test results and free treatment if you have a disease. If you feel that you do not want to be part of this survey you are free to refuse. It should take about 35 minutes to complete the questionnaire.

All of the information will be strictly confidential and your name will not be on any of the forms or blood and urine samples. If you wish to know your HIV status we will arrange for an HIV test to be done for you separately. If you agree to participate you will be asked to sign this form to ensure you understand the aims of the project and agree to participate in the project. This form cannot be linked to your questionnaire or blood samples so all results will remain confidential.

**Consent**

I the undersigned agree to participate in the above mentioned study. I understand the aims of the study which have been clearly explained to me.

Signed Date

# Appendix 5. Questionnaire for the baseline survey

**Identification sticker**

**Carletonville Study**
**July/August 1998**

## Questionnaire

## Men and women

1. Background characteristics & migrancy
2. Marriage
3. Sexual Relations
4. STDs and health issues
5. Knowledge of AIDS
6. Risk perception and behaviour change
7. Condom use

**Section 1 Background characteristics**

*For all refusals please place a large R in the Coding categories column.*

**Type of housing**

| | | | |
|---|---|---|---|
| Council area | 1 | Private area | 2 |
| Squatter settlement | 3 | Site and service scheme | 4 |
| Mine Hostel | 5 | Council Hostel | 6 |
| Hotspot | 7 | Place | |

| No. | Questions and filters | Coding categories |
|---|---|---|
| Q200 A | *If council or private area:* Are you living in a backyard shack? | Yes 1<br>No 2 → **Q201** |
| Q200 B | If yes: Are you paying rent? | Yes 1; No 2 |

| | | |
|---|---|---|
| Q201 | RECORD SEX OF RESPONDENT | Male 1; Female 2 |
| Q202 | What is your date of birth?<br>[*Probe for best estimate*] | DATE: / / |
| Q203 | Have you ever attended school?<br>IF YES: What was the highest level that you completed? | Primary 1; Secondary 2<br>Post matric 3; None of the above 4 |
| Q206 | What ethnic group do you belong to? | Sotho 1; Zulu 2; Pedi 3; Shangaan 4; Xhosa 5; Tswana 6; Swazi 7; Ndebele 8; Malawian 9; Tsonga 10; Other 11<br>Specify |
| Q207 | Where were you born? | Same City 1; Other urban area 2; Rural area 3; Other countries 4 |
| Q208 | How long have you stayed in this city? | YEARS \|__\|__\|<br>[Since birth, ENTER 98 ]<br>[If less than one month, ENTER 00 month]<br>MONTHS \|__\|__\| |
| Q208 B | Would you call yourself a migrant worker (someone who has to live away from their family for work)? | Yes 1; No 2 |
| Q210 | How many years or months do you intend to live in this city? | YEARS \|__\|__\|<br>[Forever, ENTER 97]<br>[Don't know, ENTER 96]<br>MONTHS \|__\|__\| |
| Q211 | In the last 12 months, that is since last ...., did you make any trips of more than one night outside this city? [Probe] | Yes 1<br>No 2 → **Q214**<br>Lived less than 1 year in city 3 → **Q214** |

*"Now I am going to ask you more details about trips you have made out of the city"*

[For each trip out of this city ask Q212 to Q213]

| **No.** | **Questions** | **Trip(s)** | | | | |
|---|---|---|---|---|---|---|
| | Number of trips made: | **1** | **2** | **3** | **4** | **5** |
| Q212 | How long were you away for this trip? (in days) | | | | | |
| Q213 | When you were away, where did you go? Rural area 1; Other urban area 2; Other country 3; Rural home 4 | | | | | |

| **No.** | **Questions** | **Coding categories** |
|---|---|---|
| Q214 | What is your usual occupation? [*Probe: what kind of work do you do most of your time? Record verbatim and then code]* | Work for a mining company 1; Domestic work outside your home 2; Selling things 3; Unemployed 4; Manual labour 5; Professional 6 Sex work 7; Other 8 |
| Q215 | Are you now? [*Read out*] | Employed full time 1; Employed part time 2; Self employed 3; Full-time housewife 4; Unemployed and not looking for work 5; Unemployed and looking for work 6; Student/ scholar 7; Retired/ pensioner/ disabled 8 |
| Q215 A | How much money do YOU earn every month? [*Probe carefully and make sure pensions, rents for property and disability allowances are included*] | R |
| Q217 | How often did you have drinks containing alcohol in the last four weeks? Would you say ? [*Read out*] | Never 0; At least once a day 1; Less than once a day but at least once a week 2; Less than once a week 3 |

| | | |
|---|---|---|
| Q218 | Are there any groups, clubs or associations which people in Carletonville can belong to? [*Read out and probe for others*]<br>Women's group<br>Stokvel (rotating credit)<br>Church group<br>Political parties<br>Sports group/club<br>Trade unions<br>Burial society<br>Youth Group<br>Residents association/street committee | Yes 1; No 2 |
| Q219 | Which of the following groups in Carletonville are you a member of? [*Read out*]<br>Women's group<br>Stokvel (rotating credit)<br>Church group<br>Political parties<br>Sports group/club<br>Trade unions<br>Burial society<br>Youth Group<br>Residents association/street committee | Yes 1 No 2 |
| Q220 | Would you say that being a member of this group has had a positive impact on your life?<br>Women's group<br>Stokvel (rotating credit)<br>Church group<br>Political parties<br>Sports group/club<br>Trade unions<br>Burial society<br>Youth Group<br>Residents association/street committee | Yes 1; No 2; Not a member 3 |

| | | |
|---|---|---|
| Q221 | Generally speaking, would you say that most people can be trusted or would you say that you have to be careful when dealing with other people? | Most people can be trusted 1; You have to be careful with other people 2 |
| Q222 | Generally speaking, would you say that most of the time people try to be helpful to others, or would you say that people mostly look after themselves? | People try to be helpful 1; People tend to mostly look after themselves 2 |
| Q223 | Did you vote in the last national elections (1994)? | Yes 1; No 2 |
| Q224 | Can ordinary people like you trust the government to look after your interests? | Yes 1; No 2 |
| Q225 | Is this neighbourhood a pleasant place to live? | Yes 1; No 2 |
| Q226 | Is your neighbourhood a safe place to live? | Yes 1; No 2 |
| Q227 | Do you feel that you have a lot in common with your neighbours? | Yes 1; No 2 |
| Q228 | Are you in control of your life or do you feel that you are a victim of circumstances beyond your control? | In control 1; Victim of circumstances 2 |
| Q229 A | In the last week have you given or received advice on personal issues?<br>IF YES: [*Read out*]<br>Was this with someone ...? | Yes 1; No 2<br>who is a local friend 3<br>who is a local relative 4<br>who is a person living elsewhere 5 |
| Q229 B | In the last week have you lent or borrowed money?<br>IF YES: [*Read out*]<br>Was this with someone...? | Yes 1; No 2<br>who is a local friend 3<br>who is a local relative 4<br>who is a person living elsewhere 5 |
| Q229 C | In the last week have you given or received help with childcare or household work?<br>IF YES: [*Read out*]<br>Was this with someone...? | Yes 1; No 2<br>who is a local friend 3<br>who is a local relative 4<br>who is a person living elsewhere 5 |

**Section 2 Husbands, wives and regular partners**

*A regular partner refers to someone who you are married to, or live with as if you are married. A regular partners may also be a partner who you are committed to but don't live with.*

| No. | Questions and filters | Coding categories |
|---|---|---|
| Q303 | Are you now married, committed to or living as married, single, separated/divorced or widowed? | Married or living as married 1; Committed but not living together 2; Single 3 → **Q324B**; Separated/ divorced 4 → **Q325** Widowed 5 → **Q325** |
| Q304 | How many husbands/wives or regular partners do you have? | One 1; Two 2; Other 3; Specify ..... |

*"Now I am going to ask you more details about your current regular partner(s): Firstly, what are the initials of your current regular partner(s)?* [see below]
If more than 2 partners, ask about 2 favourite partners
[For each current regular partner ask Q307 to Q319]

| No. | Questions | Regular Partner(s) | |
|---|---|---|---|
| | **First name (initials)** | **1** | **2** |
| Q307 | How long have you been married, committed to or living as married with this person? [*If less than one year, enter 00*] Years | \|__\|__\| | \|__\|__\| |
| Q308 | How old is he/she? [*Probe*] Years | \|__\|__\| | \|__\|__\| |
| Q309 | Do you usually live together in the same house/compound? Yes 1 → **Q315**; No 2 | | |
| Q310 | [*IF NO*] Where does he/she usually live? Same city 1; Other city 2; Rural 3; Abroad 4 | | |
| Q315 | How many times did you have sex with your regular partner in the last week? That is in the last 7 days from last ..... to this ..... Number | \|__\|__\| | \|__\|__\| |

| | | | |
|---|---|---|---|
| Q317 A | Do you use condoms with this regular partner...? [*Read out*]<br>Never 1→ **Q319**; Sometimes 2;<br>Always 3 | | |
| Q318 | [If always or sometimes]<br>Why do you use condoms?<br>To avoid pregnancy 1; To avoid giving him/her a disease 2; To avoid getting a disease 3; Pressure from partner 4; Other 5; specify ..... | | |
| Q319 | [If never or sometimes]<br>What was the main reason that you never or do not always use a condom with this regular partner?<br>Not available 1; Too expensive 2; Partner objected 3; Don't like them 4; Made a decision not to 5; Using another form of contraception 6; Other 7; specify ..... | | |
| | **GO BACK TO Q307 [If more than one regular partner]** | | |
| Q324 B | Have you ever had penetrative sexual intercourse? By penetrative sex I mean when the penis enters the vagina, anus or mouth. [*Probe*] Yes 1; No 2 → **Q602** | | |
| Q325 | How old were you when you had penetrative sexual intercourse for the first time? | Age<br>\|__\|__\| | |
| Q326 | How many different sexual partners did you have penetrative sex with up to now?<br>[*Probe*] | Number<br>\|__\|__\|__\| | |

**Section 3 Sexual relations with casual partners (partners other than your regular partners)**

***"Now I would like to ask you a few questions about other partners that you may have had IN THE LAST 12 MONTHS, that is since ... ."***

| No. | Questions | Coding categories |
|---|---|---|
| Q401 | How many times have you had sexual intercourse with anyone (else) in the last 12 months (other than a regular partner)? This includes mistresses, girlfriends, casual partners, prostitutes, or somebody you met in a bar or at a special occasion. | NUMBER \|__\|__\|__\|<br>[*IF NONE,* → **Q502** for men and → **Q521** for women] |
| Q402 | How many different people have you had sexual intercourse with in the last WEEK (apart from regular partner(s)?<br>How many in the last MONTH (including in the last week)? | [*Refused or don't know ENTER 999*]<br>NUMBER \|__\|__\|__\|<br><br>NUMBER \|__\|__\|__\| |

***"Think of the last casual partner that you had sex with. What are his/her initials?"***

| No. | Questions | Coding categories |
|---|---|---|
| | **Initials or Don't know (DK):** | |
| Q404 | What educational level has he/she completed? | Primary 1; Secondary 2; Post-Matric 3<br>None of the above 4; Don't know 5 |
| Q405 | How old is he/she?<br>*[Probe rather than accepting don't know*] *If don't know ENTER 99* | \|__\|__\| |
| Q406 | Is he/she married or living as married, committed but not living together, divorced, separated, widowed, or single? | Married or living as married 1; Committed but not living together 2; Single 3; Separated/ divorced or widowed 4; Don't know 5 |
| Q408 | When did you have sex with him/her for the first time? | Month Year<br>\|__\|__\| \|__\|__\|__\|__\| |

| | | |
|---|---|---|
| Q408 B | Where did you have sex the first time with him/her? | Same city 1 → **Q409B**; other urban area 2; rural area 3 |
| Q409 | [*IF OUTSIDE THIS CITY*]<br>Why were you there? Was it for | [*Read out*]<br>Work 1; Family reasons 2; To collect/give money 3; Attending school 4; Other 5; specify ….... |
| Q409 B | Does this person live in Carletonville? | Yes 1; No 2 → **Q412** |
| Q409 C | IF YES: What type of area do they live in? | Council area 1; Private area 2; Squatter settlement in township 3; Site and service area 4; Mine hostel 5; Council hostel 6; Squatter area near mines 7; Don't know 8 |
| Q412 | How long did you know him/her before having sexual intercourse?<br>*[If MORE than 5 years, ENTER 99, If LESS than 1 day, ENTER 00]* | Months \|__\|__\|<br>OR<br>Days \|__\|__\| |
| Q413 | Are these sexual relations currently going on or has the sexual relationship ended? | Relationship going on ;<br>Relationship ended 2 → **Q417**; Do not know 3 → **Q417** |
| Q414 | [IF CURRENT RELATION] How many times in the last week did you have sex with this person? That is in the 7 days from last ..... to this ..... | \|__\|__\| → Q418A |
| Q417 | [If relationship finished]<br>How long did the relationship last? (How long was it between the first time you had sex together and the last time?)<br>[*If less than one day ENTER* 00] | Days \|__\|__\|<br>OR<br>Months \|__\|__\| |
| Q418 A | Did you use condoms with this casual partner...? [*Read out*] | Never 1→ **Q421**; Sometimes 2; Always 3 |

| | | |
|---|---|---|
| Q420 | [If always or sometimes]<br>Why did you use condoms? | To avoid pregnancy 1; To avoid giving him/her a disease 2;To avoid getting a disease 3; Pressure from partner 4; Other 5; specify ..... |
| Q421 | [IF NEVER OR SOMETIMES]<br>What was the main reason that you never or did not always use a condom with this casual partner? | Not available 1; Too expensive 2; Partner objected 3; Don't like them 4; Made a decision not to 5; Using another form of contraception 6; Other 7 specify .....…. |
| Q425 | If you took a guess, how many partners do you believe he/she has had in the last month (apart from you)? | Number \|__\|__\|__\| |
| Q426 | [MEN ONLY]<br>Was this person a sex worker?<br>[WOMEN ONLY]<br>Did this man pay you for sex? | Yes 1; No 2 |

## Section 4 STDs and health issues

***"Now I would like to ask you some questions about your health in the last 12 months."***

| No. | Questions and filters | Coding categories |
|---|---|---|
| **Q501** | **MEN ONLY** | **WOMEN → Q521** |
| Q502 | Some men experience pain during urination or have a discharge from the penis. During the last 12 months, have you noticed any such pain or discharge? IF YES: How many episodes started in the last 12 months? | NUMBER \|__\|__\|<br>[*If none ENTER 00*] |
| Q503 | At present, do you have any pain, when passing urine? | Yes 1; No 2 → **Q505** |
| Q504 | For how long do you have this pain? | Days \|__\|__\|__\| |
| Q505 | In the last 24 hours, did you have any discharge from the penis? | Yes 1; No 2 → **Q507** |

| | | |
|---|---|---|
| Q506 | For how long did you have this discharge? | Days \|__\|__\|__\| |
| Q507 | Some men experience sores in the genital area. During the last 12 months, have you noticed any such sores?<br>IF YES: How many episodes started in the last 12 months? | NUMBER \|__\|__\|<br>[*If none ENTER 00*] |
| Q508 | At present, do you have any sores on the genital area? Are they painful? | Yes, without pain 1; Yes, painful 2; No 3 → **Q510** |
| Q509 | For how long have you had these sores? | Days \|__\|__\|__\| |
| **Q510** | **FILTER: SEE Q502 to Q508**<br>**No episodes ↓** **One or more episodes → Q519** | |
| Q511 | Do you consider these sores, discharges or the pain which I have mentioned to be the symptoms of illness? | Yes 1; No 2; Don't know 3 |
| Q512 | For the last episode. Did you:<br>Seek advice from friend or relative?<br>Use medicine that you had at home or made yourself?<br>Seek advice from a traditional healer?<br>Obtain medicine from traditional healer?<br>Seek advice from a clinic or a hospital?<br>Obtain drugs from a clinic or a hospital?<br>Buy medicine from a pharmacy or shop?<br>Obtain drugs from a mobile clinic?<br>Get advice from a private GP?<br>Obtain drugs from a private GP?<br>Wait for the symptoms to go away on their own? → **Q515**<br>Do some other thing? (specify) _____ | Yes 1; No 2 |
| Q513 | For the last episode, how many days did you have symptoms for before seeking treatment? | Days \|__\|__\|__\| |
| Q515 | Did you tell (any of) your casual or regular partner(s) about this last episode? | Yes 1; No 2 |

| | | |
|---|---|---|
| Q516 | Do you think that the infection you experienced can be passsed to your casual or regular partner(s)? | Yes 1; No 2 → **Q519**; Don't know 3 →**Q519** |
| Q517 | While you had the symptoms, did you do anything to prevent passing the infection to, (any of) your casual or regular partners? (Seeking treatment excluded) | Yes 1; No 2 → **Q519** |
| Q518 | IF YES, what did you do? (*Record verbatim, then code)* _____ | Abstain from sex 1; Use a condom 2; Other 3 |
| Q519 | [Must be answered]<br>Are you circumcised? (use local terms for operation) | Yes 1; No 2<br>→ **Q602** |
| | **WOMEN ONLY** | |
| Q521 | In the last 12 months, did you have sex during menstruation (with any of your partners)? | Yes 1; No 2 |
| Q522 | Are you currently doing something or using any method to delay or avoid pregnancy? | Yes 1; No 2 → **Q528**; Pregnant 3 → **Q528** |
| Q523 | [If yes] Which method are you using? | Pill 1; IUD 2; Injections 3; Diaphragm/ foam/jelly 4; Condom 5; Calendar/Safe period 6; Withdrawal 7; Sterilization 8; Other 9 specify _____ |
| Q528 | Do you usually use something to tighten or dry your vagina before sexual intercourse? | Always 1; Often 2; Rarely 3; Never 4 → **Q530** |
| Q529 | [If yes] What do you use? | |
| Q530 | Some women experience an unusual discharge from the vagina or pain in the lower stomach. During the last 12 months, have you noticed any such discharge or pain?<br>IF YES: How many episodes started in the last 12 months? | NUMBER \|__\|__\|<br>[*If none ENTER 00*] |

| | | |
|---|---|---|
| Q531 | In the last 24 hours, did you have any unusual discharge from the vagina? | Yes 1; No 2 → **Q536** |
| Q532 | For how long did you have this discharge? | Days \|__\|__\|__\| |
| Q533 | Does this discharge itch? | Yes 1; No 2 |
| Q534 | Is this discharge normal for you? | Yes 1; No 2; Don't know 3 |
| Q535 | Is the discharge more than usual? | Yes 1; No 2; Don't know 3 |
| Q536 | Some women experience sores in the genital area. During the last 12 months, have you noticed any such sores?<br>IF YES: How many episodes started in the last 12 months? | NUMBER \|__\|__\|<br>[*If none ENTER 00*] |
| Q537 | At present, do you have any sores in the genital area? Are they painful? | Yes, without pain 1; Yes, painful 2; No 3 → **Q539** |
| Q538 | For how long have you had these sores? | Days \|__\|__\|__\| |
| **Q539** | **FILTER: SEE Q530 to Q538**<br>**No episodes ↓** **One or more episodes → Q602** | |
| Q540 | Do you consider these sores, discharges or the pain which I have mentioned to be the symptoms of illness? | Yes 1; No 2; Don't know 3 |
| Q541 | For the last episode. Did you:<br>Seek advice from friend or relative?<br>Use medicine that you had at home or made yourself?<br>Seek advice from a traditional healer?<br>Obtain medicine from traditional healer?<br>Seek advice from a clinic or a hospital?<br>Obtain drugs from a clinic or a hospital?<br>Buy medicine from a pharmacy or shop?<br>Obtain drugs from a mobile clinic?<br>Get advice from a private GP?<br>Obtain drugs from a private GP?<br>Wait for the symptoms to go away on their own? → **Q544** | Yes 1; No 2 |

| | | |
|---|---|---|
| | Do some other thing? (specify) _____ | |
| Q542 | For the last episode, how many days did you have symptoms for before seeking treatment? | Days \|__\|__\|__\| |
| Q544 | Did you tell (any of) your casual or regular partner(s) about this last episode? | Yes 1; No 2 |
| Q545 | Do you think that the infection you experienced can be passed to your casual or regular partner(s)? | Yes 1; No 2 → **Q602**; Don't know 3 → **Q602** |
| Q546 | While you had the symptoms, did you do anything to prevent passing the infection to, (any of) your regular or casual partners? (Seeking treatment excluded) | Yes 1; No 2 → **Q602** |
| Q547 | IF YES, what did you do? (*Record verbatim, then code*) | Abstain from sex 1; Use a condom 2; Other 3 specify _____ |

**Section 5 Knowledge of aids**

| **No.** | **Questions and filters** | **Coding categories** |
|---|---|---|
| Q602 | I am going to read out some statements about protection against HIV/AIDS. For each statement please tell me whether you think it is true or not.<br>People can protect themselves from HIV/AIDS by:<br>Having a good diet<br>Staying with one faithful partner<br>Avoiding public toilets<br>Using condoms during sexual intercourse<br>Avoiding touching a person who has AIDS<br>Avoiding sharing food with a person who has AIDS<br>Avoiding being bitten by mosquitoes or similar insects | True 1; Not true 2; Don't know 3 |

| | | |
|---|---|---|
| | Making sure any injection they have is done with a clean needle | |
| Q603 | Do you think that a person infected with HIV always shows symptoms or can such a person look perfectly healthy? | Always symptoms 1; Can look healthy 2; Don't know 3 |

**Section 6 Risk perception and behaviour change**

| No. | Questions and filters | Coding categories |
|---|---|---|
| Q701 | Has any relative, friend or colleague of yours ever had HIV/AIDS? | Yes 1; No 2; Not sure 3 |
| Q702 | What are the chances that you might catch HIV? Would you say there is no chance, a moderate chance or a good chance? | No chance 1; Moderate chance 2; Good chance 3 Don't know 4; Already infected 5 |
| Q703 | Have you made any changes in your sexual behaviour to avoid HIV? | Yes 1; No 2 → **Q705** |
| Q704 | When did you start making these changes? Within the last 12 months or longer ago? | Within last 12 months 1; Longer ago 2 |
| Q704 B | What changes have you made? *[Record exactly what is said]* _____ | Always use condoms 1; Sometimes use condoms 2; Have fewer partners 3; Other 4 |
| Q705 | Would you be willing or not willing to take care of a family member with AIDS? | Willing 1; Not willing 2; Do not know 3 |
| Q706 A | If you were infected with HIV would you tell anyone or would you keep it a secret? | Tell somebody 1; Keep it a secret 2 → **Q801** |
| Q706 B | Who would be the first person you would tell if you were infected with HIV? | Relative 1; Friend 2; Regular partner 3; Casual partner 4; Employer 5; Other 6; Specify _____ |

**Section 7 Condom use**

| No. | Questions and filters | Coding categories |
|---|---|---|
| Q801 | **FILTER: SEE Q317A AND Q418A** | |

| | **Condoms used ↓** | **Condoms not used → Q805** |
|---|---|---|
| Q802 | Have you ever used a condom | Yes 1; No 2 |
| Q805 | Do you know any places or people where you can obtain condoms? | Yes 1; No 2 → **Q812** |
| Q806 | Which places or people do you know where you can obtain condoms [*Read out*] | Shop 1; Pharmacy 2; Hospital/Clinic 3; Family planning centre 4; Bar/hotel 5; Carletonville project/Zodwa 6; Private GP 7; Mine medical service 8; Mine hostel 9 Mobile clinic 10; Peer educators 11; Other 12 specify _____ |
| Q807 | Have you ever bought condoms? | Yes 1; No 2 → **Q812;** Don't know **3 → Q812** |
| Q808 | [*IF YES*] What brand did you buy last? | Lovers plus 1; Don't know 2; Female condoms 3; Other brand 4 specify _ |
| Q812 | Which of these best describes your thoughts about using condoms to prevent AIDS with a regular partner? Would you say [*Read out*] | You haven't made a decision 1; You've decided not to use a condom 2; You've decided to use condoms but don't use them yet 3; You use condoms some of the time 4; You use condoms all of the time 5 |
| Q814 | Which of these best describes your thoughts about using condoms to prevent AIDS with casual partners? Would you say [*Read out*] | You haven't made a decision 1; You've decided not to use a condom 2; You've decided to use condoms but don't use them yet 3; You use condoms some of the time 4; You use Condoms all of the time 5 |

**Section 8 Attitudes to the project**

| No. | Questions and filters | Coding categories |
|---|---|---|
| Q901 | Before being asked to be in this survey had you ever heard of Mothusimpilo centre/project? | Yes 1; No 2 |
| Q902 | What do you think the chances are that the Mothusimpilo project will increase condom use in Carletonville? [*READ OUT*] | Good chance 1; Moderate chance 2; Poor chance 3 No chance 4 |
| Q903 | What is the reason for the answer in Q902? [*Record exactly what is said*] | |

# Appendix 6. Policy on needle stick injuries

1. Needles must be disposed of using the dispenser provided to avoid the need to recap needles.
2. All nurses and nursing assistants involved in taking blood will be vaccinated against Hepatitis B at the start of the project.
3. If anyone has a needle stick injury they will be taken immediately to Johannesburg and put onto AZT and 3TC. A supply of AZT and 3TC is available at the SAIMR through Prof. Ron Ballard. (Work: 011 489 9490; Cell: 082 807 4964; Home: 011 883 5680). The donor will be tested for HIV, hepatitis B, hepatitis C, and syphilis. If the donor test for HIV is negative the treatment can stop, if it is positive it will continue for two months.
4. If the donor is E-antigen positive for hepatitis B, the recipient will be given a hepatitis B booster even if they have already been vaccinated.
5. In the event of a needle-stick injury the affected person must make a written report describing the exact circumstances of the injury within 24 hours of it happening.

I have read and understood this document
Signed: Date:

# Appendix 7. Laboratory tests

## HIV tests

The major antigens from the envelope proteins of HIV-1 and HIV-2 have been identified and cloned using recombinant DNA technology, then expressed and purified. The Capillus HIV-1/HIV-2 assay uses these two proteins bound to polystyrene latex beads as the basis of a direct latex aggregation assay for detecting antibodies to HIV-1 and/or HIV-2 in serum and plasma. The assay is performed on a capillary slide which consists of a mixing well area, at one end of which is a capillary flow channel which leads to a viewing window. The latex reagent and test sample are mixed in the well. The mixed reagents are drawn to the flow channel and begin to flow by capillary action towards the viewing window. Samples positive for HIV-1 or HIV-2 cause the antigen coated latex to aggregate. The capillary flow enhances the binding of specific antibodies to the latex and hence promotes aggregation. The reaction is read visually when the latex solution reaches the viewing window. Aggregation in the viewing window is regarded as positive, a smooth milky white appearance negative. A positive Capillus test indicates a high probability that antibodies to HIV-1 and/or HIV-2 are present. The test does not discriminate between antibodies to HIV-1 and HIV-2.

## Syphilis

The Immutrep-Carbon Antigen is a non-treponemal flocculation test for reagin antibodies in serum or plasma. The antigen contains carbon particles to improve the visual reading of the result thus obviating the requirement for a microscope when recording the test results. Approximately 50µl serum are mixed with 16µl of a well mixed antigen suspension. The appearance of medium and large aggregates indicate a positive result, finely dispersed aggregates a weak positive reaction and a smooth grey appearance a negative result. A semi-quantitative test was performed by diluting all positive specimens in saline and then testing

these dilutions in the normal test procedure. The titre recorded is the highest dilution at which the test yields a positive result.

The Cellognost Syphilis H® is a *Treponema pallidum* Haemagglutination Test which detects antibodies specific to *Treponema pallidum*, the bacterium which causes syphilis. The Cellognost Syphilis reagent consists of stabilised human erythrocytes sensitised with *Treponema pallidum* antigen. If specific antibodies are present in serum or plasma, they cross link the sensitised erythrocytes in the reagent. A +++ positive result consists of an agglutination pattern evenly distributed over the entire bottom of the V-shaped well. In some cases the edges of the agglutinates are crumpled. A loose, irregularly-shaped spongy button is classified as a ++ positive reaction is while a somewhat enlarged button with slightly irregular edges is classified as a + positive reaction. A sharply defined button indicates no agglutination of erythrocytes and is a negative result.

## Gonorrhoea

The first step of the procedure is the amplification of DNA, specifically of the 48 base pair sequence of the Opa gene. This sequence is conserved in all strains of *Neisseria gonorrhoeae* and is the most specific to *N. gonorrhoeae.* The four oligonucleotide probes in the LCx® assay recognise and hybridise with a specific target sequence, the 48 base sequence, within the Opa gene of *N. gonorrhoeae* DNA. The oligonucleotides are designed to complement the 48 base sequence so that in their presence, the probes will bind next to one another. They can then be enzymatically joined to form the amplification product which subsequently serves as an additional target sequence during further rounds of amplification.

The two pairs of oligonucleotide probes in the assay are labelled with haptens, immunoreactive chemical groups. Each individual probe has either a capture hapten, recognised by an antibody attached to MEIA microparticles or a detection hapten, recognised by an antibody bound to alkaline phosphatase. The amplification product is automatically

transferred to a well with microparticles coated with anti-capture hapten. The amplifaction product plus any unligated probes carrying the capture hapten are bound by these microparticles. The reaction mixture is then transferred to a glass fibre matrix to which the microparticles bind irreversibly. A wash step removes the unbound probes, leaving only the detection hapten. The bound microparticle complexes are then incubated with the alkaline phosphatase conjugate, which binds to the detection hapten. This antibody conjugate binds only to amplification product. The antibody conjugate can then be detected by addition of the substrate, 4-methylumbelliferyl phosphate, which is dephosphorylated by alkaline phosphatase to produce a fluorescent molecule, 4-methylumbelliferone, that is measured by MEIA optical assembly.

All calculations are performed automatically by the LCx analyser. The presence or absence of *N. gonorrhoeae* is determined by relating the LCx assay results to the cut-off value which is the mean of LCx Gonorrhoea calibrator rates. A sample to cut-off ratio greater than or equal to 1.20 is positive for *N. gonorrhoeae*, a ratio less than or equal to 0.80 is negative, and a ratio between 0.80 and 1.20 yields an equivocal result which requires re-testing. Table A7.1 summarizes the performance of the test using urine samples (compared to culture results).

Table A7.1 Sensitivity and Specificity of the LCx® *Neisseria gonorrhoeae* Assay

| | | Sensitivity% (95% C.I.) | Specificity% (95% C.I.) |
|---|---|---|---|
| Women | Symptomatic | 95.6 (84.9–99.5) | 100 (98.1–100) |
| | Asymptomatic | 92.0 (74.0–99.0) | 99.1 (95.3–100) |
| Men | Symptomatic | 99.4 (96.8–100) | 96.6 (93.9–98.4) |
| | Asymptomatic | 85.7 (42.1–99.6) | 99.6 (97.6–100) |

## Chlamydia

In addition to its chromosomal DNA, *Chlamydia trachomatis* harbours a cryptic plasmid, which is found in all serovars at approximately ten copies per elementary or reticulate body. The Ligase Chain Reaction target is located within this plasmid and is a short sequence which is highly conserved among all the serovars of *Chlamydia trachomatis* but is not found in other species.

The LCx® *Chlamydia trachomatis* Assay uses the nucleic acid amplification method (Ligase Chain Reaction) to directly detect the presence of *C. trachomatis* plasmid DNA in urine samples. The biological principles of the test are the same as of the LCx® *Neisseria gonorrhoeae* assay described above.

All readings and calculations are performed automatically by the LCx analyser. The presence or absence of *C. trachomatis* plasmid DNA is determined by relating the LCx assay results to the cut-off value which is the mean of LCx Chlamydia calibrator rates. A sample to cut-off ratio equal or larger than 1.00 is regarded as positive for *Chlamydia trachomatis.* Table A7.2 summarizes the performance of the test using urine samples as measured against a direct fluorescent monoclonal antibody test on tissue culture and LCx assay specific for the major outer membrane protein gene region of *Chlamydia trachomatis*

Table A7.2 Sensitivity and specificity of the LCx® *Chlamydia trachomatis* assay

| | | Sensitivity% (95% C.I.) | Specificity% (95% C.I.) |
|---|---|---|---|
| Women | Symptomatic | 97.2 (85.5–99.9) | 100 (99.0–100) |
| | asymptomatic | 95.8 (85.8–99.5) | 100 (98.7–100) |
| Men | symptomatic | 92.0 (83.4–97.0) | 96.6 (98.0–100) |
| | asymptomatic | 91.7 (74.0–99.0) | 100 (98.1–100) |

# Appendix 8. Curve fitting

For the plots of prevalence against age for men and women in Khutsong (Figure 3.2) the curves fitted to the data were log-normal curves (Williams, Gouws, Abdool Karim and Wilkinson, 2000; Williams, Gouws, Colvin, Sitas *et al.* 2000) so that the fitted curves have the form

$$P(a) = \frac{N}{\sigma\sqrt{2\pi}(a - a_0)} \mathrm{e}^{-(\ln(a-a_0)-m)^2/2\sigma^2} \qquad 8.1$$

where $a_0$ is the off-set, $m$ is the mean and $\sigma$ the standard deviation of the fitted curve which is normalised to $N$. For the mineworkers and the commercial sex workers the data were fitted to straight lines. For the data in Figure 3.2 the following parameter values were obtained using maximum likelihood fitting (Williams and Dye, 1994).

Table A8.1 Parameters for the fits to the data shown in Figure 3.2. $p$ is the significance level for the goodness of fit based on the deviance.

| | Khutsong men | Khutsong women | | Mineworkers | Women in hotspots |
|---|---|---|---|---|---|
| $N$ | 10.9 | 14.9 | $a$ | 0.322 | 1.014 |
| $m$ | 31.6 | 26.2 | $b$ | –0.001 | –0.010 |
| $\sigma$ | 0.42 | 0.55 | | | |
| $p$ | 0.445 | 0.579 | $p$ | 0.543 | 0.074 |

For the plots of prevalence against the number of sexual partners the data in Figure 3.3 were fitted to a curve starting from zero and converging exponentially to a variable asymptote so that the fitted curves have the form

$$P(n) = A\left(1 - \exp^{-\alpha n}\right)$$

where $A$ is the asymptotic value and $\alpha$ gives the rate of convergence to the asymptote and therefore determines (with $A$) the risk per partnership.

For the plots of lifetime exposure to syphilis (Figure 3.8) the data were fitted to logistic curves with a variable asymptote so that the fitted curves have the form

$$P(a) = \frac{N\mathrm{e}^{\alpha+\beta a}}{1+\mathrm{e}^{\alpha+\beta a}}$$

Table A10.2 Parameters for the fits to the data shown in Figure 3.8. $p$ is the significance level for the goodness of fit based on the deviance.

| | Khutsong men | Khutsong women | Mineworkers |
|---|---|---|---|
| $N$ | 0.613 | 0.590 | 0.379 |
| $\alpha$ | –6.686 | –11.299 | –2.293 |
| $\beta$ | 0.233 | 0.584 | 0.111 |
| $p$ | 0.769 | 0.302 | 0.295 |

# Appendix 9. Publications

This appendix lists papers published by people working on the project that relate directly or indirectly to the project. The abstracts may be found on the project web-site (www.cisr.co.za/aidsproject/) and copies of the papers listed here can be obtained from the authors.

## Edited conference proceedings

1. HIV/AIDS: social approaches. Campbell, C. and G. Hayes (Guest Editors) (1998) *Special Edition of Psychology in Society*, 54 (3).
2. *Managing HIV/AIDS in South Africa: Lessons from Industrial Settings* Proceedings of a Workshop held in Johannesburg, November 1997. Williams, B. G., Campbell, C. and MacPhail, C. (editors), (CSIR, Johannesburg, 1999) 214 pp.
3. *Priorities for the Management of HIV/AIDS Transmission in the Mining Industry*. Proceedings of a Workshop held in Johannesburg, October 1995. Williams, B. G. and Campbell, C. (editors), (ERU, Johannesburg, 1996) 186 pp.

## Editorials

4. Mines, migrancy and HIV in South Africa—managing the epidemic. Williams, B. G. and Campbell, C. (1996) *South African Medical Journal* **86** 1249–1251.

## Papers

5. 'I think condoms are good but, aai, I hate those things': Condom use among adolescents and young people in a southern African township. MacPhail, C. and Campbell, C. (2000) *Social Science and Medicine* in press.
6. A model of HIV transmission on South African mines: implications for control. Williams, B.G. and Campbell, C. (1996) *Southern African Journal of Epidemiology and Infection* **11** 51–55.

7. Academic research and HIV/AIDS in South Africa. Campbell, C. and Williams, B.G. (1996) *South African Medical Journal* **86** 55–60.
8. Attendance versus compliance with TB treatment in an occupational setting: a pilot study Mqoqi, N., Churchyard, G., Kleinschmidt, I. and Williams, B.G. (1997) *South African Medical Journal* **87** 1517−1521.
9. Beyond the biomedical and behavioural: Towards an integrated approach to HIV prevention in the Southern African mining industry Campbell, C. and Williams, B.G. (1999) *Social Science and Medicine* **48** 1625–1639.
10. Creating alliances for disease management in industrial settings: A case study of HIV/AIDS in workers in South African gold mines. Williams, B.G. and Campbell C.M. (1998) *International Journal of Occupational and Environmental Health* **4** 257−264.
11. Criteria for the control of drug-resistant tuberculosis. Dye, C. and Williams, B.G. (2000) *Proceedings of the National Academy of Sciences* in press.
12. Evaluating HIV prevention programmes: conceptual challenges. Campbell C.M. and Williams, B.G. (1998 ) *Psychology in Society* **24** 57–68.
13. Evaluating HIV-prevention programmes: Do current indicators do justice to advances in intervention? MacPhail, C. and Campbell, C. (2000) *South African Journal of Psychology* in press.
14. Evaluating the impact of tuberculosis control: number of deaths prevented by short-course chemotherapy in China. Dye, C., Zhao, F., Scheele, S., Williams, B.G. (2000). *International Journal of Epidemiology* **29** 558–564.
15. Gender as an obstacle to condom use: HIV prevention amongst commercial sex workers in a mining community. Campbell, C., Mzaidume, Y. and Williams, B. G. (1998) *Agenda* **39** 50−57.
16. High incidence of HIV infection among young women in rural South Africa: developing a cohort for intervention trials. Wilkinson, D., Abdool Karim, S.S., Williams, B. and Gouws, E. (1998) in press.
17. Managing disease on the goldmines: ‘work-related’ and ‘non-work-related’ diseases on the South African gold mines. Campbell, C.M.

and Williams, B.G. (1988) *South African Journal of Public Health* **88** 785–795.

18. Migrancy, masculine identities and AIDS: The psycho-social context of HIV transmission on the South African gold mines. Campbell, C. (1997) *Social Science and Medicine* **45** 273–281.
19. Moving beyond health education: the role of social capital in conceptualising 'health enabling communities'. Campbell, C. (2000) *Health Promotion International* in press.
20. *Mycobacterium kansasii* and *Mycobacterium scrofulaceum* isolates from HIV-negative South African gold miners: incidence, clinical significance and radiology. Corbett, E.L., Hay, M., Churchyard, G.J., Herselman, P., Clayton, T., Williams, B.G., Hayes, R., Mulder, D., and De Cock, K.M. (1999) *International Journal of Tubercle and Lung Disease* **3** 501–507.
21. Nontuberculous mycobacteria: defining disease in a prospective cohort of South African miners. Corbett, E.L., Blumberg, L., Churchyard, G.J., Moloi, N., Mallory, K., Clayton, T., Williams, B.G., Chaisson, R.E., Hayes, R.J. and De Cock, K.M. American (1999) *Journal of Respiratory and Critical Care Medicine* **160** 15–21.
22. Patterns of infection: using age prevalence data to understand the epidemic of HIV in South Africa. Williams, B.G., Gouws, E., Colvin M., Sitas, F., Ramjee, G., Abdool Karim, S.S. (2000) *South African Journal of Science* in press.
23. Perceptions of health on a Johannesburg goldmine. Macheke, C. and Campbell, C. (1998) *South African Journal of Psychology* **28** 146–153.
24. Prospects for global tuberculosis control under the WHO DOTS strategy. Dye, C., Garnett, G.P., Sleeman, K. and Williams, B.G. (1998) *Lancet* **353** 1886–1891.
25. Representations of gender, respectability and commercial sex in the shadow of AIDS: A South African case study. Campbell, C. (1998) *Social Science Information* **37** 687–707.

26. Risk factors for pulmonary mycobacterial disease in South African gold miners: a case-control study. Corbett, E.L., Churchyard, G.J., Clayton, T., Herselman, P., Williams, B.G., Hayes, R., Mulder, D. and De Cock, K.M. (1999) *American Journal of Respiratory and Critical Care Medicine* **159** 94–99.
27. Selling sex in the time of AIDS: the psycho-social context of condom use by southern African sex workers. Campbell, C. (2000) *Social Science And Medicine* **50** 479–494.
28. Sexual behaviour, heterosexual transmission, and the spread of HIV in sub-Saharan Africa: a simulation study. Auvert, B., Buonamico, G., Lagarde, E. and Williams, B.G. *Computers and Biomedical Research* (2000) **33** 84–96.
29. Strategies for the control of drug-resistant tuberculosis. Dye, C. and Williams, B.G. (1999) *Proceedings of the National Academy of Sciences* in press.
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34. Where are we now? Where are we going? The demographic impact of HIV/AIDS in South Africa. Williams, B.G., Gouws, E., and Abdool Karim, S.S. (2000) *South African Journal of Science* in press.

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35. Challenging the stereotype: dominant norms and dissident voices in young peoples' accounts of their sexuality. MacPhail, C. and Campbell, C. (2000) in preparation.
36. Dying for a drink: alcohol abuse and HIV prevention in southern Africa. Campbell, C., Williams, B., Mzaidume, Y. and Kelly, M. (2000) in preparation.
37. Estimating HIV Incidence Rates From Age Prevalence Data in Epidemic Situations Williams, B.G., Gouws, E., Wilkinson, D. and Abdool Karim, S.S. (1998) submitted.
38. Grassroots participation, peer education and HIV prevention amongst sex workers in South Africa. Campbell, C. and Mzaidume, Y. (2000) submitted.
39. Make or break: the role of stakeholders in the successful outcome of HIV intervention programmes, lessons from Carletonville, South Africa. Campbell, C. and Williams, R. (2000) in preparation.
40. Relative risk of HIV infection amongst young men and women in a South African township. Campbell, C., MacPhail, C. and Williams, B. G. (2000) submitted.
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50. Community-led HIV prevention by South African sex workers. Mzaidume, Y., Williams, B.G. and Campbell, C.M. *Research for Sex Work* **3** June 2000 6–7.

51. HIV/AIDS in the Mining Industry: Current Status, Future Prospects. Williams, B. G. and Campbell, C. *Newsletter of the Mine Medical Officers Association of South Africa* 1996 pp. 13–16.
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Durban: July 2000[52]

57. Assessing the risk HIV/AIDS in the Carletonville gold mining area. Williams, B.G., Gilgen, D., Campbell, C., Taljaard, D., Ballard, R., van Dam, C.J., MacPhail, C., Lurie, M., Moema, S., Mzaidume, Y. and Rasego, B.

52 This list is being prepared before the AIDS 2000 meeting and some of the papers may appear in the list of abstracts for that meeting in a different form.

58. Challenging the stereotype dominant norms and dissident voices in young peoples' accounts of their sexuality. MacPhail, C. and Campbell, C.
59. Cutting it fine: Male circumcision practises and the transmission of STDs in Carletonville Taljaard, D. and Auvert, B.
60. Dramatic epidemic of HIV infection among young women in Carletonville (South Africa) Auvert, B., Williams, B.G., Campbell, C., MacPhail, C., Ballard, R., Carton M. and Gouws E.
61. Drawing it out Mapping the HIV/STD epidemic in Carletonville Cooper, A., van Dam, C.J., Becker, K.M., Williams, B.G., MacPhail, C. and Moema, S.
62. Dying for a drink: Alcohol and HIV transmission among South African sex workers. Mzaidume, Y., Campbell, C., Williams, B.G. and Kelly, M.
63. Evaluating the impact of a community-led HIV prevention programme in South Africa context, conceptual framework and methodology. Taljaard, D., Campbell, C., Williams, B.G. and van Dam, C.J.
64. Gender and the relative risk of HIV infection amongst young men and women in a South African township. Campbell, C., MacPhail. C., Williams, B.G. and van Dam, C.J.
65. Getting it together: Syndromic management training for health professionals in Carletonville. Rasego, B., Ballard, R. and Wright, J.
66. Grassroots participation, peer education and sexual health a case study of community-led HIV prevention amongst South African sex workers. Campbell, C. and Mzaidume, Y.
67. HIV Prevalence amongst miners and their partners and non-migrants and their partners. Lurie, M., Williams, B.G., Abdool Karim, S., Garnett, G. and Zuma, K.
68. Improved partner notification activities in a South African mining community. Rasego, B., Wright, J.M., Leong, M.G., Ye Htun, Y. and Ballard, R.C.

69. Interventions and behaviour a change for the better in Carletonville? Van Dam, C.J., Campbell, C.M., Williams, B.G., MacPhail, C. and Ndhlovu, L.
70. Into the pocket, onto the penis: Condom distribution in Carletonville, South Africa. Moema, S., Neilssen, G., Mzaidume, Y. and Rasego, B.
71. Make or break: the role of stakeholders in the successful outcome of HIV intervention programmes. Williams, R., Campbell, C. and Williams, B.G..
72. Migrant women and HIV infection. Zuma, K., Lurie, M., Williams, B.G., Gouws, E. and Campbell, C.
73. Patterns of infection: using age prevalence and incidence data to understand the epidemic of HIV in South Africa Williams, B.G., Gouws, E., Abdool Karim, S.W., Abdool Karim, Q., Colvin, M., Sitas, F. and Ramjee, G.
74. Peer education: Lessons learnt from the Carletonville project Mzaidume, Y., Asiedu, K., Ndhlovu, L. and Campbell, C.
75. Sending labour, spreading AIDS Migrancy and the spread of HIV infection in Southern Africa. Lurie, M.
76. Sexual networks and routes of STD and HIV infection. Ndhlovu, L., MacPhail, C., Campbell, C.M., Williams, B.G. and van Dam, C.J.
77. STD and HIV infection in Carletonville, South Africa a community based survey. Van Dam, C.J., Ballard, R., Neilssen, G., Williams, B.G., Gilgen, D., Htun, Y., Fehler, G., Radebe, F., Tshabalala, V., Campbell, C.M. and MacPhail, C.
78. The evaluation of the STD standard of care before and after STD interventions at Carletonville. Ndhlovu, L., Harrison, A., Rasego, B., van Dam, J. and Williams, B.G.
79. Trends in routine STD surveillance data at the start of a syndromic management programme in Carletonville, South Africa. Moema, S., Leong, G., Rasego, B., Taljaard, D., Williams, B.G. and Ballard R.
80. Understanding the difference in age prevalence of HIV infection in men and women. Williams, B.G., Gouws, E. and Auvert, B.

81. What is a health enabling community? Social capital and HIV in a southern African mining community. Campbell, C., Williams, B.G. and Mzaidume Y.
82. Where are we now, where are we going to? Community surveys for HIV intervention and control programmes. Taljaard, D., Taljaard, R., MacPhail, C., Williams, B. G., Campbell, C., Phatedi, G. and Moema, S.
83. Who wants to know? Desire to know ones HIV status in two contrasting studies. Mkaya, D., Taljaard, D., Williams, B.G., Qwana, E. and Lurie, M.

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