FINAL REPORT

The Impact of the HIV/AIDS Epidemic on the University of the Free State: Magnitude, Implications and Management

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EXECUTIVE SUMMARY

- In our epidemiological analysis, we projected (a) the impact of HIV on numbers of school-leavers eligible to enter UFS, (b) the prevalence and incidence of HIV amongst UFS staff and students, and (c) the incidence of AIDS and death among staff and students, over a ten-year period. To this end, we employed Markov models, based on South African epidemiological evidence.

- We found that the numbers of school-leavers eligible to apply to university, when accounting for the impact of HIV/AIDS, will on average decline by 3.3% per annum (school-leavers from Free State province) and 1.1% per annum (school-leavers from other provinces in South Africa) over the next nine years (2005-14). The number of school-leavers eligible to apply to UFS in particular will on average decline by 2.4% per annum over the same period. Sensitivity analysis, moreover, suggests that this downward trend is likely regardless of the assumptions. Yet, average annual changes in the number of eligible enrolees are relatively moderate until 2010; in some cases even representing moderate growth, but thereafter the decline in numbers accelerate substantially. Importantly, it is not only the HIV/AIDS epidemic, but the demographic transition in general that are driving the projected decline in the number of persons eligible to enrol at university. In fact, HIV/AIDS accounts for only a small proportion (half or less of a percentage point) of the average annual decline in school-leavers during the time of their enrolment in primary and secondary school.

- Amongst the 2,333 UFS staff on the Bloemfontein and Qwaqwa campuses, HIV prevalence was estimated at about 5 percent in 2003. HIV prevalence rates in 2003 were estimated to be highest amongst unskilled support services staff (8.8 percent). Yet, these employees make up 14.7 percent only of the total staff complement. Hence, although HIV prevalence rates are lower amongst more skilled workers, a substantial number of new HIV infections, new AIDS cases and AIDS deaths will occur amongst skilled workers, in particular amongst skilled support services staff and academic staff, which together represent 80 percent of the total staff complement. On aggregate, we estimated that a total of 320 new HIV infections, 149 new AIDS cases, and 78 AIDS deaths will occur amongst staff over the ten-year period.

- We estimated, moreover, that approximately 9 percent of students at UFS were infected with HIV in 2003. This figure will increase to about 14 percent by 2013. Every year approximately 258 new HIV infections, 168 new AIDS cases and 89 AIDS deaths will occur amongst students over the ten years between 2004 and 2013. The numbers of new HIV infections per year will increase slowly over the next ten years, whilst AIDS incidence and death rates will increase substantially.

- Our model produced lower prevalence estimates than ASSA models, but for staff our results were in keeping with prevalence estimates from the surveys in the most comparable workforce populations. The burden of HIV/AIDS on staff is thus likely to be substantial. But it will be lower than in many other workforce populations, partly due to the large proportion of skilled and highly skilled staff and the racial composition of staff. HIV prevalence amongst whites, which makes up a substantial proportion of the staff complement, generally is lower than amongst other population groups. Substantial numbers of students will also be affected by HIV/AIDS, raising questions about the university's responsibility in respect of students with HIV and AIDS, and the importance of awareness and prevention. Yet, the declining numbers of pupils in schools and the resultant decline in university enrolees over the next ten years may represent a much greater threat to tertiary education institutions than the impact of HIV/AIDS on current student numbers.

- We estimated the financial implications for UFS of HIV/AIDS amongst employees based on the results of our epidemiological analysis and using an adjusted version of the costing model developed by Rosen *et al*. (2004). As expected, the average cost per HIV infection was higher at higher levels of skill, given that the magnitude of these costs derives from mean salary levels. The major components of the AIDS tax on employees were on-the-job productivity loss, medical costs, death and disability benefits, and sick leave. The combined average aggregate cost of HIV/AIDS amongst employees at both the Bloemfontein and Qwaqwa campuses amounted to R6.8 million per annum, or R2,938 per employee, which translates into 3.5 percent of total annual salaries and wages and 1.7 percent of total annual operating expenses.

- Incident HIV infections and AIDS cases amongst students at UFS are estimated to translate into a considerable cost in terms of loss of revenue. On average, HIV/AIDS amongst students will cost UFS almost R4 million per annum over the next ten years. This translates into an average cost per enrolled student of R1,646 and approximately one percent of total annual operating expenses.

- On average, therefore, the total cost to UFS of incident HIV infections and AIDS cases and deaths amongst staff and students amounted to R10.8 million per annum over the next ten years, which on average represents 2.8 percent of annual operating expenses.

- The cost of interventions which can either keep employees from becoming infected (such as compulsory prevention and awareness programmes conducted during the induction of new staff members of students), or that can extend the productive lives of infected employees or can ensure that students complete their studies (treatment programmes) represent but a fraction of the costs of the impact of HIV/AIDS on staff and students. Thus, further investments by UFS, its partners and government in prevention and treatment programmes for staff and students are economically prudent, if not from a company perspective, then definitely from a societal perspective.

- One may argue that the free provision of ARV in the public sector, which is currently under way, relieves UFS of a duty to provide treatment to staff and students, this despite our findings indicating that this is an economically prudent option. For a variety of reasons, however, UFS may still want to invest in treatment for staff and students, but should, at the minimum, invest money in selling to students and employees the importance of being tested and determining their HIV status (thus marketing the VCT service on campus and available in public health care facilities), which will enable infected persons to access treatment in the public or the private health care sectors, given that the returns on treatment are considerable.

- In order to collect information about the needs and constraints faced by staff, students, community organisations, and management in coping with the epidemic and the manner in which they envisage these needs and constraints should be addressed - which is central to our study - a range of focus group discussions were conducted with a range of stakeholders.

- Students were generally aware of current campaigns, programmes and activities, most of which centre around awareness programmes aimed at the distribution of information regarding HIV/AIDS and of condoms. However, students almost unanimously agreed that participation in these activities was generally low and that the effectiveness of these programmes can be improved, especially via improved coordination and better communication. Moreover, ignorance and myths surrounding HIV/AIDS persist. Importantly, students also highlighted the need for information programmes to go beyond the distribution of knowledge about HIV transmission and safe sex, and emphasised the need for knowledge about how to manage exposures to risk of infection and about how people who are infected can deal with the disease, and, live positively with HIV/AIDS. A need was also expressed for special efforts aimed at involving students that do not stay on residences on campus in HIV/AIDS-related activities, given that current programmes often fail to reach these students. Lecturers and management generally are perceived to distance themselves from the problem and not to be actively involved in HIV/AIDS-related activities on campus. There appears to be a definite need to scale up on the provision of HIV/AIDS-related services and to mainstream HIV/AIDS into other campus activities.

- Employees on the Qwaqwa campus were relatively more likely to have reported visible impacts or direct experiences of HIV/AIDS, in particular the effects of these experiences on morale. Support to infected employees (and students) by management and by unions is constrained due to the lack of disclosure and to the resulting lack of knowledge about the extent of the problem and of whom to support. Employees in general were not aware of HIV/AIDS-related programmes aimed at staff members, even where in fact such programmes did exist, and moreover felt that these programmes are targeted as students rather than at staff. Employees felt that unions were not supportive in terms of prevention and awareness activities and that unions mainly focused on providing support to the bereaved person's family, once the person has died. Participants also felt that a concerted effort should be made to provide the necessary support to employees, including the dissemination of awareness information and access to counselling and treatment, and to encourage employees to go for HIV tests and/or to disclose their status.

- The policy of UFS on HIV/AIDS does in fact address most of these and other specific concerns raised by students and staff members in terms of perceived needs. Importantly, however, the focus group discussions generally highlighted the fact that the response by UFS to the HIV/AIDS epidemic, although sound in terms of its nature, is constrained by a lack of coordination, poor communication and lack of resources, an issue to which we turn again in due course.

- Representatives of NGOs and CBOs were of the opinion that UFS, as an important partner in the community's response to HIV/AIDS, can contribute in the following ways: (a) provide financial assistance to local organisations involved in HIV/AIDS education, home-based care and other activities, which would allow these organisations to expand their services, (b) assist organisations in training personnel and volunteers in project management, advanced HIV/AIDS awareness, as well as health care and social work, (c) encourage or require from students to become involved in the activities of these organisations as volunteers, possibly as part of UFS's community service learning initiative, thus aiding organisations in expanding their services, (d) assist organisations in educating community members regarding the procedure to be followed in adopting orphaned children, which would enable them to access foster grants, and (e) employ research to enhance the response to HIV/AIDS in local communities. It is hoped that the above suggestions can provide some ideas of how the response of UFS to HIV/AIDS in terms of its impact on the larger community should go beyond an exclusive focus on awareness and prevention alone, also to include capacity building initiatives and community outreach programmes aimed at mitigating the impact of the epidemic.

- Health professionals at UFS felt that the current response to HIV/AIDS is highly fragmented, uncoordinated, and under-resourced, which resulted in participants experiencing high levels of frustration. Given the complex nature of the HIV/AIDS epidemic, they felt that the response of UFS to the epidemic needs to be integrated and multi-faceted. Participants felt that the ideal way to respond to HIV/AIDS would be to have team of various professionals provide all HIV/AIDS-related services in one facility as a one-stop service. Respondents were also of the opinion that there existed no coordinated strategy for fundraising to mobilise the resources required to fund such an integrated, coordinated response to HIV/AIDS. Importantly, strong opinions surfaced in regard to the extent to which the AIDS Centre (now called the Life Skills Centre) and the response of UFS to the epidemic is under-resourced, with similar perceptions having been raised in focus group discussions with staff, students and union and student council representatives. Evidence in terms of the nature of responses by higher education institutions in South Africa comparable in size to or even smaller than UFS provided further evidence of the extent to which this is indeed the case. Despite its response being under-resourced, however, the University's policy on HIV/AIDS and its response to the epidemic compares well to the responses by other institutions of higher education in South Africa. The response of UFS to the epidemic is therefore not lacking in terms of content, but lacking in terms of effectiveness as a result of being relatively under-resourced. Hence, UFS needs to take action in deciding how it can go about mobilising the necessary funding to expand and strengthen its response to HIV/AIDS.

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1. BACKGROUND AND PROBLEM STATEMENT

The HIV/AIDS epidemic in South Africa

The HIV/AIDS epidemic poses a great threat to the economies of developing countries in general, and to those on the African continent in particular. Over the next ten to fifteen years, the epidemic has the potential to erode development gains made in past decades. As the disease takes its toll amongst the economically active population, production and demand are expected to decline, which will slow down economic growth and job creation. The AIDS epidemic generally lags about eight years behind the HIV epidemic. This explains why the impact of the high HIV prevalence rates currently observed will only really materialise in five to ten years' time, i.e. once it has progressed into AIDS.

According to recent estimates from both the United Nations Programme on HIV/AIDS and the World Health Organisation (WHO), 42 million people, including 3.2 million children were living with HIV world wide at the end of 2002 (UNAIDS, 2002). However, the greatest concentration of the epidemic is in the developing world and the worst affected region is Sub-Saharan Africa. In 2002 the region hosted almost 70 percent of all HIV-positive people and 94 percent of infected children (UNAIDS, 2002).

South Africa is no exception and is being affected fundamentally by the epidemic. In 2001 UNAIDS (2002) estimated the adult prevalence of HIV among the 15-49 age group at 20.1 percent. The ASSA2000 model put adult prevalence among those aged 20-65 years at 24.1 percent (ASSA, 2003). A recent national household survey in turn estimates the 2002 figure of adult prevalence among those older than 25 years at 15.5 percent (Sishana and Simbayi, 2002). It is startling, moreover, to note that in terms of absolute numbers of people living with HIV or AIDS, South Africa is second only to India. Yet, India has twenty times the population of South Africa (National Population Unit, 2000).

The implications of HIV/AIDS for our country are alarming. According to the Metropolitan-Doyle model, the number of South African living with HIV/AIDS will increase from 160 000 to almost one million between 2000 and 2010. The annual number of AIDS deaths is estimated to increase from 120 000 to between 545 and 635 thousand between 2000 and 2010. The number of children younger than fifteen years orphaned by AIDS has been estimated to reach 800 000 by 2005, rising to more than 1.95 million by 2010 (Abt Associates, 2001). These infected individuals and affected children all belong to individual households and their deaths will have a significant impact on their families. In addition, the employers of these infected individuals face the consequences of losing these workers to AIDS-related illness. It is thus increasingly important to that HIV/AIDS be understood and planned for in South Africa.

Impact on the South African economy and the higher education sector

The education sector, which for years has merely been considered as a key sector to combat the epidemic, is no exception. Being a labour-intensive institution catering principally for young people in an AIDS-affected society, the sector is vulnerable to the many impacts of the epidemic. The higher education sector contributes directly to the human capital of the South African nation and the threat of HIV/AIDS to the demographics and dynamics of campuses is evident. The youth, moreover, is the cohort with the fastest growing rate of HIV infection (Whiteside and Sunter, 2000: 32).

Furthermore, the negative implications on social and economic progress of a high death rate among this age category cannot be overstated.

Yet, the full impact of HIV/AIDS on the education system is not clear, because the epidemic has nowhere run its full course and because relatively few studies have endeavoured to quantify the impact of HIV/AIDS on this sector. The costs to organisations, resulting from the epidemic, have been relatively well documented and include costs related to increased absenteeism, direct and indirect medical costs, increased labour turnover, decreased productivity, and employee benefits payable to employees living with and dying of HIV/AIDS. Case studies conducted in South Africa and other developing countries provide some information on the nature of this impact of the epidemic on organisations. So, for example, the cost of HIV/AIDS per employee has been estimated at between US$49 and US$300 (Whiteside *et al*., 1999). In a sugar mill in Kwazulu-Natal the total annual cost per worker was estimated at R8464 (Morris *et al*., 2000). HIV/AIDS-related costs in other companies have been estimated as ranging between 0.4 and 8,6 percent of the total wage bill (Aventin and Huard, 2000; Rosen *et al*., 2004). Yet, no study has attempted to quantify the 'AIDS tax' on institutions of higher education in terms of HIV/AIDS amongst employees, although some evidence did emerge from the literature as to some of the AIDS-related financial costs faced by some universities elsewhere in Africa. In mid-1999, for instance, the University of Zambia estimated that it was spending close to US$ 1,500 each month on funeral grants and expenses (Kelly, 2001a: 25). In some universities that provide funeral transportation, HIV-related deaths seem to have been the main reason explaining an increase in the use of vehicles, and, therefore, the expenses of these universities. For instance, at the University of Nairobi, funeral-related vehicle use tripled from 7 percent of total transport requests in 1991 to 22 percent in 1999 (Kelly, 2001a: 25). These, however, reflect only some of the costs to universities of HIV/AIDS and the 'AIDS tax' on such institutions may also look quite different from that reported for other companies, given that the workforce in organisations of this nature include a relatively high proportion of skilled and particularly highly skilled employees, as a result of the nature of its core business (i.e. knowledge creation and management).

In addition, there are few reliable estimates of HIV prevalence at the university level. HIV testing has been conducted at some institutions of higher education in South Africa, with a prevalence rate of 1.1 per cent (13 from 1,217 students tested) being reported for the Rand Afrikaans University (Uys *et al*., 2001; Alexander and Ichharam, 2002). Stremlau and Nkosi (2001) in turn have reported prevalence rates of 26 and 12 per cent respectively for female and male students aged 20-24 at the University of Durban-Westville. However, these results are limited insofar as the voluntary nature of the testing probably means that prevalence is underestimated. Chetty (2000), on the other hand, has estimated HIV prevalence amongst technikon undergraduates and undergraduate and postgraduate university students at respectively 24.5, 22 and 11 percent. He estimates that these figures will increase to 36, 33, and 22 percent respectively by 2005.

In general, it seems, many studies of HIV/AIDS at higher education institutions in South Africa and elsewhere in the world have focused almost exclusively on knowledge, awareness and sexual behaviour amongst students. All of these studies note that students were generally knowledgeable about the causes and modes of transmission of HIV/AIDS. They were able to specify the activities that constitute high-risk behaviour, as well as the best ways to protect them from HIV infection. Yet, evidence suggests that this knowledge is not translated into changes in sexual behaviour, with many students participating in risky sexual behaviour, this while negative perceptions about condom use continue to persist. Furthermore, many students believe that they are not vulnerable to HIV infection as a result of thinking that the disease affects others and that they themselves are not at risk (Uys, 2002).

Thus, the epidemic stands to affect the institutional capacity of the education system at all levels through its impact on the individuals who comprise it, on the processes that govern its operations, and on the financial and material resources required to carry out its activities. In all cases, the human resources at risk are students and all those who have roles in the delivery of education services including teachers, education officers, inspectors, planning officers, management personnel, and curriculum and examination specialists. The epidemic affects the education sector in different but interrelated ways. More directly, the epidemic affects the sector through the reduction of the supply of and the demand for education. AIDS deaths of lecturers, for example, are likely to have serious negative implications for the supply of education, given that the death of one person affects a larger number of learners. As a case in point, it is estimated that 'a death or absence of a single teacher affects the education of between 20 and 50 children' (Barnett and Whiteside, 2001: 311), a ratio that will be even higher in institutions of higher education. The epidemic also affects the quality, resourcing, the process, the content and the role of education. Furthermore, HIV/AIDS may affect donor support and the way in which education should be organised (Shaeffer, 1994; Kelly, 2000a-d). These impacts exacerbate the task the current government faces in addressing the legacy of apartheid by ensuring adequate levels of quality of education for all South Africans (Abt Associates, 2001). Thus, all institutions of higher education will, to a greater of lesser extent, be affected by the epidemic and they need to develop and implement strategies to address these impacts of the HIV/AIDS epidemic.

For this reason, knowledge about the impact of HIV/AIDS on institutions of higher education is crucial in informing and guiding the response of management to HIV/AIDS, not only in terms of fighting the epidemic, but also in terms of planning its research and training activities, and of mitigating the impact of the disease. To minimise the effects of the epidemic requires concerted and sustained efforts in areas not traditionally addressed by higher education organisations – efforts aimed at minimising workforce susceptibility and organisational vulnerability. The success, moreover, with which universities will achieve this, is dependent on understanding the current and future profile of the epidemic, measuring its impact within the workplace and on markets, pooling resources and working in partnership.

Rationale for the project

Early response to the HIV/AIDS epidemic is as important for organisations as it is for individuals, high-risk groups and government. In fact, the recent report by the Council for Higher Education (CHE) focusing on a review of higher education in the first ten years of democracy in South Africa, argues that ‘higher education institutions need to link HIV/AIDS initiatives to strategic planning’ (Lickindorf, 2004). According to Barnett and Whiteside (1998), we may think of the epidemic's impact on the University in terms of the following five stages:

- the appearance of HIV in the wider community
- the sporadic occurrence of illness and death in the organisation
- the first significant interruptions or disruptions to work caused by continuing employee illness, absenteeism or death
- the recruitment and training of new employees in response to greatly increased employee mortality or morbidity
- the recognition that the entire way of working in the organisation must be redesigned to cope with the epidemic

Clearly, according to Barnett and Whiteside (1998/2001), the total cost to the organisation will be significantly reduced if the decisions to respond are pre-emptive and early rather than responsive and late. Especially in large organisations, management strategies aimed at mitigating the impact of HIV/AIDS need to be developed and implemented, which are precisely those strategies that this research will ultimately inform.

In addition, a legal obligation rests on organisations to manage the epidemic strategically. In December 2000, the Minister of Labour issued the Code of Good Practice regarding HIV/AIDS and employment in terms of the Employment Equity Act (1998) and the Labour Relations Act (1995). The Code’s primary objective is to set out guidelines for employers and trade unions to implement so as to ensure that individuals with HIV infection are not unfairly discriminated against in the workplace. This part of the code deals with:

- the creation of a non-discriminatory workforce
- HIV-testing, confidentiality and disclosure

- the provision of equitable employee benefits
- dismissals
- the management of grievance procedures

The secondary objective of the Code is to provide guidelines for employers, employees and trade unions on how to manage HIV/AIDS in the workplace and it emphasises the necessity of a holistic response to the epidemic. In this regard the Code includes five key principles:

- the creation of a safe working environment
- the implementation of procedures to manage occupational incidents and claims for compensation
- the establishment of measures to prevent the spread of HIV
- the implementation of strategies to assess and reduce the impact of the epidemic upon the workplace
- the support of individuals infected with or affected by HIV/AIDS so that they work productively for as long as possible

This assessment of the magnitude, implications and management of the HIV/AIDS epidemic will inform the compliance with these guidelines, as well as informing the University's strategic response to the HIV/AIDS epidemic.

2. OBJECTIVES

The project aims to determine the magnitude of the impact on and the implications of the HIV/AIDS epidemic on the University of the Free State (UFS), while, in the process informing its response to the epidemic. The latest National Plan for Higher Education envisages that the Uniqwa campus of the University of the North and the Bloemfontein campus of Vista University be integrated with UFS. The former, which is now known as the Qwaqwa campus of the University of the Free State, officially became part of UFS in January 2003, whereas the latter was officially integrated with UFS in January 2004. This study focuses on the existing Bloemfontein campus of UFS as well as the Qwaqwa campus. The Vista campus was excluded from the study, given that the data collection phase of the research was concluded before the Vista campus was officially integrated with the main UFS campus. Organisation's responses to HIV/AIDS have three elements, namely management strategies, workplace programmes, and community participation (Health Economics and HIV/AIDS Research Division, 2000). The research will inform all three of these responses, based on the results of the institutional audit, epidemiological modelling and cost analyses that form part of the project.

The project has the following broad objectives:

- to audit and critically assess the existing HIV/AIDS strategies and responses of UFS by means of an institutional audit
- to determine the susceptibility of UFS to the future impact of HIV/AIDS by means of an institutional audit
- to collect information about the needs and constraints faced by staff, students, community organisations and management in coping with the epidemic, as well as the manner in which these groups think these needs and constraints should be addressed
- to conduct epidemiological and demographic modelling to project the future impact of HIV/AIDS incidence and mortality in UFS
- to estimate the future cost of HIV/AIDS to UFS over the next ten years, distinguishing between aggregate cost, cost per AIDS death, cost per employee, and costs as percentage of wages/salaries
- to integrate the research findings into recommendations for the strategic management of the future impact of HIV/AIDS by UFS, outlining different alternatives and scenarios

3. APPROACH AND METHOD

Ethical considerations

The study was conducted in a legally and ethically acceptable manner that ensured that the fundamental and constitutional rights of past and current employees and students were not infringed upon. Participation in the research by employees and students was voluntary, confidential and with free and informed consent. The study required access to medical information about past and current employees, which were obtained in a manner that guaranteed privacy and confidentiality. The study and attendant protocols were approved by an ethics committee of the University of the Free State. Furthermore, various stakeholders were consulted in the development and implementation of the study.

Sub-projects:

The study comprised three separate but interdependent research projects, namely an epidemiological-cum-demographic modelling exercise, a cost analysis, and an institutional audit. The details of the respective methodologies, which are discussed in the designated sections of the report, include combinations of focus group discussions and the analysis of existing data.

3.1 Epidemiological analysis

HIV/AIDS affects all sectors of the South African population, and the burden of illness is likely to increase over the next decade as people who were infected with HIV/AIDS during the 1990s develop clinical AIDS. The prevalence of HIV infection, however, varies widely between different subgroups of the population. For most subgroups, HIV prevalence is unknown, as it requires blood testing which is costly and ethically problematic, and many people are reluctant to be tested. It is possible, however, to make informed estimates by extrapolating the results of studies carried out in similar populations to another population of interest. These estimates may need to be adjusted, for example for the age, sex, and socio-economic distribution of the population of interest. (We preferred the term 'sex' to that of 'gender', given that gender encompasses much more than physiological differences between men and women.) Simple mathematical models, with explicit assumptions, are used to make these adjustments, to forecast future prevalence and incidence rates of HIV and AIDS.

Prevalence and incidence of HIV:

The ideal way to estimate HIV prevalence is to test the blood of all, or a random sample, of the population of interest. Such surveys, however, tend to have low response rates. This results in HIV prevalence estimates that are likely to be upwardly – or downwardly – biased. The prevalence of HIV among subgroups of the South African population is in most cases unknown, and needs to be extrapolated from epidemiological information for other populations.

Recent studies have estimated the prevalence of HIV infection among South African university students (Alexander and Ichharam, 2002) and among various workforce populations (Rosen *et al*., 2004). But no prevalence data are available for the UFS population itself. It is likely, based on other universities' experience, that the response rate of an HIV testing survey would be low, and therefore produce biased results. Instead we preferred to employ epidemiological models to estimate the impact of HIV/AIDS on UFS.

The most valid and precise South African estimate of HIV prevalence is for women receiving antenatal care in government clinics. These prevalence rates cannot be directly generalised to men, who tend to become infected at later ages. The prevalence rates can also not be directly generalised to UFS staff and students, who tend to come from higher socio-economic groups and are less likely to be African than antenatal clinic attendees. Antenatal HIV surveillance data are however useful in showing trends over time in HIV prevalence.

The Nelson Mandela/HSRC Study of HIV/AIDS, conducted in 2002, was the largest study to have estimated HIV prevalence in a random sample of the whole South African population (Shisana and Simbayi, 2002). The sample was stratified and large enough to estimate HIV prevalence rates and risk factors among subgroups of the population. The main problem with this study was that as many as 38 percent of respondents in the sample were not tested for HIV (they refused), which means that HIV prevalence could be substantially over- or underestimated. Another problem with this study is that only limited analyses of these data have been reported and the actual data are not publicly available for further analysis. For example, prevalence estimates have been stratified by age and sex, and by age and ethnicity, but not by sex and ethnicity. So it does not show whether male/female HIV prevalence ratios are the same for different ethnic groups as they are for the whole (mostly African) population. Similarly, HIV prevalence is stratified by educational attainment but not by educational attainment and age, so that what seem to be educational effects may just be age effects, and vice versa. However, a logistic regression analysis reported by the authors usefully estimated the independent effects of several socio-demographic variables on HIV risk, including educational attainment, income and population group, but with limited adjustment for age. Acknowledging the limitations of these results, we nonetheless used these data as the main basis for our model, paying particular attention to variations in HIV prevalence rates between subgroups in the population.

Surveys of HIV prevalence among students were conducted at the University of Durban-Westville (now part of the University of Kwazulu-Natal) and the Rand Afrikaans University (RAU) in 1999 and 2001 respectively. The UDW prevalence estimate was surprisingly high (26 and 12 percent amongst female and male students respectively) (Stremlau and Nkosi, 2001), while the RAU estimate was surprisingly low (1.1 percent) (Alexander and Ichharam, 2002). The survey response rate in the RAU study was relatively low. A total of 1,217 students from a population of 14,679 volunteered to participate in the study. Test results were obtained for 1,188 students. This represents 8.1 percent of the total student population (Ichharam and Martin, 2002) and suggests that those tested may represent atypical subgroups of the student population. Hence, this particular result is unlikely to be applicable to UFS.

Surveys of HIV prevalence amongst several employee populations, moreover, have reflected large variations in HIV prevalence rates between different populations. For example, Rosen *et al*. (2004) report HIV prevalence rates in six employee populations, stratified by job grade. The average HIV prevalence rates ranged from 7.9 percent (for a company in the utility sector) to 29 percent (for a company in the agri-business sector). Rosen *et al*. (2004) also show that HIV prevalence varies widely between job categories. For example, HIV prevalence rates amongst unskilled workers ranged from 12.4 to 39.4 percent, for skilled workers from 2.5 to 39.5 percent, and for supervisors and managers from 2.3 to 14.3 percent (Rosen *et al*., 2004). Unfortunately for our purposes, none of these surveys included staff from tertiary education institutions, but the results do provide a perspective on how realistic our own estimates are.

The Actuarial Society of Southern Africa (ASSA) model of HIV prevalence and incidence among the entire South African population is widely used. Another ASSA model has been developed specifically for workforce populations (ASSA, 2003). This model allows users to enter data on the numbers of employees, stratified by sex and job category, for each year of age. Based on several assumptions about the HIV prevalence and incidence for each sex and job category and year of age, it provides a weighted estimate of HIV prevalence in the overall population over time. Despite the sophistication of this model, with mortality and HIV prevalence finely stratified by sex and year of age, it has a key limitation of not taking population group into account. This is explicitly motivated by the assumption that population group is not useful when age, sex and job category are known. This assumption however conflicts with the results of the Nelson Mandela/HSRC prevalence survey, which shows population group to be strongly associated with HIV prevalence, independently of other social, economic and demographic variables (Sishana and Simbayi, 2002). This is especially a problem when applying the model to the UFS staff population, which is predominantly white, in contrast to other workforce populations that are mainly African. It is possible, however, to change the assumptions in epidemiological models about the relative risk of HIV infection in different job strata, which, if these were known, would be adequate. However, these relative risks are not known for the UFS population, so we instead were forced to make use of one the most powerful socio-economic variables in post-apartheid South Africa, namely population group. We thus decided not to use the ASSA model for our primary analysis, but rather to use it as a secondary sensitivity analysis with which to compare the results from our own baseline epidemiological model.

Incidence and prevalence of HIV, AIDS, and deaths due to AIDS:

Valid and reliable estimates of morbidity and mortality due to HIV/AIDS in South African subpopulations are even more elusive than prevalence estimates. This is mainly because, with routinely collected data, AIDS is often not stated or known to be the underlying cause of illness or death, and because, with special surveys, very large sample size with high follow-up rates are necessary. Estimates of HIV incidence in South Africa have tended to rely on backward calculation using epidemiological models, with incidence rates imputed to match observed trends in prevalence. Mortality estimates have been estimated by comparing the age and sex distribution of death between the present and the pre-AIDS era. Thus increased deaths rates between the ages of about 15 to 40 are attributed to AIDS as the most likely cause (Dorrington *et al*., 2001). This is not useful for smaller populations with insufficient deaths to allow adequate precision.

The natural history of HIV/AIDS progression in African populations is, however, now relatively well understood, so it is possible to estimate the numbers infected with HIV who will develop clinical AIDS and die each year. The ASSA workforce model, mentioned above, incorporates estimates of AIDS incidence, AIDS mortality, and non-AIDS mortality, and so projects numbers of cases of AIDS and deaths over time. Our reservations about the prevalence assumptions employed in this model also affect the incidence and mortality projection, which follows from the prevalence estimates. We have consequently used our own model to forecast numbers of new AIDS cases and deaths.

The main aim of the epidemiological analysis was to estimate the prevalence of HIV, and the incidence of HIV infections, AIDS cases and AIDS deaths, among UFS staff and students from 2004-2013. We also aimed to assess the likely impact of HIV/AIDS on the numbers of school-leavers eligible to enter UFS over this period. As such, the epidemiological analysis consisted of three parts:

- an estimate of the numbers of school-leavers eligible to apply for admission to UFS (i.e. having a university exemption pass) over time
- an estimate of HIV prevalence among staff and students at the Bloemfontein and Qwaqwa campuses of UFS
- an estimate of the numbers of staff and students with HIV, developing AIDS and dying from AIDS over ten years at the Bloemfontein and Qwaqwa campuses of UFS

In addition, we conducted sensitivity analyses of the staff and student models. For this purpose, we employed the ASSA provincial and workforce models. We compared the results of the primary analyses with the results we would have obtained using different models and assumptions. We now proceed to discuss in more detail the methods employed in achieving each of the objectives of the epidemiological analysis.

(a) School-leaver model

We estimated the numbers of Free State high school pupils who would matriculate with university exemption passes over the period 2003 to 2014, and who would thus be eligible to apply to study at UFS in the following year. The numbers represented for a specific year in the model, represent the number of school-leavers eligible to apply to study at UFS in the same year. In other words, the estimate reflects the estimated number of school-leavers from the previous year. These numbers were estimated based on the numbers of pupils enrolled at South African schools in 2002, and on the assumptions tabulated below.

Table 1: Assumptions of the school-leaver model

- Actual learner enrolments by grade in the Free State province and other provinces in South Africa in 2002
- Average attrition rates (drop-outs minus repeats) in the Free Sate province and other provinces in South Africa for grades 1-12, calculated based on actual enrolment figures for the period 1993-2002 as five-year moving averages
- HIV prevalence from HSRC 2002 survey:
    - 5.6 percent for ages 2-14 years overall, being higher in higher grades because of repeats being older. Same prevalence for males and females
    - 9.3 percent for age >14 years overall, increasing with age, and higher for females than males (prevalence in males increasing with age from 6-7 percent and in females from 8-15 percent). Note that for 15-14 year olds the Free State prevalence is similar to national figures.
- Age-specific HIV prevalence will stay about the same over the next 10 years
- Mortality rate in people with HIV = 7 percent per year (equivalent to 10 years median survival)
- Mortality rate in learners without HIV = 0.1 percent per year
- University exemption pass rate in grade 12 = 14 percent in the Free State and 15 percent in the rest of South Africa (Strauss *et al*., 2001)

Our first model included only school-leavers from the Free State province. This model was then extended to include school-leavers from all other South African provinces, using the same assumptions about progression through school, and HIV incidence and mortality. The numbers of non-Free State school-leavers were then combined with Free State numbers. It did not make sense simply to add these Free State and non-Free State numbers, as non-Free State school-leavers are much less likely to enter UFS. Therefore, non-Free State numbers of matriculation exemptions were weighted by 3.4%. This was based on the observation that, in 2003, 62.3% of UFS undergraduates were from the Free State province, and 30% percent were from other provinces (7.7% were from other countries). In turn, 6.6% of all grade 12 pupils on average were from the Free State and 93.4% were from other provinces over the period 1993-2002. The relative risk of going to UFS for a non-Free Free State scholar compared with a Free State scholar was therefore calculated as follows: (30/93.4) / (62.3/6.6) = 3.4 percent.

(b) Staff and student models

To describe the numbers of people, and the age, sex and population group distributions of academic and support services staff, and of undergraduate and postgraduate students at Bloemfontein and Qwaqwa in 2003, we obtained detailed information regarding the current staff employed and students enrolled at UFS. We constructed a spreadsheet for each staff and student group, with a row for each year of age and columns for each population group/sex combination. The information for staff members was stratified according to the following four employment categories: academic staff ('academic'), highly skilled support services personnel ('mx'), skilled support services personnel ('administrative'), and unskilled support services personnel ('unskilled'). These four staff categories were also employed as stratification criteria in the costing analysis (see elsewhere). Employees listed in the database of current personnel (temporary and permanent) were assigned to these four categories of employees on the basis of their salary and/or position. The 'academic staff' category includes all personnel employed as junior lecturers or researchers up to the level of dean. The 'highly skilled support services staff' category includes employees employed as assistant directors, deputy directors or directors, as well as deans and the rectorate. The 'skilled support services staff' category includes employees employed at senior administrative assistants, administrative officers, senior administrative officers or chief administrative officers. Lastly, the 'unskilled support services staff' category includes employees designated as labourers, office assistants or administrative assistants. We entered the numbers of students in each category, calculated from the detailed database of student details, and the corresponding HIV prevalence extrapolated from the 2002 HSRC prevalence survey in our model (Sishana and Simbayi, 2002). These extrapolations were based on the assumptions about HIV prevalence detailed in the following table.

Table 2: Assumptions of the baseline staff and student epidemiological models

Staff model:

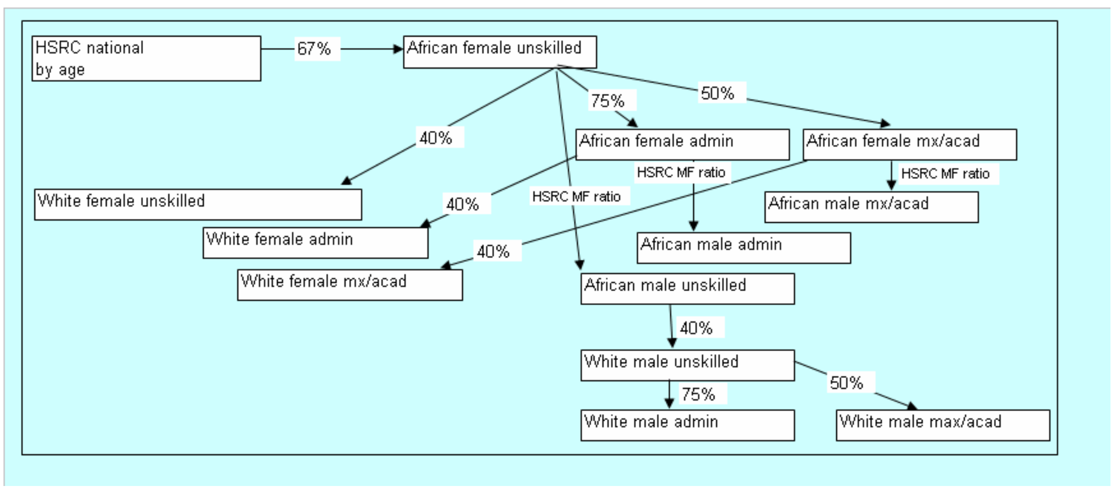
- Staff numbers exclude contracted out services workers and Department of Health employees, but include all temporary and permanent employees from all four population groups.
- Among African women support staff, age distribution is as in HSRC 2002 survey. Among African support staff, prevalence as for students, i.e. 1/3 less than all Africans because income "enough for a few extras" [10 versus 15 percent] but more because they have matric [21 percent versus 9, 13 and 17 percent].
- Among African academic and senior managerial staff, prevalence=50 percent of unskilled staff of same sex (10 percent with tertiary education versus 21 percent with matric and 17 percent with high school education).
- African male:female ratio for academic and support staff as in HSRC survey.
- For White, Asian and Coloured staff, prevalence 40 percent of combined males and females for Africans, with equal male and female prevalence rates at each year of age.

Student model:

- HIV in African females: from HSRC 5-year age bands, smoothed by year to give same average for each band; multiplied by 2/3 to account for higher education (1/3 lower if tertiary education, but highest with matric) and income (1/3 lower if income leaves 'some money for extras').
- HIV in African males: ratio M:F from M:F ratios for both sexes in 5 year bands.
- Whites, Asians and Coloureds: M=F; same age distribution as African males and females combined (assuming equal numbers of males and females); prevalence among whites or coloureds = 40 percent of prevalence in Africans; prevalence in Indians = 10 percent of prevalence in Africans.

As shown in Figure 1, we started by assuming that the age distribution of HIV prevalence among unskilled African female employees was as reported in the HSRC survey (Sishana and Simbayi, 2002). These figures were reduced by a third because they presumably "have enough for basic necessities" – which the HSRC survey found to be associated with a 33 percent lower prevalence. Prevalence rates for unskilled African males at each age were then calculated from the male:female prevalence ratios reported at each age. We then calculated prevalence rates for African academic staff as 50 percent of the HIV prevalence for unskilled staff, in keeping with the HSRC survey finding that having a tertiary education was associated with a 50 percent lower prevalence than having a high school education (Sishana and Simbayi, 2002). Administrative staff were assumed to have prevalence rates half way between those of unskilled and academic staff, that is, 75 percent of the prevalence among unskilled staff. Prevalence rates for White, Asian and Coloured staff were then calculated as 40 percent of the rates for Africans, again in keeping with the HSRC survey as far as the ratio between the HIV prevalence for Africans and Whites is concerned (Sishana and Simbayi, 2002). (We thus assume that HIV prevalence will be similar amongst White, Asian and Coloured staff.) However, in the absence of evidence to the contrary, we assumed that non-African males and females would have equal prevalence rates at each age. The following figure illustrates how prevalence rates were calculated.

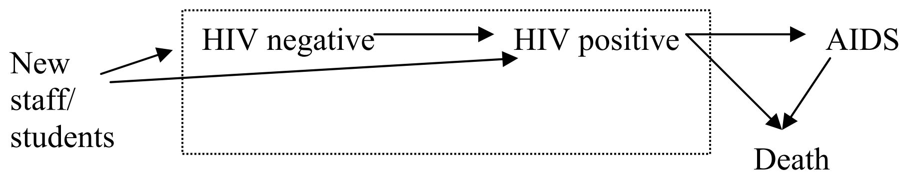
Figure 1: Assumptions regarding HIV prevalence per staff category



To estimate HIV prevalence rates among students, we first calculated rates for African women at each age. We assumed that these prevalence rates were 2/3 of the rates for African women in the HSRC survey, which found that having a tertiary education, or having 'enough money for some extras', was associated with a 1/3 lower prevalence (Sishana and Simbayi, 2002). For Africans, we assumed that the male:female prevalence ratios were the same as in the HSRC survey. For White, Asian and Coloured students we assumed that males and females had the same HIV prevalence rates at each age, there being an absence of evidence to the contrary.

For each of the staff and student groups, we then constructed Markov models to estimate the numbers of people without HIV, with HIV but not yet with clinical AIDS, and who died due to AIDS or other causes of death, for each of the following 10 years until 2013. We assumed that staff who developed clinical AIDS or died would be replaced in the workforce by persons with similar HIV prevalence. The possible states in the model are reported in Figure 2.

Figure 2: States in Markov model



These models assumed the following annual transition probabilities, from HIV negative to HIV positive to AIDS and finally to death (Table 3). These transition probabilities are based on published evidence from HIV cohorts elsewhere in Africa. They assume that transition probabilities are steady over time, and do not take account of the distributions of people with recent or long-standing HIV infection. They also assume that these processes are not reversed or delayed, which is generally true without antiretroviral or preventive antibiotic treatment. Triple antiretroviral therapy is estimated to reduce mortality rates by about 70 percent (Jordan *et al*., 2002).

For simplicity we assumed that the annual HIV incidence would be 1.5 percent per year in all groups. This figure is derived from the ASSA workforce model. The probabilities of developing AIDS, and of dying if one has AIDS, were based on African cohort studies. The probability of dying without AIDS was derived from the ASSA workforce model, taking the average non-AIDS death rate for males and females aged between 20 and 50 years.

Table 3: Assumptions regarding annual transition probabilities

To: state during next cycle	From: state during current cycle HIV-	HIV+	AIDS
HIV negative	0.981	0	0
HIV positive	0.015[a]	0.915	0
People with AIDS	0	0.075[b]	0.400
Deaths	0.004[c]	0.010	0.600[d]
Total	1.000	1.000	1.000

Notes: (a) We also employed a 1 and 2 percent annual incidence rate in our sensitivity analyses, (b) median 8.9 years delay assumed, (c) ASSA NewSelect average for workforce without HIV, age 20-50 years, male and female combined, (d) equivalent to 8 months median survival with clinical AIDS (Morgan *et al*., 2002).

For staff, we assumed that employees who developed AIDS or who died were replaced in the model by employees with similar HIV prevalence rates as current UFS staff of the same staff category, age, sex, and population group. For students, we also assumed that first year undergraduate or postgraduate students who developed AIDS or died were replaced in the model by students with similar HIV prevalence rates as current UFS students of the same age, sex and population group. Thus, we assumed that students in later years of study could not be replaced with post-first year students from other universities.

(c) Sensitivity analyses

We compared the results from the base model, which employed the above methods and assumptions, with the results obtained from two models of the Actuarial Society of South Africa (ASSA, 2003):

Firstly, the ***Provincial ASSA model*** is based on the whole Free State provincial population, taking into account age and sex but not population group, education or job grade. It projects HIV prevalence and incidence rates over time for the whole population. We used this model's age and sex stratified prevalence rates, weighted by the age and sex distribution of the UFS staff and student populations. We also used this model's range of HIV incidence rates for the whole Free State population (2.3 percent in 2004 to 1.6 percent in 2013). As in the basic model, we assumed that all who contract AIDS would leave, and that all who died or left were replaced by new staff without AIDS, and with the same HIV prevalence as staff in 2003. In keeping with the demography of the Free State population, this model is heavily weighted by low income Africans, and would thus be expected to produce higher prevalence rates than our base model.

Table 4: Staff categories in UFS and ASSA workforce models

ASSA NewSelect model	UFS model
1. Unskilled (equivalent to single sex hostel residents)	None comparable
2. Semi-skilled	Unskilled (presumed not to be in single sex hostels), administrative and technical assistant
3. Skilled	Lecturer, administrative or technical officer
4. Middle management	Senior lecturer, associate professor, assistant director
5. Senior management	Dean, professor, director, rectorate

Secondly, we employed the ***ASSA NewSelect model for workforce populations***, which takes into account the age, sex and job grade distribution of a given population, and projects HIV, AIDS, deaths and disabilities, in our sensitivity analysis. We assumed that those who left or died were replaced and that the age, sex and job grade distribution of the employee population would not change. As the job grades used in the ASSA model were not directly comparable to the UFS staff categories employed in our analysis, we assumed certain correspondences between staff grades in the two models (Table 4).

3.2 Costing analysis

In the following pages, we elaborate on the methods employed in estimating the financial impact on UFS of incident HIV infections and AIDS cases and deaths amongst staff and students respectively.

(a) Staff costs

In a number of recent papers, Rosen *et al*. (2003/04) present some calculations of the cost to companies of HIV/AIDS and future benefits to firms of becoming involved in combating HIV/AIDS. However, the assumptions on which their calculations are based, were derived from studies conducted in other countries (i.e. Malawi and Botswana) or from case studies of select South African companies. These assumptions are not necessarily equally applicable to other organisations. One needs therefore to conduct an in-depth study to put an accurate value on the costs of HIV/AIDS to UFS. We did just that. These estimates and projections do moreover, where necessary and possible, allow for different scenarios of the possible future impact of HIV/AIDS on the organisation. Furthermore, we approach a costing perspective similar to that employed in the larger literature on the impact of HIV/AIDS on companies (Morris *et al*., 2000; Booysen and Molelekoa, 2002; Ambert, 2002; Rosen *et al*., 2003/04), namely a ‘provider’ or in this case an ‘employer’ perspective, with the emphasis on estimating the costs incurred by the employer or company. Thus, we do not include in our costing analysis, as is normal in cost-effectiveness analysis, the costs incurred by the patient and society at large. Yet, we provide suggestions in the text as to how the inclusion of some of these costs in the analysis would most likely affect the results.

With a view to enabling management to make informed decisions about the impact of HIV/AIDS on UFS and the management of this problem, we, based on the results of the epidemiological analysis, and using an adjusted version of the costing model developed by Rosen *et al*. (2003/04)

- estimated the net present value of the future cost of HIV/AIDS to UFS over the next ten years, distinguishing between aggregate cost, cost per incident HIV infection, and cost as percentage of annual wages/salaries and annual operating expenses
- determined the main components of HIV/AIDS-related costs
- compared the net present value of these HIV/AIDS-related costs with the net present value of the cost of different prevention and treatment interventions with a view to identifying the returns on interventions which can be implemented so as to mitigate the impact of HIV/AIDS on UFS, individual employees and the student body at large.

We collected a range of baseline information to inform the assumptions employed in the costing model. This information, amongst others, included the following:

- the current student fee structure and government subsidies
- the number of employees employed by UFS
- the composition of the workforce (by age, sex, population group and skill level)
- the total monthly or annual wage/salary bill of UFS
- the average annual turnover of UFS over the past five years
- the nature of pension and employee benefits accruing to UFS employees that are medically retired or that die whilst in service of the employer
- details about other employee benefits related to HIV/AIDS deaths (e.g. sick leave and funeral leave and expenses)
- details on in-house health care services and support services related to HIV/AIDS provided by the university to both students and staff
- details about the resources (personnel time and/or costs) employers currently allocate to HIV/AIDS care and programmes accessed by staff and students
- the cost of recruiting and training new employees

It was also necessary to collect certain data on employees who had died during the recent past while in service of UFS or who had taken medical retirement. Morris *et al*. (2000) employed a similar methodology in their study of the impact of HIV/AIDS on a South African sugar mill, as did Rosen *et al*. (2003/04). This information is required to estimate certain components of the cost of HIV/AIDS to employers, particularly the cost of absenteeism and the impact of HIV/AIDS on productivity. For this purpose, we obtained a list of those employees at UFS who died in service or who were medically retired during the past six years (n=119). In order to get to the likely impact of HIV/AIDS in particular, which mainly affects adults, we sampled from this list those employees who were younger than 50 years at death or medical retirement and who in the last year prior to death or retirement had taken sick leave (n=34). Of these persons, 65 percent died in service, whilst 35 percent were retired medically. We then proceeded in the following manner:

Firstly, we obtained from the human resources department the data as to how many days of sick leave and normal leave these persons took during the two years preceding death or retirement. These data were employed to inform our assumptions regarding the mean or median number of days of sick leave and normal leave which HIV/AIDS-affected employees will take in the 24 months preceding death or retirement (see elsewhere the detail on the assumptions included in the costing analyses).

Secondly, after identifying those persons who were the direct supervisors of these employees at the time, we conducted telephonic interviews and or administered self-administered questionnaires to gather information regarding the productivity impacts of the epidemic. In order to keep the identified employees from being stigmatised as being HIV/AIDS-positive, the purpose of the survey was explained to respondents as being a study aimed at assessing the impact of ill health on staff productivity. We managed to collect information for 76 percent (26) of the 34 employees of whom 4 employees (15 percent of the sample) were not known to and/or could not be remembered by the supervisor, which translates into a non-response rate of 24 percent. A copy of the research instrument employed for this purpose, which was also employed by Rosen *et al*. (2003/04) for this same purpose, but was also translated into Afrikaans for the purpose of our study, is included in Appendix B to this report. The instrument includes, amongst others, questions regarding the productivity of the person, the section/department where they were employed, as well as the productivity of the person who replaced the deceased employee or retiree. The analysis of the responses to these questionnaires informed our assumptions regarding the productivity impacts of the epidemic on the employees of UFS (see elsewhere the detail on the assumptions included in the costing analyses). Given the relatively small sample size (n=22), it was not possible to analyse the data across the four categories of employees identified in our epidemiological and costing analyses (two categories included fewer than five persons). Consequently we adopted the same assumptions for all four categories of employees.

The Rosen *et al*. (2004: 318) costing model, which we adjusted slightly for the purposes of our analysis, employs the above data to 'estimate the [net] present value [NPV] of the cost of incident, not prevalent, HIV infections', based on the results of the epidemiological analysis. There are two benefits in adopting this particular approach. *Firstly*, employers will only experience the impact of the costs of the epidemic 5-10 years following a new infection, given the long latency period between HIV infection and AIDS. Thus, the analysis presents an estimate of what an HIV infection which occurs today will eventually cost the employer. *Secondly*, such an approach allows one to compare this liability of future costs with the cost of current interventions which can keep persons from being infected by HIV to start with or which can prolong their productive lives, thus translating into profitable investments (Rosen *et al*., 2004).

As mentioned above, the estimated number of new HIV infections, new AIDS cases and AIDS deaths per staff category are employed in the costing analysis. The staff categories are the same four employed in the baseline epidemiological analysis. For the purpose of the costing analysis, however, and to fit with the format of the model of Rosen *et al*. (2004), the four staff categories were further disaggregated by sex (male versus female), population group (African versus non-African), and age (under 35 years, 35-49 years, 50 years plus), which resulted in the cost analysis being conducted across twelve clusters of employees per staff category. We employed the same Markov model described elsewhere in these pages to estimate the HIV prevalence, HIV incidence, and AIDS incidence estimates required as input into the Rosen *et al*.'s (2004) costing model.

Table 5: Assumptions in baseline staff costing model

Staff category	Academic staff	Unskilled support staff	Skilled support staff	Highly skilled support staff
A. HIV/AIDS parameters				
1. Number of years between HIV infection and death or ill-health retirement	9.0	9.0	9.0	9.0
2. Discrete mortality rate used in model (%)	7.5	7.5	7.5	7.5
3. Percentage of AIDS cases that end in death in service	65	65	65	65
4. Percentage of AIDS cases that end in ill-health retirement	35	35	35	35
B. Financial parameters				
1. Discount rate (real)(%)	5.2	5.2	5.2	5.2
2. Mortality adjustment factor	0.840	0.840	0.840	0.840
3. Annual inflation rate (%)	0	0	0	0
4. Annual increase in salary (nominal, %)	0	0	0	0
C. Productivity parameters				
1. Wage multiplier	1.6	1.33	1.33	1.6
2. Sick days 0-365 days before death in service (days)	29.5	29.5	29.5	29.5
3. Sick days in 366-730 days before death in service (days)	10.5	10.5	10.5	10.5
4. Sick days in 0-365 days before ill-health retirement (days)	69.0	69.0	69.0	69.0
5. Sick days 365-730 days before ill-health retirement (days)	12.0	12.0	12.0	12.0
6. Average sick days taken per year (whole workforce) (days)	3.6	3.6	3.6	3.6
7. Average other leave days taken per year (whole workforce) (days)	10.9	10.9	10.9	10.9
8. Productivity loss (% on days present in last 0-365 days)	33.3	33.3	33.3	33.3
9. Productivity loss (% on days present in last 366-730 days)	40.0	40.0	40.0	40.0
10. Supervisor's time required in last year of service (days)	2	2	2	2
11. Workdays per month (days)	21.67	21.67	21.67	21.67

Staff category	Academic staff	Unskilled support staff	Skilled support staff	Highly skilled support staff
D. Medical care parameters				
1. Medical aid benefit ceiling for HIV/AIDS treatment (Rand)	30,000	30,000	30,000	30,000
2. Share of medical aid premium paid by company (%)	66.7	66.7	66.7	66.7
3. Administrative overhead on medical aid benefits (% of claims)	20.4	20.4	20.4	20.4
E. End of service benefits parameters				
1. Probability that employee is in medical aid scheme	Proportion of employees in each category appointed permanently	Proportion of employees in each category appointed permanently	Proportion of employees in each category appointed permanently	Proportion of employees in each category appointed permanently
2. Probability that employee is in pension or provident fund	Proportion of employees in each category appointed permanently	Proportion of employees in each category appointed permanently	Proportion of employees in each category appointed permanently	Proportion of employees in each category appointed permanently
3. Probability of belonging to pension or provident fund or group life insurance scheme	0.64 pension fund; 0.35 provident fund; 1.00 group life insurance scheme	0.64 pension fund; 0.35 provident fund; 0.00 group life insurance scheme	0.64 pension fund; 0.35 provident fund; 1.00 group life insurance scheme	0.64 pension fund; 0.35 provident fund; 1.00 group life insurance scheme
4. Risk benefit due upon death in service (multiple of salary)	2x pension fund; 4x provident fund; 4x group life insurance	2x pension fund; 4x provident fund; 4x group life insurance	2x pension fund; 4x provident fund; 4x group life insurance	2x pension fund; 4x provident fund; 4x group life insurance

Staff category	Academic staff	Unskilled support staff	Skilled support staff	Highly skilled support staff
5. Risk benefit due upon ill-health retirement (% of salary)	82.5% pension fund; 100% provident fund; 1.6x salary group life insurance	82.5% pension fund; 100% provident fund; 1.6x salary group life insurance	82.5% pension fund; 100% provident fund; 1.6x salary group life insurance	82.5% pension fund; 100% provident fund; 1.6x salary group life insurance
6. Share of risk benefits paid by company	0.5	0.5	0.5	0.5
7. Administrative overhead on risk benefits (% of claims)	10.9% pension fund; 15.6% provident fund	10.9% pension fund; 15.6% provident fund	10.9% pension fund; 15.6% provident fund	10.9% pension fund; 15.6% provident fund
8. Funeral benefit (lump sum)(Rand)	3,000	3,000	3,000	3,000
9. Share of funeral benefit paid by company	0.5	0.5	0.5	0.5
10. Group life benefit upon death in service (multiple of salary)	4	4	4	4
11. Share of group life benefit paid by company	0.5	0.5	0.5	0.5
12. Normal retirement age	65	65	65	65
F. Recruiting parameters				
1. Percentage of new hires who are internal (%)	100	100	100	100
2. Percentage of new hires who are external (%)	0	0	0	0
3. Direct cost of recruitment per internal hire (Rand)	6,031.53	603.15	6,031.53	6,031.53
4. Direct cost of recruitment per external hire (Rand)	18,094.59	1,809.46	18,094.59	18,094.59
5. Time required/hire from non-recruiting staff in next band up (days)	3	1	2	3
6. Time positions are vacant (months)	2	0	1	2
G. Training parameters				
1. Direct cost of training per internal hire (Rand)	1,725	453	891	1,621
2. Direct cost of training per external hire (Rand)	1,725	453	891	1,621
3. Trainer's time per new employee (days)	1	1	1	1
4. Trainer's salary per day (Rand)	350	350	350	350

Staff category	Academic staff	Unskilled support staff	Skilled support staff	Highly skilled support staff
5. Time spent in orientation or induction training (days)	1	1	1	1
6. Time spent in training courses (days)	3	3	3	3
7. Time required for internal hire to reach full productivity (months)	6	0.5	3	6
8. Time required for external hire to reach full productivity (months)	6	0.5	3	6
9. Productivity during start-up period for internal hire (%)	62.5	62.5	62.5	62.5
10. Productivity during start-up period for external hire (%)	62.5	62.5	62.5	62.5

Sources and other notes: Most assumptions were derived from in-house documents and data obtained from the human resources and finance departments of UFS. **B1:** The discount rate of 5.2% represents the average real interest rate for South Africa. **B2:** Cost estimates were adjusted by the mortality adjustment factor (MAF), given that the distribution of mortality around the assumed survival period (8.9 years) is normally skewed to the right and that discounting consequently results in an over-weighting (under-weighting) of the costs for those persons that die earlier (later). **C1:** The wage multipliers exceed one, because we assume, as do Rosen *et al*. (2004: 322), that the perfect substitution of absent workers is not possible and that the absence of employees results in other factors of production being used less efficiently. We furthermore assume that these effects are greater at higher levels of skill, hence the higher wage multipliers assumed for academic and highly skilled support staff. **C2-7:** These assumptions, as explained in the text, were derived from documents detailing official leave policy and/or the leave records of all employees and employees aged 15-49 years that died in service or took medical retirement in the past six years. **C8-9, F5-6, G7-10:** These assumptions, as explained in the text, were derived from the information obtained from the supervisors of employees aged 15-49 years who died in service or took medical retirement in the past six years. **D3:** Derived from information on administrative overheads and total value of claims reported for medical aid to which UFS employees belong (Council for Medical Schemes, 2004). **E7:** Calculated by dividing the administrative expenditure by the total value of claims against the UFS pension and provident funds, as reported in the latest annual reports of these funds. **F3-4:** Derived from data on the total expenditure over the past five years on advertisements, accommodation and travel expenses, and other expenses associated with recruitment, as well as the average number of new employees appointed in the past five years. We assumed the recruitment cost of unskilled staff to be a tenth of that for skilled and highly skilled staff. **G1-2:** Derived from the average skills levy (in Rand) deducted from the salary of employees at different post levels.

In the costing model, the data and information described above were employed to estimate the various unit costs and total average cost per incident HIV infection in each staff category, assuming that HIV-positive employees remain in the workforce until they either die or take medical retirement. In calculating the various unit costs, a distinction is drawn between so-called direct and indirect costs associated with the HIV/AIDS epidemic. Direct costs include the cost of retirement benefits, death and disability benefits (which include funeral costs), medical care, and the recruitment and training of a replacement. Indirect costs include the cost of absenteeism, loss of productivity while at work, supervisor time, vacancy and the loss of productivity associated with a replacement employee having to learn the ropes (Rosen *et al*., 2003/04).

The assumptions employed in the baseline model are described in detail in Table 5. The same assumptions were employed in estimating the costs for the Bloemfontein and Qwaqwa campuses of UFS. The proportion of staff that is members of the medical aid fund and the pension/provident fund was calculated separately for the Bloemfontein and Qwaqwa campuses. The proportion of staff at each campus employed as permanent staff was employed in the model as assumption regarding coverage of these employee benefits. The mean salary for each cluster of employees was derived from the salary data provided to us by the human resources department. These mean salaries were used to estimate those costs calculated in respect of the annual or daily salary of employees or their supervisors (see Table 5). (In our sensitivity analysis, as explained elsewhere, we also employed median salaries.) Given that the Qwaqwa campus has now been officially integrated with the Bloemfontein main campus following negotiations about adjustments in salaries to be implemented over the next three years, we employed the mean salaries for Bloemfontein campus staff in the Qwaqwa model. The average cost per HIV infection calculated in this manner was also expressed as a multiple of mean salary in order to have an indication of the relative magnitude of the cost of HIV/AIDS at different job levels.

In addition, we calculated the aggregate cost of HIV/AIDS, by staff category and in total, by multiplying the average cost per infection by the estimated number of incident HIV infections per year. The aggregate cost per staff category was then expressed as a percentage of the annual salary bill, whereas the total aggregate cost across staff categories was expressed as a percentage of the total annual salary bill and annual operating expenses. These cost estimates, however, are driven entirely by the assumptions in the costing model. To this end, it is worth noting that the costs included in this model, as well as in a number of similar company studies by the likes of Morris *et al*. (2000), Booysen and Molelekoa (2002), Ambert (2002), and Rosen *et al*. (2003/04), generally only succeed in quantifying some of the direct costs and indirect costs, whilst excluding some of the indirect, systemic costs of the HIV/AIDS epidemic. (The same can be said about the assumptions on productivity estimates derived from the results of the supervisor interviews. Ideally, one would want to capture these productivity impacts in more concrete terms, but in the absence of a prospective research design and detailed information on work performance, this was not possible.) Not being able to value all costs associated with HIV/AIDS, thus implies that the cost of HIV/AIDS to employers reported in these pages and in other studies may in fact be underestimated. It is for this reason, and based upon the relatively conservative assumptions employed in our costing model (see Table 5), that we believe that the results for our baseline costing model err on the safe side. The sensitivity analysis, however, illustrates the extremely wide range of cost estimates obtained when alternative assumptions are employed in the costing model.

Following our estimation of the cost of HIV/AIDS, we estimated the returns on interventions pertaining to treatment and prevention. In the case of treatment, we assumed that anti-retroviral therapy costs R3,500 per annum, based on the reported cost of triple-drug therapy in developing countries having fallen to less than US$500 per patient per year (Rosen *et al*., 2003). We estimated the return on treatment for each staff category under the assumptions that treatment would extend the productive life of employees by one, three, five, or seven years. The savings were calculated by subtracting the sum of the present value of the cost of providing treatment for the assumed number of years (e.g. if we assume treatment extends life by three years, UFS will need to provide treatment for a total of five years: the two years the person would have had AIDS without treatment plus the additional three years) and the present value of the cost per infection discounted over the additional life years saved (e.g. in this case, the cost per infection is discounted over an additional three years since these costs will only be incurred three years later) from the present value per infection assuming no treatment (in other words, the results of the model described above). The return on treatment was then calculated as savings expressed as a percentage of cost per infection as estimated at baseline.

Geffen (2002), however, argues that the cheapest triple-combination HAART regimen available in South Africa, which is not always a medically appropriate prescription for patients, costs around R684 per month, which translates into an annual cost of treatment of R8,208. The Free State Department of Health, moreover, budgets for the drugs provided in the public sector ARV programme at R500 per patient per month, which amounts to R6,000 per patient per annum. Furthermore, these costs include only drug costs and exclude the costs, amongst others, of laboratory tests and of monitoring patients, not to mention the indirect costs incurred by patients in accessing treatment. In this sense, our estimates of the returns on treatment may be upwardly biased, given that the cost of treatment is underestimated. Then again, for reasons explained above, the cost per infection may be underestimated. This means that treatment may still be a viable option for companies if the true cost of HIV/AIDS to employers is employed as grounds for a decision on providing treatment in the workplace or not. Furthermore, this approach to calculating the returns on treatment may in fact be defendable if the goal be to inform the employer whether the provision of treatment is economically justifiable, given that the employer may in actual fact only incur the drug costs, leaving the patient and/or provider to incur the other costs related to treatment. If our goal of course had been to estimate the cost-effectiveness of treatment from a provider or societal perspective, which it is not, one would have had to approach such analysis in a completely different manner.

Another possible criticism to our attempts at estimating the return on treatment would of course be the point that the South African government in 2003 decided to make anti-retroviral therapy available in the public sector free of charge. This may cause the reader to argue that our analysis aimed at estimating the returns on treatment is not relevant, given that employers such as UFS can leave the provision of treatment up to government. However, as Rosen (2004) argues, there are good reasons why employers may want to secure treatment for its employees now, rather than wait for government. For the following reasons, infected UFS employees may succumb to the disease without having received public sector ARV treatment, thus translating into a ‘loss’ of the savings to UFS of providing treatment to its employees:

- Treatment will not immediately be available at all public health care facilities. As a result, UFS employees may not live close enough to a public sector treatment facility to access treatment.
- The roll-out plan envisages that treatment will be provided to a certain number of patients only, with this number increasing as the roll-out progresses, but which means that not everyone coming forward for treatment will receive treatment immediately, a problem which is being exacerbated by the ongoing delays in rolling out the current public sector ARV programme.
- The time required for employees to access public ARV treatment may in itself result in lower productivity, while the need to take leave to access treatment may compromise individual confidentiality.
- The company will have no direct involvement in the programme and can therefore do little to ensure high uptake and reliable delivery of treatment services.

For these reasons, it is still necessary to estimate the likely return on treatment, even if only to sell to employers the importance of encouraging employees to go for VCT to determine their HIV status and to access ARV treatment in the public or even private health care sectors.

In the case of prevention, we estimated the returns on a prevention intervention that costs R20 per employee per year. We employed this particular cost estimate, given that Rosen *et al*. (2003) report that a STD management programme implemented at South African mining companies cost in the order of US$3 per employee per year, which at the current exchange rate translates into approximately R20 per employee per year. Yet, we preferred not to describe the intervention as an STD programme *per se*, but rather to estimate the returns on a prevention intervention of similar costs, which acts as an illustration of the likely returns on interventions of this nature. The return on an intervention of this nature was calculated in the following manner: Firstly, we estimated the net present value of the cost of financing such intervention over a period of ten years. We then assumed that such intervention would aid us in averting 40 percent of HIV infections occurring at baseline and therefore of HIV/AIDS costs incurred in 2013 (baseline *plus* 10 years), which are the future costs associated with those infections occurring at baseline, assuming a median survival of nine years as we do in our costing model (see Table 5 and discussion on epidemiological analysis). The return on the intervention programme then represents these savings expressed as a percentage of the cost of the intervention. We also calculated the return on prevention interventions of similar costs if we assume that we at baseline avert one HIV infection only, which represents a more pessimistic picture of the likely success of awareness and prevention activities in averting HIV infections.

We first estimated the costs and the returns to treatment and prevention interventions in the baseline scenario. We then proceeded to conduct a wide-ranging sensitivity analysis in order to determine how changes in the costing assumptions affect our estimates of the cost to UFS of HIV/AIDS amongst staff and the estimated returns on treatment and prevention interventions. We provided a so-called ‘best case’ and ‘worst case’ costing scenario, which respectively employ those assumptions that would result in the lowest and highest estimate of costs. Essentially, the ‘best case’ (‘worst case’) costing scenario entails assuming that, compared to the baseline model…

- a smaller (larger) proportion of AIDS cases end in death in services
- infected employees take the same (more) days of sick leave prior to death or ill-health retirement
- the workforce takes more (fewer) days of sick and normal leave
- the productivity loss resulting from absenteeism is lower (greater)
- supervisors spend less (more) time managing HIV/AIDS
- the medical aid benefit ceiling for HIV/AIDS treatment is the same (higher)
- all employees are members of the pension (provident) fund
- the direct and indirect cost of recruitment and training is lower (higher)

- positions that become vacant are vacant for a shorter (longer) period of time
- new employees are more (less) productive when starting work
- new employees achieve full productivity over a shorter (longer) period of time

The detailed assumptions underlying these 'best case' and 'worst case' costing scenarios are described in Appendices D and E respectively. (Note that we, in sensitivity analysis, only varied the assumptions in the costing model and not the epidemiological assumptions. It is for this reason that we throughout the text defined these as the 'best case' and 'worst case' costing scenarios respectively.) The detail regarding the assumptions employed in this sensitivity analysis are reported together with the detailed results of the sensitivity analysis in Appendices F (Bloemfontein) and G (Qwaqwa). In addition, we also determined how the sensitivity estimates from the epidemiological analysis (those estimates based on the ASSA models) would impact on our estimates of the aggregate cost of HIV/AIDS. We discuss these implications in the text. In this case, we reported the results as those of the 'best case' costing and epidemiological scenario.

(b) Student costs

Apart from employing the Rosen *et al*. (2004) costing model to estimate the cost of HIV/AIDS to UFS in terms of its impact on employees, we also estimated the cost to UFS of the impact of the epidemic on students, in particular revenue received in the form of class fees and subsidies. The impact of HIV/AIDS in this case results from students not being able to complete their studies as a results of the psychosocial and physical difficulties in having to deal with being HIV-positive and/or living with AIDS. The focus, therefore, is on the direct impact of HIV/AIDS on students. We did not attempt also to model the indirect impact of HIV/AIDS on students' families, which may cause revenue from class fees to decline, as HIV/AIDS-affected households will not be in a position to fund the studies of their children or relatives. In situations where households are required to pay for education, as is the case with higher education both in South Africa and most developing countries, the effect on the affordability may result from the direct loss of family income due to AIDS, from the death and illness of productive members of the family, and the loss of income due to the costs of treatment, care and funeral costs (Gachuhi, 1999). However, part of this indirect impact of the epidemic on universities may be subsumed in our analysis, given that HIV infection is likely to be clustered in households. In other words, infected students are likely to come from HIV/AIDS-affected households, which may also struggle to cope and therefore not be in a position to spend much on education. Hence, our assumptions about HIV infected students and students with AIDS not being able to complete their studies, in part also reflects the wider impact of the epidemic on the families to which these students belong.

Table 6: Assumptions in baseline student costing model

A. HIV/AIDS parameters	
1. Proportion of new HIV cases not completing their studies	0.100
2. Proportion of new AIDS cases not completing their studies	0.800
3. Proportion of AIDS deaths not completing their studies	1.000
4. Proportion of affected students deregistering following enrolment	0.500
B. Student body composition parameters	
1. Proportion of undergraduate students in the humanities	0.590
2. Proportion of undergraduate students in natural sciences	0.410
3. Proportion of honours students in the humanities (natural sciences)	0.880 (0.120)
4. Proportion of masters students in the humanities (natural sciences)	0.560 (0.440)
5. Proportion doctoral students in the humanities (natural sciences)	0.490 (0.510)
6. Proportion of postgraduate students enrolled at honours level	0.420
7. Proportion of postgraduate students enrolled at master's level	0.490
8. Proportion of postgraduate students enrolled at doctoral level	0.090
9. Proportion of enrolled students completing their studies (undergraduate)	0.829
10. Proportion of enrolled students completing their studies (honours)	0.800
11. Proportion of enrolled students completing their studies (masters)	0.600
12. Proportion of enrolled students completing their studies (doctoral)	0.250
C. Government subsidy parameters	
1. Subsidy per undergraduate humanities student (Rand)	11,257
2. Subsidy per undergraduate natural science student (Rand)	30,564
3. Subsidy multiple for honours students	2.000
4. Subsidy multiple for master's students	3.000
5. Subsidy multiple for doctoral students	4.000
6. Average annual increase in subsidy (%)	0.0%
D. Class fee parameters	
1. Average annual undergraduate class fee (Rand)	7,011
2. Class fee multiple for honours students	1.374
3. Class fee multiple for masters students	1.259
4. Class fee multiple for doctoral students	1.296

Table 6: Assumptions in baseline student costing model (continued)

D. Class fee parameters (continued)	
5. Proportion of subsidy paid on completion of studies	1.000
6. Proportion of class fees paid at registration (undergraduate)	0.530
7. Proportion of class fees paid at registration (honours)	0.390
8. Proportion of class fees paid at registration (masters)	0.250
9. Proportion of class fees paid at registration (doctoral)	0.240
10. Average annual increase in class fees (%)	0.0%
11. Credit at deregistration (%)	50%
12. Cancellation fee (Rand)	720
13. Average annual increase in cancellation fee (%)	0.0%
E. Financial parameters	
1. Discount rate	5.2%
2. Mortality adjustment factor (MAF)	0.840

Sources and other notes: Most assumptions were derived from in-house documents and other data obtained from the human resources and finance departments of UFS. Importantly, these assumptions are driven by the previous policy regarding the subsidisation of universities, which has recently been replaced by a complex new policy. **A1-4:** These assumptions are not based on any empirical findings, given that no such information exists, nor can such data be obtained in the absence of knowing all past and current students' HIV status. **E1:** The discount rate of 5.2% represents the average real interest rate for South Africa. **E2:** Cost estimates were adjusted by the mortality adjustment factor (MAF), given that the distribution of mortality around the assumed survival period (8.9 years) is normally skewed to the right and that discounting consequently results in an over-weighting (under-weighting) of the costs for those persons who die earlier (later).

This estimation of the impact of HIV/AIDS on revenue is a relatively novel aspect of this study insofar as most studies of the impact of HIV/AIDS on private and public sector institutions estimate and document only the impact on employees (or in other words the cost per infection amongst employees). Though the impact of the epidemic on other aspects of business is emphasised in the general literature and in particular in macroeconomic impact studies, little empirical work has been carried out in terms of estimating these impacts of the epidemic, as they will affect specific institutions. As with employee costs, the results of the epidemiological analysis of the impact of HIV/AIDS on students were employed to inform this part of our costing analysis. We estimated the net present value of the cost to UFS of incident HIV infection and AIDS cases and deaths amongst students in terms of loss of revenue in the form of class fees and government subsidies. The assumptions employed in this part of the costing analysis are described in detail in Table 6.

As we did in the case of the analysis of the cost to UFS of HIV/AIDS amongst employees, we here estimated the returns on treatment and prevention interventions targeting students. The return on a prevention intervention for students was calculated in the following manner. Firstly, we estimated the net present value of the average annual cost of financing such intervention over a period of ten years, assuming that the intervention costs R20 per student per annum. We assumed that such intervention would aid us in averting 40 percent of the new HIV infections occurring each year and therefore 40 percent of the average annual cost of incident HIV infections. The return on the intervention programme represents these savings expressed as a percentage of the cost of the intervention programme. Given that our interest was in estimating the returns on prevention to UFS alone, we did not account for the future costs associated with HIV/AIDS which the community will save if these HIV infections are averted (e.g. costs incurred by the public or private health care sectors in treating the infected person, the costs incurred by the future employer of the infected person, and the costs incurred by government in subsidising the education of the infected persons). However, the inclusion of these savings in estimating the return on prevention efforts at institutions of tertiary education would result in an even larger return, thus providing an even more convincing argument for the private sector, government and donors to finance prevention efforts at universities.

Treatment, on the other hand, would allow us to avert the costs associated with AIDS, i.e. the revenue and class fees lost as a result of students with AIDS not completing their studies and deregistering. The average annual savings from treatment were calculated by subtracting the sum of the average annual net present value of providing treatment to all students with AIDS from the average annual net present value of the savings in the aggregate cost of HIV/AIDS. We assumed that 50 percent of students on treatment would then complete their studies and that 80 percent of AIDS deaths amongst students would be averted if treatment were provided to all students with AIDS. The average annual return on treatment was calculated by expressing these estimated average annual savings as a percentage of the net present value of the average annual cost of treatment. We also estimated the returns on treatment if we varied the percentage of AIDS deaths averted and the percentage of students on treatment who complete their studies. Although the same limitations discussed above in terms of estimating returns to treatment for students apply to our analysis of returns on treatment for students, it can also be considered prudent for the same reasons related elsewhere.

We again conducted sensitivity analysis and provided a so-called ‘best case’ and ‘worst case’ costing scenario, which respectively employed those assumptions which resulted in the lowest and the highest estimate of the cost to UFS in terms of the projected impact of HIV/AIDS on students. Essentially, the ‘best case’ (‘worst case’) costing scenario entails assuming that, compared to the baseline model…

- fewer (more) students affected by HIV/AIDS fail to continue and complete their studies
- the student body includes fewer (more) students in the Natural Sciences
- enrolments at post-graduate level are biased towards honours-level (doctoral) studies
- a smaller (greater) proportion of students complete their studies
- the government subsidy of students enrolled at universities decline (increase)
- class fees are lower (higher)
- a smaller (the same) proportion of the government subsidy is paid when students graduate or in other words complete their studies
- students pay a larger (smaller) proportion of their class fees at registration
- a smaller (the same) proportion of class fees is refunded on deregistration
- the fee for cancellation of registration increases (does not increase) over time
- the discount rate is higher (lower)

The detail regarding the specific assumptions employed in these sensitivity analyses and the results of the analysis are reported in Appendices H and I respectively. In addition, we also determined how the alternative estimates from the epidemiological analysis (those estimates based on the ASSA models) would impact on our estimates of the aggregate cost to UFS of the impact of HIV/AIDS on students. In this case, we reported the results as those of the ‘best case’ costing and epidemiological scenario.

In the final instance, we aggregated the estimated cost to UFS of the impact of HIV/AIDS on staff and students, presenting in this case the aggregate costs in the baseline scenario and the 'best case' and 'worst case' scenarios. The total costs calculated in this manner were also expressed as a percentage of total annual operating expenses. We did this in order to present a picture of the absolute and relative magnitude of the total estimated cost to UFS of HIV/AIDS.

3.3 Institutional audit

Information on current policies and strategies and the future impact of HIV/AIDS was gathered from key informants and stakeholders through focus group discussions. The guidelines developed by Barnett and Whiteside (1998) and the Health Economics and HIV/AIDS Research Division (HEARD) (2000) at the University of Natal was used for this purpose. The audit focused on five main aspects of assessments of this nature, which are detailed below.

A. Determine the internal risk profile of UFS:

- Are employees particularly susceptible to HIV infection?
- Are there areas where the illness or death of key workers will jeopardise the continued viability of the organisation?
- Are there reserve sources of the necessary skills should workers with such skills be lost due to HIV/AIDS?
- How will the changing costs of labour influence costs?
- Is the workplace HIV/AIDS programme optimal in terms of preventing new HIV infection?

B. Determine the external risk profile of UFS:

- Is university education an essential or a luxury item and is its market vulnerable to changing levels of disposable income?
- Who is the "client" and will the client profile change as the epidemic intensifies?
- Is the health and social infrastructure adequate to cope with increasing numbers of infected workers and community members?

- Is the Free State province considered to be an investment risk as a result of the HIV/AIDS epidemic?
- How will the effects of the HIV/AIDS epidemic on the country's economy in general affect the organisation?

C. Assess current management strategies regarding HIV/AIDS:

- HIV/AIDS policy and other health care interventions in the workplace
- Risk profiles
- Cost analysis (which is discussed in more detail below)
- Skills succession plan
- Analysis of legal obligations
- Data collection and analysis
- Commitment by management and unions
- Long term strategies aimed at reducing risk factors

D. Assess current workplace programmes of UFS regarding HIV/AIDS:

- Programme implementation processes
- Awareness activities
- Peer education
- Training
- Condom promotion and distribution
- Testing and counseling
- STD management
- Infection control programmes
- Wellness programmes
- Programme monitoring

E. Assess current community responses of UFS to HIV/AIDS:

- Interaction with current and potential partners
- Available organisational resources
- Participation in community projects
- Initiation of community projects

- Support for NGO and community-based organisations

Focus group discussions:

Focus group discussions were conducted between October 2002 and April 2003 with various stakeholders to collect information about the needs and constraints faced by staff, students, community organisations and management in coping with the epidemic and their perspective on how needs and constraints should be addressed. Where necessary, focus groups were stratified by age, sex, population group, level of employment, or other criteria to discern differences among distinct sub-groups within the larger groups of staff and students. The exact nature of these focus groups (e.g. the type of participants, the manner of stratification and the sampling strategy) and the number of focus groups to be conducted were determined in concert with representatives of the respective stakeholders. The facilitators of the focus groups included individuals that speak the local languages, which ensured accurate and complete understanding and transcription of the responses. In the case of the focus groups with staff and students respectively, a list of the names and contact details obtained from the human resources section represented the sampling frame. Based on established protocols, sampled respondents were contacted telephonically and were invited to the focus group discussion after free and informed consent. The number of participants in each focus group discussion ranged from 6-12. Focus group discussions were tape-recorded with the consent of participants and later transcribed. The questions that were used to facilitate the focus group discussions with staff, students and NGOs and CBOs are included in Appendix A. When necessary, participants in the focus group discussions, particularly managers, were requested to provide documentation such as policy documents and financial information to inform the research and/or corroborate their view points. The focus group discussions with staff and students were conducted first. Results of, and issues identified at, these discussions together with the preliminary results of the epidemiological and costing analyses informed and guided subsequent focus group discussions with representatives of the student council, union representatives and management. A total of 36 focus group discussions with over 250 participants were conducted. The focus group discussions included 8 with staff, 20 with students, 2 with community-based organisations and NGOs working in HIV/AIDS, 2 with union representatives, one with Kovsie Health and the AIDS Centre at UFS, one with the SRC student council, one with the finance department, and one with the human resource department. The limitation of this methodology is that the responses recorded here are those of the participants alone, and cannot be construed to be representative of all students, staff members or other stakeholders. Nevertheless, we are confident the results of the focus group discussions provide a good understanding of and insight into what is happening in regards to HIV/AIDS at UFS.

4. RESULTS

In the following three sections, we discuss separately the results of the epidemiological analysis, the costing analysis, and the institutional audit. These results are then integrated in the summary and conclusions, which are presented in Section 5.

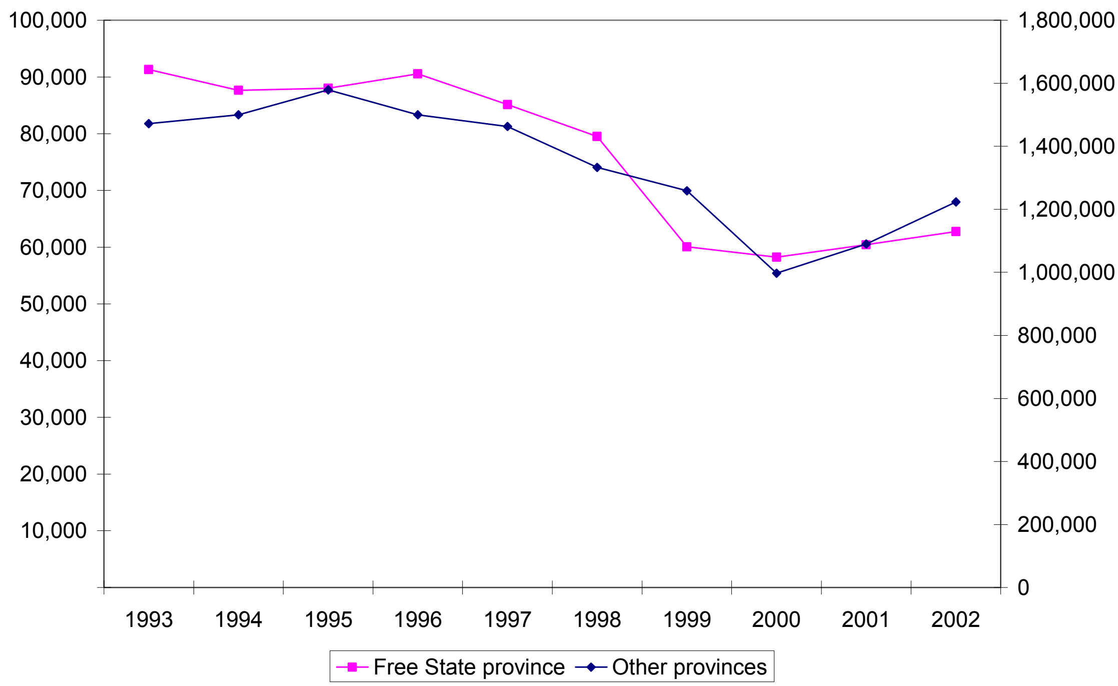
4.1 Epidemiological analysis

In this section, we discuss the main findings from the epidemiological analysis aimed at (i) estimating the number of school-leavers eligible for university exemption, (ii) estimating both the current prevalence of HIV amongst staff and students, and (iii) at projecting the future impact of HIV/AIDS on staff and students at UFS.

(a) Numbers of matriculants with university exemption

Numbers of matriculation exemptions are forecasted to decline relatively dramatically over the next ten years because of declining enrolment. This general decline in enrolment is reflected in the number of learners in grade 1 in each year over the period 1993-2002 (Figure 3), which over time translates into fewer enrolments in higher grades. On average, the number of learners in grade 1 declined by 2.9% per annum between 1995 (the year these numbers peaked) and 2002. Simkins (2002), moreover, reports that the average annual growth in total school enrolment has declined from 4.21% per annum for the period 1990 to 1995 to 0.05 percent only over the period 1995-2000. Future projections of school enrolments in turn show that enrolment will decline from 11 827 thousands pupils in 2000 to 11 624 (2005) and 11 366 (2010) thousand (Simkins, 2002).

Figure 3: Number of learners enrolled in grade 1 in the Free State province and in other provinces in South Africa (1993-2002)



There are a number of explanations for this phenomenon. *Firstly*, this situation reflects the demographic transition characterising most developing countries, including South Africa, as illustrated in demographic projections by the United Nations Population Division (UNPD) and the Institute for Futures Research (IFR). To project population demographics, the UNPD – in accordance with demographic practice - applies assumptions regarding future trends in fertility, mortality, and migration of the target population. For modelling purposes, the medium variant projection (one of six projection variants employed by the UNPD) was applied to South Africa, with detailed population estimates reported for the period 2000 to 2025. The UNPD defines medium-fertility countries as countries where fertility has been declining but whose level was still above 2.1 children per woman in 2000-2005. Total fertility for South Africa is assumed to converge eventually toward a level of 1.85 children per woman during the entire projection period (up to 2050). The IFR also recently published detailed demographic projections for South Africa, in this case for the period 1996-2031 (Haldenwang, 2001), using similar demographic techniques but employing alternative assumptions to the UNPD. From both the UNPD (2005) and the IFR (2001) models it appears that a decline in the number of school-leavers – and thus also in the number of school-leavers eligible to apply for admission to UFS – is inevitable. Although the two models cannot be compared unconditionally due to differences in their underlying assumptions, both models point at dwindling numbers in all comparative age cohorts. The UNPD model, however, sets the starting point of this decline further into the future (2015) than the IFR model (2006), particularly for the age cohort older than 15 years.

In the *second* instance, the situation also in part reflects the impact of HIV/AIDS on society. The HIV/AIDS epidemic reduces the number of school-age children in two ways (Shaeffer, 1994; Kelly, 2000c): On the one hand, numbers decline as fertility rates decline, not only due to the demographic transition in general, but due to the prevalence of HIV/AIDS in women of child-bearing age. On the other hand, numbers of school-age children decline as those children who are born HIV-positive die before reaching school-going age. In both cases the result is lower school enrolment (Simkins, 2002).

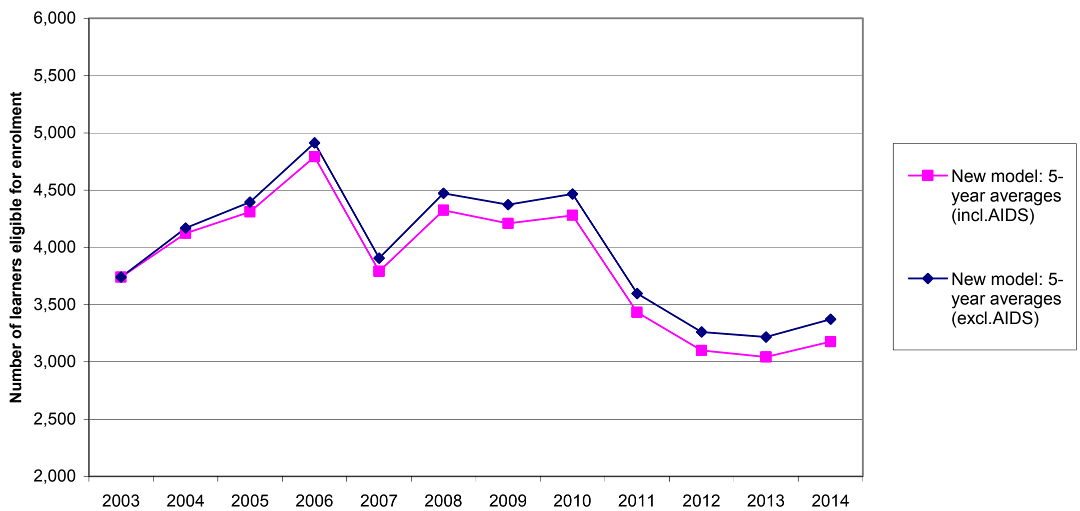
Yet, the epidemic is reducing the number of children in school not merely because it leads to fewer children in need of education, but also because parents cannot afford to send their children to school or children are taken from school. In situations where schooling requires households to pay for education, the effect on the affordability may result from the direct loss of family income due to AIDS, from the death and illness of productive members of the family, and the loss of income due to the costs of treatment, care and funeral costs (Gachuhi, 1999:3). However, the lack of financial resources due to AIDS is not the only reason which keeps children out of school (Kelly, 2000c). (The hardships faced, not only by HIV/AIDS-affected households, but many others living in a society characterised by high levels of unemployment and poverty, means that poverty most likely also explains why many other children are not enrolled in school.) Children who enter school may also drop out of school because they may be HIV-infected or are needed to work or to care for sick adults. They may also drop out for reasons of trauma caused by the illness and death of family members. In fact, AIDS orphans alone – estimated to be 626,458 in 2004 and projected to increase to 2 million by 2015 (Dorrington *et al*., 2004) – represent a considerable number of children unlikely to continue their school, given that a significant proportion of these orphans are likely not to attend school, as they are in a constant battle for economic survival. In addition, children may be ostracised, discriminated against and suffer from stigma when it is known that their family members have HIV/AIDS (Kelly, 2000c). For instance, at Rakai Primary School in Uganda a pupil explained that some of her friends no longer played with her and instead pointed fingers at her saying that she might also have AIDS because her father died of AIDS (as quoted in Shaeffer, 1994: 14). Finally, an extended family may be less inclined to continue the education of orphaned children than the education of their own children (Kelly, 2000c). The Thuthuzela Abantwana project in Cape Town, on the other hand, which works with families with HIV-positive children, found that most families are already stretched to their financial limits and that support is crucial in enabling them to meet their children's needs (Bollinger and Stover, 1999: 4).

Thirdly, changes in enrolment figures also reflect the ability of the educational system to retain children (Simkins, 2002). Thus, declining enrolment may also reflect inefficiencies within the educational system rather than only a demographic transition, the impact of the HIV/AIDS epidemic, or poverty in general.

The resultant reduced demand for education at the primary and secondary level has serious implications for higher education. The smaller number of primary and secondary school candidates will work its way through the system to generate an even smaller number of candidates for admission to universities. Simkins (2002), for example, estimates that undergraduate enrolments at South African universities will drop to 285,266 by 2010, which represents 92 percent of 1995 enrolment rates. Yet, Simkins (2002), on aggregate, projects that first qualifications from universities and technikons will increase over the period 2000-2010 due to increased efficiency within the higher education system. On aggregate, the stock of university graduates will increase from

577,680 in 2000 to 747,128 to 2010, but at a slower rate compared with the average annual growth in the pool of graduates recorded prior to 2000 (Simkins, 2002).

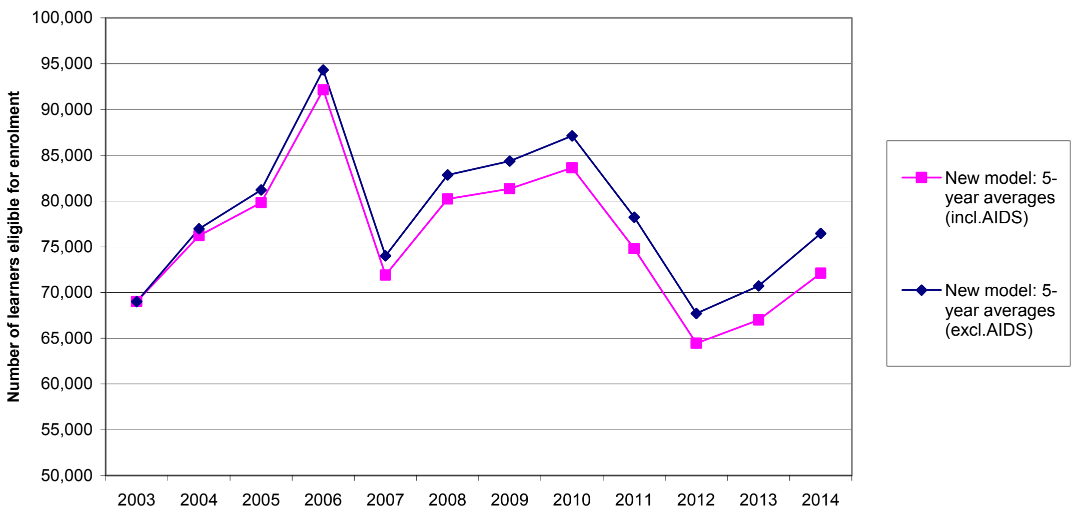
Figure 4: Projected numbers of learners in the Free State province that are eligible for university enrolment (2003-14)



Note: Numbers are reported for the year in which those with exemption will be enrolling at university. In other words, the estimated number of school-leavers eligible for university enrolment in 2003 reflects the estimated number of exemptions for 2002.

Figures 4 and 5 reflect the projected number of learners in the Free State province and in other provinces in South Africa respectively that are estimated to be eligible for university enrolment. The numbers, when accounting for the impact of HIV/AIDS, will on average decline by 3.3% (Free State province) and 1.1% per annum (other provinces) over the next nine years (2005-14). (We focus here on this period, given that this represents the current planning horizon: changes in estimated exemptions from this year forward.) These general downward trends in numbers occur only towards the end of the period. The estimated numbers of students that are eligible for university enrolment remain relatively unchanged until 2010. In fact, in some cases the estimated numbers of exemptions even increased moderately over this period (2005-10). The number of eligible enrolees from the Free State province will on average decline by 0.1% per annum over this period (2005-10), while numbers of eligible enrolees from other provinces on average will grow by 0.9%. Between 2010 and 2014, however, numbers of eligible enrolees will decline substantially: 7.2% per annum in the case of the Free State province and 3.6% per annum in the case of other provinces in South Africa.

Figure 5: Projected numbers of learners from other provinces in South Africa that are eligible for university enrolment (2003-14)



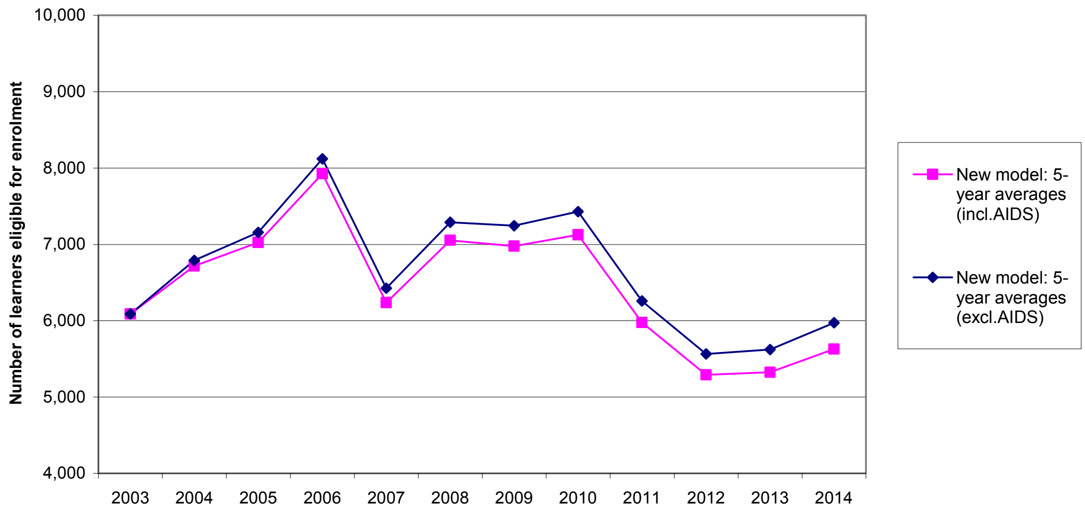
Note: Numbers are reported for the year in which those with exemption will be enrolling at university. In other words, the estimated number of school-leavers eligible for university enrolment in 2003 reflects the estimated number of exemptions for 2002.

As explained above, it is not only the HIV/AIDS epidemic but the demographic transition in general that are driving the decline in school enrolment behind this decline in the number of persons eligible to enrol at university. In fact, the HIV/AIDS epidemic itself has a relatively small effect on this trend. This is reflected in the relatively small difference between the projected numbers of persons eligible for enrolment in the AIDS and no-AIDS scenarios (Figures 4 and 5). In the no-AIDS scenario, the number of school-leavers eligible to apply to university will on average decline by 2.9% (Free State province) and 0.7% per annum (other provinces) over the next nine years (2005-14). Put another way, HIV/AIDS accounts for only a 0.4 and 0.5 average annual percentage point decline in the projected number of learners in the Free State and other provinces respectively that are eligible for university enrolment subsequent to 2005. Thus, deaths due to HIV/AIDS have little influence on the numbers of school-leavers eligible to apply for admission to university. However, the gap between the AIDS and no-AIDS scenarios did increase marginally over time, given that HIV prevalence rates are projected to increase slightly over time.

The reason for this relatively small impact of the epidemic on the estimated number of exemptions is that few students will contract clinical AIDS while still at school. Furthermore, for those who do become infected while at school, there will be a median of 9 years delay from HIV seroconversion to AIDS. Because HIV/AIDS is transmitted sexually and children infected at birth are likely to die before age seven, as Simkins (2002) rightly points out: '[F]ew learners entering school without being infected will actually die of AIDS while at school, except for some over-age learners in Grades 10 to 12'. Those learners who are infected (estimated at some 500,000), he argues, will most likely only die before age 30 (Simkins, 2002) and therefore only once they have actually completed their studies.

It did not make sense simply to add the Free State and non-Free State numbers to calculate the total number of school-leavers eligible for enrolment at UFS, as non-Free State school-leavers are much less likely to enter UFS. Therefore, non-Free State numbers of matriculation exemptions were weighted by 3.4%. These weighted figures are represented in Figure 6, which reflects a similar trend to that in Figures 4 and 5. The number of school-leavers eligible to apply to UFS, when accounting for the impact of HIV/AIDS, will on average decline by 2.4% per annum over the next nine years (2005-14). (As explained above, we focus here on this period, given that this represents the current planning horizon: changes in estimated exemptions from this year forward.) The numbers of eligible enrolees is estimated to on average grow marginally until 2010 (0.3% per annum). Between 2010 and 2014, however, numbers will drop substantially, on average declining by 5.7% per annum. For reasons explained above, the HIV/AIDS epidemic itself has a relatively small effect on this trend. This is reflected in the relatively small difference between the projected numbers of persons eligible for enrolment in the AIDS and no-AIDS scenarios (Figures 6). In the no-AIDS scenario, the number of school-leavers eligible to apply to UFS will on average decline by 2% per annum over the next nine years (2005-14). Put another way, HIV/AIDS accounts for only a 0.4 average annual percentage point decline in the projected number of learners eligible for enrolment at UFS subsequent to 2005.

Figure 6: Projected numbers of learners in South Africa that are eligible for university enrolment at UFS (2003-14)



Note: Numbers are reported for the year in which those with exemption will be enrolling at university. In other words, the estimated number of school-leavers eligible for university enrolment in 2003 reflects the estimated number of exemptions for 2002. Non-Free State numbers of matriculation exemptions were weighted by 3.4% as non-Free State school-leavers are much less likely to enter UFS compared with matriculants from the Free State province.

Our results, however, are relatively sensitive to assumptions regarding attrition rates. In the model employed to estimate the results reported in Figures 4 to 6, we employed a five-year moving average for attrition rates between each grade, calculated from enrolment figures for 1993 to 2002. We also ran the model for attrition rates calculated based on three-, seven- and nine-year averages. The full results of these sensitivity analyses are reported in Appendix J. The sensitivity analysis shows that in the AIDS scenario, the average annual decline over the next nine years (2005-14) in the number of eligible enrollees from the Free State province varied between 2.2% (seven-year moving average) and 3.6% (nine-year moving average). The average annual decline in the number of eligible enrollees from other provinces in South Africa ranged from 0.8% (three-year moving average) to 1.7% (seven- and nine year moving averages). In terms of eligible numbers of enrolees at UFS in general, the average annual decline ranged between 2.1% (seven-year moving average) and 2.8% (nine-year moving average). Yet, in all cases the results paint the same picture, with eligible numbers of enrolees declining over the next ten years, though remaining relatively unchanged until 2010 and only then declining relatively substantially.

We also investigated the sensitivity to our results of assumptions about university exemption rates, attrition rates and HIV prevalence rates with a view to estimating how each of these parameters needs to improve to ensure that the same number of learners that qualified for enrolment at university in 2005, at a minimum do so (a) by 2014 and (b) in each of the subsequent years (2005-14). Importantly, the estimated numbers of eligible university enrolees will not reach 2005 levels again, even if HIV prevalence rates are zero. If 2005 levels of enrolment are to be achieved by 2014, attrition rates over this period need to improve by 29.5% and 11% in the Free State province and in other provinces respectively. If 2005 enrolment levels are at least to be sustained over the entire period, attrition rates over this period (2005-14) need to improve by 37% and 29.5% in the Free State province and in other provinces respectively. Exemption rates of at least 19% and 16.6% are required if 2005 levels of enrolment are to be achieved by 2014 in the Free State province and in other provinces respectively. If 2005 enrolment levels are at least to be sustained over this period, exemption rates need to rise to 19.9% and 18.6% in the Free State province and in other provinces respectively. Such relatively large improvements in attrition and exemption rates one may argue are not realistically attainable, thus implying that the anticipated decline in the numbers of eligible enrolees is a stark reality. Nevertheless, improvements in through-put and exemption rates remain important, because such improvements not only will aid in cushioning this negative trend, but also stand to contribute to the development of South Africa insofar as it translates into a more efficient educational system and better standards of education.

(b) Estimated HIV prevalence amongst staff and students (2003)

About 5 percent of all staff, or an estimated 113 people, were infected with HIV in 2003 (Table 7). Unskilled staff were much more likely to be infected with HIV compared with employees from other staff categories. Staff at QwaQwa campus were also much more likely to be infected with HIV than employees at the Bloemfontein campus of UFS. The reason for the estimated HIV prevalence being lowest amongst highly skilled support services staff and academic staff at Bloemfontein campus (under three percent) was that members of these two groups were more likely to be older, male and white compared with employees in other staff categories at the two campuses of UFS.

Table 7: Estimated HIV prevalence rates amongst staff (2003)

	Academic staff	Unskilled support services staff	Skilled support services staff	Highly skilled support services staff	Total
Total staff:					
Total HIV+	26	30	54	2	113
Total staff	859	342	1,013	110	2,333
HIV prevalence (%)	3.0	8.8	5.4	2.2	4.9
Bloemfontein staff:					
Total HIV+	19	27	48	2	97
Total staff	754	307	957	98	2,116
HIV prevalence (%)	2.6	9.0	5.0	1.9	4.6
Qwaqwa staff:					
Total HIV+	6	9	7	1	16
Total staff	105	35	56	12	217
HIV prevalence (%)	6.1	7.8	11.8	5.1	7.9

We estimated that approximately 9.1 and 11.5 percent of students at the Bloemfontein and Qwaqwa campuses of UFS were infected with HIV in 2003 (Table 8), which translated into an HIV prevalence rate of 9.2 for all students. Prevalence rates were higher among postgraduates and Qwaqwa students than amongst undergraduate students at Bloemfontein campus.

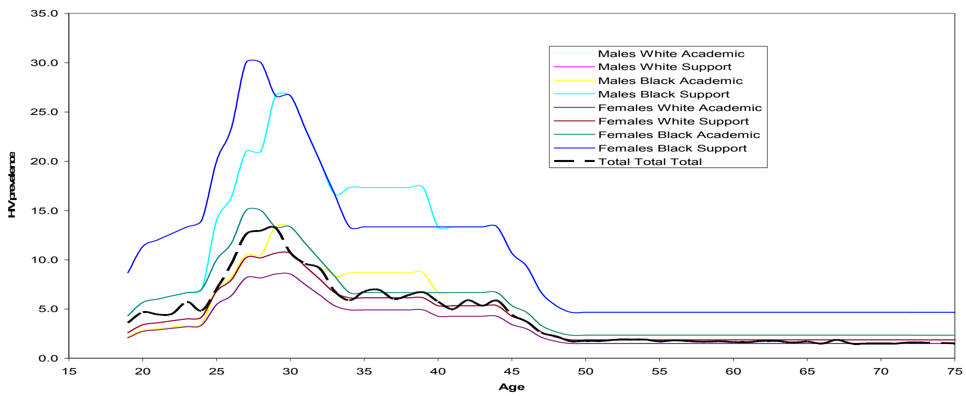
Table 8: Estimated HIV prevalence rates amongst students (2003)

	Undergraduate students	Postgraduate students	All students
Bloemfontein	7.1	12.1	9.1
Qwaqwa	11.5		11.5

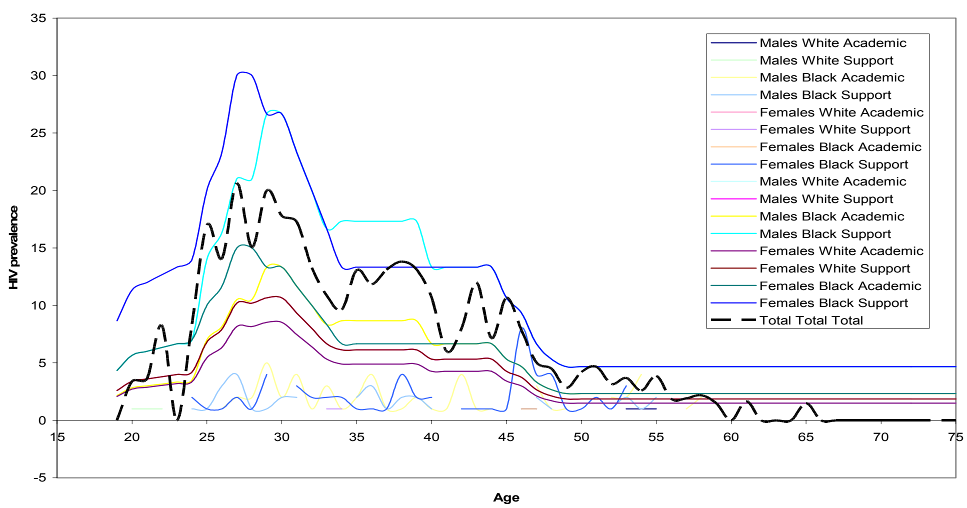
Figure 7 presents the age distributions of HIV, stratified by sex and population group. HIV prevalence is highest in students and staff groups with higher proportions of Africans aged 25-35 years.

Figure 7: Estimated HIV prevalence amongst staff and students (2003)

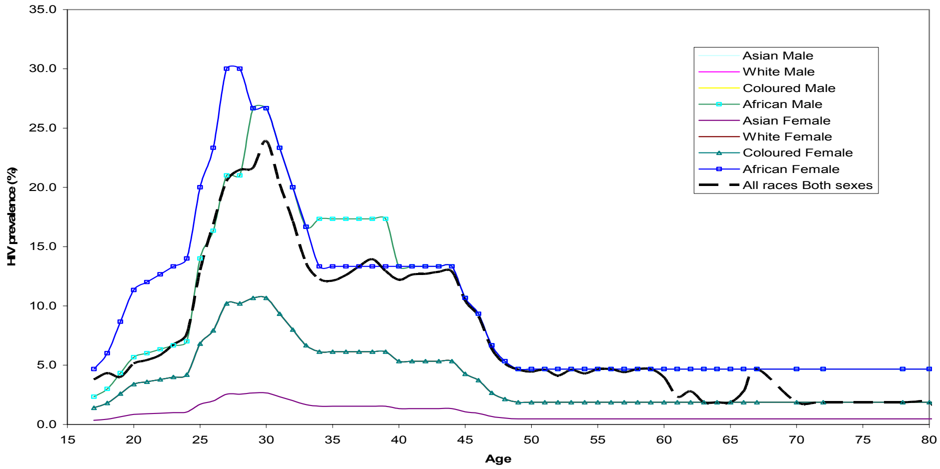
(a) HIV prevalence among Bloemfontein staff



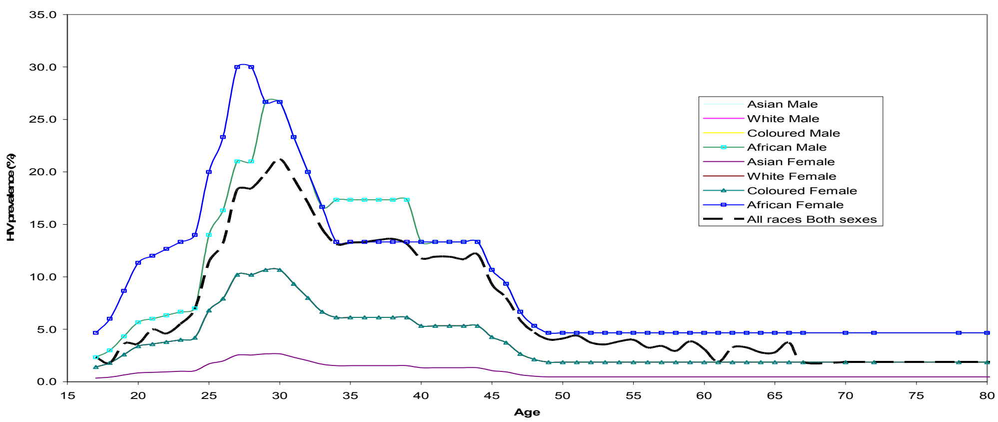
(b) HIV prevalence among Qwaqwa staff



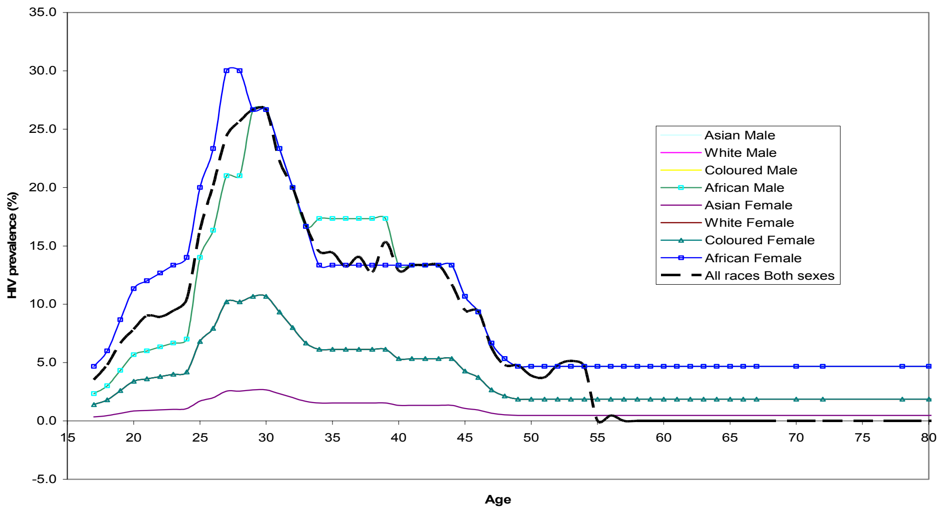
(c) HIV prevalence among Bloemfontein undergraduate students



(d) HIV prevalence among Bloemfontein postgraduate students



(e) HIV prevalence among Qwaqwa undergraduate students



Note: For staff, HIV prevalence rates were assumed to be the same for White, Asian and Coloured staff.

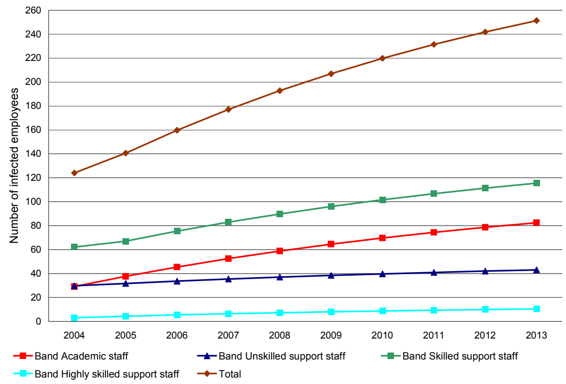
(c) Projected impact of HIV/AIDS on staff (2004-13)

The annual projected number of total HIV infections amongst staff, the estimated HIV prevalence rate, the number of new HIV infections, and the number of AIDS deaths are presented in Figure 8 for the Bloemfontein and Qwaqwa campuses of UFS. In summary, we project that as many as 215 employees will be HIV-positive in any given year. Over the ten-year period, a total of 320 employees will become infected with HIV (new HIV infections), while a total of 149 employees will develop AIDS (new AIDS cases), and 78 employees will die as a result of AIDS (AIDS deaths). This translates into an average annual number of new HIV infections amongst staff of 32, 15 new AIDS cases per annum, and 8 AIDS deaths per annum, this amongst a total workforce of 2,333 employees.

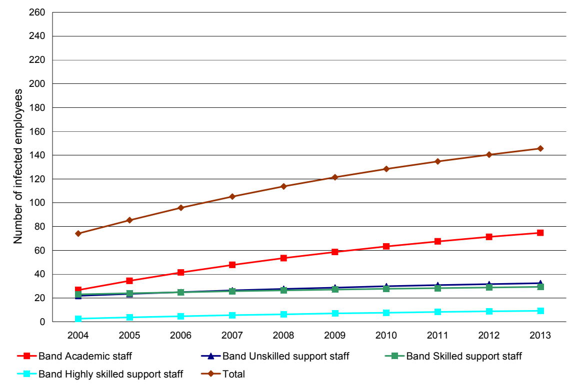
Figure 8: Projected impact of HIV/AIDS on staff (2004-13)

(a) Annual estimated number of HIV infections

(i) Bloemfontein campus

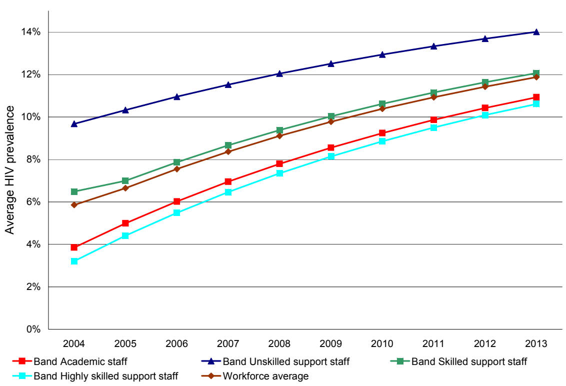


(ii) Qwaqwa campus

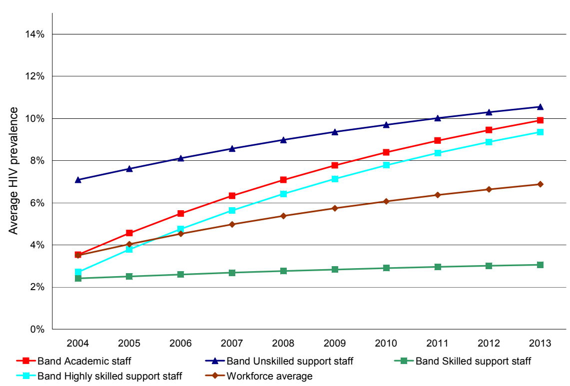


(b) Projected HIV prevalence rates

(i) Bloemfontein campus

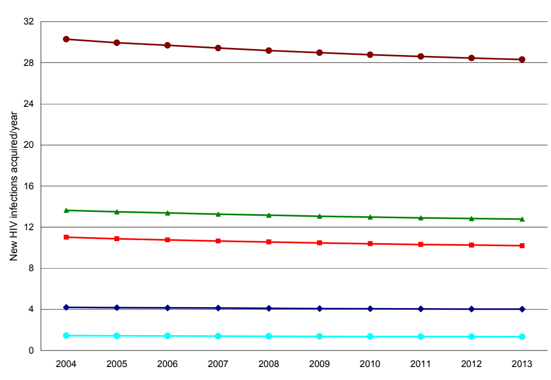


(ii) Qwaqwa campus

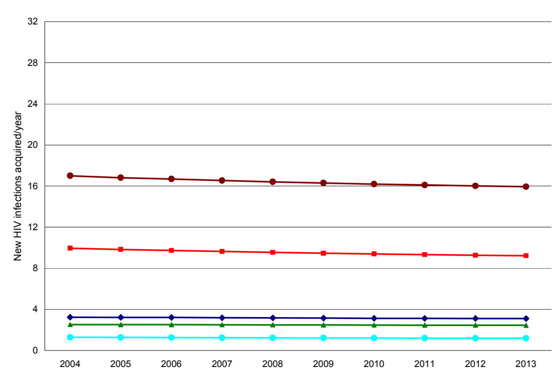


(c) Annual estimated number of new HIV infections

(i) Bloemfontein campus

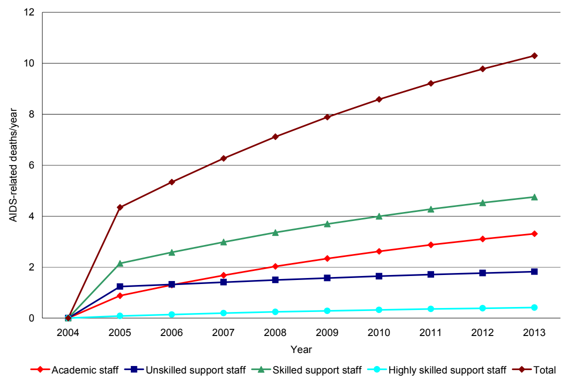


(ii) Qwaqwa campus

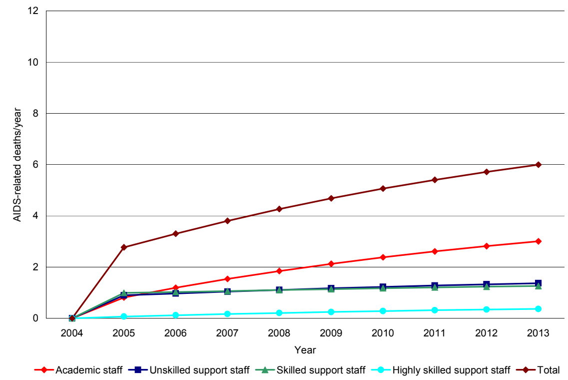


(d) Annual estimated number of AIDS-related deaths

(i) Bloemfontein campus



(ii) Qwaqwa campus



Evidence on staff mortality at other institutions of higher education in Africa, although vague and ambiguous, does present evidence of a relatively high number of AIDS-related deaths. In Zambia, during the period 1994-2000 the relatively small University of the Copperbelt lost 17 academic and 72 non-academic staff due to AIDS (Kelly, 2001b: 3). The University of Zambia also reported total staff deaths of 352 during the period 1990-1999 (Kelly, 2001a: 17). The crude death rate for staff in 1999 (even when this takes account of AIDS deaths in the national population) was higher than the national mortality rate. That most of these deaths were due to AIDS can be deduced from the ages they occurred: 53 per cent were in the age range 20-34, and 44 percent in the age range 34-39. Similarly, at the Jomo Kenyatta University of Kenya an annual average of four AIDS deaths occurred among staff during the period 1995-1999 (Kelly, 2001a: 17). The University of Nairobi also believes that an average of two members of the immediate university community die from AIDS each week (Kelly, 2001a: 17). Unfortunately, these figures are not reported in relation to total staff numbers, which makes it impossible to get an idea of the magnitude of the problem and to compare the results with our projections.

Figure 8 also suggests that the total numbers of employees with HIV and dying each year could increase slightly over time. Each year over the ten-year period, seven employees at Bloemfontein campus and one employee only at Qwaqwa campus could die from AIDS, mostly amongst skilled support services staff (Bloemfontein campus) and academic staff (Qwaqwa campus) respectively. These figures could be expected to be higher if the incidence of HIV is higher than 1.5 percent, if numbers of staff or students increase over time, and especially if the numbers of African staff aged 25 to 35 years increases. However, if employees with HIV/AIDS received anti-retroviral therapy (not modelled), these numbers of employees with HIV could be even higher, as treatment would prolong their lives and increase the period of survival, while the numbers of employees dying from AIDS would decline. In fact, if people with HIV /AIDS were treated with anti-retroviral drugs and antibiotics the numbers of deaths could decline by up to 75 percent (Jordan *et al*., 2002).

Table 9: Composition of projected number of HIV infections, new HIV infection, AIDS cases and AIDS deaths by staff category (%)

	Bloemfontein campus	Qwaqwa campus	Total
A. Total HIV infections			
Academic staff	30.6	45.2	32.2
Unskilled support services staff	19.1	16.7	18.9
Skilled support services staff	46.6	33.3	45.1
Highly skilled support services staff	3.7	4.8	3.9
Total	*100.0*	*100.0*	*100.0*
B. New HIV infections			
Academic staff	36.2	51.2	37.5
Unskilled support services staff	14.0	16.8	14.3
Skilled support services staff	45.1	26.1	43.4
Highly skilled support services staff	4.7	5.9	4.8
Total	*100.0*	*100.0*	*100.0*
C. New AIDS cases			
Academic staff	29.7	44.5	31.3
Unskilled support services staff	19.9	16.7	19.6
Skilled support services staff	46.8	34.1	45.4
Highly skilled support services staff	3.6	4.7	3.7
Total	*100.0*	*100.0*	*100.0*
D. AIDS deaths			
Academic staff	29.2	44.2	30.9
Unskilled support services staff	20.3	16.7	19.9
Skilled support services staff	46.9	34.5	45.5
Highly skilled support services staff	3.5	4.6	3.6
Total	*100.0*	*100.0*	*100.0*

In Table 9, we present the composition of these projected numbers of HIV infections, AIDS cases and AIDS deaths across the four different staff categories for each of the two campuses, as well as for all staff. Interestingly, at Bloemfontein campus the largest proportion of new HIV infections, new AIDS cases and AIDS deaths will occur amongst skilled support services staff (almost half), followed by academic staff (a third). At Qwaqwa campus on the other hand, almost half will occur amongst academic staff. On aggregate, almost half of new HIV infections, new AIDS cases and AIDS deaths will occur amongst skilled support services staff and a third amongst academic staff. Hence, three quarters or more of new HIV infections, AIDS cases and AIDS deaths amongst staff will occur amongst these two categories of employees.

This is interesting, moreover, insofar as the perception often is that awareness and prevention activities should target the unskilled rather than the skilled, given that they are more at risk of HIV infection, as HIV prevalence rates among them are generally relatively high. In terms of absolute numbers, though, the magnitude of the problem is greater amongst skilled categories of staff (obviously institutions of higher education employ more skilled than unskilled personnel due to the core nature of their business), thus suggesting that it is equally important to target these categories of employees as part of awareness and prevention activities.

Sensitivity analyses of staff models:

In the following discussion, we reflect on the results of the sensitivity analysis we conducted as part of our epidemiological analysis.

The ASSA Provincial model:

We applied the ASSA provincial HIV prevalence projections for 2003, weighted by the age and sex distribution of the UFS staff population, and ignoring population group, educational level or socio-economic status (ASSA, 2003). This produced an HIV prevalence estimate of 21.1 percent for Bloemfontein campus and 24.5 percent for Qwaqwa campus (Table 10). Entering these prevalence assumptions into our baseline Markov model resulted in the following projections of HIV prevalence and deaths. We also show the sensitivity of the results to different assumptions about mortality rates in people without HIV.

Table 10: Estimated HIV prevalence (2003) and projected number of deaths (2004-2013): Baseline *versus* ASSA provincial models

Source of HIV prevalence estimates	Estimated HIV prevalence (2003)	Assumed annual HIV incidence 2.3%*			Assumed annual HIV incidence 1.6%*		
		Annual mortality without HIV			Annual mortality without HIV		
		0%	0.1%	0.5%	0%	0.1%	0.5%
Bloemfontein:							
Baseline model	4.2	130	149	226	108	127	206
ASSA provincial model	21.1	248	265	335	228	246	317
Qwaqwa:							
Baseline model	7.8	16	18	25	14	15	23
ASSA provincial model	24.5	28	29	36	26	27	34

Notes: Estimated HIV prevalence rates are for African and White staff only. The baseline model assumed an annual HIV incidence of 1.5 percent. The figures in the table present total deaths amongst African and Whites only. Total deaths include AIDS deaths.

This illustrates that using the prevalence estimates from the ASSA provincial model, which account for neither population group, income nor education, produces HIV prevalence estimates that are more than two to four times as high as estimates based on our model informed by the HSRC survey HIV prevalence estimates. Consequently, mortality projections are 50 and 90 percent higher than in the baseline model. The results also show that the mortality projections are only moderately sensitive to assumptions about the HIV incidence and mortality rates amongst people not infected with HIV. Most of these deaths would occur amongst people infected with HIV, that is, due to AIDS. About 70 percent of these deaths could be prevented by treatment with HAART.

The ASSA NewSelect workforce model:

This model assumes that the HIV prevalence and incidence rates in each job grade, and for females compared with males, are lower than the rates in the general population (see Table 11 for details on the adjustments in HIV prevalence rates). Consequently one would expect the numbers of deaths to be much lower than when applying the ASSA provincial model estimates.

Table 11: Key assumptions of the ASSA NewSelect workforce model

Job grade	1	2	3	4	5
A. Adjustments to HIV prevalence rates (%):					
Multiplicative adjustment	100	72	25	10	10
B. Adjustments to HIV incidence rates (%):					
Multiplicative adjustment	100	72	25	10	10
Gender (female versus male)	80				

The summary results derived from our sensitivity analysis are reported in Table 12 below, while the detailed output is presented in Appendix C, including projections of the numbers of disabilities and ill-health retirements. According to this model, the estimated HIV prevalence amongst UFS employees in 2003 was 9 percent (Bloemfontein campus) and 6.9 percent (Qwaqwa campus). (Note that the estimated HIV prevalence reported here again is for Africans and Whites only, and excludes the small number of employees classified as Asians or Coloureds (89 employees or 3.8 percent only of the total workforce at the Bloemfontein and Qwaqwa campus). As a result, the differences between the results of the two sensitivity analyses presented here and the results for all population groups are likely to be insignificant, as was evident from the results for the baseline model which included Africans and Whites only, but differed little from the results presented in the previous pages. For example, in the case of the estimated total number of deaths over the ten-year period (2004-13), the difference between the results including all population groups and that including Africans and Whites only was three only.) The projected total number of deaths amongst staff between 2004 and 2013 was 158 for Bloemfontein campus and ten for Qwaqwa campus. Of these deaths, 55 deaths at Bloemfontein campus would be due to AIDS and none at Qwaqwa campus. As pointed out earlier, provision of HAART would prevent as many as eight deaths amongst employees at Bloemfontein campus, but none at Qwaqwa campus.

Table 12: Estimated HIV prevalence (2003) and projected number of deaths (2004-2013): All models

Source of HIV prevalence estimates	Estimated HIV prevalence (2003)	Projected number of deaths (2004-13)
Bloemfontein:		
Baseline model	4.2	
ASSA provincial model	21.1	
ASSA NewSelect workforce model	9.0	158
Qwaqwa:		
Baseline model	7.8	
ASSA provincial model	24.5	
ASSA NewSelect workforce model	6.9	10

Notes: Estimated HIV prevalence rates are for African and White staff only. The baseline model assumed an annual HIV incidence of 1.5 percent. The figures in the table present total deaths amongst African and Whites only. Total deaths include AIDS deaths.

These results from the sensitivity analyses differ substantially from our baseline model in the following important ways. *Firstly*, it is estimated that HIV prevalence could be much higher than in the baseline model, particularly for Qwaqwa campus. *Secondly*, partly as a consequence of this, the baseline model predicts many fewer deaths due to AIDS than the two alternative models. However, the baseline model predicts many more deaths that are not related to AIDS. In summary, therefore, these sensitivity analyses indicate how the model is sensitive to various assumptions. These differences are not due mainly to the different models' designs – they are all spreadsheet models of transitions within populations from being uninfected with HIV, to being infected with HIV, to having AIDS, to dying. All use roughly similar estimates of the HIV incidence and mortality rates. The most importance difference seems to lie in assumptions about the current HIV prevalence among subgroups of the population. This difference translates into considerable differences in terms of the numbers of employees estimated to be infected with HIV and the numbers which will develop AIDS and die from AIDS.

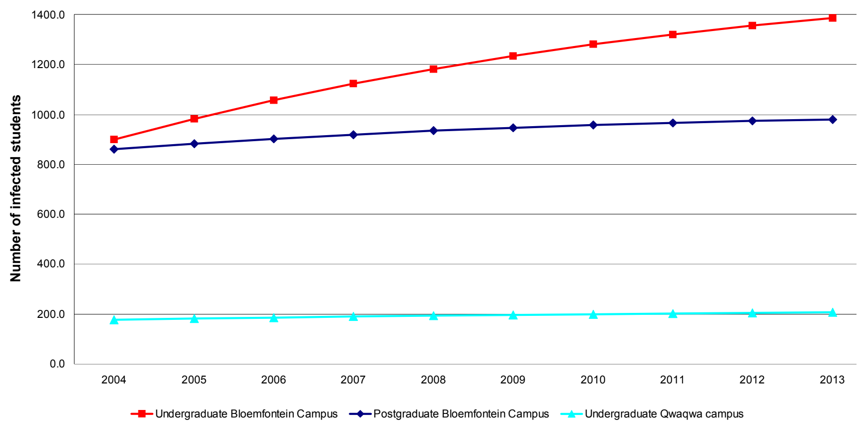
(d) Projected impact of HIV/AIDS on students (2004-13)

Over the ten-year period from 2004 to 2013 an average of 1,182 undergraduate and 932 postgraduate students at the Bloemfontein campus would be infected with HIV at any time in any given year, compared with 194 students at Qwaqwa campus (Figure 9).

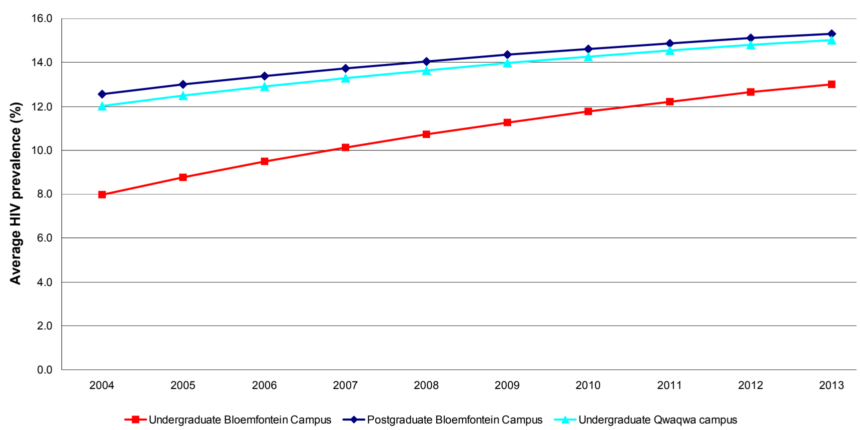
Therefore, the average number of students at UFS infected with HIV was estimated at 2,308, this compared with the reported 161 HIV-positive students amongst RAU's student population of almost 15 thousand (Ichharam and Martin, 2002).

Figure 9: Projected impact of HIV/AIDS on students (2004-2013)

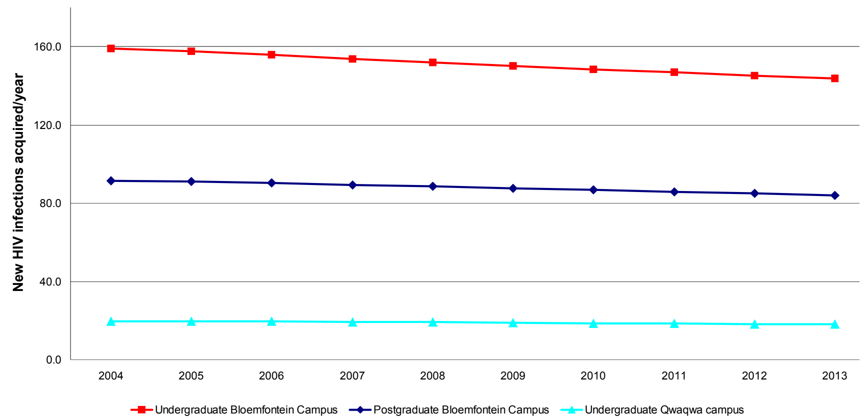
(a) Annual estimated number of HIV infections



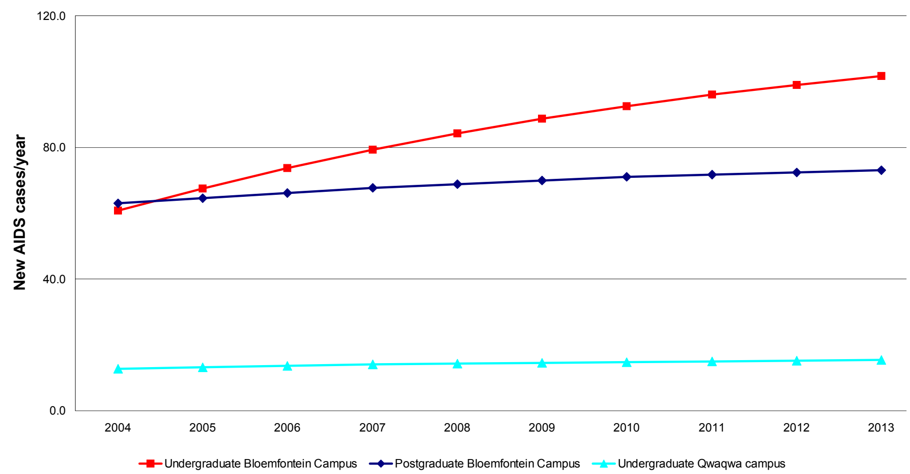
(b) Projected HIV prevalence rates



(c) Annual estimated number of new HIV infections



(d) Annual estimated number of new AIDS cases



(e) Annual estimated number of AIDS-related deaths

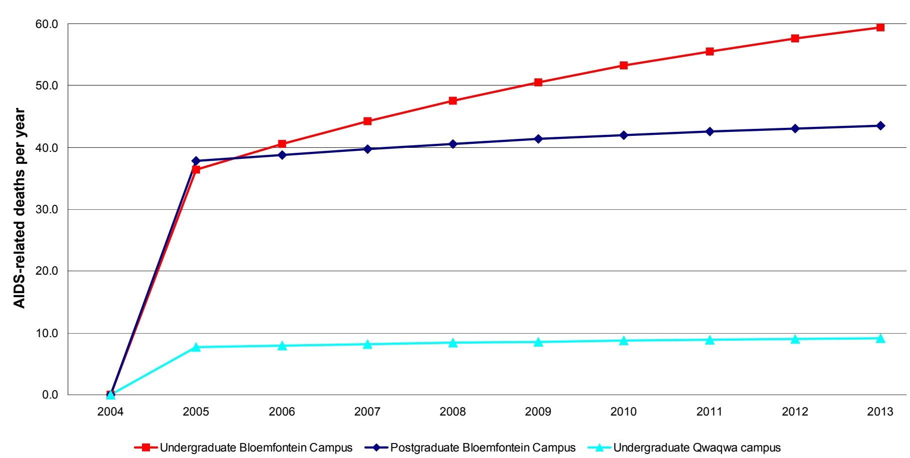


Figure 9 also illustrates how the numbers of students with HIV would increase slightly over time amongst undergraduates and postgraduates at both UFS campuses as HIV prevalence rates continue to increase over the ten-year period. The average number of new HIV infections amongst under- and postgraduate students at Bloemfontein campus were estimated at 151 and 88 per annum respectively, whilst an estimated 19 new HIV infections occurred each year amongst students at Qwaqwa campus over the ten-year period. In total, therefore, an estimated 258 new HIV infections occurred amongst students at UFS over the ten-year period.

Table 13: Projected numbers of AIDS-related deaths amongst students

		Total number of students (2003)	Estimated HIV prevalence rate (2003)	Total projected number of AIDS-related deaths (2004-13)
Total all students:		19,843	9.2	890
Bloemfontein undergraduate:				
Asian	Male	114	1.1	3
White	Male	2,218	3.8	66
Coloured	Male	202	4.2	6
African	Male	2,234	9.0	99
Asian	Female	126	0.8	3
White	Female	2,801	3.5	81
Coloured	Female	346	3.3	10
African	Female	3,370	12.1	179
Total		11,411	7.1	445
Bloemfontein postgraduate:				
Asian	Male	51	1.6	1
White	Male	963	5.9	34
Coloured	Male	51	6.2	2
African	Male	1,895	16.3	124
Asian	Female	41	1.5	1
White	Female	1,003	6.0	36
Coloured	Female	41	6.2	1
African	Female	2,901	14.1	171
Total		6,946	12.1	369
QwaQwa campus (predominantly undergraduate):				
Male		723	9.3	33
Female		763	13.9	45
Total		1,486	11.5	76

Note: Totals may not add up due to rounding.

The average annual numbers of new AIDS cases were estimated at 84 and 69 amongst under- and postgraduate students at Bloemfontein campus respectively. The average number of new AIDS cases occurring at the Qwaqwa campus in turn amounted to 14 per annum. This brings the estimated average number of new AIDS cases amongst students at UFS to 167 per annum. The corresponding estimates of the average annual number of AIDS deaths amounted to 45 (undergraduate students at Bloemfontein campus), 37 (postgraduate students at Bloemfontein campus), and 8 (Qwaqwa campus) per annum, which translated into a total of 89 AIDS-related deaths per annum over the ten-year period (Table 13).

Hence, the output of higher education institutions is being affected fundamentally by the epidemic in terms of new HIV infections and deaths amongst students. It is difficult, moreover, to track student deaths because students may not actually die while they are on campus, but during a vacation or following withdrawal from studies (Kelly, 2001a). However, there is some empirical evidence concerning deaths of campus students. For instance, two of the largest schools at the University of Zambia experienced more than 20 student deaths in the first semester of 2000 (Kelly, 2001a: 18). Given the long period between HIV infection and the emergence of full-blown AIDS, however, many infected students may not die until they have graduated from the university and have entered the world of work (Kelly 2001a: 18). For instance, 30 per cent of nurses graduating from the University of Natal are dying within three years of completing their study programme (quoted in Kelly, 2001b: 3). Such a high death rate of professionals not only annuls the role of education, but it also makes economic planning difficult. This points to the further consequences of the epidemic for human capital, with relatively large numbers of people who have received 12 or more years of education dying in the prime of their lives, thus turning this investment of government in education into a loss (Simkins, 2002).

Sensitivity analysis:

No other South African HIV/AIDS models, to our knowledge, are directly applicable to comparable student populations. However, we applied the ASSA provincial HIV prevalence projections for 2003 to our data, weighted by the age and sex distribution of the UFS student population, ignoring population group, educational level or socio-economic status (ASSA, 2003). Thus, we pessimistically assumed that the HIV prevalence for each sex at each year of age was the same as the ASSA prevalence estimates for the whole Free State population. This produced an HIV prevalence estimate of 22.7 percent for undergraduate students in Bloemfontein, 26.3 percent for postgraduate students in Bloemfontein, and 23.3 percent for students at the Qwaqwa campus of UFS. On aggregate, the HIV prevalence amongst all students was estimated at 24 percent. Entering these HIV prevalence assumptions into our baseline model resulted in the following projections of HIV prevalence and AIDS deaths over the ten-year period between 2004 and 2013 (Table 14).

Table 14: Application of ASSA Free State provincial HIV prevalence rates to UFS students

	Number of students (2003)	**Estimated HIV prevalence (2003)**	**Average annual number with HIV (2004-2013)**	**Average annual number of AIDS-related deaths (2004-13)**
Bloemfontein undergraduate	11,411	22.7	2,295	96
Bloemfontein postgraduate	6,946	26.3	1,159	66
QwaQwa all students	1,483	23.3	305	13
Total	19,843	24.0	4,157	174
Baseline model	*19,843*	*9.2*	*2,308*	*89*

Note: Totals may not add up due to rounding.

As the prevalence in 2003 was assumed to be more than double the prevalence in the baseline model, the numbers of students with HIV and the numbers of AIDS-related deaths were almost double those projected in the baseline model. However, it is highly unlikely that HIV prevalence was as high as in the general Free State population.

Table 15: Estimated annual HIV prevalence and AIDS-related deaths if annual HIV incidence is 1 or 2 percent (instead of 1.5 percent)

Population	HIV Incidence	Average annual number with HIV (2004-2013)	Average annual number of AIDS-related deaths (2004-13)
Bloemfontein undergraduates	1.0%	970	38
	Baseline model: 1.5%	1,182	45
	2.0%	1,338	51
Bloemfontein postgraduates	1.0%	809	33
	Baseline model: 1.5%	932	37
	2.0%	1,052	41
QwaQwa all students	1.0%	167	7
	Baseline model: 1.5%	194	8
	2.0%	220	9
Total	1.0%	1,946	78
	Baseline model: 1.5%	2,308	89
	2.0%	2,610	100

Note: Totals may not add up due to rounding.

We then changed the assumption in the baseline model with regard to the annual incidence of HIV, which we now assumed to be one or two percent (compared with 1.5 percent in the baseline epidemiological model). The results indicate that if the HIV incidence estimate in the baseline model was halved (doubled), the mean number of students with HIV declined (increased) by 15.7 (13.1) percent, while the mean number of AIDS-related deaths per annum declined (increased) by 12.4 (12.4) percent (Table 15). Because of the median nine-year lag from HIV incidence to death, many infected students would graduate from UFS before developing AIDS or dying. Again, although we know little about sexual behaviour among UFS students, it is unlikely that the HIV incidence rate would be as high as in the general population because of the lower proportion already infected with HIV. However, it should be remembered that a relatively small number of infected individuals with large numbers of sexual partners could have a disproportionate effect on HIV transmission rates in a population.

4.2 Costing analysis

We first discuss in more detail the estimates of staff costs for Bloemfontein and Qwaqwa campuses respectively, before we discuss the results of the costing model for students. In the final part of this section, these cost estimates are combined to present an estimate of the aggregate cost to UFS of HIV/AIDS amongst staff and students.

(a) Staff costs

Given that the Bloemfontein and Qwaqwa campuses effectively represent two separate business units of UFS, we have decided to distinguish in our analysis between the costs of HIV/AIDS to UFS at the Bloemfontein and Qwaqwa campuses. The findings presented in these pages are based on the application of the costing model described elsewhere in this report.

(i) Bloemfontein campus

Table 16 reports the average cost per HIV infection at Bloemfontein campus over the ten-year period in NPV, including a breakdown of the components of these costs, as well as estimates of the relative magnitude of these costs. The cost per HIV infection was estimated at R76,212 for unskilled support services staff, R87,667 for skilled support services staff, R270,770 for academic staff, and R708,873 for highly skilled support services staff respectively. As expected, therefore, the cost per infection was higher at higher levels of skill, given that the magnitude of these costs derives from mean salary levels at different skill levels (Figure 10).

It is interesting to note is that our estimates of the average cost per HIV infection are noticeably higher than the estimates reported by Rosen *et al*. (2004) in their six company study. This most probably reflects the fact that a much higher proportion of employees at UFS qualify for the various employee benefits such as medical aid, retirement benefits and group life insurance compared with the companies included in their study. For example, in half of these companies, less than thirty percent of all employees had access to medical aid benefits (Rosen *et al*., 2004).

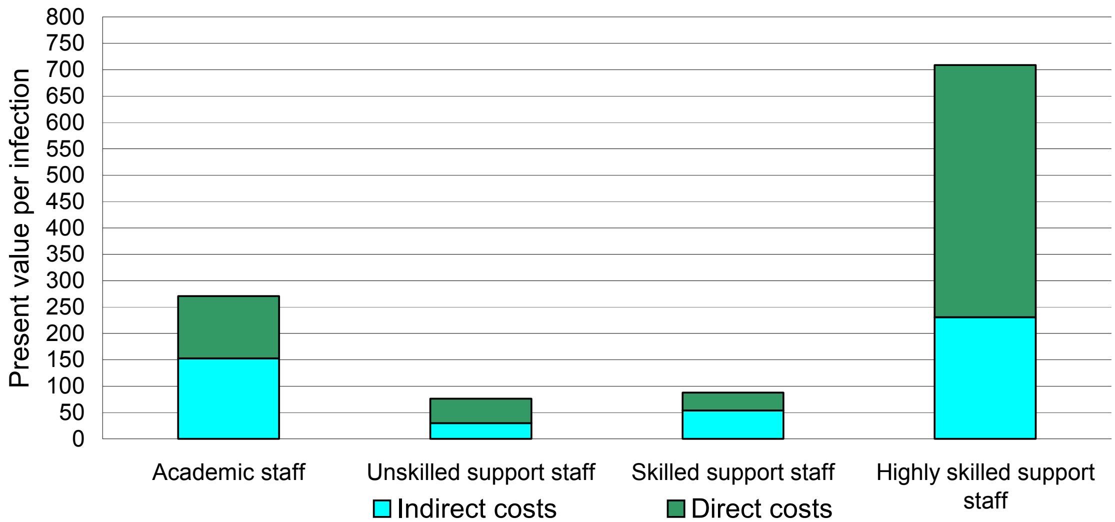
Table 16: NPV of average cost per HIV infection (Rand)(2004): Bloemfontein campus

	Academic staff	Unskilled support staff	Skilled support staff	Highly skilled support staff	Total
Sick leave	30,929	7,214	11,649	28,595	
On-the-job productivity loss	90,085	21,010	33,930	152,275	
Supervisor's time	1,931	595	1,943	1,943	
Vacancy	8,648	190	2,016	13,152	
Reduced productivity during start-up	21,141	958	4,360	34,894	
Death and disability benefits	88,229	15,596	8,902	435,341	
Medical costs	25,676	30,087	21,181	38,598	
Recruitment	3,212	321	3,212	3,212	
Training	919	241	474	863	
Total indirect costs	152,734	29,967	53,898	230,859	
Total direct costs	118,036	46,245	33,769	478,013	
Average cost per infection	***270,770***	***76,212***	***87,667***	***708,873***	
Average cost as a multiple of mean salary	2.5	2.5	1.7	5.2	
Annual aggregate cost (Rand)	3,136,511	357,120	1,228,948	1,064,154	5,786,733
Annual aggregate cost as % of total annual salaries and wages	3.6	3.6	2.4	5.6	3.5
Annual aggregate cost as % of annual operating expenses					1.5

The estimated average cost per infection respectively represented 2.5 (unskilled support services staff), 1.7 (skilled support services staff), 2.5 (academic staff), and 5.2 times (highly skilled support services staff) the mean salary in each staff category. Although these ratios compare more or less with the ratios reported by Rosen *et al*. (2004) in their six company study, the ratio for highly skilled support services staff is considerably higher (their estimates reported for managers ranged between 0.5 and 3.2 compared with our ratio of 5.2).

In terms of annual aggregate costs, the cost of HIV/AIDS in each of these four staff categories amounted to R357 thousand (unskilled support services staff), R1.2 million (skilled support services staff), R3.1 million (academic staff), and R1 million (highly skilled support services staff) respectively in 2004. These costs respectively represented 3.6 (unskilled support services staff), 2.4 (skilled support services staff), 3.6 (academic staff), and 5.6 percent (highly skilled support services staff) of total annual salaries and wages in each staff category. The sum total of the cost of HIV/AIDS thus amounted to almost R5.8 million per annum at the Bloemfontein campus of UFS in 2004, which represents 3.5 percent of total annual salaries and wages, and 1.5 percent of the annual operating expenses of UFS. Again, these estimates of the relative magnitude of the cost of HIV/AIDS for the most part fall within the range of estimates reported by Rosen *et al*. (2004) for six other companies. For example, the annual aggregate cost amounted to between 0.4 and 5.9 percent of total salaries and wages in the six companies (Rosen *et al*., 2004). However, as with the average cost per HIV infection, our estimate for highly skilled support services staff considerably exceeds the estimates reported by Rosen *et al*. (2004). For managers, the average annual aggregate cost of HIV/AIDS in the six companies included in their study ranged between 0.1 and 1.7 percent of total salaries and wages, compared with our estimate of 5.6 percent. In addition, aggregate costs expressed as a percentage of annual operating expenses is much higher than for the companies included in the Rosen *et al*. (2004) study, where the estimates ranged between 0.01 and 0.64 percent of annual operating expenses compared with our 1.5 percent.

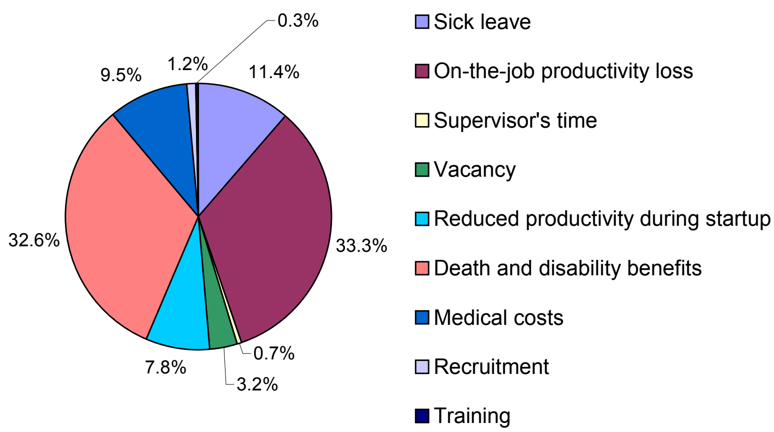
Figure 10: NPV of average cost per HIV infection (Rand)(2004): Bloemfontein campus



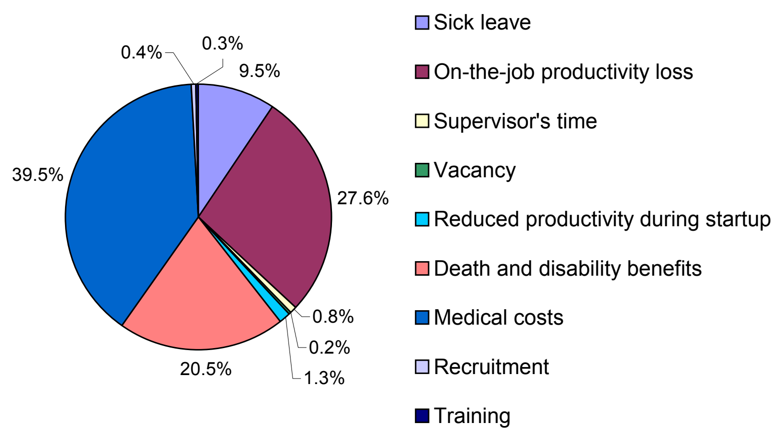
Interestingly, the composition of the average cost of HIV/AIDS varied substantially across the different staff categories (Figures 10 and 11). Direct costs include the cost of retirement benefits, death and disability benefits, medical care, and the recruitment and training of a replacement. Indirect costs include the cost of absenteeism, loss of productivity while at work, supervisor time, vacancy and the loss of productivity associated with a replacement employee having to learn the ropes (Rosen *et al*., 2003/04). In terms of the distinction between direct and indirect costs of HIV/AIDS, indirect costs made up a larger proportion of the cost per HIV infection in the case of skilled support staff (61.5 percent versus 38.5 percent) and academic staff (56.4 percent versus 43.6 percent). In the case of unskilled support services staff (39.3 percent versus 60.7 percent) and highly skilled support services staff (32.6 percent versus 67.4 percent), direct costs in turn made up a larger proportion of the estimated cost per HIV infection. These differences are the result of a relatively larger proportion of unskilled support services staff and highly skilled support staff being assumed to have access to benefit schemes (in other words, a larger proportion of these staff were employed on a permanent basis) compared with skilled support services staff and academic staff. This is evident from the discussion below on the contribution of specific costs to the estimated cost per HIV infection (Figure 10).

Figure 11: Composition of NPV of average cost per HIV infection (2004): Bloemfontein campus

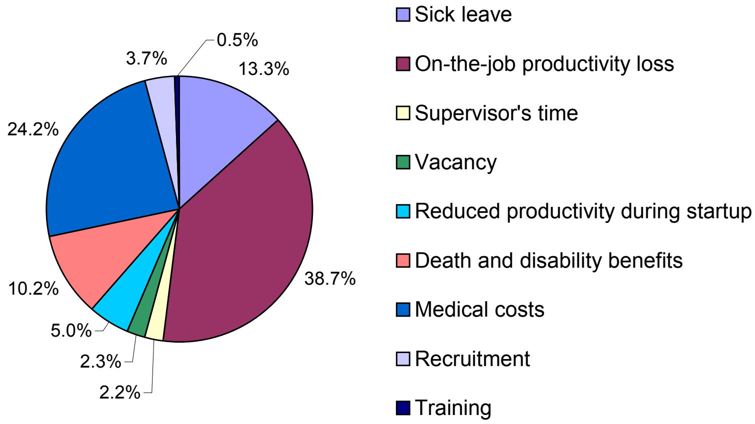
(a) Academic staff



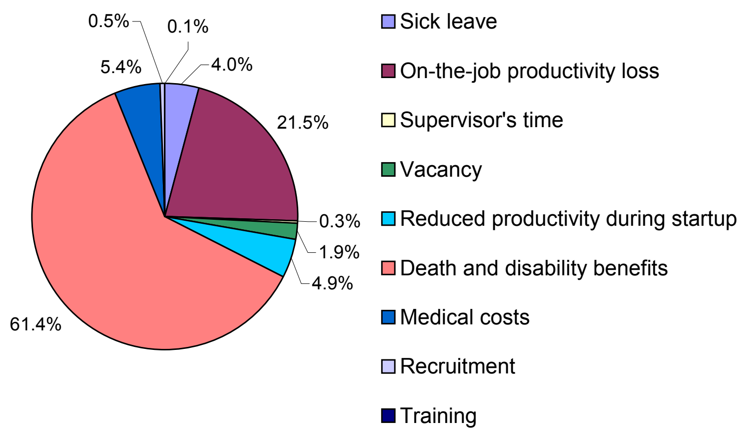
(b) Unskilled support staff



(c) Skilled support staff



(d) Highly skilled support staff



The differences in the composition of the average cost per HIV infection by staff category were equally interesting when it came to the individual components. In the case of unskilled support services staff, medical costs represented almost four-tenths of the cost per infection (39.5 percent). The second and third largest components of the cost per HIV infection were on-the-job productivity loss (27.6 percent) and death and disability benefits (20.5 percent) respectively. Hence, the three largest cost components represent almost nine-tenths of the cost per HIV infection for unskilled support services staff, while sick leave accounted for another 9.5 percent of the cost per HIV infection. The same three components of the cost of HIV/AIDS, namely medical costs, on-the-job productivity loss, and death and disability benefits, featured amongst the three largest components of the cost per HIV infection amongst highly skilled support services staff. In this case, death and disability benefits made up the largest share of the cost per HIV infection (61.4 percent), while on-the-job productivity loss (21.5 percent) and medical costs (5.4 percent) made up just more than a quarter of the cost per HIV infection amongst highly skilled support services staff. These three components of the cost per HIV infection, namely medical costs, on-the-job productivity loss, and death and disability benefits, constituted almost ninety percent of the total estimated cost per infection.

The three largest components of the cost per HIV infection amongst skilled support services personnel were on-the-job productivity loss (38.7 percent), medical costs (24.2 percent), and sick leave (13.3 percent) respectively, which combined represent just more than three-quarters of the cost per HIV infection. The cost of death and disability benefits accounted for another 10.2 percent of the cost per HIV infection amongst skilled support services staff. The same four components featured amongst the largest components of the cost per HIV infection amongst academic staff. Here, on-the-job productivity loss accounted for a third of the cost per HIV infection, while death and disability benefits made up an almost equally large proportion of the cost of HIV/AIDS (32.6 percent). The third and fourth largest components of the cost per HIV infection amongst academic staff were sick leave (11.4 percent) and medical costs (9.5 percent) respectively.

Interestingly, on-the-job productivity loss represented either the largest or second largest component of the cost per HIV infection in all of the four staff categories, which suggests that the loss of productivity resulting from the HIV/AIDS epidemic represents one of its major economic impacts on companies. Furthermore, medical costs, death and disability benefits, and sick leave also featured consistently amongst the larger cost components. In the case of our analysis, therefore, the costs of HIV/AIDS related to the time required by supervisors to manage HIV/AIDS, resultant vacancies, recruitment and training of new staff, and the initial reduced productivity of these new employees represented a relatively small proportion of the estimated cost per HIV infection. Productivity loss (here inclusive of supervisor time), sick leave, and death and disability benefits also featured amongst the major components of the cost of HIV/AIDS in six companies in southern Africa (Rosen *et al*., 2004), though medical costs did not feature as prominently in all companies, given the fact that fewer employees had access to medical aid in half of these companies.

Table 17: NPV of average annual aggregate cost of HIV/AIDS amongst staff (2004-13): Bloemfontein campus

Year	Total NPV of new HIV infections (Rand)	Percentage of total annual salaries and wages	Total nominal cost of HIV/AIDS in year incurred (Rand)	Percentage of total annual salaries and wages
2004	5,786,733	3.46%	178,909	0.11%
2005	5,713,711	3.41%	1,230,849	0.74%
2006	5,655,937	3.38%	1,677,224	1.00%
2007	5,600,135	3.35%	2,084,730	1.25%
2008	5,549,940	3.32%	2,454,339	1.47%
2009	5,504,784	3.29%	2,787,865	1.67%
2010	5,464,157	3.27%	3,088,880	1.85%
2011	5,427,616	3.24%	3,360,576	2.01%
2012	5,394,762	3.22%	3,605,825	2.16%
2013	5,365,232	3.21%		

The findings presented in Table 17 suggest that the HIV/AIDS epidemic, in terms of its impact on employees at Bloemfontein campus, holds major financial implications for UFS. The average annual NPV of new HIV infections over the ten-year period amounts to R5.5 million, which on average represents 3.3 percent of total annual salaries and wages. The average nominal value of the cost of HIV/AIDS incurred in each year in turn amounts to almost R2.3 million, which on average represents 1.4 percent of total annual salaries and wages. As will be made clear at a later stage, the costs of interventions which can either keep employees from becoming infected, or can extend the productive lives of infected employees represent but a fraction of these costs, thus making investments by UFS in prevention and treatment programmes economically prudent. Before we proceed to this discussion of the returns on prevention and treatment programmes, we need to reflect on the results of the sensitivity analysis (Table 18).

Table 18: Summary of results of sensitivity analysis of staff costs (2004): Bloemfontein campus

	Best case costing scenario	Baseline costing scenario	Worst case costing scenario
A. Academic staff			
NPV of average cost per infection	171,769	270,770	1,058,929
NPV of annual aggregate costs	1,988,734	3,136,511	12,752,202
Annual aggregate costs as % of total annual salaries and wages	2.3	3.6	10.8
B. Unskilled support staff			
NPV of average cost per infection	57,822	76,212	182,021
NPV of annual aggregate costs	272,746	357,120	780,408
Annual aggregate costs as % of total annual salaries and wages	2.7	3.6	7.7
C. Skilled support staff			
NPV of average cost per infection	60,406	87,667	470,169
NPV of annual aggregate costs	840,752	1,228,948	6,764,975
Annual aggregate costs as % of total annual salaries and wages	1.7	2.4	9.9
D. Highly skilled support staff			
NPV of average cost per infection	431,951	708,873	1,319,267
NPV of annual aggregate costs	646,790	1,064,154	2,006,310
Annual aggregate costs as % of total annual salaries and wages	3.4	5.6	10.7
E. Total			
NPV of average cost per infection	3,749,021	5,786,733	22,303,895
NPV of annual aggregate costs	2.2	3.5	10.3
Annual aggregate costs as % of annual operating expences	0.9	1.5	5.6

Evident from Table 18 is the wide range of estimates of the cost per HIV infection and of the resulting aggregate costs, in particular the extreme nature of the worst case costing scenario estimates when compared with the results from the baseline costing model, which are obtained when we vary the assumptions in the costing analysis (see Appendices D, E and F). According to these results, the cost per HIV infection amongst unskilled support staff at Bloemfontein campus ranged from R58 to R172 thousand. This translated into aggregate costs ranging from R272 to R780 thousand, which represented 2.7 and 7.7 percent of total annual salaries and wages respectively. In the case of skilled support services personnel, the cost per HIV infection ranged from R60 to R470 thousand. This translates into aggregate costs ranging from R840 thousand to R6.7 million, which represented 1.7 and 9.9 percent of total annual salaries and wages respectively.

As with the baseline results for Bloemfontein campus, the cost of HIV infections amongst academic staff represented the largest proportion of the aggregate costs to UFS of HIV/AIDS (more than half). In the best case scenario, the cost per HIV infection amounted to almost R172 thousand, which translated into almost R2 million in terms of aggregate costs and represented 2.3 percent of total annual salaries and wages. In the worst case costing scenario, the cost per HIV infection amongst academic staff amounted to just more than R1 million. When multiplied by the total number of estimated infections amongst academic staff, this translated into an extraordinary R12.7 million, which represented 10.8 percent of total annual salaries and wages for academic staff at Bloemfontein campus.

Despite the aggregate costs being greater amongst academic staff at Bloemfontein campus, however, the cost per HIV infection is highest amongst highly skilled support services staff, primarily because these employees represent the highest paid employees at the university, which includes its Deans and the staff in the Rectorate. In this case, the cost per HIV infection ranged from R432 thousand to R1.3 million respectively, which translated into costs of between R647 thousand and R2 million approximately. These aggregate costs of HIV infection amongst highly skilled support services staff amounted to between 3.4 and 10.7 percent of total annual salaries and wages.

It is, however, important to note the variation in the estimated aggregate cost of HIV/AIDS amongst employees from all staff categories who work at the Bloemfontein campus of UFS. In the best case costing scenario, HIV infections amongst employees will cost UFS R3.7 million, which represents 2.2 percent of total annual salaries and wages, and 0.9 percent of total annual operating expenses. In the worst case costing scenario, the aggregate costs of HIV infection amongst UFS employees at Bloemfontein campus amounted to a sum of R22.3 million. This huge amount represents 10.3 percent of total annual salaries and wages paid to UFS employees at Bloemfontein campus, and 5.6 percent of the total annual operating expenses of UFS.

Table 19: Best case costing and epidemiological scenario (2004): Bloemfontein campus

	Best case costing and epidemiological scenario	Baseline costing scenario
A. Academic staff		
NPV of annual aggregate costs	1,606,478	3,136,511
Annual aggregate costs as % of annual salary bill	1.8	3.6
B. Unskilled support staff		
NPV of annual aggregate costs	234,183	357,120
Annual aggregate costs as % of annual salary bill	2.4	3.6
C. Skilled support staff		
NPV of annual aggregate costs	696,563	1,228,948
Annual aggregate costs as % of annual salary bill	1.4	2.4
D. Highly skilled support staff		
NPV of annual aggregate costs	538,100	1,064,154
Annual aggregate costs as % of annual salary bill	2.8	5.6
E. Total		
NPV of annual aggregate costs	3,075,324	5,786,733
Annual aggregate costs as % of annual salary bill	1.4	3.5
Annual aggregate costs as % of annual operating expences	0.8	1.5

However, the best costing scenario represented in Table 18 is not the most favourable scenario that can be presented in regard to the cost to UFS of HIV/AIDS amongst employees at Bloemfontein campus. When we employ the ASSA provincial model results from the sensitivity analysis in the epidemiological analysis (or in other words the 'best case epidemiological scenario'), the results reported in Table 18 further improves (in other words, the estimated cost of HIV/AIDS declines), given that this model resulted in lower HIV prevalence estimates amongst staff at Bloemfontein campus. According to these results, the aggregate costs of HIV infections in the four staff categories amounted to R234 thousand (unskilled support services staff), R696 thousand (skilled support services staff), R1.6 million (academic staff), and R538 thousand (highly skilled support services staff) respectively (Table 19). The aggregate cost across all staff categories in turn amounted to just more than R3 million, which represented 1.4 percent of total annual salaries and wages, and 0.8 percent of total annual operating expenses. The question, however, is whether future investments by UFS in prevention and treatment programmes would be economically prudent, a question that one can answer based on the estimated cost to UFS of new HIV infection amongst employees. We first consider the estimated returns on treatment interventions for employees at the Bloemfontein campus of UFS, and then we discuss the estimated returns on prevention interventions targeting employees at the Bloemfontein campus of UFS.

According to the results presented in Table 20, investments in treatment are economically prudent in all staff categories if treatment can extend the productive lives of HIV infected employees at Bloemfontein by at least five years (Figure 12). In all these cases, treatment results in cost savings, ranging from R83 per HIV infection (unskilled support services staff) to R211 thousand per HIV infection (highly skilled support services staff), which in turn translate into returns of between less than one and more than 800 percent. If extensions in productive life afforded by treatment are of shorter duration, however, these investments in treatment will not be economically prudent for unskilled support services staff. In the case of skilled support services staff, treatment needs to extend productive life by more than one year for the investment in treatment to result in savings.

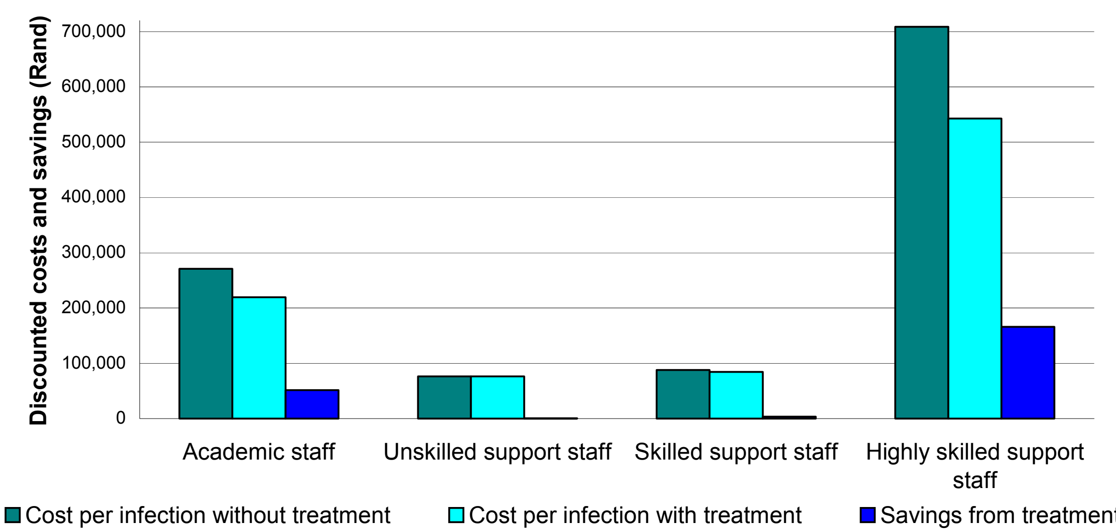
Table 20: Estimated returns on treatment of staff (2004): Bloemfontein campus

	Academic staff	Unskilled support staff	Skilled support staff	Highly skilled support staff
Average NPV of cost per infection (Rand)	270,770	76,212	87,667	708,873
NPV of cost of treatment	8,455	8,455	8,455	8,455
NPV of cost of infection (+1 year)	244,663	68,864	79,215	640,526
Net savings per infection (Rand)	17,652	-1,107	-2	59,892
Return (%)	209	-13	0	708
NPV of cost of treatment	14,084	14,084	14,084	14,084
NPV of cost of infection (+3 years)	221,074	62,225	71,577	578,769
Net savings per infection (Rand)	35,612	-96	2,006	116,020
Return (%)	253	-1	14	824
NPV of cost of treatment	19,713	19,713	19,713	19,713
NPV of cost of infection (+5 years)	199,759	56,225	64,676	522,966
Net savings per infection (Rand)	51,298	274	3,278	166,193
Return (%)	260	1	17	843
NPV of cost of treatment	25,325	25,325	25,325	25,325
NPV of cost of infection (+7 years)	180,499	50,804	58,440	472,544
Net savings per infection (Rand)	64,946	83	3,902	211,004
Return (%)	256	0	15	833

Note: The notations (+1 year) to (+7 year) in the table refers to the number of years that a person with HIV will gain in terms of life expectancy if on treatment for the same period of time plus 2 years. The assumption here is that the person will go onto treatment once AIDS symptomic, in other words two years prior to having died to having taken ill-health retirement.

However, the findings suggest that intervention is close to cost neutrality, with the loss per infection having amounted to between R1 (unskilled support services staff: three year extension in productive life) and R1,107 (unskilled support services staff: one year extension in productive life) only. Most importantly, moreover, the savings per infection amongst more highly skilled employees, notably academic staff and highly skilled support services staff, more than exceeds these small losses from treatment interventions for staff at lower skill levels. The returns on treatment calculated under each of the alternative scenarios in the sensitivity analysis for each of the four staff categories (Appendix G), present a broadly similar picture. Hence, the evidence suggests that treatment for employees is an economically prudent strategy to be considered by UFS as a response to the HIV/AIDS epidemic. (We preferred the term 'prudent' to that of 'feasible', given that the results were close to cost neutrality and that this study does not assess the capability of UFS to actually provide treatment.) Rosen *et al*. (2003), similarly report treatment to be an economically prudent option for companies as response to the HIV/AIDS epidemic. Treatment, however, only pushes the costs of HIV infections further into the future as it extends the productive lives of employees and thus results in savings. The question, therefore, is whether investments in prevention programmes could not yield even greater returns, given that prevention efforts will help UFS avert HIV infections, thus averting the entire future cost of an HIV infection, as issue to which we turn in due course.

Figure 12: NPV of net savings from treatment of staff assuming productive life increase by 5 years (2004): Bloemfontein campus



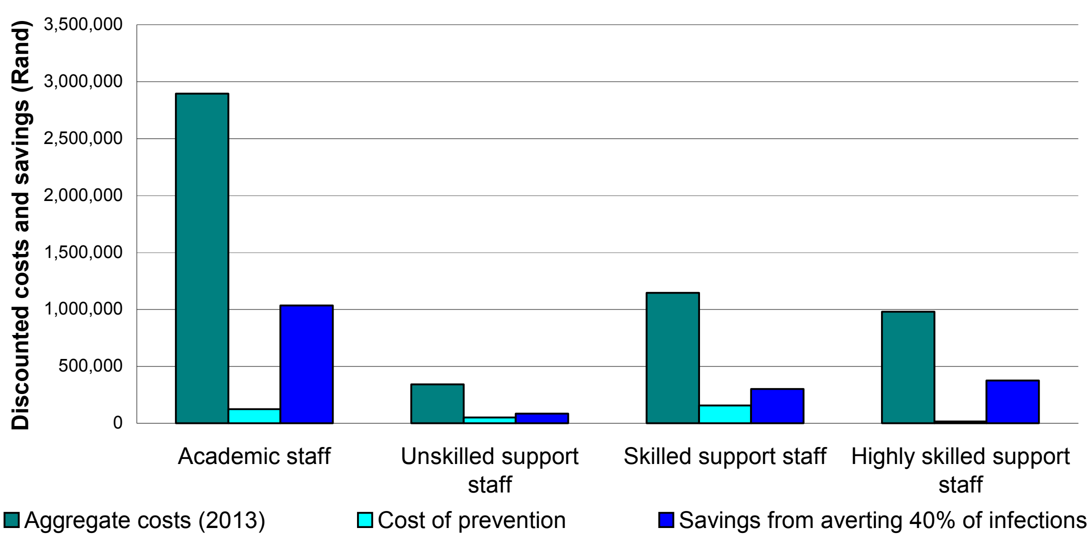
As explained elsewhere, UFS may think that the free provision of ARV in the public sector, which is currently being rolled out, relieves it of a duty to provide treatment itself, this despite the findings indicating that this is an economically prudent option in terms of the response of UFS to the epidemic. As Rosen (2004) points out, there are other reasons why employers may want to secure treatment for its employees. Current UFS employees may succumb to the disease without having received public sector ARV treatment, which would translate into a 'loss' of the savings to UFS of providing treatment to its employees. This, amongst others, may happen because treatment will not immediately be available at all public health care facilities and that not all patients will immediately receive treatment, that the need to take leave to access treatment may compromise individual confidentiality, and that UFS will have no direct involvement in the programme and can therefore do little to ensure high uptake and reliable delivery of treatment services (Rosen, 2004). Hence, UFS at the minimum should sell to employees the importance of being tested and of determining their HIV status and thus to access ARV treatment in the public or even private health care sectors, given that the returns on treatment are considerable.

Table 21: NPV of estimated returns on prevention intervention amongst staff (2004): Bloemfontein campus

	Academic staff	Unskilled support staff	Skilled support staff	Highly skilled support staff	Total
NPV of annual aggregate costs (2013)	2,895,958	341,920	1,146,861	980,493	5,365,232
Number of staff members	754	307	957	98	2,116
Cost per staff member per year (Rand)	20	20	20	20	20
NPV of 10-year intervention	123,955	50,470	157,328	16,111	347,864
Percentage of new HIV infections averted at baseline	40	40	40	40	40
Savings in aggregate costs incurred in 2013	1,158,383	136,768	458,744	392,197	2,146,093
Net savings/loss	1,034,428	86,298	301,416	376,086	1,798,229
Return (%)	835	171	192	2,334	517
x fold return	8.3	1.7	1.9	23.3	5.2
Savings in averting one new HIV infection at baseline	270,770	76,212	87,667	708,873	1,143,522
Net savings/loss	146,815	25,742	-69,661	692,762	671,703
Return (%)	118	51	-44	4,300	193
x fold return	1.2	0.5	-0.4	43.0	1.9

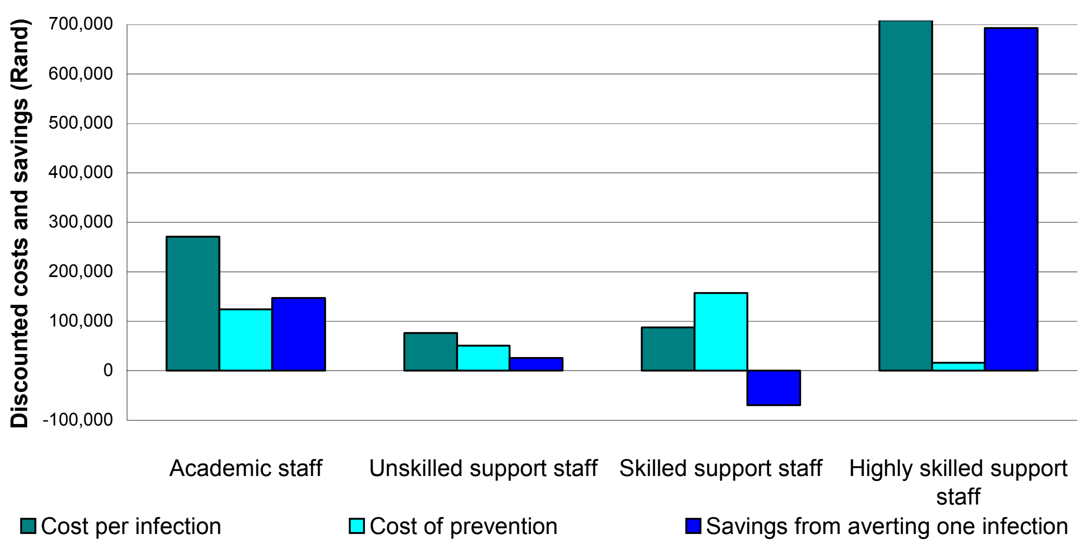
The findings presented in Table 21 suggest that a prevention programme for employees, like treatment, is an economically prudent strategy for responding to HIV/AIDS at the Bloemfontein campus of UFS. If a prevention intervention costing R20 per employee per year can be effective in averting forty percent of HIV infections, the resulting net savings will amount to R1.8 million, which translates into a return of 517 percent or a 5.2 fold return on an investment of almost R350,000. The net savings amongst the different staff categories amount to R86 thousand (unskilled support services staff), R301 thousand (skilled support services staff), R1 million (academic staff), and R376 thousand (highly skilled support services staff) respectively (Figure 13). The return on such investment in a prevention programme for employees is smallest amongst unskilled support staff (1.7 fold) and greatest amongst highly skilled support staff (23.3 fold). The returns on prevention programmes calculated under each of the alternative scenarios in the sensitivity analysis for each of the four staff categories (Appendix F), present a broadly similar picture.

Figure 13: NPV of estimated returns on prevention intervention amongst staff assuming 40 percent of new HIV infections are averted (2004): Bloemfontein campus



In fact, a prevention programme of this nature will be economically prudent, even if it translates into one HIV infection only being averted in each staff category (Table 20 and Figure 14). (We preferred the term 'prudent' to that of 'feasible', given that the results were close to cost neutrality and that this study does not assess the capability of UFS to actually provide treatment.) The net savings amongst the different staff categories amounts to R25 thousand (unskilled support services staff), -R69 thousand (skilled support services staff), R146 thousand (academic staff), and R692 thousand (highly skilled support services staff) respectively. The resulting net savings will amount to R671 thousand, which translates into a return of 193 percent or a 1.9 fold return on an investment of almost R350,000.

Figure 14: NPV of estimated returns on prevention intervention amongst staff assuming one new HIV infection is averted (2004): Bloemfontein campus



As with the case of the analysis of returns on treatment interventions, therefore, the net savings amongst more highly skilled employees, notably academic staff and highly skilled support services staff in terms of averted HIV infections, more than exceeds the small or negative returns at lower levels of skill. Hence, the evidence suggests that a prevention programme for employees at Bloemfontein campus is an economically prudent strategy to be considered by UFS as a response to the HIV/AIDS epidemic. Rosen *et al*. (2003) also conclude that prevention is an economically prudent response to the epidemic and estimates returns on prevention programmes in the workplace upwards of R100 thousand per annum.

As in the case of our consideration of the returns on interventions in treatment, therefore, the results suggest that the campus-wide implementation of such intervention is economically prudent, despite returns being lower amongst employees with lower levels of skill. In fact, any policy which discriminates between different classes of employees in terms of treatment and intervention programmes is not only inequitable and illegal, but also doomed to failure insofar as it will destabilise the institution and thus result in major productivity costs.

(ii) Qwaqwa campus

Table 22 reports the average cost per HIV infection at Qwaqwa campus over the ten-year period in NPV, including a breakdown of the components of these costs, as well as estimates of the relative magnitude of these costs. The cost per HIV infection was estimated at R104,313 for unskilled support services staff, R112,959 for skilled support services staff, R205,020 for academic staff, and R523,033 for highly skilled support services staff respectively. (The fact that the estimated cost per HIV infection amongst unskilled and skilled support services staff is relatively higher for Qwaqwa campus compared with Bloemfontein campus is the result of a higher proportion of staff in these categories being employed permanently and thus qualifying for employee benefits such as medical aid, group life insurance and a pension/provident fund). As expected, therefore, the cost per infection was higher at higher levels of skill, given that the magnitude of these costs derives from mean salary levels at different skill levels (Figure 15).

Table 22: NPV of average cost per HIV infection (Rand)(2004): Qwaqwa campus

	Academic staff	Unskilled support staff	Skilled support staff	Highly skilled support staff	Total
Sick leave	29,168	7,235	9,452	30,378	
On-the-job productivity loss	84,954	21,072	27,529	161,768	
Supervisor's time	1,931	595	1,943	1,943	
Vacancy	8,648	190	2,016	13,152	
Reduced productivity during start-up	21,141	958	4,360	34,894	
Death and disability benefits	38,568	33,387	36,085	355,128	
Medical costs	16,480	40,313	27,888	29,757	
Recruitment	3,212	321	3,212	3,212	
Training	919	241	474	863	
Total indirect costs	145,842	30,050	45,300	242,135	
Total direct costs	59,179	74,263	67,659	388,960	
Average cost per infection	***205,020***	***104,313***	***112,959***	***523,033***	
Average cost as a multiple of mean salary	2.0	3.4	2.8	2.7	
Annual aggregate cost (Rand)	462,189	83,019	123,591	103,129	771,928
Annual aggregate cost as % of total annual salaries and wages	4.3	4.2	1.5	4.4	3.4
Annual aggregate cost as % of annual operating expenses					0.2

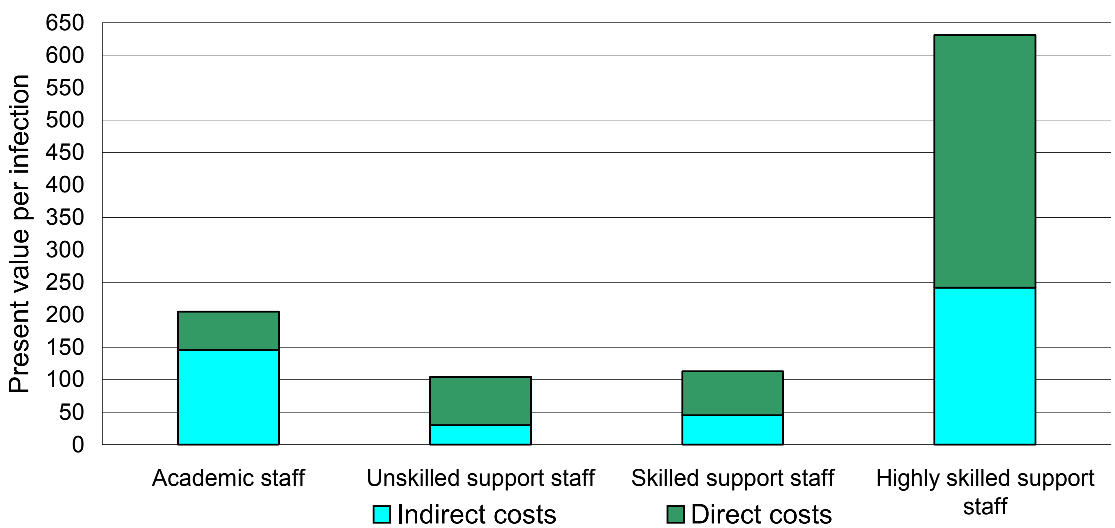
Again, our estimates of the cost per HIV infection are noticeably higher than the estimates reported by Rosen *et al*. (2004) in their six-company study. This most probably reflects the fact that a much higher proportion of employees at UFS qualify for the various employee benefits such as medical aid, retirement benefits and group life insurance compared with the companies included in their study. For example, in half of these companies, less than thirty percent of all employees had access to medical aid benefits (Rosen *et al*., 2004).

The estimated cost per infection respectively represented 3.4 (unskilled support services staff), 2.8 (skilled support services staff), 2.0 (academic staff), and 2.7 (highly skilled support services staff) times the mean salary in each staff category. These ratios compare more or less with the ratios reported by Rosen *et al*. (2004).

In terms of aggregate costs, the cost of HIV/AIDS in each of the four staff categories amounted to R83 thousand (unskilled support services staff), R123 thousand (skilled support services staff), R462 thousand (academic staff), and R103 thousand (highly skilled support services staff) respectively in 2004. These costs respectively represented 4.2 (unskilled support services staff), 1.5 (skilled support services staff), 4.3 (academic staff), and 4.4 (highly skilled support services staff) percent of total annual salaries and wages in each staff category. The sum total of the cost of HIV/AIDS thus amounted to almost R2.4 million at the Qwaqwa campus of UFS, which represents 3.4 percent of total annual salaries and wages, and 0.2 percent of the annual operating expenses of UFS. As was the case for Bloemfontein campus, these estimates of the relative magnitude of the cost of HIV/AIDS for the most part fall within the range of estimates reported by Rosen *et al*. (2004) for six other companies. For example, the aggregate cost amounted to between 0.4 and 5.9 percent as a percentage of total salaries and wages, and between 0.01 and 0.64 of annual operating expenses (Rosen *et al*., 2004). However, our estimates for academic staff and highly skilled support services staff in most cases considerably exceed the estimates reported by Rosen *et al*. (2004). For supervisors and managers (the staff category in their analysis which we assume compares best with the highly skilled staff in academia and top management in our analysis), the aggregate cost of HIV/AIDS in these six companies exceeded five percent in one instance only (Rosen *et al*., 2004).

Interestingly, the composition of the cost of HIV/AIDS varied substantially across the different staff categories (Figures 15 and 16). As explained elsewhere, direct costs include the cost of retirement benefits, death and disability benefits, medical care, and the recruitment and training of a replacement, whereas indirect costs include the cost of absenteeism, loss of productivity while at work, supervisor time, vacancy and the loss of productivity associated with a replacement employee having to learn the ropes (Rosen *et al*., 2003/04). In respect of the distinction between direct and indirect costs of HIV/AIDS, indirect costs made up only a larger proportion of the cost per HIV infection in the case of academic staff (71.1 percent versus 28.9 percent). In the three other staff categories, direct costs made up a larger proportion of the cost per HIV infection. The respective proportions of the cost per HIV infection that were attributed to indirect costs and direct costs were: unskilled support services staff (28.8 percent versus 71.2 percent), skilled support services staff (40.1 percent versus 59.9 percent), and highly skilled support services staff (46.3 percent versus 53.7 percent). These differences in the composition of the cost per HIV infection are primarily the result of a relatively larger proportion of unskilled, skilled and highly skilled support staff assumed to have access to benefit schemes (in other words, a larger proportion of such staff were employed on a permanent basis) compared with academic staff. This is evident from the discussion below on the contribution of specific costs to the estimated cost per HIV infection (Figure 16).

Figure 15: NPV of average cost per HIV infection (Rand)(2004): Qwaqwa campus

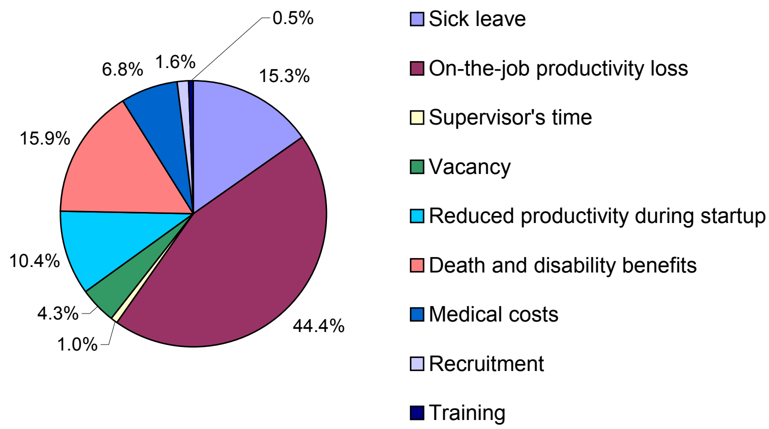


The differences in the composition of the cost per HIV infection by staff category were equally interesting when it came to individual components, as was the case with the results for Bloemfontein campus. In the case of unskilled support services staff, on-the-job productivity loss represented just more than a third of the cost per infection (34.3 percent). The second and third largest components of the cost per HIV infection were medical costs (27.4 percent) and death and disability benefits (22.7 percent) respectively, followed by sick leave (11.8 percent). Hence, the four largest cost components represented more than ninety percent of the cost per HIV infection for unskilled support services staff. The same four components of the cost of HIV/AIDS, namely on-the-job productivity loss, medical costs, death and disability benefits, and sick leave featured amongst the four largest components of the cost per HIV infection amongst skilled support services staff, although the relative ranking of the various components changed slightly. In the case of skilled support services staff, on-the job productivity loss again made up the largest share of the cost per HIV infection (32.1 percent), while death and disability benefits (25.6 percent), medical costs (19.8 percent), and sick leave (11 percent) represented the three other major components of the cost per HIV infection. These four components of the cost per HIV infection constituted almost ninety percent of the total estimated cost per infection amongst skilled support services staff.

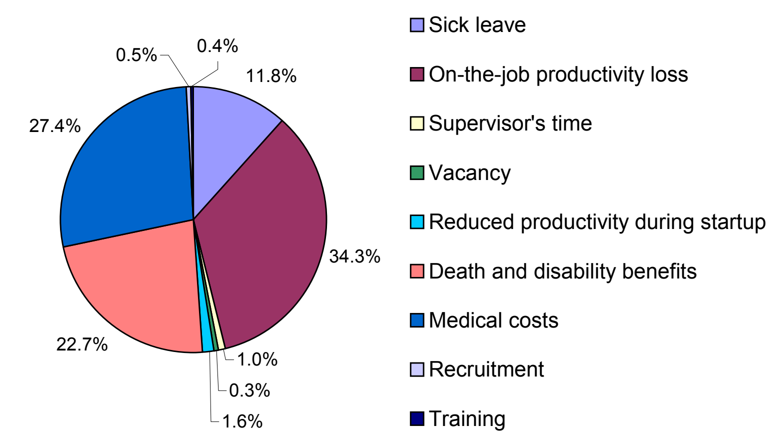
Although three of these cost components, i.e. on-the-job productivity, death and disability benefits and sick leave, also featured amongst the major cost components when it came to higher skill levels - notably academic staff and highly skilled support services staff - reduced productivity during start-up also now represented one of the four largest cost components. In the case of academic staff, the four largest cost components, in order of importance, were on-the-job productivity loss (44.4 percent), death and disability benefits (15.9 percent), sick leave (15.3 percent), and reduced productivity during start-up (10.4 percent) respectively. The four largest components of the cost per HIV infection amongst highly skilled support services personnel, again in order of importance, in turn were death and disability benefits (56.3 percent), on-the-job productivity loss (25.6 percent), reduced productivity during start-up (5.5 percent), and sick leave (4.8 percent) respectively, which together represented more than ninety percent of the estimated cost per HIV infection.

Figure 16: Composition of NPV of average cost per HIV infection (2004): Qwaqwa campus

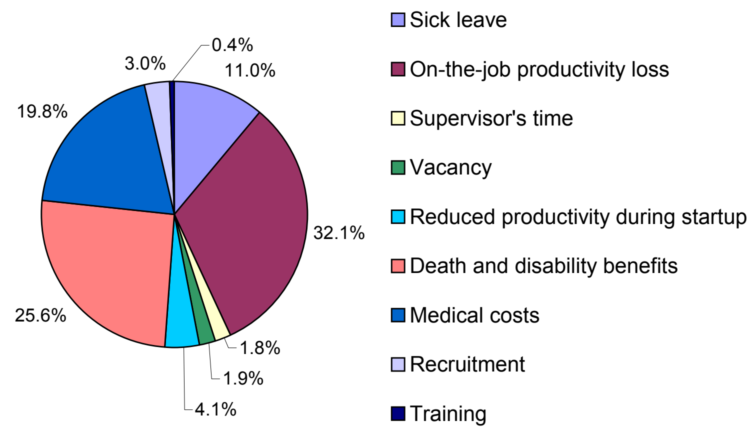
(a) Academic staff



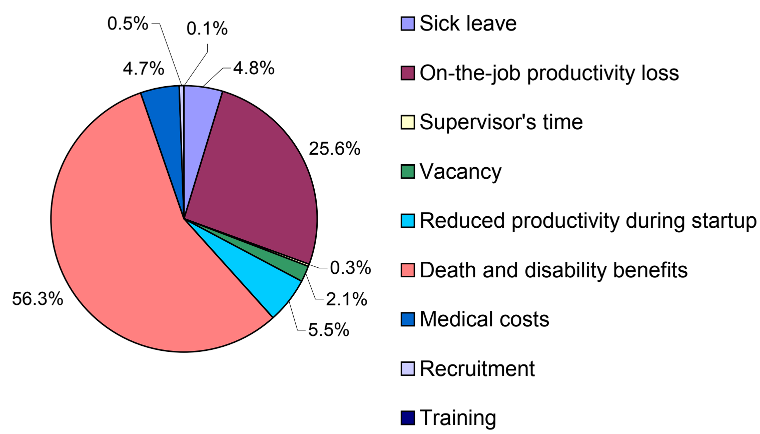
(b) Unskilled support staff



(c) Skilled support staff



(d) Highly skilled support staff



Hence, on-the-job productivity loss, as with the results for Bloemfontein campus, represented either the largest or second largest component of the cost per HIV infection in all of the four staff categories. In addition, reduced productivity during start-up also represented one of the relatively more significant components of the cost per HIV infection in the case of higher skill levels, notably amongst academic staff and highly skilled support services staff. This suggests that the loss of productivity resulting from the HIV/AIDS epidemic represents one of its major economic impacts on companies. Furthermore, medical costs, death and disability benefits, and sick leave also featured consistently amongst the larger cost components. In the case of our analysis, therefore, the costs of HIV/AIDS related to the time required by supervisors to manage HIV/AIDS, resulting vacancies, and recruitment and training of new staff, represented a relatively small proportion of the estimated cost per HIV infection. Productivity loss (here inclusive of supervisor time), sick leave, and death and disability benefits also featured amongst the major components of the cost of HIV/AIDS in six companies in southern Africa (Rosen *et al*., 2004), though medical costs did not feature as prominently in all companies, given the fact that fewer employees had access to medical aid in half of these companies.

Table 23: NPV of average annual aggregate cost of HIV/AIDS amongst staff (2004-13): Qwaqwa campus

Year	Total NPV value of new HIV infections (Rand)	Percentage of total annual salaries and wages	Total cost of HIV/AIDS in year incurred (Rand)	Percentage of total annual salaries and wages
2004	771,928	2.23%	58,648	0.17%
2005	953,418	2.06%	411,340	0.89%
2006	1,140,303	1.96%	566,959	0.97%
2007	1,322,562	1.89%	747,298	1.07%
2008	1,502,831	1.83%	929,633	1.13%
2009	1,492,846	1.82%	1,014,957	1.24%
2010	1,483,863	1.81%	1,092,225	1.33%
2011	1,475,788	1.80%	1,162,210	1.42%
2012	1,468,534	1.79%	1,225,608	1.49%
2013	1,462,024	1.78%		

The findings presented in Table 23 suggest that the HIV/AIDS epidemic, in terms of its impact on employees at Qwaqwa campus, will have major financial implications for UFS, as was the case for Bloemfontein campus. The average total annual net present value of new HIV infection amounted to R1.3 million, which on average represents 1.9 percent of total annual salaries and wages. The average value of the nominal cost of HIV/AIDS incurred in each year in turn amounted to R800 thousand, which on average represents 1.1 percent of total annual salaries and wages. As will be made clear at a later stage, the costs of interventions that can either keep employees from becoming infected, or can extend the productive lives of infected employees represent but a fraction of these substantial costs of HIV/AIDS, thus making investments by UFS in prevention and treatment programmes economically prudent. Before we proceed to such discussion of the returns on prevention and treatment programmes at Qwaqwa campus, we need to reflect on the results of the sensitivity analysis (Table 24).

Table 24: Sensitivity analysis of staff costs (2004): Qwaqwa campus

	Best case costing scenario	Baseline costing scenario	Worst case costing scenario
A. Academic staff			
NPV of average cost per infection	124,478	205,020	1,043,859
NPV of annual aggregate costs	277,939	462,189	2,433,959
Annual aggregate costs as % of annual salary bill	2.6	4.3	16.4
B. Unskilled support staff			
NPV of average cost per infection	78,388	104,313	180,149
NPV of annual aggregate costs	62,163	83,019	144,084
Annual aggregate costs as % of annual salary bill	3.2	4.2	7.2
C. Skilled support staff			
NPV of average cost per infection	80,152	112,959	429,866
NPV of annual aggregate costs	88,071	123,591	438,555
Annual aggregate costs as % of annual salary bill	1.1	1.5	4.2
D. Highly skilled support staff			
NPV of average cost per infection	307,551	523,033	1,185,601
NPV of annual aggregate costs	60,965	103,129	228,453
Annual aggregate costs as % of annual salary bill	2.6	4.4	9.7
E. Total			
NPV of annual aggregate costs	489,137	771,928	3,245,051
Annual aggregate costs as % of annual salary bill	2.1	3.4	11.0
Annual aggregate costs as % of annual operating expenses	0.1	0.2	0.8

It is evident from Table 24 that estimates of the cost per HIV infection and of the resultant aggregate costs are affected considerably when we vary the assumptions in the costing analysis (see Appendices C, D and F). In particular, the results of the worst case costing scenario differ substantially from those of the baseline costing model. According to these results, the cost per HIV infection amongst unskilled support staff ranged from R78 to R180 thousand. This translated into aggregate costs ranging from R62 thousand to

R144 thousand, which represented 3.2 and 7.2 percent of total annual salaries and wages respectively. In the case of skilled support services personnel, the cost per HIV infection ranged from R80 thousand to R430 thousand. This translates into aggregate costs ranging from R88 thousand to R438 thousand, which represented 1.1 and 4.2 percent of total annual salaries and wages respectively.

As with the results for Bloemfontein campus, the cost of HIV infections amongst academic staff represented the largest proportion of the aggregate costs to UFS of HIV/AIDS at Qwaqwa campus (in this case three-quarters in the worst case scenario). In the best case costing scenario, the cost per HIV infection amounted to almost R124 thousand, which translated into almost R277 thousand in terms of aggregate costs and represented 2.6 percent of total annual salaries and wages. In the worst case costing scenario, the cost per HIV infection amongst academic staff amounted to just more than R1 million. When multiplied by the total number of estimated infections amongst academic staff, this translated into an extraordinary R2.4 million, which represented 16.4 percent of total annual salaries and wages for academic staff at Qwaqwa campus.

Despite the aggregate costs being greater amongst academic staff, however, the cost per HIV infection is highest amongst highly skilled support services staff at Qwaqwa campus, as was the case at Bloemfontein campus, primarily because these employees represent the highest paid employees at the university. In this case, the cost per HIV infection ranged from R307 thousand to almost R1.2 million respectively, which translated into aggregate costs of between R60 thousand and R228 thousand only, given the small number of estimated HIV infections and resulting AIDS deaths amongst this very small group of employees. These aggregate costs of HIV infection amongst highly skilled support services staff amounted to between 2.6 and 9.7 percent of total annual salaries and wages paid to highly skilled support services staff at Qwaqwa campus.

It is, however, important to note the variation in the estimated aggregate cost of HIV/AIDS amongst employees from all staff categories employed at Qwaqwa campus. In the best case costing scenario, HIV infections amongst employees will cost UFS R489 thousand, which represents 2.1 percent of total annual salaries and wages, and 0.1 percent only of total annual operating expenses. In the worst case costing scenario, the aggregate costs of HIV infection amongst UFS employees at Qwaqwa campus amounted to a sum of R3.2 million. This amount represented 11 percent of total annual salaries and wages paid to UFS employees at Qwaqwa campus, and 0.8 percent of the total annual operating expenses of UFS.

Table 25: Best case costing and epidemiological scenario (2004): Qwaqwa campus

	Best case costing and epidemiological model	Baseline costing model
A. Academic staff		
NPV of annual aggregate costs	224,516	462,189
Annual aggregate costs as % of total annual salaries and wages	2.1	4.3
B. Unskilled support staff		
NPV of annual aggregate costs	53,374	83,019
Annual aggregate costs as % of total annual salaries and wages	2.7	4.2
C. Skilled support staff		
NPV of annual aggregate costs	72,967	123,591
Annual aggregate costs as % of total annual salaries and wages	0.9	1.5
D. Highly skilled support staff		
NPV of annual aggregate costs	50,720	103,129
Annual aggregate costs as % of total annual salaries and wages	2.1	4.4
E. Total		
NPV of annual aggregate costs	401,577	771,928
Annual aggregate costs as % of total annual salaries and wages	1.7	3.4
Annual aggregate costs as % of annual operating expenses	0.1	0.2

Yet, the best case costing scenario represented in Table 24 is not the most favourable scenario which can be presented with regard to the cost to UFS of HIV/AIDS amongst employees at Qwaqwa campus. When we employ the ASSA provincial model results from the sensitivity analysis in the epidemiological analysis, the estimated cost of HIV/AIDS declines further, given that this model resulted in lower HIV prevalence estimates amongst staff. In this case, the aggregate costs of HIV infections in the four staff categories, amounted to only R53 thousand (unskilled support services staff), R73 thousand (skilled support services staff), R224 thousand (academic staff), and R50 thousand (highly skilled support services staff) respectively (Table 25). The aggregate cost across all staff categories in turn amounted to just more than R400 thousand, which represented 1.7 percent of total annual salaries and wages for staff at Qwaqwa campus, and 0.1 percent of total annual operating expenses.

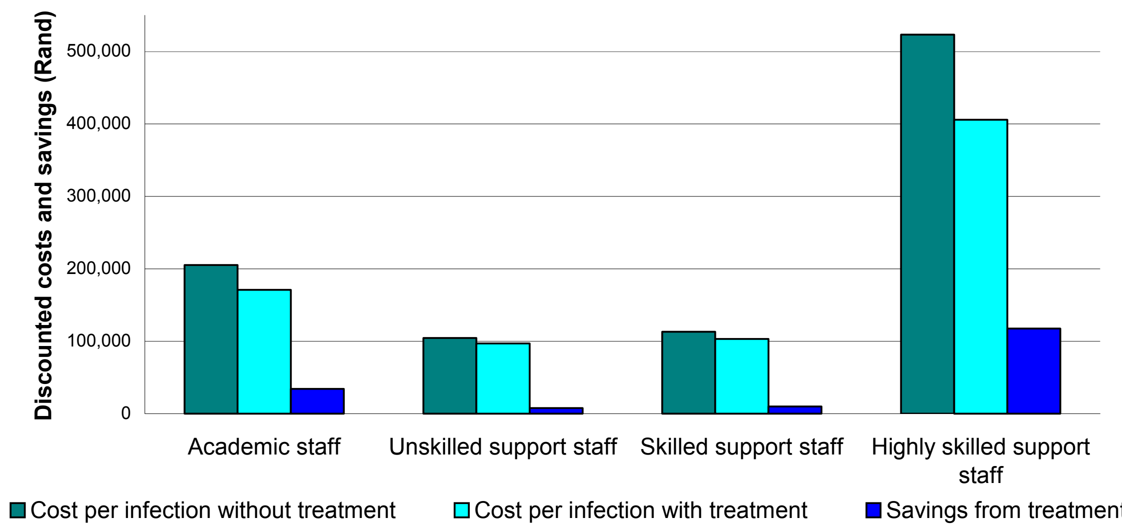
Table 26: NPV of estimated returns on treatment of staff (2004): Qwaqwa campus

	Academic staff	Unskilled support staff	Skilled support staff	Highly skilled support staff
Average NPV of cost per infection	205,020	104,313	112,959	523,033
NPV of cost of treatment	8,455	8,455	8,455	8,455
NPV of cost of infection (+1 year)	185,253	94,255	102,068	472,604
Net savings per infection (Rand)	11,312	1,603	2,436	41,974
Return (%)	134	19	29	496
NPV of cost of treatment	14,084	14,084	14,084	14,084
NPV of cost of infection (+3 years)	167,392	85,167	92,227	427,038
Net savings per infection (Rand)	23,544	5,061	6,648	81,911
Return (%)	167	36	47	582
NPV of cost of treatment	19,707	19,707	19,707	19,707
NPV of cost of infection (+5 years)	151,252	76,956	83,335	385,864
Net savings per infection (Rand)	34,060	7,649	9,917	117,461
Return (%)	173	39	50	596
NPV of cost of treatment	25,325	25,325	25,325	25,325
NPV of cost of infection (+7 years)	136,669	69,536	75,300	348,661
Net savings per infection (Rand)	43,026	9,451	12,334	149,047
Return (%)	170	37	49	589

Note: The notations (+1 year) to (+7 year) in the table refers to the number of years that a person with HIV will gain in terms of life expectancy if on treatment for the same period of time plus 2 years. The assumption here is that the person will go onto treatment once AIDS symptomic, in other words two years prior to having died to having taken ill-health retirement.

The question, however, is whether future investments by UFS in prevention and treatment programmes would be economically prudent, a question that one can again answer based on the estimated cost to UFS of new HIV infection amongst employees at Qwaqwa campus. We first consider the estimated returns on treatment interventions for employees, and then discuss the estimated returns on prevention interventions targeting employees.

Figure 17: NPV of estimated savings from treatment of staff assuming productive life increases by 5 years (2004): Qwaqwa campus



According to the results presented in Table 26, investments in treatment are economically prudent in all staff categories if treatment can extend the productive lives of HIV infected employees at Qwaqwa campus. (We preferred the term 'prudent' to that of 'feasible', given that the results were close to cost neutrality and that this study does not assess the capability of UFS to actually provide treatment.) This is the case regardless of whether treatment extends the productive lives of employees by one, three, five or even seven years. In all these cases, treatment results in cost savings, which in the case of an extension in productive life of five years, ranges from R7,649 per HIV infection (unskilled support services staff) to R117 thousand per HIV infection (highly skilled support services staff)(Figure 17). These savings in turn translates into returns of between 39 and 596 percent on the money spent on providing treatment to HIV-positive employees. (The reason for treatment resulting in cost savings at all skill levels and under all scenarios, unlike the situation at Bloemfontein campus where this was not the case, is that the estimated cost per HIV infection amongst unskilled and skilled support services staff at Qwaqwa campus exceeded the estimated cost per HIV infection amongst the same staff categories at Bloemfontein campus, thus translating into net returns on treatment.)

The returns on treatment calculated under each of the alternative scenarios in the sensitivity analysis for each of the four staff categories (Appendix G), present a broadly similar picture. Hence, the evidence presented here suggests that treatment for employees at Qwaqwa campus is an economically prudent strategy to be considered by UFS as a response to the HIV/AIDS epidemic. Rosen *et al*. (2003), similarly report treatment to be an economically prudent option for companies as a response to the HIV/AIDS epidemic. (We preferred the term 'prudent' to that of 'feasible', given that the results were close to cost neutrality and that this study does not assess the capability of UFS to actually provide treatment.) As was explained elsewhere, treatment only pushes the costs of HIV infections further into the future as it extends the productive lives of employees, thus resulting in savings. The question, however, is whether investments in prevention programmes would yield even greater returns, given that prevention efforts will help UFS avert HIV infections, thus averting the entire future cost of an HIV infection amongst employees.

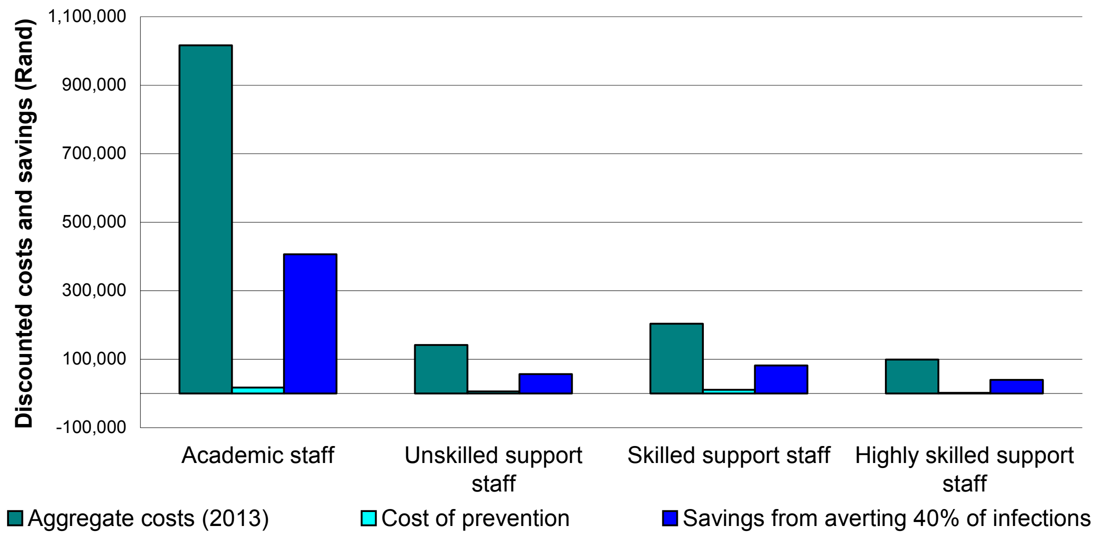
As explained elsewhere, UFS may think that the free provision of ARV in the public sector, which is currently in progress, relieves it of a duty to provide treatment itself, this despite the findings indicating that this is an economically prudent option in terms of the response of UFS to the epidemic. Again, for reasons explained elsewhere, UFS at the minimum should sell to employees the importance of being tested and of determining their HIV status and thus access to ARV treatment in the public or even private health care sectors, given that the returns on treatment are considerable.

Table 27: NPV of estimated returns on prevention intervention amongst staff (2004): Qwaqwa campus

	Academic staff	Unskilled support staff	Skilled support staff	Highly skilled support staff	Total
NPV of annual aggregate costs (2013)	1,016,770	141,813	203,827	99,614	1,462,024
Number of staff members	105	35	65	12	217
Cost per staff member per year (Rand)	20	20	20	20	20
NPV of 10-year intervention	17,262	5,754	10,686	1,973	35,674
% of new HIV infections averted at baseline	40	40	40	40	40
Savings in aggregate costs incurred in 2013	406,708	56,725	81,531	39,845	584,810
Net savings/loss	389,446	50,971	70,845	37,873	549,136
Return (%)	2,256	886	663	1,920	1,539
x fold return	22.6	8.9	6.6	19.2	15.4
Savings in averting one new HIV infection at baseline	205,020	104,313	112,959	523,033	945,325
Net savings/loss	187,758	98,559	102,274	521,060	909,651
Return (%)	1,088	1,713	957	26,413	2,550
x fold return	10.9	17.1	9.6	264.1	25.5

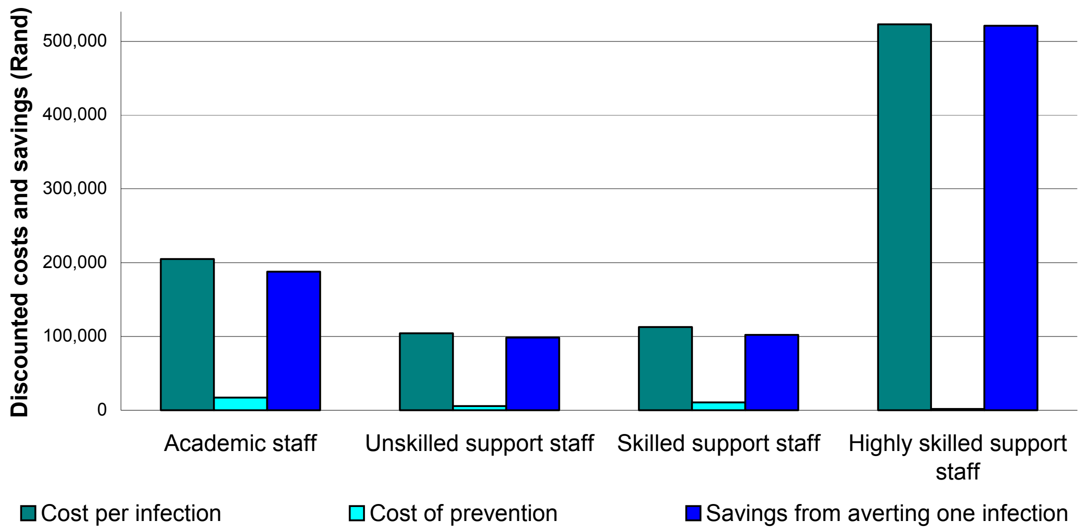
The findings presented in Table 27 suggest that a prevention programme for employees at Qwaqwa campus, like treatment, is an economically prudent strategy for responding to HIV/AIDS. (We preferred the term ‘prudent’ to that of ‘feasible’, given that the results were close to cost neutrality and that this study does not assess the capability of UFS to actually provide treatment.) Rosen *et al*. (2003) also conclude that prevention is an economically prudent response to the epidemic and estimates returns on prevention programmes in the workplace upwards of R100 thousand per annum. If a prevention intervention costing R20 per employee per year can be effective in averting forty percent of HIV infections, the resulting net savings will amount to R549 thousand, which translates into a return of 1,539 percent or a 15.4 fold return on an investment of just R35 thousand.

Figure 18: NPV of estimated returns on prevention intervention amongst staff assuming 40 percent of new HIV infections are averted (2004): Qwaqwa campus



The net savings amongst the different staff categories amounted to R51 thousand (unskilled support services staff), R70 thousand (skilled support services staff), R389 thousand (academic staff), and R37 thousand (highly skilled support services staff) respectively (Figure 18). The return on such investment in a prevention programme for employees was smallest amongst unskilled support staff (8.9 fold) and greatest amongst academic staff (22.6 fold). (A prevention programme resulted in net savings in all staff categories, unlike at Bloemfontein campus where this was not the case at lower levels of skill. As explained elsewhere, this was the result of the estimated cost per HIV infection amongst unskilled and skilled support services staff at Bloemfontein campus being considerably lower than the estimated cost per HIV infection amongst the same staff categories at Qwaqwa campus, thus not translating into net returns on prevention efforts.) The returns on treatment calculated under each of the alternative scenarios in the sensitivity analysis for each of the four staff categories (Appendix G), present a broadly similar picture.

Figure 19: NPV of estimated returns on prevention intervention amongst staff assuming one new HIV infection is averted (2004): Qwaqwa campus



In fact, a prevention programme of this nature will be economically prudent, even if it translates into one HIV infection only being averted in each staff category at Qwaqwa campus (Table 27 and Figure 19). In this case, the net savings amongst the different staff categories amounted to R98 thousand (unskilled support services staff), R102 thousand (skilled support services staff), R187 thousand (academic staff), and R521 thousand (highly skilled support services staff) respectively. The resulting net savings will amount to almost R910 thousand, which translates into a 25.5 fold return on an investment of just more than R35 thousand. (The reader may note here that the net savings from a prevention programme averting one HIV infection per staff category exceeds the net savings from a prevention programme that averts 40 percent of HIV infections. The reason for this is that the estimated number of HIV infections per staff category in some cases was less than one, thus resulting in smaller returns on prevention efforts than when we assume that one HIV infection is averted. In this case, the results may present a more realistic picture of returns on prevention programmes, given that an individual will either be infected or not: one cannot have half a person being infected by HIV.)

Thus, as with the analysis of returns on treatment interventions, the evidence suggests that a prevention programme for employees at Qwaqwa campus is an economically prudent strategy to be considered by UFS as a response to the HIV/AIDS epidemic, as is a treatment programme for employees at Qwaqwa campus. This was also the case at Bloemfontein campus. In order however to get a picture of the total cost to UFS of HIV/AIDS amongst employees at both these campuses, we need to aggregate the costs for Bloemfontein and Qwaqwa campuses, which is the topic of the next section.

(c) Bloemfontein and Qwaqwa campuses

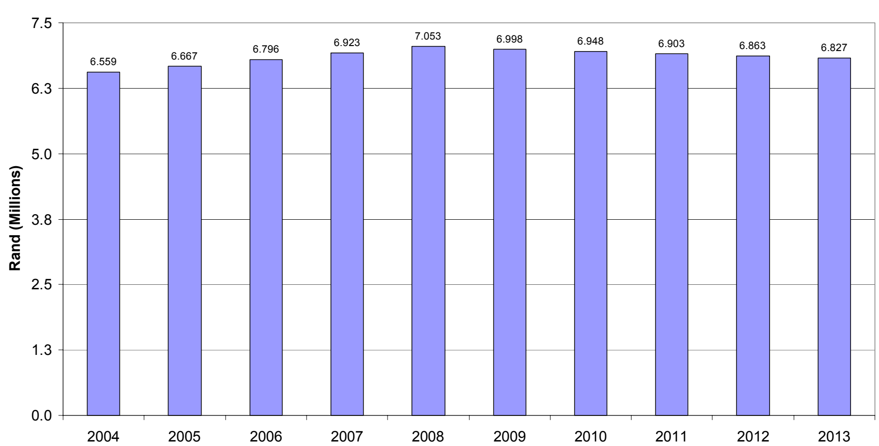
The findings presented in Table 28, which aggregates the estimated costs of HIV/AIDS we presented separately above for each of the two campuses, suggest that the HIV/AIDS epidemic, in terms of its aggregate impact on employees at the Bloemfontein and Qwaqwa campuses of UFS, will have major financial implications. In terms of the estimated aggregate costs for 2004, the cost of HIV/AIDS in each of the four staff categories in the baseline costing scenario amounted to R440 thousand (unskilled support services staff), R1.3 million (skilled support services staff), R3.6 million (academic staff), and R1.1 million (highly skilled support services staff) respectively. The sum total of the cost of HIV/AIDS thus amounted to just more than R6.5 million in 2004, which represents 3.5 percent of total annual salaries and wages, and 1.7 percent of the annual operating expenses of UFS. As was mentioned elsewhere, these estimates of the relative magnitude of the cost of HIV/AIDS amongst employees for the most part fall within the range of estimates reported by Rosen *et al*. (2004) for six other companies in southern Africa. Here, the aggregate cost amounted to between 0.4 and 5.9 percent as a percentage of total salaries and wages (Rosen *et al*., 2004). However, aggregate costs expressed as a percentage of annual operating expenses is much higher than for the companies included in the Rosen et al. (2004) study, where the estimates ranged between 0.01 and 0.64 percent of annual operating expenses compared with our 1.5 percent.

Table 28: NPV of annual aggregate cost of HIV/AIDS amongst staff (2004)

	Best case costing and epidemiological scenario	Baseline costing scenario	Worst case costing scenario
Academic staff	1,830,994	3,598,700	15,186,161
Unskilled support staff	287,557	440,139	924,492
Skilled support staff	769,530	1,352,539	7,203,530
Highly skilled support staff	588,821	1,167,283	2,234,763
Total	*3,476,901*	*6,558,661*	*25,548,946*

Figure 20 presents the average annual net present value of the aggregate cost of HIV/AIDS to UFS over the next ten years. The evidence suggests that the burden of HIV/AIDS on UFS in terms of its impact on employees will remain considerable. On average, the impact of HIV/AIDS on staff at the Bloemfontein and Qwaqwa campuses will cost UFS R6.8 million over this period, which on average again translates into 3.5 percent of total annual salaries and wages and 1.7 percent of the total annual operating expenses of UFS.

Figure 20: NPV of average annual aggregate staff costs (Rand) (2004-13): Baseline costing scenario



As was evident from the sensitivity results for Bloemfontein and Qwaqwa campuses presented elsewhere, the aggregate cost of HIV/AIDS to UFS varies considerably between the various costing and epidemiological scenarios. In the best case costing and epidemiological scenario, which employed the epidemiological input from the ASSA provincial model together with the best case costing scenario assumptions, the aggregate cost to UFS of HIV/AIDS amongst employees at the Bloemfontein and Qwaqwa campus amounted to almost R3.5 million, compared with a huge R25.5 million in the worst case costing scenario (Table 28). This respectively translated into between 1.8 and 13.4 percent of total annual salaries and wages, and between 0.9 and 6.4 percent of total annual operating expenses.

Figure 21: NPV of average annual aggregate staff costs (Rand) (2004-13): Best and worst case costing scenarios

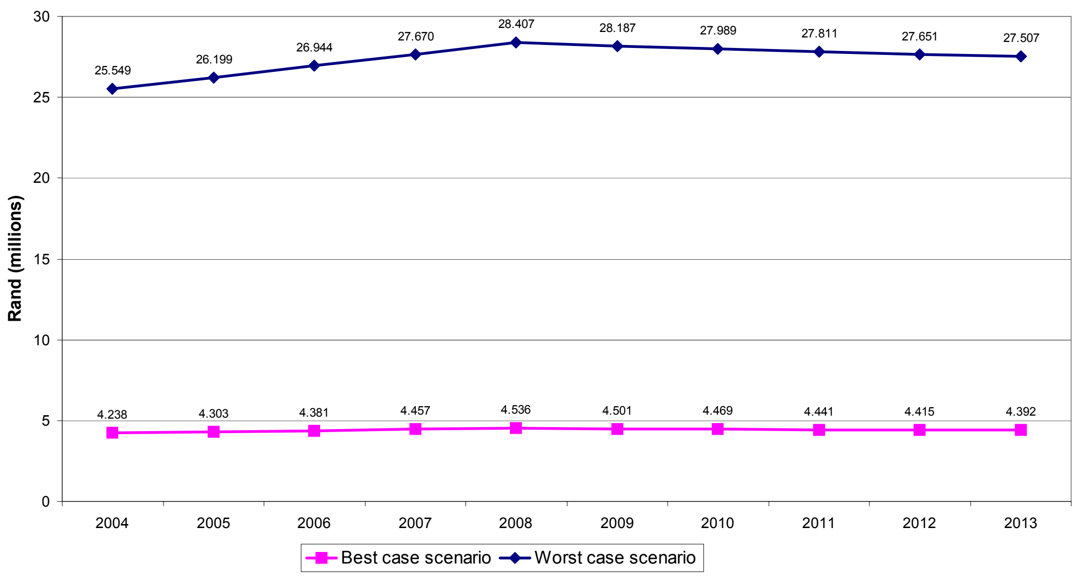
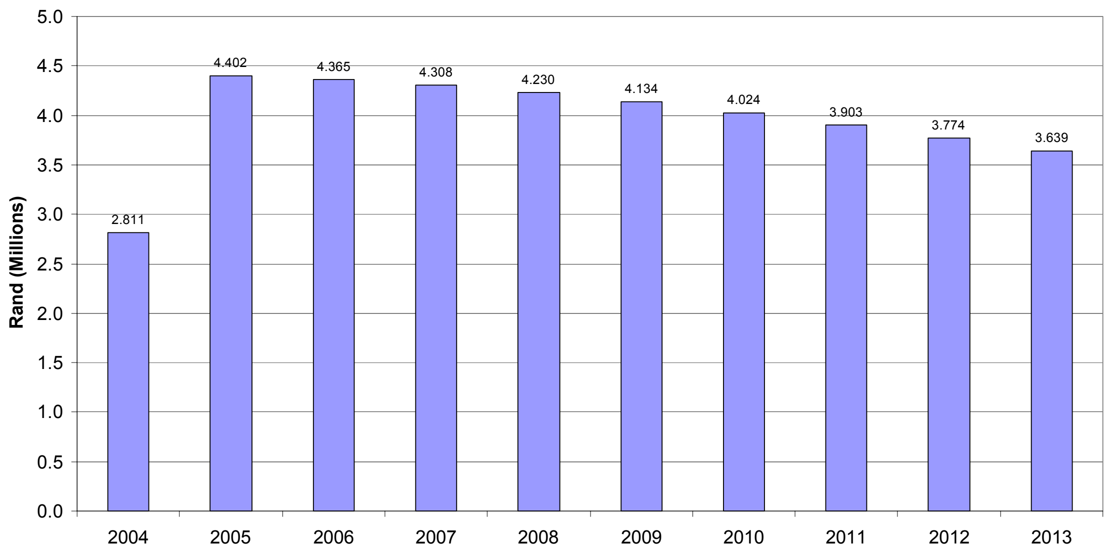


Figure 21, which presents the aggregate cost of HIV/AIDS under the best case costing scenario (the best case scenario here represents the scenario which did not employ the epidemiological inputs derived from the ASSA provincial model, but employed the baseline epidemiological results) and worst case costing scenarios respectively, paint a similar picture. In this case, the average annual aggregate cost of HIV/AIDS ranged between R4.4 million (best case scenario) and R27.4 million (worst case scenario). This on average translated into between 2.3 and 14.4 percent of total annual salaries and wages, and between 1.1 and 6.9 percent of annual operating expenses. Most importantly, as was shown elsewhere, treatment and prevention programmes represent economically prudent options for addressing the impact of HIV/AIDS amongst employees at UFS, by, one the one hand extending the productive lives of infected employees, and on the other by averting HIV infections and the future cost to UFS of the resulting AIDS death. Yet, UFS faces costs of HIV/AIDS not only in terms of HIV infections and AIDS deaths occurring amongst employees, but also in terms of HIV infections and AIDS deaths amongst students. Subsequently, the focus now shifts to the cost to UFS of the impact of HIV/AIDS on students and the estimated loss of revenue received in the form of class fees and government subsidies, which we estimated with the aid of the costing model for students described in the methods section of this report.

(b) Student costs

Incident HIV infections and AIDS cases amongst students at UFS is estimated to translate into a considerable cost in terms of revenue foregone. Figure 22 reports the annual net present value of the cost to UFS of incident HIV infections and AIDS cases amongst students over a ten-year period, based on the baseline costing model and assumptions discussed in the methods section of this report. On average, this cost to UFS of HIV/AIDS amongst students amounted to almost R4 million per annum, ranging from a low of R2.8 million in 2004 to a high of R4.4 million in 2005. (Note that the cost is much lower in 2004, given that no AIDS deaths are incurred in this particular year, as 2003 is the base year of the epidemiological model.) This on average translated into a cost per enrolled student of R1,646 and approximately one percent of total annual operating expenses of UFS, ranging from 0.7 (2004) to 1.1 percent (2005) of total annual operating expenses. (If the averages are calculated over a nine-year period only, which is perhaps more realistic for the reason noted above, the average annual cost of HIV/AIDS amounted to just more than R4 million and still on average represented approximately one percent of total annual operating expenses. Therefore, the results are not significantly different when calculating the average aggregate costs and its relative magnitude across nine rather than ten years.)

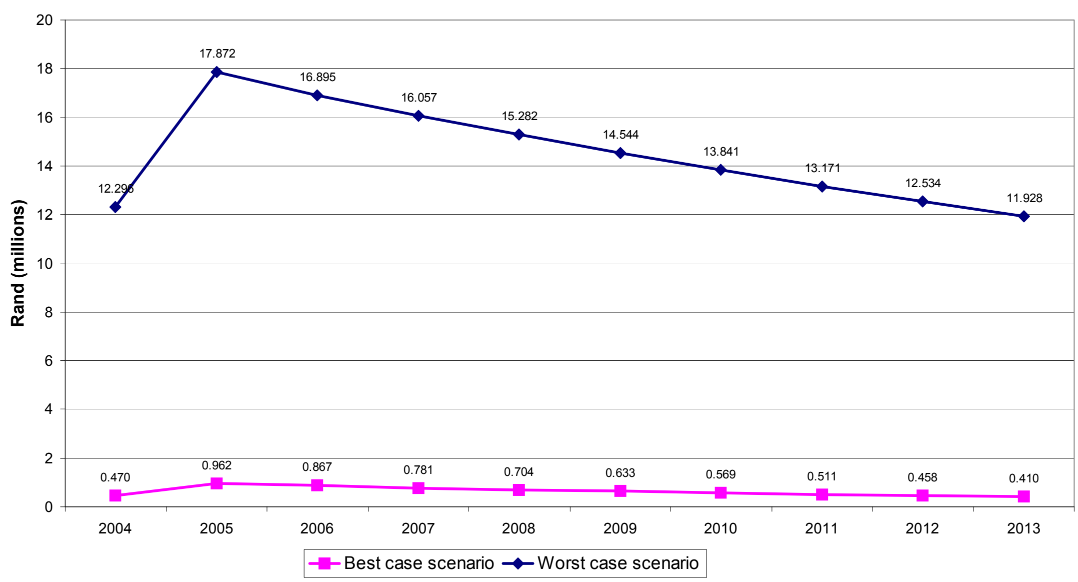
Figure 22: NPV of average annual aggregate student costs (Rand) (2004-13): Baseline costing scenario



It is also interesting to note the composition of the aggregate cost in terms of HIV infections versus AIDS cases, different types of students, and the two campuses. Under the baseline scenario, 55.1 percent of the aggregate costs to UFS of HIV/AIDS amongst students resulted from incident AIDS cases, 34.2 percent from incident AIDS deaths, and 10.7 percent only from incident HIV infections. This of course is the result of assuming that a smaller proportion of HIV infected students than students with AIDS will not complete their studies (refer Table 6), given that it is likely that HIV infection will not be as devastating to deal with as AIDS. Moreover, relatively few students are likely to know their HIV status, thus resulting in fewer students interrupting their studies. AIDS, however, will cause students to be more likely to interrupt their studies, given its devastating impact on their health.

In terms of the distinction between undergraduate and postgraduate students, a relatively larger proportion of the aggregate costs resulted from HIV infections and AIDS cases and deaths amongst postgraduate students. In the baseline scenario, 55 percent of the aggregate cost was attributed to postgraduate students and 45 percent to undergraduate students. This in turn is the result of government subsidies and class fees being higher for postgraduate students than for undergraduate students (see Table 6). Given, moreover, that the number of students at the Bloemfontein campus far exceeds the number of students at the Qwaqwa campus, and that postgraduate students for the most part are studying at the Bloemfontein campus, almost 95 percent of the aggregate cost to UFS of HIV/AIDS amongst students was attributed to Bloemfontein campus and 6.4 percent only to Qwaqwa campus. Thus, the brunt of the economic impact on UFS of HIV/AIDS amongst students in absolute terms at least (in other words, in terms of the number of students affected and the aggregate cost of the resulting impact) will be felt at the Bloemfontein campus.

Figure 23: NPV of average annual aggregate student costs (Rand) (2004-13): Best and worst case costing scenarios



As with aggregate staff costs, the estimated cost to UFS of HIV/AIDS amongst students varied considerably across the best and worst case costing scenarios (Figure 23). On average, the aggregate costs amounted to between R636 thousand and R14.4 million per annum over the ten-year period, which in turn translated into between 0.2 and 3.6 percent of total annual operating expenses. The cost of this 'AIDS tax' per enrolled student amounted to between R164 (best case scenario) and R4,396 (worst case scenario), compared with the R1,646 per enrolled student in the baseline costing scenario. (When calculated across a nine-year period, these estimates of average annual aggregate costs amounted to between R655 thousand and R14.7 million, which translated into between 0.2 and 3.7 percent of total annual operating expenses. Again, therefore, calculating the absolute and relative magnitude of costs across nine rather than ten years did not have a major effect on our results.)

The composition of these costs was not much different from the baseline costing scenario in terms of the type of student or the campus. Again, for reasons explained elsewhere, a relatively larger proportion of total costs was attributed to postgraduate students compared with undergraduate students. Furthermore, in excess of ninety percent of these costs was attributed to students at the Bloemfontein campus. Interestingly, however, the composition of the aggregate cost to UFS of HIV/AIDS amongst students was different under the best and worst case costing scenarios in the case of the proportion of these costs attributed to AIDS cases and AIDS deaths, than was the case with the baseline costing scenario. Incident HIV infections, for reasons explained above, under each scenario represented the smallest proportion of the aggregate cost to UFS of HIV/AIDS amongst students. In the best case costing scenario, the largest proportion of costs was attributed to incident AIDS deaths (50.7 percent), followed by incident AIDS cases (42.6 percent), and incident HIV infections (6.7 percent). Under the worst case costing scenario, as in the baseline costing scenario, the largest proportion of costs was attributed to incident AIDS cases (60.7 percent), followed by incident AIDS deaths (31.5 percent) and incident HIV infections (7.9 percent).

Given these considerable costs to UFS of incident HIV infections and AIDS cases and deaths amongst students, we need to determine whether investments in prevention and treatment interventions amongst students represent economically prudent strategies for responding to HIV/AIDS, as was the case with treatment and prevention programmes targeting employees.

Figure 24: NPV of estimated cost of and returns on prevention intervention which averts 40 percent of HIV infections amongst students (2004-13)

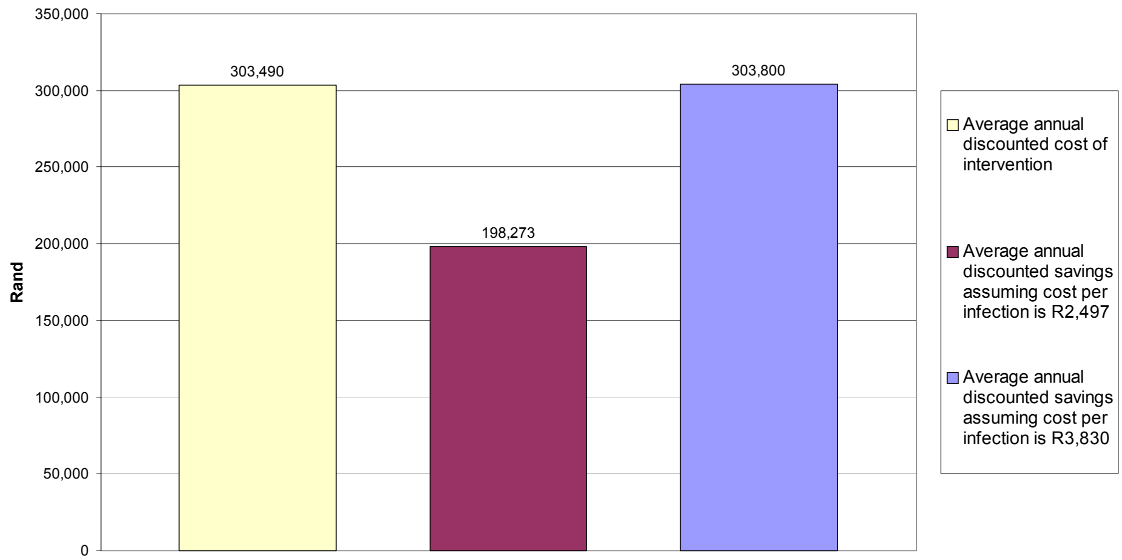


Figure 24 reports the estimated return on a prevention intervention amongst students costing R20 per student per annum. Such intervention will cost just more than R300 thousand per annum. In the baseline scenario, assuming that we can avert 40 percent of HIV infections amongst students, the total savings will amount to almost R200 thousand. Yet, this is not an economically prudent option in that the cost of the intervention exceeds the savings. (As explained in the methods section of this report, this is the result of the savings to UFS being calculated only in terms of HIV infections being averted, which, as we saw above, represented the smaller share of the aggregate cost to UFS of HIV/AIDS amongst students, given that the future benefits from averting the AIDS costs related to a current HIV infection will not accrue to UFS, but to society at large. As argued, elsewhere, the inclusion of these savings to society in our calculation, for example in terms of health care costs averted and the loss of skilled labour averted, will most definitely result in the said prevention programme being economically prudent.) However, we chose to conduct analyses to determine under what conditions such prevention programme amongst students will be economically prudent if we concentrate on the cost implications for UFS *per se*. In order for the intervention to be cost neutral, in other words for savings and costs to break even, the cost per HIV infection needs to be as high as R3,830 (Figure 24), which is the case only in the worst case costing scenario. Alternatively, a prevention programme amongst students will be cost neutral only if as many as 61 percent of HIV infections are averted, or if the intervention is cheaper than R13 per student per annum (or, in other words, costs less than R260 thousand per annum). Under these conditions, the savings from HIV infections amongst students being averted will be equal to or just exceed the cost of the intervention.

Therefore, unlike in the case of a prevention programme targeting staff, a prevention programme targeting students cannot be construed to make economic sense. Importantly, however, the inclusion in the calculation of savings to society, as explained elsewhere, will see the intervention become economically prudent. As a result, UFS, in respect of its larger role in society as 'factory' of human capital and skilled labour should nevertheless invest in prevention, as these interventions will have considerable longer term benefits for the entire economy and society at large. The question this raises, however, is to what extent government, realising the importance of this, will come to the party in terms of actively supporting and financing awareness and prevention activities at institutions of higher education. Government has chosen to do so at the primary and secondary levels of education, where it supports awareness and prevention activities in the form of a conditional grant which finances the life skills programme. Up to now, however, the financing of these efforts at tertiary levels has been the responsibility of institutions of higher education themselves and/or of donor agencies and philanthropies which have come to the aid of these institutions. The danger, therefore, is that government assumes that the message about awareness and prevention is effectively shared at school level, but that when adolescents leave school the awareness and prevention campaigns targeting the youth in general and the South African population at large will be as effective in sustaining efforts to change behaviour and bring the HIV epidemic under control. Of course, we cannot fully explore or research this important issue here, as this falls beyond the scope of this report, but we can emphasise the fact that government perhaps needs to reconsider its role in actively supporting and funding awareness and prevention activities at institutions of higher education.

In contrast to what is the case with prevention for students, the results suggest that treatment interventions targeting students do indeed represent an economically prudent response to HIV/AIDS. This, of course, is the result of a larger proportion of the aggregate cost to UFS of HIV/AIDS amongst students deriving from AIDS cases and deaths rather than HIV infection, as was explained elsewhere. Given these larger costs, investments in treatment can more easily be offset by savings resulting from the fact that fewer infected students will interrupt their studies and that the resultant loss in class fees and government subsidies will decline. Under the assumption that 50 percent of students with AIDS will complete their studies and that 80 percent of AIDS deaths will be averted if students have access to anti-retroviral treatment, the net savings from treatment for students will amount to almost R2 million, which translates into an almost three-fold return (Table 29). In our analysis, we also varied these assumptions of the proportion of infected students with AIDS who complete their studies and the proportion of student AIDS deaths that are averted (see Table 29), adjusting the one assumption while keeping the other constant. Importantly, treatment remained an economically prudent option in most cases (estimated returns exceeded 100 percent in all cases), even when we assumed that only 10 percent of students with AIDS complete their studies or that 10 percent only of AIDS deaths are averted. The lowest return on treatment was estimated at just more than 100 percent, assuming that 50 percent of students with AIDS complete their studies and that 10 percent of AIDS deaths are averted. In turn, the highest return on treatment was estimated at almost 450 percent, in other words, a 4.5 x return, assuming that 90 percent of students with AIDS complete their studies and that 80 percent of AIDS deaths are averted.

Table 29: NPV of estimated returns on treatment of students (2004-13)

	Percentage of AIDS cases completing studies with treatment (assuming 80% of AIDS deaths now averted):								
	10%	20%	30%	40%	**50%**	60%	70%	80%	90%
Average annual discounted costs	661,622	661,622	661,622	661,622	**661,622**	661,622	661,622	661,622	661,622
Average annual discounted savings	1,583,771	1,839,503	2,095,236	2,350,968	**2,606,701**	2,862,433	3,118,166	3,373,898	3,629,631
Net savings	922,149	1,177,881	1,433,614	1,689,346	**1,945,079**	2,200,811	2,456,544	2,712,276	2,968,009
Return (%)	139	178	217	255	**294**	333	371	410	449
	Percentage of AIDS deaths averted with treatment (assuming 50% of AIDS cases now complete studies):								
	10%	20%	30%	40%	50%	60%	70%	**80%**	90%
Average annual discounted costs	661,622	661,622	661,622	661,622	661,622	661,622	661,622	**661,622**	661,622
Average annual discounted savings	1,444,667	1,610,672	1,776,677	1,942,682	2,108,686	2,274,691	2,440,696	**2,606,701**	2,772,706
Net savings	783,045	949,050	1,115,055	1,281,060	1,447,064	1,613,069	1,779,074	**1,945,079**	2,111,083
Return (%)	118	143	169	194	219	244	269	**294**	319

As with our discussion of the returns on investments in prevention efforts, we assumed only that UFS would save some of the costs incurred in terms of loss of revenue from class fees and government subsidies. Thus, we did not factor into our calculation the savings which will accrue to government and society at large in terms of extending the productive lives of these persons by a number of years. As was evident from the discussion of returns on treatment of staff members, the future employers of these graduates will enjoy some of these savings. In addition, the wider economy will benefit insofar as these skilled individuals will be contributing to the economy for longer, while society will benefit in terms of these infected persons being able to take care of their families and fulfilling their roles and responsibilities as members of their communities. Therefore, we can again argue that the inclusion in our calculation of these savings will result in such treatment interventions generating even larger returns.

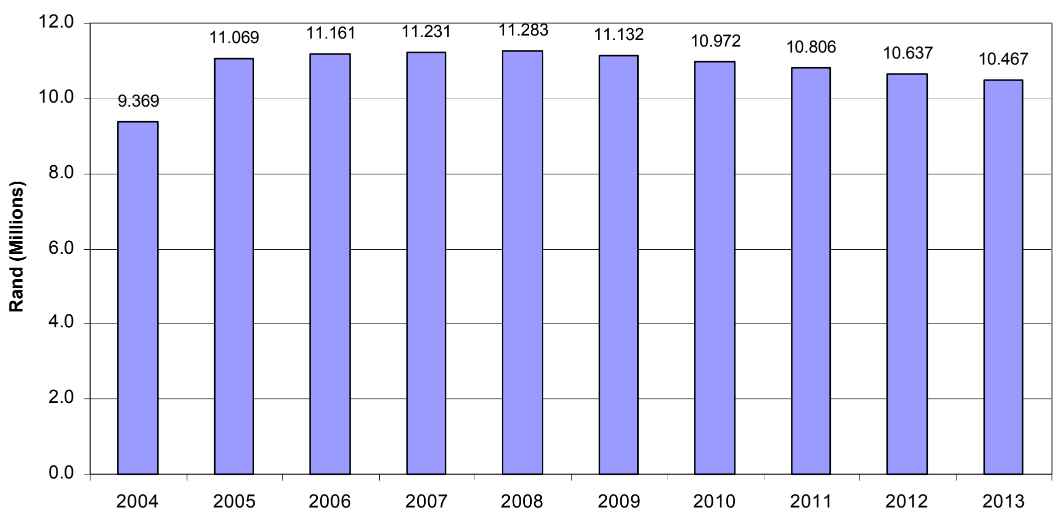
As explained elsewhere, moreover, UFS may think that the free provision of ARV in the public sector, which is currently in progress, relieves it of a duty to itself provide treatment, this despite the findings indicating that this is an economically prudent option in terms of the response of UFS to the epidemic. (We preferred the term 'prudent' to that of 'feasible', given that the results were close to cost neutrality and that this study does not assess the capability of UFS to actually provide treatment.) For reasons also explained elsewhere, current students of UFS may succumb to the disease without having received public sector ARV treatment, which would translate into a 'loss' of the savings to UFS of providing treatment to students. Consequently, UFS at a minimum should sell to students the importance of being tested and of determining their HIV status and thus to access ARV treatment in the public or even private health care sectors, given that the returns on a treatment programme for students have been shown to be considerable.

(c) Total cost to UFS of impact of HIV/AIDS on staff and students

In this final section of the discussion of the results of the costing analysis, we present a picture of the total cost to UFS of HIV/AIDS, aggregating the staff and students costs discussed above. Figure 25 reflects that these aggregate costs ranged between R10 and

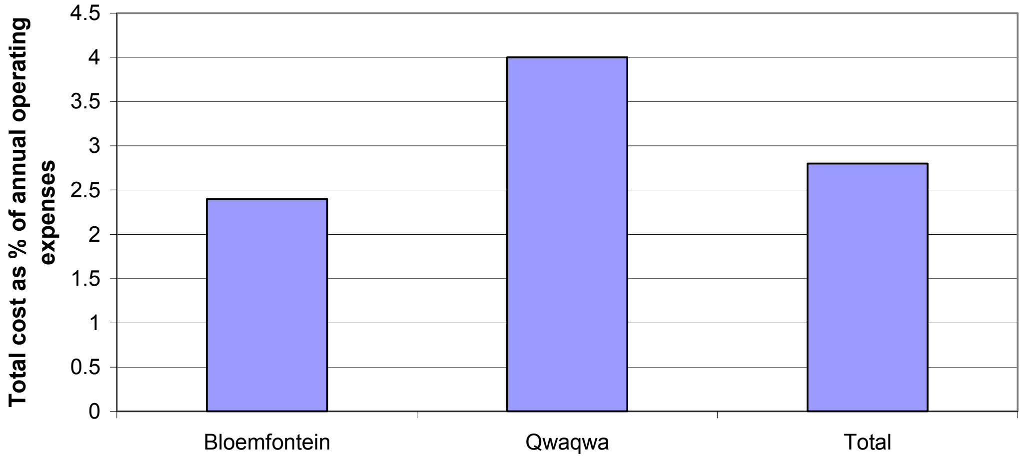
R11 million over this ten-year period. On average, the total cost to UFS of incident HIV infections and AIDS cases and deaths amongst staff and students amounted to R10.8 million per annum. The average annual total costs for the Bloemfontein and Qwaqwa campuses represented R9.2 and R1.5 million respectively. This means that 88 percent of the total cost of HIV/AIDS was incurred in terms HIV infections and AIDS cases and deaths estimated to occur on the Bloemfontein campus, with its considerably larger number of employees (2,116 *versus* 217) and students (18,357 *versus* 1486), compared with 12 percent for Qwaqwa campus.

Figure 25: NPV of average annual aggregate costs (Rand)(2004-13): Baseline costing scenario



The total cost to UFS of HIV/AIDS constituted a relatively large share of total annual operating expenses. On average, total costs of HIV/AIDS translated into 2.8 percent of total annual operating expenses over the ten-year period, with the total costs for the Bloemfontein and Qwaqwa campuses on average having amounted to 2.4 and 0.4 percent of total annual operating expenses respectively (Figure 25). Yet, despite this considerable 'AIDS tax' on UFS (Figures 25 and 26), our findings have also showed how investments in prevention and treatment programmes for staff and students can result in considerable cost savings, thus limiting the financial impact of HIV/AIDS on UFS.

Figure 26: NPV of average annual aggregate cost of HIV/AIDS as % of total annual operating expenses (2004-13): Baseline costing scenario



Again, the combined results from the sensitivity analysis show just how wide the range of estimates is in respect of the total cost to UFS of incident HIV infections and AIDS cases amongst staff and students. In Figure 27, we present the total annual estimated cost under the best and worst case costing scenarios respectively over the ten-year period. According to the results presented in Figure 27, the total costs on average ranged between R8.4 (best case scenario) and R31.3 million (worst case scenario) per annum over the ten-year period. In the best case costing scenario, the average annual total costs for the Bloemfontein and Qwaqwa campuses amounted to R7.3 and R1.0 million respectively, compared with R25.0 and R6.2 million respectively in the worst case costing scenario. Again, therefore, the major share of the total cost of HIV/AIDS was incurred in terms HIV infections and AIDS cases and deaths occurring on the Bloemfontein campus, with its considerably larger number of employees and students compared with Qwaqwa campus.

Figure 27: NPV of average annual aggregate costs (Rand)(2004-13): Best and worst case costing scenarios

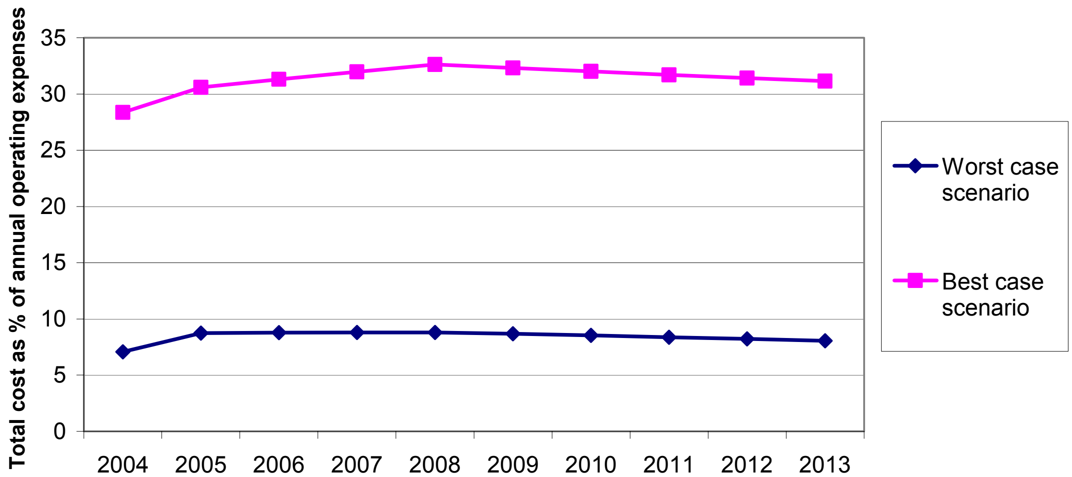
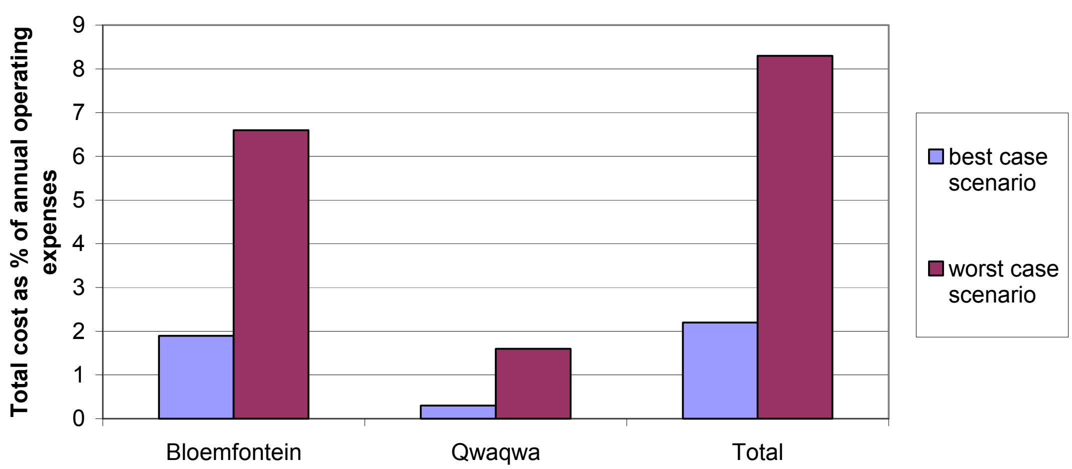


Figure 28: NPV of average annual aggregate costs of HIV/AIDS as % of total annual operating expenses (2004-13): Best and worst case costing scenarios



In terms of the sensitivity analysis, the total cost to UFS of HIV/AIDS constituted a relatively large share of total annual operating expenses, ranging from 2.2 (best case costing scenario) to 8.3 percent (worst case costing scenario) of total annual operating expenses. In the best case costing scenario, the average annual total costs for the

Bloemfontein and Qwaqwa campuses amounted to 1.9 and 0.3 percent of total annual operating expenses respectively, compared with 6.6 and 1.6 percent respectively in the worst case costing scenario (Figure 28). Yet, despite this considerable 'AIDS tax' on UFS (Figures 27 and 28), our findings also showed that investments in prevention and treatment programmes for staff and students can result in considerable cost savings.

4.3 Institutional audit

As was reported in the section on methods, we employed focus group discussions to inform the institutional audit. To this end, we conducted focus group discussions with students, staff and local NGOs and CBOs working in HIV/AIDS, as well as with representatives of the student council, unions, in-house health care personnel, the human resources department and the finance department at UFS. These focus groups were conducted between October 2002 and April 2003. Where necessary, focus groups were stratified amongst others by age, sex, population group, level of employment, or other criteria so as to accurately assess the opinions of distinct groups of students and staff. A total of 36 focus group discussions that involved in excess of 250 stakeholders were conducted. The focus group discussions included 8 with staff, 20 with students, 2 with community-based organisations and NGOs working in HIV/AIDS, 2 with union representatives, one with Kovsie Health and the AIDS Centre at UFS, one with the SRC student council, one with the finance department, and one with the human resource department. In the following pages, we summarise the insights gained from these focus group discussions. In the case of the focus group discussions with students, staff and local NGOs and CBOs working in HIV/AIDS, we employed the questions that guided these focus group discussions to structure our discussion (see Appendix A).

(a) Focus group discussions with students

How in your experience has HIV/AIDS affected your lives as students at UFS?

Only a small number of student respondents indicated that they did know someone with HIV/AIDS. Although some respondents did note that all people are in fact affected by the epidemic in some way or another (including, for example, the financial difficulties resulting from having to deal with HIV/AIDS at the household level and the possible future decline in student numbers), most respondents indicated that they did not know someone with HIV/AIDS. However, one should bear in mind that in a focus group discussion fear and stigmatisation may create substantial response bias and that this may explain the reluctance of respondents to indicate that they know someone with HIV/AIDS or someone they expect may have AIDS. Yet, as some respondents recognised, one also needs to bear in mind that students may become infected with HIV whilst at university, but that most will not die while students, at least not while studying as undergraduate students, given the long delay, that is, between becoming infected with HIV and contracting AIDS. Participants in focus group discussions at Qwaqwa campus, however, did note that some students had also died of AIDS.

Respondents also suggested how HIV/AIDS affects them in ways other than personally knowing someone with HIV/AIDS. Here the main concern of respondents was the possible stigmatisation of and discrimination against HIV-infected persons. In fact, some respondents felt that other students and lecturing staff do not know how to treat someone with HIV or AIDS as a result of a lack of information and ignorance. Furthermore, some respondents recognised that infected or affected students may not be able to complete their studies due to emotional difficulties in dealing with HIV/AIDS. Others highlighted the fact that students, particularly in the Faculty of Medicine, are at risk of needle stick injuries and may become infected with HIV in this manner. Yet, numerous participants in the focus group discussions argued that, "AIDS has definitely not affected the lives of students" because they reportedly are not changing their behaviour in response to prevention and awareness activities.

How do you feel about the views of academic staff and management at UFS regarding HIV/AIDS? E.g. are they open about the topic, do they integrate it into their courses, do they express an awareness of HIV/AIDS-related initiatives at the University?

According to students, management and their lecturers in particular do not generally mention HIV/AIDS or say anything about HIV/AIDS activities on the campus, except where HIV/AIDS is the particular focus of a lecture or part of the prescribed topical course work. For example, one respondent was of the opinion that, “The University staff is not open about HIV/AIDS. Not all [lecturers] integrate HIV/AIDS into their courses. One could even suggest that they are shy to talk about the disease”. However, based on a comparison of the responses from participants in the focus group discussions on Qwaqwa and Bloemfontein campus, it appears as if this is less of a problem at Qwaqwa campus and that lecturing staff here are more involved in HIV/AIDS activities and that more lecturers integrate HIV/AIDS into their curricula than was the case on Bloemfontein campus. Psychology, biology, medicine, geography and some economic and management sciences were mentioned as example of where HIV/AIDS is discussed as part of the course work. Furthermore, respondents noted that all students in the Faculty of Medicine on the Bloemfontein campus are briefed by faculty staff on the policy and procedures to follow in event of needle stick injuries. Respondents also perceived the student council on the Bloemfontein campus to be too silent on the topic of HIV/AIDS. Respondents offered various reasons for this supposed silence on HIV/AIDS on the part of lecturers, including the generation gap, which according to focus group participants may explain why lecturers do not openly communicate about HIV/AIDS to students. Other respondents were of the opinion that it is not the responsibility of lecturers to spread information about HIV/AIDS and that it in any case would not be an effective channel of communication, given the different perceptions of staff members regarding HIV/AIDS. Respondents also felt HIV/AIDS in some cases to be insufficiently integrated into academic courses in terms of content.

Are you aware of any HIV/AIDS campaigns or programmes that are currently in place on the campus?

Generally, student respondents were aware of some activities, but some participants in the focus group discussions appeared not to be aware or to have little specific information regarding HIV/AIDS activities. Levels of awareness of current activities and programmes seemed to be higher at Qwaqwa than in Bloemfontein campus. Respondents were aware of the following structures, programmes or activities:

- Existence of the AIDS Committee of the UFS
- AIDS information sessions taking place at residences
- Availability of AIDS testing and counselling services on campus (VCT)
- Visibility of AIDS posters on campus (Lovelife and own UFS posters)
- AIDS awareness days/weeks
- Annual AIDS candle light memorial service
- The distribution of condoms in residences
- The training of volunteers as AIDS counsellors
- The availability of AIDS pamphlets and condoms

Importantly, however, it seemed that awareness regarding current HIV/AIDS activities and programmes were significantly lower amongst male respondents, given that the male focus groups consistently listed fewer activities than were listed in female focus group discussions. To this end, it may be particularly important to devise strategies to involve male students more actively in HIV/AIDS activities and programmes and to increase awareness of HIV/AIDS amongst male students.

Have you found these programmes/campaigns useful and appropriate?

Respondents, despite a relatively low awareness of HIV/AIDS-related activities, once prompted regarding the current activities and programmes, agreed that these activities and programmes were useful and informative. However, a number of respondents were of the opinion that the current activities and programmes had no or few strengths, given the lack of knowledge regarding the said activities and programmes. Consequently, much more attention was paid to a discussion of the supposed weaknesses of the current HIV/AIDS activities and programmes.

What do you think has not worked well with these programmes/campaigns or what has been lacking?

As explained above, a large part of the focus group discussions with students (and with staff) was taken up by the discussion of the supposed weaknesses of current HIV/AIDS activities and programmes. In general, a number of respondents were of the opinion that the effectiveness of current HIV/AIDS activities and programmes is constrained by the 'AIDS fatigue' amongst students. Students are so overwhelmed by continually being bombarded with information on HIV/AIDS that they simply do not take much issue with new information about HIV/AIDS activities and programmes. As one respondent put it: "I have discovered that there is a problem these days. There has been so much talk about AIDS, AIDS, AIDS. So much so that when you talk to people about AIDS they go oh yes, yes, yes we have heard it all before".

Participants in the focus group discussions made two important points regarding the limitations of two specific HIV/AIDS initiatives on campus. Firstly, the initiative to distribute condoms on campus was faulted for no condoms being available in the condom dispensers that were installed for this purpose. (We should note here that a decision was taken rather to distribute condoms centrally at Kovsie Health, given the wide criticism from various avenues of the campus-wide distribution of condoms. At Qwaqwa campus, condoms are also distributed centrally from the AIDS Centre.) Secondly, and quite interestingly, many participants in the focus group discussions were of the opinion that the current emphasis in awareness activities on knowledge about the nature of the disease, the transmission of the virus, and how to keep from becoming infected, although necessary, is not sufficient. The idea, therefore, was that there is a need to move beyond the 'safe sex' message in information and awareness campaigns regarding HIV/AIDS. These students indicated that awareness activities should also, amongst others, disseminate information to students on how to deal with the risk of infection posed by exposure to blood, the preparedness of residences to deal with these and other infection risks, and information on living positively with HIV/AIDS.

Respondents also felt that current HIV/AIDS activities and programmes targeting students can only be more effective if…

- More students become actively involved in HIV/AIDS activities and programmes. The feeling was that too few students are actively involved due to the voluntary nature of participation in these activities and programmes. Some respondents, moreover, were of the opinion that knowledge of statistics regarding the actual HIV prevalence on campus is required to drive greater participation, given that this will create awareness of the reality and magnitude of the problem HIV/AIDS poses to students at UFS.

- Activities are made more ‘interesting’ so as to attract more student participation (see above point). For example, respondents felt that the HIV/AIDS posters they did see did not really attract their attention, while the activities planned around HIV/AIDS were perceived not to be ‘fun’ to attend. (In the next section, we describe those suggestions put forward by students as to how this can be achieved, but we can also perhaps point out here that these responsibilities are often those of persons who are not trained for this specific purpose, but are health care professionals. To this end, one may need seriously to consider employing HIV/AIDS professionals who can design, manage and implement these types of activities, rather than leave this to health care professionals.)
- Activities and programmes are publicised and advertised better so that everyone is aware of what is happening and when. The call, therefore, is for better communication regarding HIV/AIDS activities. One specific example of the perceived problems regarding communication on HIV/AIDS activities and programmes is the claim by one respondent that students who volunteered to be trained as peer councillors were not contacted again regarding the actual training, this despite their providing their names and contact details. (Given that UFS had resources to train only a specified number of councillors, the supply may have outstripped the budget, which offers a possible explanation for why these students were not contacted actually to undergo training.)
- The planning of activities and programmes is better coordinated with other events and programmes on the student calendar, given that these often clash. As suggested elsewhere, this problem can be addressed by integrating certain HIV/AIDS activities into other activities, rather than having to organise these activities as separate, independent events.

What can an HIV-infected student ideally expect from the University (what should be done or be provided at the minimum to help students cope with the effects of HIV/AIDS)?

As some respondents rightly observed, the capacity of UFS to assist infected students is severely constrained by the fact that they do not know who to help, given that students do not attempt to determine their HIV status nor disclose their status if known, probably due to a combination of existing stigma and discrimination and the lack of concrete benefits or assistance to motivate disclosure. (Many people, for example, argue that the public provision of ARV treatment will see more people come forward for VCT in order to know their status, because this is required to access treatment, which in turn would result in more people disclosing their HIV status when having to go onto treatment.) Interestingly, respondents were of the opinion that having to visit the "AIDS Centre", as it was formally called, could add to this discrimination. They suggested that the name perhaps be changed so as not to stigmatise those students going there as being 'AIDS cases'. (Although formerly located within the Kovsie Health services, the AIDS Centre (now in fact called the Centre for Life Skills, a name that can be construed to counter this stigmatisation) is currently located separately from the Kovsie Health service or clinic, which may add to the perceived stigmatisation.)

As was argued elsewhere, the main concern of student respondents was the possible stigmatisation of and discrimination against HIV-infected persons. Respondents felt strongly about the fact that a person's HIV status should not be a basis for discrimination against that person and that it is important to address issues of discrimination and stigmatisation as a matter of priority. Respondents were also of the opinion that students, amongst others, have a right to information on HIV/AIDS, to access to counselling for emotional and psychosocial support, to legal support if required, to financial support in the form of student loans or bursaries, and to subsidised treatment for HIV-positive students. Respondents, for example, felt that HIV/AIDS support groups for students could contribute significantly to this support system available to infected students. The policy of UFS on HIV/AIDS (which existed in draft format for a relatively long time and was officially adopted in 2005), moreover, does address most of these specific concerns of students, apart, that is, from two issues mentioned in the focus group discussions, namely access to financial support to infected students or to subsidised treatment for students.

If you could make some suggestions to the UFS on how to improve its HIV/AIDS programmes/campaigns aimed at students, what would you say?

According to some respondents, the epidemic remains invisible, and myths, ignorance and denial surrounding HIV/AIDS continue to prevail. Respondents suggested the following ways in which current HIV/AIDS information campaigns and activities aimed at awareness and prevention can be improved, which will go some way to addressing these myths and stigma:

- Talks by AIDS activists, prominent persons from the local community, and/or people living with AIDS (PLWAs) who are peers or role models of students
- Dissemination to students of information on HIV/AIDS by either academic staff or other students during academic lectures. Note, however, that other respondents, as discussed elsewhere, considered this a sub-optimal channel of communicating information on HIV/AIDS to students.
- Wider dissemination of information on HIV/AIDS via the campus newspapers and local radio station (RSFM), which together with the above can enhance communication on HIV/AIDS and related activities and programmes. This channel of communication, as explained elsewhere, was felt to be poor. In addition, respondents suggested that pamphlets with HIV/AIDS information should be distributed at lecture halls and the main gate and HIV/AIDS posters should be displayed in the library and new student centre. HIV/AIDS activities should also be diarised on the official calendar of SRC activities, which currently does not note the dates for planned HIV/AIDS activities on campus.
- More active and visible involvement of management and of student leadership, be it the student council or house committees, in HIV/AIDS activities and programmes. A number of respondents, moreover, asked why there is no special HIV/AIDS portfolio on the student council.

- Active participation of more students and the involvement of more organisations in HIV/AIDS activities. For example, some respondents asked why organisations such as Kovsgem, the community service arm for student activities, and Golden Key, another student organisation, were not actively involved in HIV/AIDS activities. (The focus group discussion with representatives of the student council brought to light that Kovsgem is in fact involved in a number of HIV/AIDS activities, notably providing volunteers to work at Sunflower House, a home for AIDS orphans in Bloemfontein, presenting empowerment clinics at schools, which includes an HIV/AIDS component, as well as participating in Kovsgem's community project at Philippolis.) In addition, some respondents emphasised that students should not be passive participants in HIV/AIDS activities and programmes (students are often simply required to attend and listen), but should participate actively in these activities.
- Better integration of HIV/AIDS activities into other student activities with mass participation, such as arts and cultural activities such as drama and music festivals, which, as was mentioned elsewhere, will enhance participation in HIV/AIDS activities and enhance the awareness of these activities and programmes. Practical suggestions as to how this may be achieved included the integration of HIV/AIDS activities into the annual cultural day activities, presenting a play on HIV/AIDS in the student cafeteria over lunchtime, talking about HIV/AIDS issues at house meetings, or scheduling HIV/AIDS activities during class free days.
- Conscious efforts to target students on the campus of the Faculty of Medicine (on the Bloemfontein campus) and off-campus students in Bloemfontein and Qwaqwa when it comes to communication on HIV/AIDS activities and programmes, as well as awareness initiatives. These students were considered as 'isolated' from current activities of this nature, which are conducted mainly on those parts of the main campus frequented by students from other faculties and often target students in residences on the main campus.
- Some respondents felt that the awareness and information campaigns should make the impact of the disease more visible, by, for example, displaying on notice boards pictures of persons dying of AIDS, an opinion shared by some participants in the focus group discussions with staff.

- Support groups should be employed as platforms for initiating a discussion on HIV/AIDS, rather than viewing support groups as a means of differentiating between HIV-positive and –negative students. (This opinion is most probably based on a misconception, as it is general best practice for HIV/AIDS support groups to include both HIV-positive and –negative persons, with compassion for those affected by HIV/AIDS rather than HIV status being the criterion for membership.)
- An opinion that students shared with staff was the suggestion that HIV testing be conducted on campus and that these statistics on HIV prevalence be reported so as to create awareness of the problem of HIV/AIDS and to gather information on the magnitude of the problem.
- Students and lecturers should undergo an HIV/AIDS course covering various aspects of HIV/AIDS, including knowledge on awareness and prevention, but also on lifestyle and other issues. As was mentioned elsewhere, respondents identified a need to go beyond the 'safe sex' message in HIV/AIDS information campaigns. (At the University of Durban-Westville, which has since been integrated with Natal University and is now known as the University of Kwazulu-Natal, all the students attended such a course, which also carried credits for degree purposes.) This would also help to address the concerns raised by students in the focus group discussions that students and lecturing staff do not know how to treat someone with HIV or AIDS due to a lack of information and ignorance. Equipping people with these skills will empower them to deal appropriately with persons living with HIV and AIDS.

In terms of other shortcomings of existing HIV/AIDS activities and programmes, participants in the focus group discussions made the following suggestions:

- The capacity of the AIDS centre (now called the Life Skills Centre) and other groups to do HIV testing and provide VCT and other services should be expanded, as some participants in the focus group discussions indicated that they could not readily access these services. One respondent said, "I heard that there are free tests for AIDS. So I am wondering, its like there is only one doctor who is doing those tests. So you have to make an appointment and you wait and wait and wait. I think there should be more people who are doing those tests". Another said, "I was intending to do the AIDS test but I had to make an appointment and I had to wait. So I told myself I do not want to anymore”. (Given that Dr Petro Basson from the AIDS Centre, or as it is called now, the Life Skills Centre, currently provides this service and that she also has many other responsibilities, students have to make an appointment for VCT and then honour this appointment, which she indicated does not always happen. Obviously, it would be ideal if a full-time VCT service was to be available to students, but this would require that the necessary resources be invested in such a service, by, for example, employing a trained nurse for this express purpose.)

- Female participants in the focus group discussions felt strongly about the need to address the problem of ‘date rape’ and also suggested that security on campus be improved to prevent rape, for example by lighting the campus and by having guards patrolling the campus grounds at night.
- Focus group discussions on Qwaqwa campus saw participants highlight the need for gardening projects and feeding schemes, which could assist in helping those students currently involved in prostitution to earn a livelihood, so as to escape HIV infection.
- In addition, respondents from Qwaqwa campus highlighted the need to have a full-time doctor on campus, for the campus clinic to be open every day of the week, for a campus health care centre to be established, and for condoms to be made available on campus rather than being distributed centrally at the AIDS Centre (now called the Centre for Life Skills). This evidence from the focus group discussions indicates that a considerable discrepancy exists between the availability of health care services on these two campuses of UFS, with students on Bloemfontein campus, unlike those on Qwaqwa campus, having access to doctors and nurses at a health care centre every day of the week and to services rendered by the AIDS Centre (or what is now called the Life Skills Centre).

(b) Focus group discussions with staff

How in your opinion has HIV/AIDS affected your lives as employees of UFS?

Most respondents on Bloemfontein campus reported no visible impact or direct experience of the impact of HIV/AIDS. Relatively more respondents from Qwaqwa campus reported visible impacts of, or direct experiences with the epidemic, including the deaths of students and staff. Furthermore, many respondents (particularly those attending the focus group discussions on Bloemfontein campus) also indicated that they did not know an HIV-positive person or someone that had died of HIV/AIDS. Yet, a small number of respondents from Bloemfontein campus did report knowledge of individual cases of HIV illness and/or AIDS death, which they experienced as very traumatic. However, one should again bear in mind that in a focus group discussion, fear and stigmatisation may create substantial response bias, which may explain the reluctance of respondents to indicate that they did know someone with HIV/AIDS or someone they expected may have AIDS. In addition, the discussion on the impact of the epidemic on service delivery (see below) resulted in other direct and indirect impacts being identified. Respondents also indicated that they had in some instances requested information on HIV/AIDS from their supervisors, whereas one respondent only highlighted the complications high funeral attendance posed in scheduling tests and examinations.

Are there areas of work where the illness or death of key workers will jeopardise the running of the organisation and the rendering of services?

Respondents argued that the lack of knowledge of the magnitude of the problem (i.e. not knowing what the HIV prevalence rate on campus is, nor being aware of who is actually infected as explained above) makes it impossible to determine where the effects will be felt. The feeling was that the effect of HIV/AIDS-related absenteeism depends on the nature of the particular job and/or the size of the relevant department. For example, small departments that play an important role in liaising with the public may, if affected by the epidemic, face considerable problems in managing to provide a quality service. Also, respondents felt that services pertaining to the administration of student and staff records are crucial and if these services are affected, that this can severely impact on overall service delivery at UFS. Most importantly, respondents also highlighted the susceptibility of students and staff in the Faculty of Medicine to HIV infection, which may as a result impact particularly in these areas on service delivery and teaching. Academic staff felt that they already face a higher workload and that this load will be exacerbated by the epidemic, given that absenteeism is likely to increase as the HIV/AIDS epidemic takes its toll on staff members. Some respondents also felt that the payment of student fees may become problematic, as some students will not be in a position to pay their fees due to the economic burden the epidemic exerts on households.

Are there reserve sources of the necessary skills, should workers with such skills be lost due to HIV/AIDS?

Given that participants in the focus group discussions could not identify specific posts at risk and that the above discussion remained relatively general, which perhaps reflect the 'illiteracy' amongst staff of the likely impact of the epidemic, this issue could not be discussed in any detail.

How supportive, do you think, is management of HIV-infected employees?

Respondents felt that direct support is constrained due to confidentiality and stigmatisation surrounding the disease, which is further helped along by the lack of knowledge regarding the magnitude of the problem. One respondent summed this up accurately by asking, "How would management be supportive whereas people are not open about their status? I think if we were open, they would support us".

Most importantly, two contradictory perceptions surfaced from these focus group discussions. On the one hand, some respondents felt that the AIDS Centre (now called the Life Skills Centre) provides the necessary support in terms of HIV/AIDS-related services. As one respondent put it: "there is someone who often comes and talks about the causes and preventive measures about AIDS. She is working at Kovsie Health. At least this is one way of telling us that the UFS management does care about its staff". In addition, some respondents felt that good support is provided for ill persons in terms of the medical aid benefits and in-house health care services available to personnel. On the other hand, the complete lack of knowledge of the existence and activities of the AIDS Centre (or what is now called the Life Skills Centre) amongst some respondents translated into a feeling that management is not that supportive of HIV-infected employees. One respondent said: "it seems as if they [management] do not openly want to talk about AIDS". Another respondent argued: "Management does not provide support. One of my staff members has AIDS, I reported it to management and they were not concerned. In fact there was no communication from them. They were concerned with how that person could be replaced." Here the common perception was that the response of management to the problem of HIV/AIDS has been too slow and too late.

How supportive do you think are unions of HIV-infected employees?

There was a general perception amongst respondents that unions are more accessible than management in terms of providing support for HIV-infected employees, but respondents also recognised the primary role of family and friends rather than management or unions in providing support to the infected. The perception, moreover, was that unions do well in terms of support of infected persons (e.g. liaising with the supervisor of the infected person, visiting and supporting the family of the infected person, and arranging transport to funerals of employees), but do less well in terms of being actively involved in, or part of, prevention and awareness activities. Respondents felt that unions should play a key role in both awareness and support activities, but generally were not aware of exclusively union-driven activities relating to HIV/AIDS programmes on campus. In fact, some respondents from Qwaqwa campus were of the opinion that unions "do not confront the problem of HIV/AIDS in any way".

Are you aware of any HIV/AIDS workplace programmes or support strategies for infected employees that are currently in place on the campus?

Interestingly, levels of awareness of current activities and programmes seemed to be higher at Qwaqwa than on Bloemfontein campus. In the case of Bloemfontein campus, relatively few respondents were immediately aware of any such activities, even where these were known to exist, and the focus group facilitator was required to prompt respondents to elicit further responses regarding the strengths and weakness of current HIV/AIDS activities and programmes, which we discuss below. Following these prompts, most respondents reported being aware of the distribution of condoms on campus. However, there were both positive AND negative perceptions regarding the distribution of condoms on campus, particularly amongst respondents from Bloemfontein campus. The general perception can perhaps be summarised as support for the distribution of condoms amongst students, but not for the distribution of condoms amongst staff and the provision thereof in those buildings which are mainly frequented by staff.

Respondents on Bloemfontein campus in most cases were also aware of the AIDS Centre's (now called the Life Skills Centre) activities. The activities of the Centre of which respondents were aware included the availability of VCT services, the organising of AIDS awareness meetings, the distribution of key rings with condom holders to staff members during recent visits to all departments during which information was shared with staff members, the organising of the annual candlelight memorial services, as well as other activities around national and international AIDS days. Interestingly, respondents from Qwaqwa campus emphasised that the HIV/AIDS activities and programmes of which they are aware target mainly students. The nature of these activities and programmes we described in the discussion of the feedback from the focus group discussions with students. Yet, other respondents highlighted the fact that HIV/AIDS was addressed during workshops conducted with staff from the support services. Lastly, one respondent on Bloemfontein campus also mentioned that the occupational health and safety (OHS) training does include an HIV/AIDS component, compulsory training that is confined to lower skill bands.

Have you found these programmes/strategies useful and appropriate?

Almost all respondents chose not to report the strengths of current HIV/AIDS programmes or activities, perhaps, as explained above, due to the low awareness of these activities and programme, but rather focused their attention on the criticism of those current responses they have identified. As one respondent put it: "If these activities were effective, we would know about them". As in the case of the focus group discussion with students, therefore, respondents chose to emphasise the shortcomings of current HIV/AIDS activities and programmes, rather than carefully think about the strengths of the current activities and programmes.

What do you think has not worked well with these programmes/strategies or what has been lacking?

The following discussion of the responses to this question needs to be interpreted with caution, given the general lack of awareness of HIV/AIDS-related programmes and activities on campus exhibited by respondents (see above discussion).

As mentioned above, criticism of the initiative to distribute condoms on campus was particularly severe, on the one hand with good reason, but also due to strong moral opinions regarding such activities, and also misinformed perceptions. Some respondents felt that the initiative would have been acceptable if there had been communication beforehand to advise staff members regarding the decision that had been taken and to advise them that condoms would henceforth be available in all toilets in buildings on the campus. On the other hand, some respondents felt that the distribution of free condoms on campus would promote "free sex" and that condoms should therefore not be provided free or should be distributed centrally. (We should note here that a decision was taken rather to distribute condoms centrally at Kovsie Health, given the wide criticism from various avenues of the campus-wide distribution of condoms.) Condoms being available freely also resulted in condoms being misused according to some respondents. In addition, some respondents felt that more or other information, for example on ABC or lifestyle issues, should be provided with condoms rather than just making condoms freely available. On more practical grounds, the initiative was faulted in there being condom dispensers, but no condoms, an issue that was also raised by persons who participated in focus group discussions with students. There was also talk of condoms being distributed at the main gate, but these condoms being "stapled". (According to other parties, this is an unfounded criticism and no such things ever happened.) Ultimately, the feeling thus was that condom distribution alone is not an adequate response to HIV/AIDS and that a stratified response is required.

As argued above, respondents felt that HIV/AIDS requires a more holistic response. For example, there was a strong feeling amongst some respondents that moral issues require urgent attention. In fact, it was interesting that both on Bloemfontein and Qwaqwa campuses respondents from diverse cultural backgrounds called for moral regeneration. Other respondents felt that the current approach is too sensitive and that UFS should employ shock tactics to warn people about the dangers of HIV/AIDS, for example by displaying on notice boards pictures of AIDS patients, an opinion shared by some participants in the focus group discussions with students.

A number of respondents felt that the capacity of the AIDS Centre, or the Life Skills Centre as it is now called, which is driven by one person only, should be enhanced, which will result in more and better HIV/AIDS-related programmes.

Academic staff faulted current initiatives for not being monitored and evaluated, which means that we do not know if what we are doing currently really does work and actually has an effect. The nature of current activities was also faulted for other reasons. According to respondents, the purpose of these activities was not always clear, often due to poor communication, and that the activities remain one-off, irregular activities. In this case, the suggestion was made that the UFS website be used more to communicate information about HIV/AIDS activities.

Sadly, though, it was also evident from the focus group discussions (in general and not only in the case of this particular discussion point) that there remains an ‘us versus them’ attitude, which is often based on population group or socio-economic class. Some respondents feel that HIV/AIDS is a disease that does not affect them, but is affecting others. For example, one participant in the focus group discussions pointed out: “it should not be taken for granted that only black people in lower job categories are infected or affected. We are all at risk”. For this reason, it appears as if ignorance and stigma surrounding HIV/AIDS remains a reality.

What can an HIV-infected employee ideally expect from the University (what should be done or provided, at a minimum, to help employees cope with the effects of HIV/AIDS)?

Most respondents here emphasised the need for job security and protection from discrimination. According to respondents, employees have a right to information on HIV/AIDS and to confidentiality in respect of their HIV status. Respondents were of the opinion that all staff should have access to psychosocial and medical support services, including advice, counselling and a referral service. However, respondents also emphasised that HIV-infected employees should not be treated differently from employees with other diseases such as cancer and tuberculosis. To this end, respondents felt that the current policy on employee benefits accord these persons the same treatment, with employees being entitled to 120 days of sick leave per 3-year cycle, to medical aid, and to group life insurance. The current policy of UFS on HIV/AIDS (which existed in draft format for a relatively long time and was officially adopted in 2005), moreover, does address these specific concerns of staff members.

Yet, some respondents did feel that HIV-infected employees should receive some additional financial assistance, for example to pay for HAART or other chronic medication. Furthermore, respondents were of the opinion that the nature of support provided to an employee should be determined by the specific context. In this sense, respondents were particularly concerned about support for non-permanent staff. This group of employees currently does not have access to all the employee benefits accorded to permanent employees. (UFS is in the process, however, of rolling out a minimum package of basic employee benefits to all personnel, albeit at different benefit levels, regardless of temporary employment status.)

The main problem, however, is that those employees who participated in these focus group discussions did not (as far as we know that is) represent known HIV-infected employees. The ideal would be if infected employees themselves were to have answered this question, as they were the persons in need of such support from UFS. We did to this end attempt to have a focus group discussion with a HIV/AIDS support group for staff members. However, no such group existed at the time and thus the feedback from these focus group discussions should be interpreted with due caution.

If you could make some suggestions to the UFS on how to improve its HIV/AIDS programmes/strategies aimed at employees, what would you say?

Many respondents highlighted the need to address the ignorance and myths surrounding HIV/AIDS via appropriate awareness campaigns. Awareness and prevention activities amongst both staff and students should moreover be a continuous strategy, rather than being driven by one-off events or campaigns, and can also be made a compulsory component on in-service training. This can take the form of active peer counselling services and regular workshops with speakers, particularly for staff and especially at lower bands. In addition, there were suggestions that support groups be established for HIV-positive employees, that an AIDS hotline managed by HIV-positive employees be employed as support to employees. A few respondents also felt that the executive management of UFS should take a moral stance on the issue of HIV/AIDS and issue a moral code of sorts to formalise the position of UFS regarding HIV/AIDS or launch initiatives aimed at moral regeneration.

In order to determine the magnitude of the problem, it was suggested by some respondents that all employees on campus be tested so as to determine the actual HIV prevalence rate at UFS. Respondents also felt that employees should be encouraged to go for HIV tests and in infected to disclose their status, as this will aid UFS in knowing whom to assist. This would require a greater awareness regarding the availability of VCT services on campus, which some respondents felt, was lacking. One respondent, for example, said: "I know a lot of people on campus who want to take an HIV test, but they are not aware that they could go to Kovsie Health and take a test there. Let it not only be the people who visit the doctor who are tested. Advertise it on campus and let people know about it… be open about it". Respondents from Qwaqwa campus, moreover, felt that the establishment of a campus-based clinic catering for both staff and students would go a long way towards encouraging people to come forward to be tested and to hence deal with HIV/AIDS at UFS, a need that was also expressed by participants in the focus group discussions with students conducted on Qwaqwa campus.

Respondents were of the opinion that the response of UFS to HIV/AIDS can only be successful if:

- a multi-pronged communication strategy is employed to create awareness of planned policies and programmes. The suggestion was also made that this communication drive should be driven by an appropriate 'slogan'.
- clear strategies, goals and timeframes are set out, including the necessary budgetary allocation to implement these activities.
- research is employed to inform policy and the design of interventions targeting different groups, for example staff and students in the Faculty of Medicine.
- the capacity of the AIDS Centre (or what is now called the Life Skills Centre) to deliver support services is enhanced.
- everyone takes responsibility for fighting HIV/AIDS and not only those tasked with implementing HIV/AIDS activities and serving on HIV/AIDS committees on campus.
- the institutional memory is protected by rotating workers and by sharing knowledge and documenting all tasks and responsibilities.
- HIV/AIDS activities are integrated into other current annual events (e.g. the annual Cultural Day activities), rather than having HIV/AIDS activities that stand separate from other activities, leaving only those with a passion for or interest in HIV/AIDS to attend and become actively involved. On this point, there was disagreement amongst respondents as to whether the attendance of HIV/AIDS-related activities should be compulsory or voluntary. Yet, most respondents it seems felt that attendance should be voluntary rather than compulsory.
- HIV/AIDS activities and programmes are implemented with a bottom-up rather than top-down approach, e.g. targeting departments and sections first, then faculties and larger departments, and only then the entire campus.

(c) Focus group discussions with local NGOs and CBOs working in HIV/AIDS

Identify and describe the three most important ways in which HIV/AIDS has impacted your communities, i.e. what are the three most important areas of action?

NGOs and CBOs in Qwaqwa highlighted HIV/AIDS education, recreation facilities and activities for the youth, and treatment and counselling as the three most important impacts. The discussion on each of these issues can be summarised as follows:

- *HIV/AIDS education* still needs to be emphasised and needs to target youths and adults. The youth, though conscious of the existence and effects of HIV/AIDS, were perceived by respondents to continue their irresponsible sexual behaviour as if HIV/AIDS does not exist. On the other hand, adults find it difficult to speak openly about sexual matters, which is the result of the general cultural norm of treating discussion of sexual matters as a taboo. The general silence around HIV/AIDS promotes stigmatisation of those who are infected, discouraging them from disclosing their status and living their lives fully. Thus, the entire community needs to be educated and made aware of HIV/AIDS, until the stigma is dispelled and the disease is accepted and treated like other diseases such as tuberculosis. To achieve this, respondents, although not offering suggestion on how adults should be targeted, felt that HIV/AIDS education has to be integrated into the curriculum of the Department of Education (there does in fact exist such an awareness programme in schools) so that children may learn to deal with the reality of HIV/AIDS from a young age.
- In terms of *recreation facilities and activities*, respondents were of the opinion that currently the only available form of leisure activity for youths is partying at shebeens and taverns, which often ends up in irresponsible sexual behaviour such as one-night stands and unprotected sex. Respondents argued that the youth's attention could be distracted from these destructive forms of entertainment, which often increase the risk of HIV infection, if what they called positive forms of entertainment, such as swimming pools, parks, movie houses, museums and so on, could be made available in the local community.
- Lastly, participants in the focus group discussion with NGOs and CBOs discussed the issue of *treatment and counselling*. Here the argument was that treatment should be

provided to infected people to cope with the effects of HIV/AIDS and to continue living positively. In fact, most respondents agreed on the need for treatment. However, respondents also pointed out that infected persons should also be provided with counselling to help them cope with the emotional challenges posed, not only by the failure of society to accept them, but also by their deteriorating health. According to respondents, the current counselling that accompanies testing in the VCT approach is not adequate to allow those who are infected to continue to live positive lives. Counselling should be continued to ensure that people are coping with the effects of HIV/AIDS. Respondents also emphasised the need for research which can improve available medication, making ARV treatment affordable for poor South Africans and more effective in sustaining normal physical health. (These focus group discussions were conducted prior to the official announcement of the public roll-out of free ARV treatment in South Africa.) Yet, some respondents felt strongly about the fact that the provision of treatment could promote risky sexual behaviour and thus contribute to the spread of HIV/AIDS.

Interestingly, participants in the two focus group discussions with NGOs and CBOs from Bloemfontein highlighted quite different issues to those discussed by participants from Qwaqwa. In this case, the emphasis was on the problem of AIDS orphans, drivers of the epidemic, particularly the role of poverty in contributing to the spread of HIV/AIDS, as well as the sexual abuse of women (rape), the denial and stigma surrounding HIV/AIDS, as well as the impact of HIV/AIDS on productivity. The discussion on each of these issues can be summarised as follows:

- Respondents expressed concern over the growing number of *AIDS orphans* and the fact that many of these children are left to fend for themselves in a community characterised by high levels of poverty and unemployment. Respondents were also of the opinion that these children have low self-esteem and that their development is constrained. Respondents also felt that existing support often does not reach such children.
- Respondents were of the opinion that the vicious cycle of *poverty and HIV/AIDS* remains a reality and that socio-economic status plays an important role in the spread

of the virus. For example, respondents emphasised the risk of HIV infection to women forced to become commercial sex workers, the lower level of awareness amongst less educated people, and the fact that high levels of unemployment and other adverse conditions in informal settlements also contribute to the spread of the epidemic. In addition, respondents expressed concern over the high levels of *rape*, which increase the susceptibility of women to HIV infection, which they argued are, in part, explained by particular cultural norms, but are also in some cases perceived to be 'criminal' acts of revenge perpetrated by HIV infected individuals.

- Respondents felt that *denial, myths and stigma* surrounding HIV/AIDS continue to abound, often as a result of insufficient knowledge and a lack of communication about HIV/AIDS, which fosters attitudes of stigma and prejudice.
- Lastly, some respondents also noted the problem that HIV/AIDS poses to larger communities and the country at large in terms of negatively affecting the *productivity* of the citizens of our country.

What is the community currently doing to address these issues, i.e. what types of interventions and programmes are addressing these impacts?

In contrast to the discussion of the main impacts of HIV/AIDS on their local communities, where respondents from these two communities identified diverse issues, the points that were raised when it came to describing which activities and programmes were in place to address HIV/AIDS did to a certain extent overlap. Respondents indicated that the following activities and programmes were in place in Qwaqwa to deal with the above impacts:

- Home-based care by volunteers is provided to AIDS patients.
- A programme targeting AIDS orphans provides care to orphaned children.
- Numerous CBOs offer HIV/AIDS education programmes to their members.
- Communal food gardens are maintained to address the nutritional needs of the infected.
- Food parcels are issued to those affected by HIV/AIDS to improve their health.

Respondents from Bloemfontein in turn listed the following activities and programmes:

- Home-based care programmes
- The training of volunteers as AIDS counsellors and home-based carers
- HIV/AIDS support groups
- The training of the members of ward committees on HIV/AIDS
- Networking between organisations working in HIV/AIDS
- Advocacy groups

How can the University of the Free State best support these actions and initiatives in your community?

Respondents from Qwaqwa and Bloemfontein described the role of UFS in supporting these HIV/AIDS-related activities as follows:

- UFS could provide financial assistance to local organisations involved in HIV/AIDS education, home-based care and other activities, which would allow these organisations to expand their services and, in the case of Qwaqwa, also to service remote areas and close-by communities such as Senekal where such programmes do not exist, or these services are not provided. Financial assistance, respondents felt, was a serious challenge to the continuity and sustainability of these organisations and felt that UFS could make a contribution in this regard. A specific example of financial support noted by respondents included the payment or subsidisation of volunteers working for these organisations. However, financial assistance to organisations was not the only issue that featured in the focus group discussion. Some respondents, obviously speaking here as members of the community rather than employees of these organisations, argued that UFS should implement a small levy on tuition fees, the proceeds from which should be employed by UFS to finance care and support of infected and affected students or to pay compensation to those students dying of HIV/AIDS-related disease. Obviously the latter is not really realistic, but the former does suggest a possible way of financing the activities of the AIDS Centre (or Life Skills Centre as it is now called), given that both students and staff have expressed an urgent need to expand these services.

- Yet, not only financial assistance was on the agenda, but also other types of assistance. For example, respondents also felt that UFS can assist NGOs and CBOs in Qwaqwa with food supplies, given that the current HIV/AIDS food programme cannot adequately address the huge needs due to limited capacity and resources. Respondents from both communities felt that UFS can play a particularly important role in the training of the management and personnel working for these local organisations working in HIV/AIDS. Particular training needs highlighted by respondents included project management skills, advanced HIV/AIDS awareness, as well as education in health care and social work. An interesting possibility of an example of community service learning also emerged from the focus group discussions, with respondents suggesting that students assist or work as volunteers with these organisations.
- In respect of orphaned children, respondents felt that UFS can not only assist them in educating community members regarding the procedure to be followed in adopting these children, but can also assist in the education of these orphaned children.
- UFS, respondents felt, should also enter into partnership with these community-based organisations to assist them in addressing the challenges of making HIV/AIDS programmes work. In fact, respondents considered this discussion in itself to be a giant step forward towards working with community organisations. As a partner, UFS would then participate actively in the programmes of these CBOs, including workshops and seminars.
- Finally, respondents were also of the opinion that UFS can employ research to enhance the response to HIV/AIDS in local communities. Respondents, amongst other things, suggested that UFS should conduct the necessary participatory research in partnership with these organisations so as to inform the interventions and programmes implemented by them. Furthermore, UFS can contribute to AIDS vaccine research.

The current policy of UFS on HIV/AIDS (which existed in draft format for a relatively long time and was officially adopted in 2005) does emphasise the need for UFS to be involved in the community in terms of its response to the epidemic and to coordinate its efforts with NGOs and CBOs. Yet, the policy does not specify how exactly this should be done and refers in broad terms to the need to 'establish community partnership and outreach programmes for creating HIV/AIDS awareness and prevention'. In this context, it is hoped that the above suggestions can provide some ideas as to how the response of UFS to HIV/AIDS in terms of its impact on the community at large should go beyond the focus on awareness and prevention alone, to include capacity building initiatives and community outreach programmes aimed at mitigating the impact of the epidemic.

(d) Focus group discussion with representatives of the student council

The focus group discussion with sixteen representatives of the student council of 2002/03 brought to light that the council should probably be described as followers rather than leaders when it came to the organisation and implementation of HIV/AIDS-related activities on campus. Asked about the council's role in the current response to HIV/AIDS of UFS, council members indicated that one of the council members serves on the AIDS Forum. Other responses were related to responses to HIV/AIDS in general, rather than initiatives originating from the student council and which were discussed in detail above, although special mention was made of the booklet given to students from the Faculty of Medicine, which explains to them the risks and procedures to be followed with regard to exposure to needle stick injuries. Mention was also made of the need to do more than just distribute condoms and spread the message of safe sex. Respondents were of the opinion that messages about abstinence are also important and that other information on HIV/AIDS should be distributed with condoms. This again is a point that was also raised during the focus group discussion with students. Although members of the student council assisted in organising certain activities organised by the AIDS Forum or other bodies on campus - such as the annual candlelight memorial service - it was not evident that the student council had been taking an active lead in making things happen with regard to HIV/AIDS. In fact, participants during the discussion noted the problem with 'AIDS fatigue' in responding to the challenges posed by the epidemic, an issue which was also raised by students who participated in the focus group discussions with students. Some respondents highlighted the fact that HIV/AIDS is one condition or illness only and that there are many other conditions of illness that should be addressed. (Based on my own knowledge, this probably is an indication of the strong presence of medical students on the council.) Furthermore, members of the council felt that infected students who have disclosed their status should rather take an active lead in driving HIV/AIDS activities and programmes on campus. In addition, they were of the opinion that those activities which they can launch, such as media coverage on HIV/AIDS, cost money, which was not available at the time this focus group discussion was conducted. In fact, members of the council, it seems, were quite interested to become involved in HIV/AIDS activities and programmes should there be money actually to fund these initiatives. We will again reflect elsewhere in our discussion on this issue of the financing of HIV/AIDS activities and the availability of resources to make things happen when it comes to HIV/AIDS.

Confronted with the suggestion that a separate HIV/AIDS portfolio should be established on the student council, an issue which was raised during the focus group discussions with students, some members of the council responded by arguing that there is too little work too keep a member of the committee sufficiently busy. Others were of the opinion that the motivation of the council to make a concerted effort in terms of organising activities around HIV/AIDS was hampered by the low participation and involvement of students in those activities which they have attempted to make work in the past.

What was worrying, was that when the focus group discussion at one stage evolved into a general discussion on HIV/AIDS, it became evident that the myths, stigmatisation and ignorance surrounding HIV/AIDS continue to prevail, even at this level. In addition, this discussion also saw some members call for moral regeneration or a more spiritual or religious approach to HIV/AIDS. This issue was also raised in the focus group discussions with students in general.

(e) Focus group discussions with union representatives

There are currently two unions with representation on campus, the one an institutional branch of NEHAWU and the other UVPERSU, the University's own union. We conducted separate focus group discussions with representatives of these two unions. Respondents were asked about (i) the union's current role in HIV/AIDS activities and programmes and (ii) suggestions as to the nature of the union's and UFS's future response to HIV/AIDS.

(i) NEHAWU

Representatives of NEHAWU who participated in this focus group discussion indicated that union representatives play a part in distributing condoms to its members at unions meetings and also discuss HIV/AIDS issues at these meetings.

In terms of the future response of NEHAWU and of UFS to HIV/AIDS, participants in this focus group discussion felt that much more is required that to have an annual candlelight memorial service. The perception of respondents was that much more could perhaps be done if it were not for a lack of information and poor communication. Specific suggestions as to future initiatives included the following:

- The capacity of the AIDS Centre (or what is now called the Life Skills Centre) should be expanded. The Centre should specifically include the services of a social worker, and more permanent employees should be employed so that a full-time, permanent service is available to all staff members at all times.
- An HIV/AIDS hotline should be established on campus and this hotline should be manned permanently. (Alternatively, of course, the information of existing hotlines operated by other institutions can be made available to all employees.)
- There is a dire need for workshops on HIV/AIDS to be conducted amongst staff members so as to create greater levels of awareness regarding HIV/AIDS. To be successful, it is advisable that these information sessions be compulsory, that they be presented on a Thursday afternoon close to the end of the semester, that the session be conducted in the home language of employees (in this case Sesotho), and that the Department of Health be involved in these activities to distribute detailed up-to-date information on awareness and prevention issues. It was also suggested that such

training could be incorporated as a compulsory training programme into the induction process for new employees.

- Representatives of NEHAWU can together with representatives of other bodies and management take a lead in a testing campaign.
- Greater efforts should be made to create awareness amongst all employees that a VCT service, as well as other health care services, is available to employees on the campus.
- Finally, and worryingly, respondents reported that women working in the female residences were exposed to risk of HIV infection in that they have to handle sanitary towels that are not disposed of in separate receptacles provided for this purpose, but put into the normal waste baskets. This matter should be addressed as a matter of urgency.

(ii) UVPERSU

In terms of their current role in HIV/AIDS, representatives of the union noted that they mainly provide psychosocial support to members where this may be required. The respondents saw the primary role of the union with regard to HIV/AIDS as one of ensuring that the code of good conduct with regard to HIV/AIDS in the workplace is honoured, in other words, preventing discrimination against people with HIV/AIDS in the workplace. The current policy of UFS on HIV/AIDS (which existed in draft format for a relatively long time and was officially adopted in 2005) also puts the necessary emphasis on this aspect of managing HIV/AIDS in the workplace. In their opinion, no known case of discrimination against persons with HIV/AIDS has been reported at UFS. According to the respondents, this task is carried out in close collaboration with the staff from the AIDS Centre (or what is now called the Life Skills Centre). In this context, the process of retirement for ill-health reasons is handled with the utmost sensitivity and the union assists the affected member in negotiating for a change in work responsibilities. Respondents also noted that they at the time were in the process of investigating the possibility of establishing a funeral policy scheme for union members. Furthermore, the union representatives noted that UFS is in the process of phasing in pension and medical aid benefits for all temporary employees, which should go some way towards affording all employees some treatment and support benefits. Respondents also indicated that they provide support in terms of awareness and prevention activities around HIV/AIDS, although this is not their primary role in HIV/AIDS, but that these information sessions are not always well attended by staff, possibly due to the fact that these sessions are not always scheduled at a time suitable to all employees.

In terms of the union's future involvement in the response to HIV/AIDS and the University's response to HIV/AIDS, the representatives of UVPERSU offered the following suggestions:

- The union can report on HIV/AIDS-related activities and issues in the UVPERSU newsletter, as well as the electronic news lists distributed to all staff members.
- Given that the UVPERSU office is often perceived as a central place to submit complaints, the union has had experience of the negative sentiments of staff members regarding the distribution of condoms on campus. Their experience in this has been that older employees are not supportive of the distribution of condoms on campus, whilst younger staff members do not have a problem with the distribution of condoms on campus. This piece of information is valuable insofar as it validates the responses from participants in the focus group discussions with staff, where the opinion was that condoms should be made available to students, yet need not be distributed to staff members. To this end, UVPERSU suggested that the 'open' containers used to distribute condoms on campus should be sealed.
- Currently, no one is responsible on a full-time basis for awareness, prevention and support activities amongst UFS staff members. It is advisable moreover that this person should speak the home language of staff members, so that information can be communicated to staff members in their own language.
- HIV/AIDS training should perhaps be implemented as a compulsory part of staff training that must be attended by all newly appointed employees. However, it would also then be necessary to train all current employees prior to the implementation of such policy so as to ensure a basic level of information on HIV/AIDS amongst all employees.

(f) Focus group discussion with health care professionals

A focus group discussion was conducted with representatives from the AIDS Centre (now called the Centre for Life Skills) and Kovsie Health. As background to the discussion of the feedback from this focus group discussion, we will first present here a summary of the HIV/AIDS-related services and activities performed by the AIDS Centre (or Centre of Life Skills as it is now known) and Kovsie Health respectively.

The *AIDS Centre* (now called the *Centre for Life Skills*) was officially launched in 2000 and is headed by Dr Petro Basson, who is also the only permanent employee of the Centre. The Centre forms part of the Health Services division in the Dean's Office. The services provided by the Centre targets students, staff as well as the university community at large. These services are conducted with a view at all times to respecting the privacy and the dignity of the individuals concerned. Services rendered and in-house responsibilities fulfilled by the Centre include the following:

- Training in HIV/AIDS
- Dissemination of information on HIV/AIDS
- Counselling services
- Distribution of condoms
- HIV testing (VCT)
- Research into HIV/AIDS
- Development of HIV/AIDS policy
- Initiation and coordination of HIV/AIDS projects on campus
- Community service in respect of HIV/AIDS

Kovsie Health provides for the medical needs of not only students, but also of staff members and the general public. Kovsie health has a number of general physicians and nurses in its employ, as well as dieticians and physiotherapists. Consultation is available by appointment and medical aid tariffs apply. Services rendered by Kovsie Health include the following:

- Distribution of HIV/AIDS information pamphlets at reception

- Counselling on use of male and female condoms
- Referral of patients to the AIDS (or Life Skills) Centre for VCT and other services (see above)
- Prescriptions of ARV drugs by physicians when required following a general medical examination
- Presentation of information sessions on HIV and sexually transmitted diseases (STDs) or infections (STIs)
- Information session on HIV/AIDS-related and other services presented during the annual orientation of all new first-year students

During the focus group discussion the preliminary results of the epidemiological analysis and focus group discussions with students and staff members were shared with participants. Following this, a general discussion was held in respect of the experience of these persons in rendering HIV/AIDS-related services at UFS. Particular attention was paid to current constraints experienced by these people in providing an optimal service to students and staff, what they perceive to be the key challenges and needs with regard to HIV/AIDS, and to suggestions of how these problems should be addressed.

The health professionals who participated in this focus group discussion described the current response to HIV/AIDS as highly fragmented, uncoordinated, and under-resourced, which resulted in participants experiencing high levels of frustration. The feeling was also that top management is not really actively involved in making a success of the response of UFS to the HIV/AIDS epidemic. Given the complex nature of the HIV/AIDS epidemic, they felt that the response of UFS to the epidemic needs to be integrated and multi-faceted. Currently, for example, different aspects of a coordinated response to HIV/AIDS, such as the management of STIs, the provision of a social work service, and HIV/AIDS awareness activities, rest with separate structures in the organisational hierarchy. The participants felt that the ideal way to respond to HIV/AIDS would be to have team of various professionals provide all these services in one facility or one-stop service, which will be settled in one structure, rather than to continue with the current fragmented response. In this way, the Centre should become a centre for the management of lifestyles or health rather than just AIDS (as it current name in fact suggests), which respondents felt implied that changing the name of the Centre should be seriously considered (as in fact has happened since, with the Centre now being called the Life Skills Centre). A similar opinion was raised during the focus group discussions with students at UFS, given that respondents felt that the name, 'AIDS Centre', may contribute to the stigmatisation of those going there and may explain why not many students are actually utilising the services of the Centre.

The head of the Centre, who is also its only permanent employee, expressed unhappiness regarding the fact that during the past four years she has had to report to four different superiors, first to the Dean of Student Affairs (October 1999 to March 2000), then to the Dean of the Faculty of Medicine or the Head of the School of Nursing (March 2000 to March 2002), and currently to the Vice-Dean of the Faculty of Medicine (March 2002 to the present). Furthermore, this structure seems to reflect the direct line of reporting in terms of human resources management, yet, in her opinion, decisions regarding financial matters appear to be taken at another level. She felt that this apparent flux in the management hierarchy regarding the appropriate positioning of the Centre, has impacted negatively on the ability of the Centre to provide a quality service.

Furthermore, respondents were of the opinion that there is no coordinated strategy for fundraising to mobilise the resources required to fund such an integrated, coordinated response to HIV/AIDS. Again, therefore, strong opinions surfaced as regards the extent to which the Centre and the response of UFS to HIV/AIDS have been under-resourced, with similar perceptions having been raised in focus group discussions with staff, students and union representatives.

Further investigations in this regard support these claims of HIV/AIDS activities having been relatively under-resourced at UFS. *Firstly*, in terms of the level of expenditure, the current level of expenditure on the Centre (as ascertained from finance personnel) is relatively small and, approximately, amounts to only R244,132 per annum. If one also apportions the salaries of certain of the personnel of Kovsie Health and other costs of running Kovsie Health to expenditure on HIV/AIDS, the total estimated direct expenditure on HIV/AIDS by UFS amounts to approximately R300,000 per annum. In contrast, the amount of money spent on different HIV/AIDS service centres at other institutions of higher education, many of similar size or even smaller, ranges from R650,000 to millions of Rand. *Secondly*, the UFS response is also under-resourced in terms of human resources. Currently, the Centre employs only one full-time person, whereas others who are responsible for providing HIV/AIDS-related services - notably health care workers and social workers - have to perform these services in addition to their general responsibilities. Again, different HIV/AIDS service centres at other institutions of higher education around the country have been found to employ more people on a full-time basis to staff these service centres. Here, our investigation found that the number of full-time employees employed in these service centres ranges from three to as many as fifty, excluding volunteers and workers employed on a temporary basis.

The fact, moreover, is that a recent recommendation put forward to top management by the head of the Centre as to the establishment of an expanded, comprehensive, one-stop HIV/AIDS service at UFS has not been successful. In this proposal, it was proposed that the Centre be located in a new, larger facility, which should comprise seven offices, a reception area, one storeroom, two counselling rooms, one training venue, and one room to be used as a resource centre. It was proposed that this Centre be staffed by a Director and an administrative officer, in addition to five other full-time employees. These five employees, respectively, would be responsible for coordinating work in the following areas: campus projects, training, research, community services, and fundraising. Each of these five coordinators would have a committee of volunteers working with them.

Admittedly, many of these HIV/AIDS service centres at other institutions of higher education in South Africa are funded by means of substantial grants from donor agencies or international philanthropic organisations. For example, HIVAN at the University of Kwazulu-Natal, amongst others, receives support from the Carnegie Corporation and Atlantic Philanthropies. However, UFS needs to think how it can go about soliciting such grants or funding and in this way expand and strengthen its response to HIV/AIDS. (It is moreover worrying that such initiatives for fundraisings have not materialised at an earlier stage, given that it may be increasingly difficult now to mobilise such funding after the boom in AIDS funding in the 1990s.) The importance of the need to do so is further underlined by the evidence from the focus group discussions conducted as part of the larger institutional audit, which suggests that UFS has failed to respond adequately to the challenges posed by the epidemic.

Despite being under-resourced, however, the University's policy on HIV/AIDS (officially adopted in 2005) and its response to the epidemic compares well with the responses by other institutions of higher education in South Africa (Martin and Alexander, 2002). The main point, therefore, which is underlined in terms of the feedback from the various focus group discussions, is that more resources (meaning professional human resources as well as monetary resources) would go a long way towards improving the response of UFS to HIV/AIDS, which is not lacking in terms of content, but lacking in terms of effectiveness as a result of being relatively under-resourced.

(g) Focus group discussion with human resources personnel

A focus group discussion with representatives from the human resources department at UFS, in addition to communicating to participants the preliminary results of the epidemiological and costing analyses, brought the following to light:

- Human resources staff have not had to deal directly with employees affected by HIV/AIDS, but have rather experienced the impact of the epidemic on staff indirectly, notably by means of the increase in requests for special leave to attend funerals, as well as an increase in absenteeism.
- As a result, respondents indicated that the support provided to employees having to deal with HIV/AIDS is *ad hoc* and is determined by the specific circumstances of cases that do emerge. Moreover, support is also provided at a relatively late stage, given that infected employees do not come forward at an early stage. Hence, human

resource personnel normally deal with HIV/AIDS cases in terms of facilitating the process for application for medical retirement.

- Respondents also noted that the various benefit schemes to which employees of UFS belong, namely the group life insurance scheme, the pension and provident fund, and the medical aid scheme, include no clauses excluding HIV-positive employees.
- Finally, respondents expressed concern regarding the perceived failure of HIV/AIDS awareness and prevention activities to result in behaviour change.

(h) Focus group discussion with finance personnel

During a focus group discussion with representatives from the finances department at UFS, we shared with participants the preliminary results of the epidemiological and costing analyses. In this case, the main aim was to elicit comments on the costing analysis. The focus group discussion brought the following to light in this regard:

- A number of erroneous assumptions were made in the preliminary costing analysis, amongst others regarding the calculation of costs related to medical aid benefits and coverage, and the percentage of employees belonging to the pension or provident fund. Subsequently, we have corrected these assumptions, based on information supplied to us by these participants in the focus group discussion.
- Participants in the focus group discussion expressed the need to have an idea of the financial impact resulting from the increase in cases of HIV and AIDS amongst students and staff, which we in economics would call an analysis of the marginal costs of HIV/AIDS. The current cost analysis, as explained in the discussion on methods, takes exactly this approach as it determines the cost to UFS of incident HIV infections and AIDS deaths.
- Finally, participants expressed concern over the fact that the preliminary costing analysis was based solely on estimates of HIV-prevalence derived from the HSRC survey, rather than the higher HIV-prevalence rates reported in the antenatal clinic data. We have subsequently conducted the necessary sensitivity analysis in the epidemiological modelling, which we included in our sensitivity analysis for the costing analysis, illustrating how the estimated cost of HIV/AIDS to UFS changes if

different assumptions are made regarding the prevalence of HIV amongst staff and students.

5. SUMMARY AND CONCLUSIONS

This study provides a quantitative overview of the likely burden of HIV on UFS staff and student populations now and over the next ten years. As it is based on epidemiological research conducted in other populations, the projected numbers are unlikely to be precisely correct, but they do provide insights into the scale of the problem. Academic staff and senior managerial staff are at relatively low risk, compared with most South Africans, and are unlikely to suffer a major burden of illness and death. However, they are most difficult and costly to replace. Unskilled staff has the highest rates of HIV, AIDS and deaths, but unskilled staff make up a minority of the staff population, as much unskilled labour has been subcontracted out to private providers. On aggregate, almost half of new HIV infections, new AIDS cases and AIDS deaths will occur amongst skilled support services staff and a third amongst academic staff. Hence, three-quarters or more of new HIV infections, AIDS cases and AIDS deaths amongst staff will occur amongst these two categories of employees. This is interesting, moreover, insofar as the perception often is that awareness and prevention activities should target the unskilled rather than the skilled. In terms of absolute numbers, though, the magnitude of the problem is greater amongst skilled categories of staff (obviously institutions of higher education employ more skilled than unskilled personnel due to the core nature of their business). This suggests that it is equally important to target these categories of employees in awareness and prevention programmes.

The HIV prevalence estimates are in keeping with figures from some other large organisations, including several service industries. However, the HIV prevalence estimates reported here are considerably lower than in some workforces comprising mainly unskilled African workers (Rosen *et al*., 2004). Prevalence rates are about half the prevalence rates estimated using the ASSA NewSelect workforce model (which produced higher prevalence estimates for Bloemfontein than for Qwaqwa), and are much lower than estimates obtained employing the ASSA Provincial model. While there is considerable uncertainty about the true prevalence of disease, we believe that our baseline estimates are the most plausible, considering the socio-economic and ethnic composition of UFS staff and student populations. We have considered it necessary to take into account the composition of populations in terms of population group, not because race biologically determines HIV risk, but because population group is still an extremely powerful proxy indicator of major political, social, economic and historical factors shaping South African society and disease distribution.

To summarise: the number of school-leavers eligible to apply to university, when accounting for the impact of HIV/AIDS, will on average decline by 3.3% (Free State province) and 1.1% per annum (other provinces) over the next nine years (2005-14). Changes in the number of learners eligible for university enrolment are relatively moderate until 2010, with the estimated number of exemptions remaining relatively unchanged and in some cases even increasing. The number of eligible enrolees from the Free State province will on average decline by 0.1% per annum between 2005 and 2010, while numbers from other provinces on average will grow by 0.9%. Between 2010 and 2014, numbers of eligible enrolees will decline substantially: 7.2% per annum in the case of the Free State province and 3.6% per annum in the case of other provinces in South Africa. The number of school-leavers eligible to apply to UFS in particular, when accounting for the impact of HIV/AIDS, will on average decline by 2.4% per annum over the next nine years (2005-14). On average, the number of eligible enrolees will grow marginally until 2010 (0.3% per annum), but will decline by 5.7% per annum between 2010 and 2014.

We also investigated the sensitivity to our results of assumptions about university exemption rates, attrition rates and HIV prevalence rates with a view to estimating how each of these parameters needs to improve to ensure that the same number of learners that qualified for enrolment at university in 2005, at a minimum do so in each of the subsequent years (2005-14). Importantly, the estimated numbers of eligible university enrolees will not reach 2005 levels again, even if HIV prevalence rates are zero. If 2005 enrolment levels are to be sustained over the entire period, attrition rates over this period (2005-14) need to improve by 37% and 29.5% in the Free State province and in other provinces respectively. Exemption rates of at least 19.9% and 18.6% are required if 2005 levels of enrolment are to be sustained subsequent to 2005. Such relatively large improvements in attrition and exemption rates one may argue are not realistically attainable, thus implying that the anticipated decline in the numbers of eligible enrolees is a stark reality. Nevertheless, improvements in through-put and exemption rates remain important, because such improvements not only will aid in cushioning this negative trend, but also stand to contribute to the development of South Africa insofar as it translates into a more efficient educational system and better standards of education.

Applying national HIV prevalence survey data to the age, sex, population group and educational distributions of current staff and students suggests that 9.2 percent of students, and 4.9 percent of staff are currently infected with HIV. These prevalence rates will tend to increase over the next ten years if the proportions of staff or students who are African and aged between 25 to 35 years increases. Prevalence rates will decline if the incidence of HIV among those without HIV is less than the mortality rate among those with HIV, which is not however the case according to our results, which have seen HIV prevalence increase slightly over time. Over the next ten years, an estimated 2,308 of more than 18 thousand students at the Bloemfontein and Qwaqwa campuses will be infected with HIV in any given year, this compared with the reported 161 HIV-positive students amongst RAU's student population of almost 15 thousand (Ichharam and Martin, 2002). The numbers of students with HIV will also increase slightly over time among students as HIV prevalence rates continue to increase over the ten-year period. The average annual number of new HIV infections amongst students was estimated at 258, while an estimated average of 167 new AIDS and 89 AIDS-related deaths will occur per annum over the next ten years. The output of higher education institutions is thus fundamentally affected by the epidemic. The resulting high death rate of young professionals not only annuls the role of education but it also makes economic planning difficult. This points to the further consequences of the epidemic for human capital, with relatively large number of people who have received 12 or more years of education dying in the prime of their lives, thus turning this investment of government in education into a loss (Simkins, 2002). With optimal preventive treatment, however, these deaths could be reduced by about two-thirds to three-quarters.

We estimated the financial implications for UFS of HIV/AIDS amongst employees based on the results of our epidemiological analysis and using an adjusted version of the costing model developed by Rosen *et al*. (2004). In the baseline costing model, we estimated the various unit costs and total average cost per incident HIV infection in each staff category, assuming that HIV-positive employees remain in the workforce until they either die or take medical retirement. The average cost per HIV infection calculated in this manner was also expressed as a multiple of mean salary in order to have an indication of the relative magnitude of the cost of HIV/AIDS at different job levels. In addition, we calculated the aggregate cost of HIV/AIDS, by staff category and in total, by multiplying the average cost per infection by the estimated number of incident HIV infections per year. The aggregate cost per staff category was then expressed as a percentage of the annual salary bill, whereas the total aggregate cost across staff categories was expressed as a percentage of the total annual salary bill and annual operating expenses. Following our estimation of the cost of HIV/AIDS, we estimated the returns on interventions pertaining to treatment and prevention.

Apart from employing the Rosen *et al*. (2004) costing model to estimate the cost of HIV/AIDS to UFS in terms of its impact on employees, we also estimated the cost to UFS of the impact of the epidemic on students, particularly revenue received in the form of class fees and subsidies. As was the case with the employee costs, the results of the epidemiological analysis of the impact of HIV/AIDS on students were employed to inform this part of our costing analysis. We estimated the net present value of the cost to UFS of incident HIV infection and AIDS cases and deaths amongst students in respect of loss of revenue in the form of class fees and government subsidies. As we did in the case of the analysis of the cost to UFS of HIV/AIDS amongst employees, we estimated the returns on treatment and prevention interventions aimed at students. We again conducted sensitivity analyses and provided a so-called ‘best case’ and ‘worst case’ costing scenario, as we did in the case of employee costs, which respectively employ those assumptions that resulted in the lowest and the highest estimate of the cost to UFS in terms of the projected impact of HIV/AIDS on students.

In the final instance, we aggregated the estimated cost to UFS of the impact of HIV/AIDS on staff and students, presenting in this case the aggregate costs in the baseline scenario and the 'best case' and 'worst case' costing scenarios. The total costs calculated in this manner were also expressed as a percentage of total annual operating expenses. We did this in order to present a picture of the absolute and relative magnitude of the total estimated cost to UFS of HIV/AIDS.

The cost per HIV infection at Bloemfontein campus was estimated at R76,212 for unskilled support services staff, R87,667 for skilled support services staff, R270,770 for academic staff, and R708,873 for highly skilled support services staff respectively. As expected, therefore, the cost per infection was higher at higher levels of skill, given that the magnitude of these costs derives from mean salary levels. The major components of the AIDS tax on employees were on-the-job productivity loss, medical costs, death and disability benefits, and sick leave. The estimated cost per infection respectively represented 2.5 (unskilled support services staff), 1.7 (skilled support services staff), 2.5 (academic staff), and 5.2 times (highly skilled support services staff) the mean salary in each staff category. The aggregate cost of HIV/AIDS in each of the four staff categories amounted to R357 thousand (unskilled support services staff), R1.2 million (skilled support services staff), R3.1 million (academic staff), and R1 million (highly skilled support services staff). This represents 3.6 (unskilled support services staff), 2.4 (skilled support services staff), 3.6 (academic staff), and 5.6 percent (highly skilled support services staff) of total annual salaries and wages respectively. The sum total of the cost of HIV/AIDS at the Bloemfontein campus of UFS thus amounted to almost R5.8 million in 2004, which represents 3.5 percent of total annual salaries and wages, and 1.5 percent of the annual operating expenses of UFS. The average annual net present value of new HIV infections at Bloemfontein campus over the next ten years amounts to R5.5 million, or

R2,621 per employee, which on average represents 3.3 percent of total annual salaries and wages.

The results for Qwaqwa campus present much the same picture, although the aggregate costs are much lower, given the smaller staff complement. In this case, the cost per HIV infection was estimated at R104,313 for unskilled support services staff, R112,959 for skilled support services staff, R205,020 for academic staff, and R523,033 for highly skilled support services staff respectively. The estimated cost per infection respectively represented 3.4 (unskilled support services staff), 2.8 (skilled support services staff), 2.0 (academic staff), and 2.7 times (highly skilled support services staff) the mean salary in each staff category. In terms of aggregate costs, the cost of HIV/AIDS in each of these four staff categories amounted to R83 thousand (unskilled support services staff), R123 thousand (skilled support services staff), R462 thousand (academic staff), and R103 thousand (highly skilled support services staff). These costs respectively represented 4.2 (unskilled support services staff), 1.5 (skilled support services staff), 4.3 (academic staff), and 4.4 percent (highly skilled support services staff) of total annual salaries and wages in each staff category. The sum total of the cost of HIV/AIDS in 2004 thus amounted to almost R2.4 million at Qwaqwa campus, which represents 3.4 percent of total annual salaries and wages, and 0.2 percent of the annual operating expenses. Over the next ten years, the average annual net present value of new HIV infections amounts to R1.3 million, or R6,025 per employee, which represents 1.9 percent of total annual salaries and wages.

The combined aggregate cost of HIV/AIDS amongst employees at both the Bloemfontein and Qwaqwa campuses in 2004 amounted to R440 thousand (unskilled support services staff), R1.3 million (skilled support services staff), R3.6 million (academic staff), and R1.1 million (highly skilled support services staff). The sum total of these costs amounted to just more than R6.5 million. The results from the sensitivity analyses, moreover, suggest that these costs can vary between R3.5 and R25.5 million, which respectively translates into between 1.8 and 13.4 percent of total annual salaries and wages, and between 0.9 and 6.4 percent of annual operating expenses. Over the next ten years, HIV/AIDS amongst employees will, on average, cost UFS R6.8 million per annum, or R2,938 per employee, which translates into 3.5 percent of total annual salaries and wages and 1.7 percent of total annual operating expenses. The sensitivity analyses suggested that this estimate could range between R4.4 and R27.4 million per annum over the next ten years, which represents between 2.3 and 14.4 percent of total annual salaries and wages, and between 1.1 and 6.9 percent of annual operating expenses.

Yet, the University faces costs of HIV/AIDS not only in respect of HIV infections and AIDS deaths occurring amongst employees, but also in respect of HIV infections and AIDS deaths amongst students. Incident HIV infections and AIDS cases amongst students at UFS are estimated to translate into a considerable cost in terms of foregone revenue. On average, HIV/AIDS amongst students will cost UFS almost R4 million per annum over the next ten years. This translates into an average cost per enrolled student of R1,646 and approximately one percent of total annual operating expenses. In respect of the best and worst case costing scenarios, the aggregate costs amounted to between R636 thousand and R14.4 million per annum over the ten-year period, which translates into between 0.2 and 3.6 percent of total annual operating expenses. The cost of this 'AIDS tax' per enrolled student thus amounted to between R164 (best case scenario) and R4,396 (worst case scenario), compared with the R1,646 per enrolled student in the baseline scenario.

On average, the total cost to UFS of incident HIV infections and AIDS cases and deaths amongst staff and students amounted to R10.8 million per annum over the ten-year period, which on average represents 2.8 percent of annual operating expenses. The average annual total costs for the Bloemfontein and Qwaqwa campuses represented R9.2 and R1.5 million respectively. This means that 88 percent of the total cost of HIV/AIDS was incurred in terms HIV infections and AIDS cases and deaths estimated to occur on the Bloemfontein campus, with its considerably larger number of employees (2,116 versus 217) and students (18,357 versus 1486), compared to 12 percent for Qwaqwa campus. Under the best and worst case costing scenarios, the total costs of HIV/AIDS over the ten-year period ranged between R8.4 and R31.3 million respectively. This translates into between 2.2 and 8.3 percent of annual operating expenses.

The cost of interventions which can either keep employees from becoming infected (prevention and awareness programmes), or which can extend the productive lives of infected employees or can ensure that students complete their studies (treatment programmes) represent but a fraction of the costs of the impact of HIV/AIDS on staff and students. Our analysis, however, suggests that prevention programmes targeting students may not represent an economically prudent option, given that the cost of the intervention exceeds the savings. This is the result of the savings to UFS being calculated only in respect of HIV infections being averted, which represented the smaller share of the aggregate cost to UFS of HIV/AIDS amongst students. In fact, the future benefits from averting the AIDS costs related to a current HIV infection will not accrue to UFS, but to society at large. The inclusion of these savings to society in our calculation, for example in respect of health care costs averted and the loss of skilled labour averted, will most likely result in such prevention programme being economically prudent. As a result, the University, in terms of its larger role in society as a 'factory' of human capital or highly skilled labour should nevertheless invest in prevention efforts, as these interventions will have considerable longer term benefits for the entire economy and for society at large. The question this raises, however, is to what extent government, realising the importance of this, needs to support and finance awareness and prevention activities at institutions of higher education. Government does so at the primary and secondary levels of education, where it supports awareness and prevention activities in the form of a conditional grant which finances the Life Skills programme. Efforts at tertiary levels, however, have been the responsibility of institutions of higher education themselves and/or of donor agencies and philanthropies. The question, therefore, is whether government should finance these activities, given the longer-term benefits of averting infections amongst students and the need to continue to build on the prevention and awareness programmes implemented in schools. Thus, further investments by UFS and its partners in prevention and treatment programmes for staff and students are economically prudent, if not from a company perspective, then definitely from a societal perspective.

One may, moreover, argue that the free provision of ARV in the public sector, which is currently in progress, relieves UFS of a duty to provide treatment to staff and students, this despite our findings indicating that this is an economically prudent option. Yet, UFS may still want to secure treatment for students and employees, given that not all infected persons will receive treatment insofar as treatment will not immediately be available at all public health care facilities and that not all patients will immediate receive treatment, that the need to take leave to access treatment may compromise individual confidentiality, and that UFS will have no direct involvement in the programme and can therefore do little to ensure high uptake and reliable delivery of treatment services. This translates into a 'loss' of the potential savings to UFS of providing treatment to staff and students. Hence, UFS at a minimum should invest money in selling to students and employees the importance of being tested and of determining their HIV status (thus marketing the VCT service on campus and available in public health care facilities), which will enable them to access treatment in the public or private health care sectors, given that the returns on treatment are considerable.

In order to collect information about the needs and constraints faced by staff, students, community organisations, and management in coping with the epidemic and the manner in which they envisage these needs and constraints should be addressed, which is central to our study, a range of focus group discussions were conducted with a range of stakeholders. Where necessary, focus groups were stratified amongst others by age, sex, population group, and level of employment, given that different groups of participants have distinctly different needs and face different constraints. In the case of the focus groups with staff and students, a list of the names and contact details obtained from the human resources section was employed as sampling frame. Sampled respondents were contacted telephonically by a researchers and were invited to the focus group discussion after explaining to the person the objectives and importance of the research. The number of participants in each focus group discussion ranged from 6-12. Focus group discussions were recorded on audio after asking participants' permission to do so and were later transcribed with the aid of the tape recording. The focus group discussions were conducted in the language of the participants. The research team also identified other stakeholders and conducted focus group discussions with these key informants. Participants in these focus group discussions, particularly at the management level, were requested to supply the research team with documentation with regard to certain information where this was necessary to inform the research and/or corroborate their viewpoints, e.g. policy documents and financial information. The focus group discussions with staff and students were conducted first, with the feedback from these focus group discussions informing and guiding the later focus group discussions with representatives of the student council, union representatives and management, together with the preliminary results of the epidemiological and costing analyses, which were presented to these stakeholders at these meetings. A total of 36 focus group discussions were conducted, involving in excess of 250 persons from various groups of stakeholders.

Students were generally aware of current campaigns, programmes and activities, the majority of which centre around awareness programmes aimed at the distribution of information regarding HIV/AIDS and of condoms. However, students almost unanimously agreed that participation in these activities was generally low and that the effectiveness of these programmes can be improved, especially via improved coordination and better communication. Moreover, ignorance and myths surrounding HIV/AIDS continues to exist. Importantly, students also highlighted the need for information programmes to go beyond the distribution of knowledge about HIV transmission and safe sex and emphasised the need for knowledge about how to manage exposures to risk of infection and about how people who are infected can deal with the disease and live positively with HIV/AIDS. A need was also expressed for special efforts aimed at involving those students who do not stay in residences on campus in HIV/AIDS-related activities, given that current programmes often fail to reach these students. Lecturers and management are generally perceived to distance themselves from the problem and not to be actively involved in HIV/AIDS-related activities on campus. There appears to be a definite need to scale up on the provision of HIV/AIDS-related services, and to mainstream HIV/AIDS into other campus activities.

Employees on the Qwaqwa campus were relatively more likely to have reported visible impacts or direct experiences of HIV/AIDS, particularly the effects of these experiences on morale. Support to infected employees (and students) by management and by unions is constrained due to the lack of disclosure and the resulting lack of knowledge about the extent of the problem and of whom to support. Employees were generally unaware of HIV/AIDS-related programmes aimed at staff members, even where in fact such programmes did exist, and felt that these programmes are targeted at students rather than at staff. Employees felt that unions were not supportive in terms of prevention and awareness activities and that unions focused mainly on providing support to the bereaved person's family once the person had died. Participants also felt that a concerted effort should be made to provide the necessary support to employees, including the dissemination of awareness information and access to counselling and treatment, and to encourage employees to go for HIV tests and/or to disclose their status.

The current policy of UFS on HIV/AIDS, moreover, does in fact address most of these and other specific concerns raised by students and staff members in terms of perceived needs. Importantly, however, the focus group discussions in general highlighted the fact that the response by UFS to the HIV/AIDS epidemic, though sound in respect of its nature, is constrained by a lack of coordination, poor communication and lack of resources, an issue to which we turn again in due course.

Representatives of NGOs and CBOs were of the opinion that UFS, as an important partner in the community's response to HIV/AIDS, can contribute as follows: (a) provide financial assistance to local organisations involved in HIV/AIDS education, home-based care and other activities, which would allow these organisations to expand their services, (b) assist organisations in training personnel and volunteers in project management, advanced HIV/AIDS awareness, as well as health care and social work, (c) encourage or require from students to become involved in the activities of these organisations as volunteers, possibly as part of UFS's community service learning initiative, thus aiding organisations in expanding their services, (d) assist organisations in educating community members regarding the procedure to be followed in adopting orphaned children, which would enable them to access foster grants, and (e) employ research to enhance the response to HIV/AIDS in local communities. The current policy of UFS on HIV/AIDS does emphasise the need for UFS to be involved in the community in terms of its response to the epidemic and to coordinate its efforts with NGOs and CBOs. Yet, the policy does not specify precisely how this should be done and refers in broad terms to the need to 'establish community partnership and outreach programmes for creating HIV/AIDS awareness and prevention'. In this context, it is hoped that the above suggestions can provide some ideas of how the response of UFS to HIV/AIDS in terms of its impact on the community at large should go beyond an exclusive focus on awareness and prevention alone, also to include capacity building initiatives and community outreach programmes aimed at mitigating the impact of the epidemic.

Health professionals at UFS were of the opinion that the current response to HIV/AIDS is highly fragmented, uncoordinated and under-resourced, which resulted in participants experiencing high levels of frustration. The feeling was also that top management is not really actively involved in making a success of the response of UFS to the HIV/AIDS epidemic. Given the complex nature of the HIV/AIDS epidemic, these health professionals felt that the response of UFS to the epidemic needs to be integrated and multi-faceted. Participants felt that the ideal way to respond to HIV/AIDS would be to have a team of various professionals provide all HIV/AIDS-related services in one facility as a one-stop service. Respondents were also of the opinion that there existed no coordinated strategy for fundraising to mobilise the resources required to fund such an integrated, coordinated response to HIV/AIDS. Importantly, strong opinions surfaced with regard to the extent to which the AIDS Centre (now called the Life Skills Centre) and the response of UFS to the epidemic is under-resourced, with similar perceptions having been raised in focus group discussions with staff, students and union and student council representatives. Evidence in terms of the nature of responses by higher education institutions in South Africa similar in size to or even smaller than UFS provided further evidence of the extent to which this is indeed the case. Despite being under-resourced, however, the University's policy on HIV/AIDS and its response to the epidemic compares well to the responses by other institutions of higher education in South Africa.

The response of UFS to the epidemic is therefore not lacking in terms of content, but lacking in terms of effectiveness as a result of being relatively under-resourced. Hence, UFS needs to take action in deciding how it can go about mobilising the necessary funding to expand and strengthen its response to HIV/AIDS.

Similar to UFS, other institutions of higher education in South Africa have also developed responses to HIV/AIDS, including formal policies about HIV/AIDS. For instance, the University of Cape Town (South Africa) has approved an institutional policy on HIV/AIDS. The policy calls for a total and comprehensive institutional approach to combating the pandemic. These interventions range from prevention and care projects, through curriculum changes, to intensive research into medical responses and social impact. Universities in Africa have also taken a variety of measures to respond to the HIV crisis, including awareness and prevention work, counselling, care and treatment, and medical research. However, many universities in Africa have not been as responsive. At a number of universities there still is considerable uncertainty and limited understanding about HIV/AIDS (Kelly, 2001a). Many universities also lack a clear action plan and policy framework concerning the epidemic (Kelly, 2001a/b). Even in those universities which have adopted a policy framework and have responded in some way to the epidemic, as has UFS, this response is impeded by lack of coordination and commitment. A recent audit of institutions of higher education in South Africa revealed that a range of delivery gaps exists 'across the spectrum of possible interventions' (Lickindorf, 2004). In fact, only five institutions, namely the Natal and Peninsula technikons, Technikon South Africa and Natal and Vista universities, had adopted a formal policy on HIV/AIDS before 2000. Ten more institutions had adopted policies since 2000, while the policies of eight institutions by 2001 were in draft form. Ten institutions of higher education had not or were not known by 2001 to have formalised or even drafted any policy on HIV/AIDS. Yet, many universities and technikons have responded to the epidemic in a variety of ways, although not having adopted formal policies in respect of HIV/AIDS (Martin and Alexander, 2002). Hence, much remains to be done further to enhance the response of institutions of higher education in South Africa to the HIV/AIDS epidemic.

6. APPENDICES

APPENDIX A: FOCUS GROUP DISCUSSION GUIDELINES

Students	Staff	NGOs and CBOs
1. How, in your experience, has HIV/AIDS affected your lives as students at UFS?	1. How, in your opinion, has HIV/AIDS affected your lives as employees of UFS?	1. Identify and describe the three most important ways in which HIV/AIDS has impacted your communities, i.e. what are the three most important areas of action?
2. How do you feel about the views of academic staff and management at UFS regarding HIV/AIDS? E.g. are they open about the topic, do they integrate it into their courses, do they express an awareness of HIV/AIDS-related initiatives at the University?	2. Are there areas of work where the illness or death of key workers will jeopardise the running of the organisation and the rendering of services?	2. What is the community doing currently to address these issues, i.e. what types of interventions and programmes are addressing these impacts?
3. Are you aware of any HIV/AIDS campaigns or programmes that are currently in place on the campus? If so, briefly describe the nature of these programmes/campaigns.	3. Are there reserve sources of the necessary skills should workers with such skills be lost due to HIV/AIDS?	3. How can the University of the Free State best support these actions and initiatives in the community?
4. STRENGTHS: Have you found these programmes/campaigns useful and appropriate? If so, how?	4. How supportive of HIV-infected employees do you think is management?	
5. WEAKNESSES: What do you think has not worked well with these programmes/campaigns or what has been lacking?	5. How supportive of HIV-infected employees do you think are unions?	

APPENDIX A: FOCUS GROUP DISCUSSION GUIDELINES (CONT.)

Students	**Staff**	**NGOs and CBOs**
6. What can an HIV-infected student ideally expect from the University (what should be done or provided at a minimum to help students cope with the effects of HIV/AIDS)?	6. Are you aware of any HIV/AIDS workplace programmes or support strategies for infected employees that are currently in place on the campus? If so, briefly describe the nature of these programmes/strategies.	
7. If you could make some suggestions to the UFS on how to improve its HIV/AIDS programmes/campaigns aimed at students, what would you say?	7. STRENGTHS: Have you found these programmes/strategies useful and appropriate? If so, how?	
	8. WEAKNESSES: What do you think has not worked well with these programmes/strategies or what has been lacking?	
	9. What can an HIV-infected employee ideally expect from the University (what should be done or provided at a minimum to help employees cope with the effects of HIV/AIDS)?	
	10. If you could make some suggestions to the UFS on how to improve its HIV/AIDS programmes/strategies aimed at employees, what would you say?	

APPENDIX B: SUPERVISOR INTERVIEW INSTRUMENT

____

Employee's Company Identification Number

Productivity Questionnaire

To the Supervisor:

This questionnaire is part of a research study being carried out to help your company understand the impact of sickness on employee performance and productivity on the job. Please recall the employee whose identification is shown above, who died while still in service or was medically boarded. <u>With this individual employee in mind</u>, please answer the questions below. *Your responses and the identity of the employee you are describing will be kept strictly confidential*.

1. How well do you remember the employee?

____ I remember the employee very well
____ I remember the employee somewhat
____ I do not remember the employee well

2. As best you can recall, how many months before the employee was boarded or died in service did his or her performance first begin to deteriorate, compared with what it had been when he or she was healthy?

____ more than 24 months before
____ 18-24 months before
____ 12-18 months before
____ 6-12 months before
____ 4-6 months before
____ 2-4 months before
____ 1-2 months before
____ less than 1 month before
____ there was no deterioration at all

3. After performance started to deteriorate, what was the employee's attendance at work like? (We understand that attendance might have become steadily worse during the period; please just tell us which of the following best describes the average attendance of the employee.)

____ The employee was present more often than absent on sick leave
____ The employee was absent on sick leave or other leave more often than present
____ The employee was present and absent about an equal numbers of days

4. After performance started to deteriorate, how was the employee's job performance on the days he or she came to work? (We understand that performance might have become steadily worse during the period; please just tell us which of the following best describes the average job performance of the employee.)

____ Job performance was less than 20% of what it had been when the employee was healthy
____ Job performance was 21-40% of what it had been when the employee was healthy
____ Job performance was 41-60% of what it had been when the employee was healthy
____ Job performance was 61-80% of what it had been when the employee was healthy
____ Job performance was 81-100% of what it had been when the employee was healthy

5. On days when the employee was absent or his or her performance was poor, how was your unit's overall performance affected?

____ We were able to shift tasks within the unit and function without any loss of performance
____ We usually hired a casual employee or assigned overtime to make up for the sick employee's lower performance
____ Our overall performance decreased slightly (it was between 75% and 100% of usual)
____ Our overall performance decreased moderately (it was between 50% and 75% of usual)
____ Our overall performance decreased substantially (it was less than 50% of usual)

6. From the time you first noticed that the employee was sick until the medical boarding was completed or the employee had died, how many days did you spend taking care of the employee, adjusting your schedule for sick leave, processing paperwork, or doing other tasks that you did not have to do for the employee when he or she was healthy?

____ More than 30 days of my time was needed
____ Between 20 and 30 days of my time was needed
____ Between 10 and 20 days of my time was needed
____ Between 5 and 10 days of my time was needed
____ Between 2 and 5 days of my time was needed
____ Fewer than 2 days of my time was needed

7. After the employee stopped coming to work at all, for how many weeks was his or her position vacant before you found a replacement?

____ We did not replace the employee
____ I immediately moved someone else into the position, so it wasn't vacant at all
____ It was vacant for less than 2 weeks
____ It was vacant for 2-4 weeks
____ It was vacant for 1-2 months
____ It was vacant for 2-4 months
____ It was vacant for more than 4 months

8. If you did hire a replacement for the employee who died or was boarded, how many months did it take for the replacement employee to become fully productive?

____ It took more than 6 months
____ It took between 4 and 6 months
____ It took between 2 and 4 months
____ It took more than 1 month but less than 2 months
____ It took between 2 weeks and 1 month
____ It took less than 2 weeks
____ It took no time at all; the new employee was fully productive from the first day

9. During the time period you selected in Question 8 (above), how productive, on average, was the new employee compared with a fully productive employee in the same job? (Please just give us an average for the entire period.)

____ About 90% productive
____ About 75-90% productive
____ About 50-75% productive
____ 50% productive
____ Less than 50% productive

Thank you for your assistance

APPENDIX C: RESULTS OF ASSA NEWSELECT WORKFORCE MODEL

Projections for Bloemfontein campus:

Stage and treatment profile at 1 July	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
% of workforce that is clear	91.06%	90.72%	90.52%	90.41%	90.40%	90.48%	90.60%	90.76%	90.97%	91.17%
% of workforce that is in HIV stage 1	4.05%	4.00%	3.91%	3.81%	3.70%	3.57%	3.45%	3.34%	3.22%	3.12%
% of workforce that is in HIV stage 2	2.43%	2.53%	2.58%	2.60%	2.59%	2.56%	2.51%	2.45%	2.38%	2.32%
% of workforce that is in HIV stage 3	2.25%	2.51%	2.72%	2.88%	3.00%	3.08%	3.12%	3.12%	3.10%	3.07%
% of workforce that is in HIV stage 4	0.21%	0.24%	0.27%	0.29%	0.31%	0.32%	0.32%	0.33%	0.33%	0.32%
WITHOUT HAART										
Decrements and increments over the year										
New entrants	241	243	248	247	247	250	250	248	251	250
Disabilities	19	20	22	23	23	24	24	24	23	23
Ill-health retirements	2	2	2	2	2	2	2	2	2	2
Normal retirements	39	39	42	39	37	40	39	36	40	38
Withdrawals	166	166	167	167	168	168	169	169	170	170
Non-AIDS deaths	11	11	10	10	10	10	10	10	10	10
AIDS deaths	4	5	5	5	6	6	6	6	6	6
Total deaths	15	15	16	16	16	16	16	16	16	16
Crude non-AIDS mortality rate	0.46%	0.46%	0.46%	0.45%	0.45%	0.45%	0.45%	0.45%	0.45%	0.44%
Crude AIDS mortality rate	0.18%	0.20%	0.22%	0.23%	0.24%	0.25%	0.25%	0.25%	0.25%	0.25%
WITH HAART										
Decrements and increments over the year										
New entrants	241	243	248	245	245	248	247	245	247	246
Disabilities	18	19	20	21	22	22	22	22	22	22
Ill-health retirements	2	2	2	2	2	2	2	2	2	2
Normal retirements	40	40	43	39	38	40	39	37	38	37
Withdrawals	167	167	167	168	168	168	168	169	169	169
Non-AIDS deaths	11	10	10	10	10	10	10	10	10	10
AIDS deaths	4	4	4	5	5	5	5	5	5	5
Total deaths	14	15	15	15	15	15	15	15	15	15
Crude non-AIDS mortality rate	0.46%	0.45%	0.45%	0.45%	0.45%	0.45%	0.44%	0.44%	0.44%	0.44%
Crude AIDS mortality rate	0.16%	0.18%	0.19%	0.21%	0.22%	0.22%	0.23%	0.23%	0.23%	0.22%

APPENDIX C: RESULTS OF ASSA NEWSELECT WORKFORCE MODEL (CONT.)

Projections for Qwaqwa campus:

Stage and treatment profile at 1 July	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
% of workforce that is clear	93.12%	92.81%	92.74%	92.71%	92.77%	92.91%	93.09%	93.23%	93.43%	93.63%
% of workforce that is in HIV stage 1	3.06%	3.04%	2.92%	2.82%	2.70%	2.56%	2.43%	2.34%	2.24%	2.14%
% of workforce that is in HIV stage 2	1.89%	1.98%	1.99%	1.99%	1.96%	1.91%	1.85%	1.80%	1.74%	1.68%
% of workforce that is in HIV stage 3	1.77%	1.98%	2.14%	2.26%	2.33%	2.37%	2.38%	2.37%	2.34%	2.30%
% of workforce that is in HIV stage 4	0.17%	0.19%	0.21%	0.23%	0.24%	0.25%	0.25%	0.25%	0.25%	0.25%
Decrements and increments over the year										
WITHOUT HAART										
New entrants	23	20	21	21	20	20	22	21	21	21
Disabilities	1	2	2	2	2	2	2	2	2	2
Ill-health retirements	0	0	0	0	0	0	0	0	0	0
Normal retirements	6	2	4	3	2	3	4	3	3	3
Withdrawals	14	14	14	14	14	14	14	14	14	14
Non-AIDS deaths	1	1	1	1	1	1	1	1	1	1
AIDS deaths	0	0	0	0	0	0	0	0	0	0
Total deaths	1	1	1	1	1	1	1	1	1	1
Crude non-AIDS mortality rate	0.47%	0.46%	0.46%	0.46%	0.46%	0.47%	0.46%	0.46%	0.46%	0.46%
Crude AIDS mortality rate	0.15%	0.16%	0.18%	0.19%	0.19%	0.20%	0.20%	0.20%	0.19%	0.19%
WITH HAART										
New entrants	22	19	21	20	20	20	22	21	21	21
Disabilities	1	1	1	2	2	2	2	2	2	2
Ill-health retirements	0	0	0	0	0	0	0	0	0	0
Normal retirements	5	2	4	3	2	3	4	3	3	3
Withdrawals	14	14	14	14	14	14	14	14	14	14
Non-AIDS deaths	1	1	1	1	1	1	1	1	1	1
AIDS deaths	0	0	0	0	0	0	0	0	0	0
Total deaths	1	1	1	1	1	1	1	1	1	1
Crude non-AIDS mortality rate	0.47%	0.47%	0.47%	0.46%	0.46%	0.47%	0.46%	0.46%	0.46%	0.45%
Crude AIDS mortality rate	0.13%	0.14%	0.15%	0.16%	0.17%	0.17%	0.17%	0.17%	0.17%	0.17%

APPENDIX D: ASSUMPTIONS IN 'BEST CASE' STAFF COSTING MODEL

Staff category	**Academic staff**	**Unskilled support staff**	**Skilled support staff**	**Highly skilled support staff**
A. HIV/AIDS parameters				
1. Number of years between HIV infection and death or ill-health retirement	9.0	9.0	9.0	9.0
2. Discrete mortality rate used in model (%)	7.5	7.5	7.5	7.5
3. Percentage of AIDS cases which end in death in service	32.5	32.5	32.5	32.5
4. Percentage of AIDS cases which end in ill-health retirement	67.5	67.5	67.5	67.5
B. Financial parameters				
1. Discount rate (real)(%)	5.2	5.2	5.2	5.2
2. Mortality adjustment factor	0.840	0.840	0.840	0.840
3. Annual inflation rate (%)	0	0	0	0
4. Annual increase in salary (nominal, %)	0	0	0	0
C. Productivity parameters				
1. Salaries: all employees (permanent and temporary)	mean	mean	mean	mean
2. Wage multiplier	1.6	1.33	1.33	1.6
3. Sick days 0-365 days before death in service (days)	29.5	29.5	29.5	29.5
4. Sick days in 366-730 days before death in service (days)	10.5	10.5	10.5	10.5
5. Sick days in 0-365 days before ill-health retirement (days)	69.0	69.0	69.0	69.0
6. Sick days 365-730 days before ill-health retirement (days)	12.0	12.0	12.0	12.0
7. Average sick days taken per year (whole workforce) (days)	5.4	5.4	5.4	5.4
8. Average other leave days taken per year (whole workforce) (days)	38.0	38.0	38.0	38.0
9. Productivity loss (% on days present in last 0-365 days)	20.0	20.0	20.0	20.0
10. Productivity loss (% on days present in last 366-730 days)	16.7	16.7	16.7	16.7
11. Supervisor's time required in last year of service (days)	1	1	1	1
12. Workdays per month (days)	21.67	21.67	21.67	21.67

APPENDIX D: ASSUMPTIONS IN 'BEST CASE' STAFF COSTING MODEL (CONTINUED)

Staff category	Academic staff	Unskilled support staff	Skilled support staff	Highly skilled support staff
D. Medical care parameters				
1. Medical aid benefit ceiling for HIV/AIDS treatment (Rand)	30,000	30,000	30,000	30,000
2. Share of medical aid premium paid by company (%)	66.7	66.7	66.7	66.7
3. Administrative overhead on medical aid benefits (% of claims)	20.4	20.4	20.4	20.4
E. End of service benefits parameters				
1. Probability that employee is in medical aid scheme	Proportion of employees in each category appointed permanently	Proportion of employees in each category appointed permanently	Proportion of employees in each category appointed permanently	Proportion of employees in each category appointed permanently
2. Probability that employee is in pension or provident fund	Proportion of employees in each category appointed permanently	Proportion of employees in each category appointed permanently	Proportion of employees in each category appointed permanently	Proportion of employees in each category appointed permanently
3. Probability of belonging to pension or provident fund or group life insurance scheme	1.00 pension fund; 0.00 provident fund; 1.00 group life insurance scheme	1.00 pension fund; 0.00 provident fund; 1.00 group life insurance scheme	1.00 pension fund; 0.00 provident fund; 1.00 group life insurance scheme	1.00 pension fund; 0.00 provident fund; 1.00 group life insurance scheme
4. Risk benefit due upon death in service (multiple of salary)	2x pension fund; 4x provident fund; 4x group life insurance	2x pension fund; 4x provident fund; 4x group life insurance	2x pension fund; 4x provident fund; 4x group life insurance	2x pension fund; 4x provident fund; 4x group life insurance

APPENDIX D: ASSUMPTIONS IN 'BEST CASE' STAFF COSTING MODEL (CONTINUED)

Staff category	Academic staff	Unskilled support staff	Skilled support staff	Highly skilled support staff
5. Risk benefit due upon ill-health retirement (% of salary)	82.5% pension fund; 100% provident fund; 1.6x salary group life insurance	82.5% pension fund; 100% provident fund; 1.6x salary group life insurance	82.5% pension fund; 100% provident fund; 1.6x salary group life insurance	82.5% pension fund; 100% provident fund; 1.6x salary group life insurance
6. Share of risk benefits paid by company	0.5	0.5	0.5	0.5
7. Administrative overhead on risk benefits (% of claims)	10.9% pension fund; 15.6% provident fund	10.9% pension fund; 15.6% provident fund	10.9% pension fund; 15.6% provident fund	10.9% pension fund; 15.6% provident fund
8. Funeral benefit (lump sum)(Rand)	3,000	3,000	3,000	3,000
9. Share of funeral benefit paid by company	0.5	0.5	0.5	0.5
10. Group life benefit upon death in service (multiple of salary)	4	4	4	4
11. Share of group life benefit paid by company	0.5	0.5	0.5	0.5
12. Normal retirement age	65	65	65	65
F. Recruiting parameters				
1. Percentage of new hires who are internal (%)	100	100	100	100
2. Percentage of new hires who are external (%)	0	0	0	0
3. Direct cost of recruitment per internal hire (Rand)	3,015.75	301.58	3,015.75	3,015.75
4. Direct cost of recruitment per external hire (Rand)	9,047.25	904.73	9,047.25	9,047.25
5. Time from non-recruiting staff in next band up required/hire (days)	1.5	0.5	1.0	1.5
6. Time positions are vacant (months)	1.0	0	0.5	1.0
G. Training parameters				
1. Direct cost of training per internal hire (Rand)	862.50	226.50	445.50	810.50
2. Direct cost of training per external hire (Rand)	862.50	226.50	445.50	810.50
3. Trainer's time per new employee (days)	0.5	0.5	0.5	0.5

APPENDIX D: ASSUMPTIONS IN 'BEST CASE' STAFF COSTING MODEL (CONTINUED)

Staff category	Academic staff	Unskilled support staff	Skilled support staff	Highly skilled support staff
4. Trainer's salary per day (Rand)	175	175	175	175
5. Time spent in orientation or induction training (days)	0.5	0.5	0.5	0.5
6. Time spent in training courses (days)	1.5	1.5	1.5	1.5
7. Time required for internal hire to reach full productivity (months)	3.0	0.25	1.5	3.0
8. Time required for external hire to reach full productivity (months)	3.0	0.25	1.5	3.0
9. Productivity during start-up period for internal hire (%)	93.75	93.75	93.75	93.75
10. Productivity during start-up period for external hire (%)	93.75	93.75	93.75	93.75

APPENDIX E: ASSUMPTIONS IN 'WORST CASE' STAFF COSTING MODEL

Staff category	**Academic staff**	**Unskilled support staff**	**Skilled support staff**	**Highly skilled support staff**
A. HIV/AIDS parameters				
1. Number of years between HIV infection and death or ill-health retirement	9.0	9.0	9.0	9.0
2. Discrete mortality rate used in model (%)	7.5	7.5	7.5	7.5
3. Percentage of AIDS cases which end in death in service (%)	97.5	97.5	97.5	97.5
4. Percentage of AIDS cases which end in ill-health retirement (%)	2.5	2.5	2.5	2.5
B. Financial parameters				
1. Discount rate (real)(%)	5.2	5.2	5.2	5.2
2. Mortality adjustment factor	0.840	0.840	0.840	0.840
3. Annual inflation rate (%)	0	0	0	0
4. Annual increase in salary (nominal, %)	0	0	0	0
C. Productivity parameters				
1. Salaries: all employees (permanent and temporary)	median	median	median	median
2. Wage multiplier	1.6	1.33	1.33	1.6
3. Sick days 0-365 days before death in service (days)	40.13	40.13	40.13	40.13
4. Sick days in 366-730 days before death in service (days)	10.50	10.50	10.50	10.50
5. Sick days in 0-365 days before ill-health retirement (days)	104.40	104.40	104.40	104.40
6. Sick days 365-730 days before ill-health retirement (days)	32.25	32.25	32.25	32.25
7. Average sick days taken per year (whole workforce)(days)	1.8	1.8	1.8	1.8
8. Average other leave days taken per year (whole workforce)(days)	10.9	10.9	10.9	10.9
9. Productivity loss (% on days present in last 0-365 days)	100	100	100	100
10. Productivity loss (% on days present in last 366-730 days)	100	100	100	100
11. Supervisor's time required in last year of service (days)	5	5	5	5
12. Workdays per month (days)	21.67	21.67	21.67	21.67

APPENDIX E: ASSUMPTIONS IN 'WORST CASE' STAFF COSTING MODEL (CONTINUED)

Staff category	Academic staff	Unskilled support staff	Skilled support staff	Highly skilled support staff
D. Medical care parameters				
1. Medical aid benefit ceiling for HIV/AIDS treatment (Rand)	35,000	35,000	35,000	35,000
2. Share of medical aid premium paid by company (%)	66.7	66.7	66.7	66.7
3. Administrative overhead on medical aid benefits (% of claims)	20.4	20.4	20.4	20.4
E. End of service benefits parameters				
1. Probability that employee is in medical aid scheme	All employees	All employees	All employees	All employees
2. Probability that employee is in pension or provident fund	All employees	All employees	All employees	All employees
3. Probability of belonging to pension or provident fund or group life insurance scheme	0.00 pension fund; 1.00 provident fund; 1.00 group life insurance scheme	0.00 pension fund; 1.00 provident fund; 1.00 group life insurance scheme	0.00 pension fund; 1.00 provident fund; 1.00 group life insurance scheme	0.00 pension fund; 1.00 provident fund; 1.00 group life insurance scheme
4. Risk benefit due upon death in service (multiple of salary)	2x pension fund; 4x provident fund; 4x group life insurance	2x pension fund; 4x provident fund; 4x group life insurance	2x pension fund; 4x provident fund; 4x group life insurance	2x pension fund; 4x provident fund; 4x group life insurance

APPENDIX E: ASSUMPTIONS IN 'WORST CASE' STAFF COSTING MODEL (CONTINUED)

Staff category	**Academic staff**	**Unskilled support staff**	**Skilled support staff**	**Highly skilled support staff**
5. Risk benefit due upon ill-health retirement (% of salary)	82.5% pension fund; 100% provident fund; 1.6x salary group life insurance	82.5% pension fund; 100% provident fund; 1.6x salary group life insurance	82.5% pension fund; 100% provident fund; 1.6x salary group life insurance	82.5% pension fund; 100% provident fund; 1.6x salary group life insurance
6. Share of risk benefits paid by company	0.5	0.5	0.5	0.5
7. Administrative overhead on risk benefits (% of claims)	10.9% pension fund; 15.6% provident fund	10.9% pension fund; 15.6% provident fund	10.9% pension fund; 15.6% provident fund	10.9% pension fund; 15.6% provident fund
8. Funeral benefit (lump sum)(Rand)	3,000	3,000	3,000	3,000
9. Share of funeral benefit paid by company	0.5	0.5	0.5	0.5
10. Group life benefit upon death in service (multiple of salary)	4	4	4	4
11. Share of group life benefit paid by company	0.5	0.5	0.5	0.5
12. Normal retirement age	65	65	65	65
F. Recruiting parameters				
1. Percentage of new hires who are internal (%)	80	80	80	80
2. Percentage of new hires who are external (%)	20	20	20	20
3. Direct cost of recruitment per internal hire (Rand)	9,047.25	904.73	9,047.25	9,047.25
4. Direct cost of recruitment per external hire (Rand)	27,141.90	2,714.19	27,141.90	27,141.90
5. Time from non-recruiting staff in next band up required/hire (days)	4.5	1.5	3.0	4.5
6. Time positions are vacant (months)	3.0	0.25	1.5	3.0
G. Training parameters				
1. Direct cost of training per internal hire (Rand)	2,587.50	679.50	1,336.50	2,431.50
2. Direct cost of training per external hire (Rand)	2,587.50	679.50	1,336.50	2,431.50
3. Trainer's time per new employee (days)	1.5	1.5	1.5	1.5

APPENDIX E: ASSUMPTIONS IN 'WORST CASE' STAFF COSTING MODEL (CONTINUED)

Staff category	**Academic staff**	**Unskilled support staff**	**Skilled support staff**	**Highly skilled support staff**
4. Trainer's salary per day (Rand)	525	525	525	525
5. Time spent in orientation or induction training (days)	1.5	1.5	1.5	1.5
6. Time spent in training courses (days)	4.5	4.5	4.5	4.5
7. Time required for internal hire to reach full productivity (months)	9.0	0.75	4.5	9.0
8. Time required for external hire to reach full productivity (months)	9.0	0.75	4.5	9.0
9. Productivity during start-up period for internal hire (%)	31.25	31.25	31.25	31.25
10. Productivity during start-up period for external hire (%)	31.25	31.25	31.25	31.25

APPENDIX F: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (BLOEMFONTEIN CAMPUS)

Sensitivity analysis: Academic staff	**Baseline costing scenario**	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**	**Scenario 7**
	Use mean salaries all staff	Use mean salaries permanent staff	Use median salaries all staff	Use median salaries permanent staff	Probability that in medical aid = 80%, that in pension or provident fund = 68%, and that in group life insurance scheme = 80%	Probability that in medical aid, that in pension or provident fund, and that in group life insurance scheme = 100%	32.5% of AIDS cases die in service	97.5% of AIDS cases die in service
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	270,770	349,093	296,327	346,143	316,547	465,809	251,437	290,103
Average cost as a multiple of median salary	2.5	2.5	2.5	2.5	3.0	4.4	2.4	2.7
Annual aggregate cost (2004)	3,136,511	4,096,841	3,550,713	4,100,263	3,714,692	5,536,869	2,919,348	3,353,674
Aggregate cost as % of wages and salaries	3.6	3.5	3.5	3.5	4.2	6.3	3.3	3.8
(b) Composition of costs (%):								
Total indirect costs	56.4	58.4	57.5	58.3	48.3	32.8	62.6	51.1
Total direct costs	43.6	41.6	42.5	41.7	51.7	67.2	37.4	48.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,713	19,713	19,713	19,713	19,713	19,713	19,713	19,713
Net savings (Rand) in extending life by 5 years	51,298	71,839	58,001	71,065	63,303	102,448	46,228	56,368
Return (%)	260	364	294	360	321	520	235	286
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	2,895,958	3,784,790	3,277,659	3,787,375	3,431,116	5,113,171	2,695,633	3,096,282
NPV of 10-year intervention	123,955	123,955	123,955	123,955	123,955	123,955	123,955	123,955
x fold return on averting 40% of infections	8.3	11.2	9.6	11.2	10.1	15.5	7.7	9.0
x fold return on averting one HIV infection	1.2	1.8	1.4	1.8	1.6	2.8	1.0	1.3

Sensitivity analysis: Academic staff	Scenario 8	Scenario 9	Scenario 10	Scenario 11	Scenario 12	Scenario 13	Scenario 14	Scenario 15
	Discount rate = 0%	Discount rate = 2%	Discount rate = 4%	Discount rate = 6%	Discount rate = 8%	Discount rate = 10%	Discount rate = 12%	Use mean number of days of sick leave taken before death or ill-health retirement
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	338,605	301,853	279,534	266,385	259,427	256,902	257,729	281,302
Average cost as a multiple of median salary	3.2	2.8	2.6	2.5	2.4	2.4	2.4	2.6
Annual aggregate cost (2004)	3,909,496	3,490,038	3,235,925	3,086,955	3,009,060	2,982,099	2,993,706	3,263,491
Aggregate cost as % of wages and salaries	4.5	4.0	3.7	3.5	3.4	3.4	3.4	3.7
(b) Composition of costs (%):								
Total indirect costs	58.5	57.6	56.8	56.1	55.6	55.1	54.6	58.0
Total direct costs	41.5	42.4	43.2	43.9	44.4	44.9	45.4	42.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,820	19,777	19,734	19,690	19,647	19,604	19,561	19,707
Net savings (Rand) in extending life by 5 years	-19,820	14,039	38,881	58,904	76,297	92,284	107,595	54,066
Return (%)	-100	71	197	299	388	471	550	274
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	3,610,103	3,222,598	2,987,820	2,850,159	2,778,144	2,753,172	2,763,819	3,013,184
NPV of 10-year intervention	165,880	147,586	132,108	118,934	107,656	97,946	89,541	123,955
x fold return on averting 40% of infections	7.7	7.7	8.0	8.6	9.3	10.2	11.3	8.7
x fold return on averting one HIV infection	1.0	1.0	1.1	1.2	1.4	1.6	1.9	1.3

APPENDIX F: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (BLOEMFONTEIN)(CONT.)

Sensitivity analysis: Academic staff	**Scenario 16**	**Scenario 17**	**Scenario 18**	**Scenario 19**	**Scenario 20**	**Scenario 21**	**Scenario 22**	**Scenario 23**
	Average number of sick leave days for entire workforce = 1.8 days	Average number of sick leave days for entire workforce = 5.4 days	Average number of other leave days for entire workforce = 15 days	Average number of other leave days for entire workforce = 36 days	Average number of other leave days for entire workforce = 38 days	Productivity loss in 0-365 days = 20% and productivity loss in 0-365 days = 17% (50% lower than baseline)	Productivity loss in 0-365 days = 60% and productivity loss in 0-365 days = 50% (50% higher than baseline)	Productivity loss in 0-365 days = 100% and productivity loss in 0-365 days = 100%
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	271,518	270,022	269,067	260,342	259,511	225,955	316,480	429,262
Average cost as a multiple of median salary	2.5	2.5	2.5	2.4	2.4	2.1	3.0	4.0
Annual aggregate cost (2004)	3,145,528	3,127,495	3,115,973	3,010,780	3,000,762	2,596,199	3,687,608	5,047,351
Aggregate cost as % of wages and salaries	3.6	3.6	3.6	3.4	3.4	3.0	4.2	5.8
(b) Composition of costs (%):								
Total indirect costs	56.5	56.3	56.1	54.7	54.5	47.8	62.7	72.5
Total direct costs	43.5	43.7	43.9	45.3	45.5	52.2	37.3	27.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	51,500	51,108	50,857	48,569	48,351	39,551	63,291	92,869
Return (%)	261	259	258	246	245	201	321	471
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	2,904,282	2,887,634	2,876,997	2,779,884	2,770,635	2,397,147	3,404,724	4,660,024
NPV of 10-year intervention	123,955	123,955	123,955	123,955	123,955	123,955	123,955	123,955
x fold return on averting 40% of infections	8.4	8.3	8.3	8.0	7.9	6.7	10.0	14.0
x fold return on averting one HIV infection	1.2	1.2	1.2	1.1	1.1	0.8	1.6	2.5

APPENDIX F: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (BLOEMFONTEIN)(CONT.)

Sensitivity analysis: Academic staff	**Scenario 24**	**Scenario 25**	**Scenario 26**	**Scenario 27**	**Scenario 28**	**Scenario 29**	**Scenario 30**	**Scenario 31**
	Supervisor's time to manage illness = 1 day	Supervisor's time to manage illness = 3 days	Supervisor's time to manage illness = 5 days	Medical aid benefit ceiling = R35,000	100% of staff members with benefits in pension fund	100% of staff members with benefits in provident fund	90% hires internal	80% hires internal
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	269,804	271,736	273,667	275,049	263,435	283,811	271,412	272,055
Average cost as a multiple of median salary	2.5	2.5	2.6	2.6	2.5	2.7	2.5	2.6
Annual aggregate cost (2004)	3,125,872	3,147,150	3,168,428	3,182,771	3,052,960	3,285,047	3,143,588	3,150,666
Aggregate cost as % of wages and salaries	3.6	3.6	3.6	3.6	3.5	3.8	3.6	3.6
(b) Composition of costs (%):								
Total indirect costs	56.3	56.6	56.9	55.5	58.0	53.8	56.3	56.1
Total direct costs	43.7	43.4	43.1	44.5	42.0	46.2	43.7	43.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	51,050	51,557	52,063	52,426	49,380	54,724	51,472	51,641
Return (%)	259	262	264	266	251	278	261	262
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	2,886,116	2,905,799	2,925,483	2,938,698	2,818,873	3,032,998	2,902,505	2,909,052
NPV of 10-year intervention	123,955	123,955	123,955	123,955	123,955	123,955	123,955	123,955
x fold return on averting 40% of infections	8.3	8.4	8.4	8.5	8.1	8.8	8.4	8.4
x fold return on averting one HIV infection	1.2	1.2	1.2	1.2	1.1	1.3	1.2	1.2

Sensitivity analysis: Academic staff	Scenario 32	Scenario 33	Scenario 34	Scenario 35	Scenario 36	Scenario 37	Scenario 38	Scenario 39
	Direct costs per hire 50% lower	Direct costs per hire 50% higher	Other staff time per hire 50% lower	Other staff time per hire 50% higher	Time position vacant decreased by 50% for each job band	Time position vacant increased by 50% for each job band	Direct training costs decreased by 50% for each job band	Direct training costs increased by 50% for each job band
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	269,164	272,376	269,848	271,692	267,368	274,172	270,311	271,229
Average cost as a multiple of median salary	2.5	2.6	2.5	2.5	2.5	2.6	2.5	2.5
Annual aggregate cost (2004)	3,118,818	3,154,205	3,126,352	3,146,671	3,099,029	3,173,993	3,131,451	3,141,571
Aggregate cost as % of wages and salaries	3.6	3.6	3.6	3.6	3.5	3.6	3.6	3.6
(b) Composition of costs (%):								
Total indirect costs	56.7	56.1	56.3	56.6	55.9	56.9	56.5	56.3
Total direct costs	43.3	43.9	43.7	43.4	44.1	43.1	43.5	43.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	50,882	51,725	51,062	51,545	50,411	52,196	51,183	51,424
Return (%)	258	262	259	262	256	265	260	261
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	2,879,590	2,912,326	2,886,559	2,905,356	2,861,283	2,930,632	2,891,276	2,900,639
NPV of 10-year intervention	123,955	123,955	123,955	123,955	123,955	123,955	123,955	123,955
x fold return on averting 40% of infections	8.3	8.4	8.3	8.4	8.2	8.5	8.3	8.4
x fold return on averting one HIV infection	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2

APPENDIX F: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (BLOEMFONTEIN)(CONT.)

Sensitivity analysis: Academic staff	**Scenario 40**	**Scenario 41**	**Scenario 42**	**Scenario 43**	**Scenario 44**	**Scenario 45**	**Scenario 46**	**Scenario 47**
	OJT trainer days = 0.5 day and OJT trainer salary = R175/day	OJT trainer days = 1.5 days and OJT trainer salary = R525/day	Time in orientation = 0.5 days and time in training = 1.5 days	Time in orientation = 1.5 days and time in training = 4.5 days	Time to full productivity 50% lower for each job band	Time to full productivity 50% higher for each job band	Productivity during start-up = 31.25%	Productivity during start-up = 93.75%
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	270,538	271,157	269,980	271,560	261,144	280,396	286,814	254,727
Average cost as a multiple of median salary	2.5	2.5	2.5	2.5	2.5	2.6	2.7	2.4
Annual aggregate cost (2004)	3,133,955	3,140,772	3,127,810	3,145,212	3,030,453	3,242,569	3,313,274	2,959,748
Aggregate cost as % of wages and salaries	3.6	3.6	3.6	3.6	3.5	3.7	3.8	3.4
(b) Composition of costs (%):								
Total indirect costs	56.4	56.5	56.3	56.5	54.8	57.9	58.8	53.7
Total direct costs	43.6	43.5	43.7	43.5	45.2	42.1	41.2	46.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	51,243	51,405	51,097	51,511	48,779	53,828	55,511	47,096
Return (%)	260	261	259	261	248	273	282	239
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	2,893,593	2,899,899	2,887,909	2,904,007	2,797,845	2,994,070	3,059,479	2,732,436
NPV of 10-year intervention	123,955	123,955	123,955	123,955	123,955	123,955	123,955	123,955
x fold return on averting 40% of infections	8.3	8.4	8.3	8.4	8.0	8.7	8.9	7.8
x fold return on averting one HIV infection	1.2	1.2	1.2	1.2	1.1	1.3	1.3	1.1

Sensitivity analysis: Unskilled support staff	**Baseline costing scenario**	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**	**Scenario 7**
	Use mean salaries all staff	Use mean salaries permanent staff	Use median salaries all staff	Use median salaries permanent staff	Probability that in medical aid = 80%, that in pension or provident fund = 68%, and that in group life insurance scheme = 80%	Probability that in medical aid, that in pension or provident fund, and that in group life insurance scheme = 100%	32.5% of AIDS cases die in service	97.5% of AIDS cases die in service
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	76,212	77,539	77,194	79,345	78,778	104,133	72,524	79,900
Average cost as a multiple of average salary	2.5	2.4	2.4	2.4	2.5	3.4	2.3	2.6
Annual aggregate cost (2004)	357,120	361,351	372,241	376,841	336,582	447,434	337,925	376,316
Aggregate cost as % of wages	3.6	3.6	3.5	3.5	3.4	4.5	3.4	3.8
(b) Composition of costs (%):								
Total indirect costs	39.3	39.8	39.7	40.5	38.0	28.8	42.8	36.2
Total direct costs	60.7	60.2	60.3	59.5	62.0	71.2	57.2	63.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,713	19,713	19,713	19,713	19,713	19,713	19,713	19,713
Net savings (Rand) in extending life by 5 years	274	622	532	1,096	947	7,596	-693	1,241
Return (%)	1.4	3.2	2.7	5.6	4.8	38.5	-3.5	6.3
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	341,920	345,976	356,500	360,918	322,415	428,516	323,528	360,313
NPV of 10-year intervention	50,470	50,470	50,470	50,470	50,470	50,470	50,470	50,470
x fold return on averting 40% of HIV infections	1.7	1.7	1.8	1.9	1.6	2.4	1.6	1.9
x fold return on averting one HIV infection	0.5	0.5	0.5	0.6	0.6	1.1	0.4	0.6

Sensitivity analysis: Unskilled support staff	**Scenario 8**	**Scenario 9**	**Scenario 10**	**Scenario 11**	**Scenario 12**	**Scenario 13**	**Scenario 14**	**Scenario 15**
	Discount rate = 0%	Discount rate = 2%	Discount rate = 4%	Discount rate = 6%	Discount rate = 8%	Discount rate = 10%	Discount rate = 12%	Use mean number of days of sick leave taken before death or ill-health retirement
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	90,079	82,296	77,819	75,486	74,630	74,855	75,916	78,669
Average cost as a multiple of average salary	2.9	2.7	2.5	2.4	2.4	2.4	2.4	2.5
Annual aggregate cost (2004)	421,537	385,343	364,557	353,770	349,879	351,033	356,094	367,852
Aggregate cost as % of wages	4.2	3.9	3.7	3.6	3.5	3.5	3.6	3.7
(b) Composition of costs (%):								
Total indirect costs	39.7	39.5	39.4	39.3	39.2	39.1	39.1	41.2
Total direct costs	60.3	60.5	60.6	60.7	60.8	60.9	60.9	58.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,820	19,777	19,734	19,690	19,647	19,604	19,561	19,707
Net savings (Rand) in extending life by 5 years	-19,820	-10,557	-3,416	2,581	7,954	12,997	17,894	924
Return (%)	-100.0	-53.4	-17.3	13.1	40.5	66.3	91.5	4.7
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	403,596	368,942	349,041	338,713	334,987	336,091	340,937	352,199
NPV of 10-year intervention	67,540	60,091	53,789	48,425	43,833	39,880	36,457	50,470
x fold return on averting 40% of HIV infections	1.4	1.5	1.6	1.8	2.1	2.4	2.7	1.8
x fold return on averting one HIV infection	0.3	0.4	0.4	0.6	0.7	0.9	1.1	0.6

APPENDIX F: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (BLOEMFONTEIN)(CONT.)

Sensitivity analysis: Unskilled support staff	**Scenario 16**	**Scenario 17**	**Scenario 18**	**Scenario 19**	**Scenario 20**	**Scenario 21**	**Scenario 22**	**Scenario 23**
	Average number of sick leave days for entire workforce = 1.8 days	Average number of sick leave days for entire workforce = 5.4 days	Average number of other leave days for entire workforce = 15 days	Average number of other leave days for entire workforce = 36 days	Average number of other leave days for entire workforce = 38 days	Productivity loss in 0-365 days = 20% and productivity loss in 0-365 days = 17% (50% lower than baseline)	Productivity loss in 0-365 days = 60% and productivity loss in 0-365 days = 50% (50% higher than baseline)	Productivity loss in 0-365 days = 100% and productivity loss in 0-365 days = 100%
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	76,387	76,038	75,815	73,780	73,586	65,760	86,873	113,177
Average cost as a multiple of average salary	2.5	2.5	2.4	2.4	2.4	2.1	2.8	3.6
Annual aggregate cost (2004)	357,882	356,358	355,384	346,494	345,647	311,456	403,695	518,613
Aggregate cost as % of wages	3.6	3.6	3.6	3.5	3.5	3.1	4.1	5.2
(b) Composition of costs (%):								
Total indirect costs	39.5	39.2	39.0	37.3	37.2	29.7	46.8	59.1
Total direct costs	60.5	60.8	61.0	62.7	62.8	70.3	53.2	40.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	325	234	175	-358	-409	-2,462	3,076	9,974
Return (%)	1.7	1.2	0.9	-1.8	-2.1	-12.5	15.6	50.6
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	342,650	341,191	340,258	331,743	330,932	298,183	386,531	496,600
NPV of 10-year intervention	50,470	50,470	50,470	50,470	50,470	50,470	50,470	50,470
x fold return on averting 40% of HIV infections	1.7	1.7	1.7	1.6	1.6	1.4	2.1	2.9
x fold return on averting one HIV infection	0.5	0.5	0.5	0.5	0.5	0.3	0.7	1.2

APPENDIX F: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (BLOEMFONTEIN)(CONT.)

Sensitivity analysis: Unskilled support staff	**Scenario 24**	**Scenario 25**	**Scenario 26**	**Scenario 27**	**Scenario 28**	**Scenario 29**	**Scenario 30**	**Scenario 31**
	Supervisor's time to manage illness = 1 day	Supervisor's time to manage illness = 3 days	Supervisor's time to manage illness = 5 days	Medical aid benefit ceiling = R35,000	100% of staff members with benefits in pension fund	100% of staff members with benefits in provident fund	90% hires internal	80% hires internal
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	75,915	76,510	77,105	81,227	73,078	81,784	76,277	76,341
Average cost as a multiple of average salary	2.4	2.5	2.5	2.6	2.4	2.6	2.5	2.5
Annual aggregate cost (2004)	355,872	358,368	360,865	381,437	341,394	385,077	357,390	357,659
Aggregate cost as % of wages	3.6	3.6	3.6	3.8	3.4	3.9	3.6	3.6
(b) Composition of costs (%):								
Total indirect costs	39.1	39.6	40.0	36.9	41.0	36.6	39.3	39.3
Total direct costs	60.9	60.4	60.0	63.1	59.0	63.4	60.7	60.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	202	358	514	1,595	-542	1,741	297	313
Return (%)	1.0	1.8	2.6	8.1	-2.8	8.8	1.5	1.6
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	340,725	343,116	345,506	365,186	326,854	368,705	342,178	342,436
NPV of 10-year intervention	50,470	50,470	50,470	50,470	50,470	50,470	50,470	50,470
x fold return on averting 40% of HIV infections	1.7	1.7	1.7	1.9	1.6	1.9	1.7	1.7
x fold return on averting one HIV infection	0.5	0.5	0.5	0.6	0.4	0.6	0.5	0.5

Sensitivity analysis: Unskilled support staff	**Scenario 32**	**Scenario 33**	**Scenario 34**	**Scenario 35**	**Scenario 36**	**Scenario 37**	**Scenario 38**	**Scenario 39**
	Direct costs per hire 50% lower	Direct costs per hire 50% higher	Other staff time per hire 50% lower	Other staff time per hire 50% higher	Time position vacant decreased by 50% for each job band	Time position vacant increased by 50% for each job band	Direct training costs decreased by 50% for each job band	Direct training costs increased by 50% for each job band
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	76,052	76,373	76,118	76,307	76,212	76,331	76,092	76,333
Average cost as a multiple of average salary	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Annual aggregate cost (2004)	356,447	357,794	356,723	357,518	357,120	357,617	356,614	357,626
Aggregate cost as % of wages	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
(b) Composition of costs (%):								
Total indirect costs	39.4	39.2	39.2	39.4	39.3	39.4	39.4	39.3
Total direct costs	60.6	60.8	60.8	60.6	60.7	60.6	60.6	60.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	238	322	255	305	280	311	248	311
Return (%)	1.2	1.6	1.3	1.5	1.4	1.6	1.3	1.6
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	341,276	342,565	341,540	342,301	341,920	342,396	341,436	342,405
NPV of 10-year intervention	50,470	50,470	50,470	50,470	50,470	50,470	50,470	50,470
x fold return on averting 40% of HIV infections	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
x fold return on averting one HIV infection	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Sensitivity analysis: Unskilled support staff	**Scenario 40**	**Scenario 41**	**Scenario 42**	**Scenario 43**	**Scenario 44**	**Scenario 45**	**Scenario 46**	**Scenario 47**
	OJT trainer days = 0.5 day and OJT trainer salary = R175/day	OJT trainer days = 1.5 days and OJT trainer salary = R525/day	Time in orientation = 0.5 days and time in training = 1.5 days	Time in orientation = 1.5 days and time in training = 4.5 days	Time to full productivity 50% lower for each job band	Time to full productivity 50% higher for each job band	Productivity during start-up = 31.25%	Productivity during start-up = 93.75%
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	76,026	76,522	76,036	76,388	76,033	76,391	76,510	75,914
Average cost as a multiple of average salary	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.4
Annual aggregate cost (2004)	356,341	358,419	356,382	357,859	356,370	357,870	358,371	355,870
Aggregate cost as % of wages	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
(b) Composition of costs (%):								
Total indirect costs	39.2	39.6	39.2	39.5	39.2	39.5	39.6	39.1
Total direct costs	60.8	60.4	60.8	60.5	60.8	60.5	60.4	60.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	231	361	233	326	233	327	358	201
Return (%)	1.2	1.8	1.2	1.7	1.2	1.7	1.8	1.0
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	341,174	343,164	341,213	342,628	341,202	342,639	343,118	340,723
NPV of 10-year intervention	50,470	50,470	50,470	50,470	50,470	50,470	50,470	50,470
x fold return on averting 40% of HIV infections	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
x fold return on averting one HIV infection	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

APPENDIX F: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (BLOEMFONTEIN)(CONT.)

Sensitivity analysis: Skilled support staff	**Baseline costing scenario**	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**	**Scenario 7**
	Use mean salaries all staff	Use mean salaries permanent staff	Use median salaries all staff	Use median salaries permanent staff	Probability that in medical aid = 80%, that in pension or provident fund = 68%, and that in group life insurance scheme = 80%	Probability that in medical aid, that in pension or provident fund, and that in group life insurance scheme = 100%	32.5% of AIDS cases die in service	97.5% of AIDS cases die in service
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	87,667	107,149	84,545	104,714	149,739	224,512	86,971	88,363
Average cost as a multiple of average salary	1.7	1.6	1.8	1.6	3.0	4.5	1.7	1.8
Annual aggregate cost (2004)	1,228,948	1,503,346	1,152,780	1,459,173	2,136,483	3,229,912	1,221,172	1,236,725
Aggregate cost as % of wages	2.4	2.2	2.5	2.2	4.2	6.3	2.4	2.4
(b) Composition of costs (%):								
Total indirect costs	61.5	66.3	60.4	65.9	36.0	24.0	64.0	59.0
Total direct costs	38.5	33.7	39.6	34.1	64.0	76.0	36.0	41.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,713	19,713	19,713	19,713	19,713	19,713	19,713	19,713
Net savings (Rand) in extending life by 5 years	3,278	8,387	2,459	7,749	19,557	39,167	3,096	3,461
Return (%)	16.6	42.5	12.5	39.3	99.2	198.7	15.7	17.6
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	1,146,861	1,405,311	1,075,041	1,363,804	1,995,935	3,015,768	1,139,629	1,154,093
NPV of 10-year intervention	157,328	157,328	157,328	157,328	157,328	157,328	157,328	157,328
x fold return on averting 40% of HIV infections	1.9	2.6	1.7	2.5	4.1	6.7	1.9	1.9
x fold return on averting one HIV infection	-0.4	-0.3	-0.5	-0.3	0.0	0.4	-0.4	-0.4

Sensitivity analysis: Skilled support staff	**Scenario 8**	**Scenario 9**	**Scenario 10**	**Scenario 11**	**Scenario 12**	**Scenario 13**	**Scenario 14**	**Scenario 15**
	Discount rate = 0%	Discount rate = 2%	Discount rate = 4%	Discount rate = 6%	Discount rate = 8%	Discount rate = 10%	Discount rate = 12%	Use mean number of days of sick leave taken before death or ill-health retirement
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	109,012	97,415	90,403	86,308	84,186	83,480	83,847	91,634
Average cost as a multiple of average salary	2.2	1.9	1.8	1.7	1.7	1.7	1.7	1.8
Annual aggregate cost (2004)	1,525,621	1,364,303	1,266,878	1,210,136	1,180,930	1,171,487	1,177,030	1,286,918
Aggregate cost as % of wages	3.0	2.7	2.5	2.4	2.3	2.3	2.3	2.5
(b) Composition of costs (%):								
Total indirect costs	61.6	61.5	61.5	61.5	61.4	61.4	61.4	63.1
Total direct costs	38.4	38.5	38.5	38.5	38.6	38.6	38.6	36.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,820	19,777	19,734	19,690	19,647	19,604	19,561	19,707
Net savings (Rand) in extending life by 5 years	-19,820	-8,864	-777	5,774	11,488	16,754	21,806	4,324
Return (%)	-100.0	-44.8	-3.9	29.3	58.5	85.5	111.5	21.9
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	1,424,064	1,273,352	1,182,314	1,129,271	1,101,943	1,093,068	1,098,186	1,200,933
NPV of 10-year intervention	210,540	187,320	167,676	150,955	136,640	124,315	113,648	157,328
x fold return on averting 40% of HIV infections	1.7	1.7	1.8	2.0	2.2	2.5	2.9	2.1
x fold return on averting one HIV infection	-0.5	-0.5	-0.5	-0.4	-0.4	-0.3	-0.3	-0.4

Sensitivity analysis: Skilled support staff	**Scenario 16**	**Scenario 17**	**Scenario 18**	**Scenario 19**	**Scenario 20**	**Scenario 21**	**Scenario 22**	**Scenario 23**
	Average number of sick leave days for entire workforce = 1.8 days	Average number of sick leave days for entire workforce = 5.4 days	Average number of other leave days for entire workforce = 15 days	Average number of other leave days for entire workforce = 36 days	Average number of other leave days for entire workforce = 38 days	Productivity loss in 0-365 days = 20% and productivity loss in 0-365 days = 17% (50% lower than baseline)	Productivity loss in 0-365 days = 60% and productivity loss in 0-365 days = 50% (50% higher than baseline)	Productivity loss in 0-365 days = 100% and productivity loss in 0-365 days = 100%
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	87,949	87,386	87,026	83,739	83,426	70,788	104,884	147,362
Average cost as a multiple of average salary	1.8	1.7	1.7	1.7	1.7	1.4	2.1	2.9
Annual aggregate cost (2004)	1,233,065	1,224,832	1,219,572	1,171,549	1,166,976	982,283	1,480,537	2,101,292
Aggregate cost as % of wages	2.4	2.4	2.4	2.3	2.3	1.9	2.9	4.1
(b) Composition of costs (%):								
Total indirect costs	61.6	61.4	61.2	59.7	59.5	52.3	67.8	77.1
Total direct costs	38.4	38.6	38.8	40.3	40.5	47.7	32.2	22.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	3,358	3,210	3,116	2,254	2,172	-1,143	7,799	18,939
Return (%)	17.0	16.3	15.8	11.4	11.0	-5.8	39.6	96.1
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	1,150,700	1,143,021	1,138,115	1,093,321	1,089,055	916,780	1,381,533	1,960,551
NPV of 10-year intervention	157,328	157,328	157,328	157,328	157,328	157,328	157,328	157,328
x fold return on averting 40% of HIV infections	1.9	1.9	1.9	1.8	1.8	1.3	2.5	4.0
x fold return on averting one HIV infection	-0.4	-0.4	-0.4	-0.5	-0.5	-0.6	-0.3	-0.1

APPENDIX F: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (BLOEMFONTEIN)(CONT.)

Sensitivity analysis: Skilled support staff	**Scenario 24**	**Scenario 25**	**Scenario 26**	**Scenario 27**	**Scenario 28**	**Scenario 29**	**Scenario 30**	**Scenario 31**
	Supervisor's time to manage illness = 1 day	Supervisor's time to manage illness = 3 days	Supervisor's time to manage illness = 5 days	Medical aid benefit ceiling = R35,000	100% of staff members with benefits in pension fund	100% of staff members with benefits in provident fund	90% hires internal	80% hires internal
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	86,696	88,639	90,582	91,197	86,906	89,021	88,310	88,952
Average cost as a multiple of average salary	1.7	1.8	1.8	1.8	1.7	1.8	1.8	1.8
Annual aggregate cost (2004)	1,215,696	1,242,201	1,268,706	1,275,262	1,218,575	1,247,390	1,237,710	1,246,471
Aggregate cost as % of wages	2.4	2.4	2.5	2.5	2.4	2.5	2.4	2.4
(b) Composition of costs (%):								
Total indirect costs	61.0	61.9	62.7	59.1	62.0	60.5	61.0	60.6
Total direct costs	39.0	38.1	37.3	40.9	38.0	39.5	39.0	39.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	3,029	3,539	4,048	4,210	3,084	3,639	3,452	3,621
Return (%)	15.4	18.0	20.5	21.4	15.6	18.5	17.5	18.4
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	1,134,443	1,159,278	1,184,114	1,190,048	1,137,192	1,164,050	1,155,070	1,163,279
NPV of 10-year intervention	157,328	157,328	157,328	157,328	157,328	157,328	157,328	157,328
x fold return on averting 40% of HIV infections	1.9	1.9	2.0	2.0	1.9	2.0	1.9	2.0
x fold return on averting one HIV infection	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4

APPENDIX F: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (BLOEMFONTEIN)(CONT.)

Sensitivity analysis: Skilled support staff	**Scenario 32**	**Scenario 33**	**Scenario 34**	**Scenario 35**	**Scenario 36**	**Scenario 37**	**Scenario 38**	**Scenario 39**
	Direct costs per hire 50% lower	Direct costs per hire 50% higher	Other staff time per hire 50% lower	Other staff time per hire 50% higher	Time position vacant decreased by 50% for each job band	Time position vacant increased by 50% for each job band	Direct training costs decreased by 50% for each job band	Direct training costs increased by 50% for each job band
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	86,061	89,273	87,049	88,286	87,278	88,057	87,430	87,904
Average cost as a multiple of average salary	1.7	1.8	1.7	1.8	1.7	1.8	1.7	1.8
Annual aggregate cost (2004)	1,207,045	1,250,852	1,220,511	1,237,386	1,223,636	1,234,261	1,225,713	1,232,184
Aggregate cost as % of wages	2.4	2.5	2.4	2.4	2.4	2.4	2.4	2.4
(b) Composition of costs (%):								
Total indirect costs	62.6	60.4	61.2	61.8	61.3	61.7	61.6	61.3
Total direct costs	37.4	39.6	38.8	38.2	38.7	38.3	38.4	38.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	2,863	3,705	3,122	3,446	3,182	3,386	3,222	3,346
Return (%)	14.5	18.8	15.8	17.5	16.1	17.2	16.3	17.0
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	1,126,337	1,167,384	1,138,955	1,154,766	1,141,883	1,151,839	1,143,829	1,149,892
NPV of 10-year intervention	157,328	157,328	157,328	157,328	157,328	157,328	157,328	157,328
x fold return on averting 40% of HIV infections	1.9	2.0	1.9	1.9	1.9	1.9	1.9	1.9
x fold return on averting one HIV infection	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4

Sensitivity analysis: Skilled support staff	Scenario 40	Scenario 41	Scenario 42	Scenario 43	Scenario 44	Scenario 45	Scenario 46	Scenario 47
	OJT trainer days = 0.5 day and OJT trainer salary = R175/day	OJT trainer days = 1.5 days and OJT trainer salary = R525/day	Time in orientation = 0.5 days and time in training = 1.5 days	Time in orientation = 1.5 days and time in training = 4.5 days	Time to full productivity 50% lower for each job band	Time to full productivity 50% higher for each job band	Productivity during start-up = 31.25%	Productivity during start-up = 93.75%
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	87,481	87,977	87,377	87,957	85,901	89,433	90,611	84,724
Average cost as a multiple of average salary	1.7	1.8	1.7	1.8	1.7	1.8	1.8	1.7
Annual aggregate cost (2004)	1,226,413	1,233,175	1,224,996	1,232,901	1,204,861	1,253,036	1,269,095	1,188,802
Aggregate cost as % of wages	2.4	2.4	2.4	2.4	2.4	2.5	2.5	2.3
(b) Composition of costs (%):								
Total indirect costs	61.4	61.6	61.4	61.6	60.7	62.2	62.7	60.1
Total direct costs	38.6	38.4	38.6	38.4	39.3	37.8	37.3	39.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	3,235	3,365	3,208	3,360	2,821	3,747	4,056	2,512
Return (%)	16.4	17.1	16.3	17.0	14.3	19.0	20.6	12.7
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	1,144,485	1,150,821	1,143,157	1,150,564	1,124,290	1,169,431	1,184,478	1,109,244
NPV of 10-year intervention	157,328	157,328	157,328	157,328	157,328	157,328	157,328	157,328
x fold return on averting 40% of HIV infections	1.9	1.9	1.9	1.9	1.9	2.0	2.0	1.8
x fold return on averting one HIV infection	-0.4	-0.4	-0.4	-0.4	-0.5	-0.4	-0.4	-0.5

APPENDIX F: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (BLOEMFONTEIN)(CONT.)

Sensitivity analysis: Highly skilled support staff	**Baseline costing scenario**	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**	**Scenario 7**
	Use mean salaries all staff	Use mean salaries permanent staff	Use median salaries all staff	Use median salaries permanent staff	Probability that in medical aid = 80%, that in pension or provident fund = 68%, and that in group life insurance scheme = 80%	Probability that in medical aid, that in pension or provident fund, and that in group life insurance scheme = 100%	32.5% of AIDS cases die in service	97.5% of AIDS cases die in service
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	708,873	713,463	682,116	685,993	487,902	728,799	576,783	840,963
Average cost as a multiple of average salary	3.9	3.9	3.9	4.0	2.7	4.0	3.2	4.7
Annual aggregate cost (2004)	1,064,154	1,063,803	986,780	989,668	729,260	1,116,286	865,446	1,262,861
Aggregate cost as % of wages	5.6	5.7	5.6	5.7	3.9	5.9	4.6	6.7
(b) Composition of costs (%):								
Total indirect costs	32.6	32.8	32.2	32.6	47.3	31.7	37.6	29.1
Total direct costs	67.4	67.2	67.8	67.4	52.7	68.3	62.4	70.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,713	19,713	19,713	19,713	19,713	19,713	19,713	19,713
Net savings (Rand) in extending life by 5 years	166,193	167,397	159,176	160,193	108,242	171,419	131,552	200,835
Return (%)	843	849	807	813	549	870	667	1,019
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	980,493	980,173	909,380	912,031	671,971	1,028,475	797,411	1,163,575
NPV of 10-year intervention	16,111	16,111	16,111	16,111	16,111	16,111	16,111	16,111
x fold return on averting 40% of HIV infections	23.3	23.3	21.6	21.6	15.7	24.5	18.8	27.9
x fold return on averting one HIV infection	43.0	43.3	41.3	41.6	29.3	44.2	34.8	51.2

APPENDIX F: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (BLOEMFONTEIN)(CONT.)

Sensitivity analysis: Highly skilled support staff	**Scenario 8**	**Scenario 9**	**Scenario 10**	**Scenario 11**	**Scenario 12**	**Scenario 13**	**Scenario 14**	**Scenario 15**
	Discount rate = 0%	Discount rate = 2%	Discount rate = 4%	Discount rate = 6%	Discount rate = 8%	Discount rate = 10%	Discount rate = 12%	Use mean number of days of sick leave taken before death or ill-health retirement
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	862,068	777,812	727,805	699,760	686,685	684,432	690,452	710,400
Average cost as a multiple of average salary	4.8	4.3	4.0	3.9	3.8	3.8	3.8	3.9
Annual aggregate cost (2004)	1,292,086	1,166,603	1,092,239	1,050,673	1,031,474	1,028,458	1,037,818	1,066,514
Aggregate cost as % of wages	6.8	6.2	5.8	5.6	5.5	5.4	5.5	5.6
(b) Composition of costs (%):								
Total indirect costs	35.0	33.9	33.0	32.3	31.6	31.1	30.6	32.7
Total direct costs	65.0	66.1	67.0	67.7	68.4	68.9	69.4	67.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,820	19,777	19,734	19,690	19,647	19,604	19,561	19,707
Net savings (Rand) in extending life by 5 years	-19,820	67,360	132,877	186,767	234,310	278,484	321,086	166,599
Return (%)	-100	341	673	949	1,193	1,421	1,641	845
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	1,190,515	1,074,893	1,006,372	968,071	950,380	947,599	956,222	982,668
NPV of 10-year intervention	21,560	19,182	17,171	15,458	13,992	12,730	11,638	16,111
x fold return on averting 40% of HIV infections	21.1	21.4	22.4	24.0	26.2	28.8	31.9	23.4
x fold return on averting one HIV infection	39.0	39.5	41.4	44.3	48.1	52.8	58.3	43.1

Sensitivity analysis: Highly skilled support staff	**Scenario 16**	**Scenario 17**	**Scenario 18**	**Scenario 19**	**Scenario 20**	**Scenario 21**	**Scenario 22**	**Scenario 23**
	Average number of sick leave days for entire workforce = 1.8 days	Average number of sick leave days for entire workforce = 5.4 days	Average number of other leave days for entire workforce = 15 days	Average number of other leave days for entire workforce = 36 days	Average number of other leave days for entire workforce = 38 days	Productivity loss in 0-365 days = 20% and productivity loss in 0-365 days = 17% (50% lower than baseline)	Productivity loss in 0-365 days = 60% and productivity loss in 0-365 days = 50% (50% higher than baseline)	Productivity loss in 0-365 days = 100% and productivity loss in 0-365 days = 100%
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	710,137	707,609	705,993	691,245	689,840	633,119	786,139	976,780
Average cost as a multiple of average salary	3.9	3.9	3.9	3.8	3.8	3.5	4.4	5.4
Annual aggregate cost (2004)	1,066,107	1,062,201	1,059,705	1,036,919	1,034,749	947,117	1,183,527	1,478,061
Aggregate cost as % of wages	5.6	5.6	5.6	5.5	5.5	5.0	6.3	7.8
(b) Composition of costs (%):								
Total indirect costs	32.7	32.4	32.3	30.8	30.7	24.5	39.2	51.1
Total direct costs	67.3	67.6	67.7	69.2	69.3	75.5	60.8	48.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	166,530	165,867	165,444	161,576	161,207	146,332	186,462	236,459
Return (%)	845	842	839	820	818	743	946	1,200
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	982,292	978,694	976,394	955,402	953,402	872,666	1,090,472	1,361,827
NPV of 10-year intervention	16,111	16,111	16,111	16,111	16,111	16,111	16,111	16,111
x fold return on averting 40% of HIV infections	23.4	23.3	23.2	22.7	22.7	20.7	26.1	32.8
x fold return on averting one HIV infection	43.1	42.9	42.8	41.9	41.8	38.3	47.8	59.6

APPENDIX F: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (BLOEMFONTEIN)(CONT.)

Sensitivity analysis: Highly skilled support staff	Scenario 24	Scenario 25	Scenario 26	Scenario 27	Scenario 28	Scenario 29	Scenario 30	Scenario 31
	Supervisor's time to manage illness = 1 day	Supervisor's time to manage illness = 3 days	Supervisor's time to manage illness = 5 days	Medical aid benefit ceiling = R35,000	100% of staff members with benefits in pension fund	100% of staff members with benefits in provident fund	90% hires internal	80% hires internal
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	707,901	709,844	711,788	715,306	673,146	772,388	709,515	710,157
Average cost as a multiple of average salary	3.9	3.9	4.0	4.0	3.7	4.3	3.9	3.9
Annual aggregate cost (2004)	1,062,752	1,065,555	1,068,358	1,073,150	1,010,584	1,159,389	1,065,080	1,066,007
Aggregate cost as % of wages	5.6	5.6	5.7	5.7	5.3	6.1	5.6	5.6
(b) Composition of costs (%):								
Total indirect costs	32.5	32.7	32.8	32.3	34.3	29.9	32.5	32.5
Total direct costs	67.5	67.3	67.2	67.7	65.7	70.1	67.5	67.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	165,944	166,454	166,963	167,886	156,829	182,856	166,367	166,536
Return (%)	842	845	847	852	796	928	844	845
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	979,201	981,785	984,368	988,785	931,135	1,068,240	981,347	982,201
NPV of 10-year intervention	16,111	16,111	16,111	16,111	16,111	16,111	16,111	16,111
x fold return on averting 40% of HIV infections	23.3	23.4	23.4	23.5	22.1	25.5	23.4	23.4
x fold return on averting one HIV infection	42.9	43.1	43.2	43.4	40.8	46.9	43.0	43.1

APPENDIX F: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (BLOEMFONTEIN)(CONT.)

Sensitivity analysis: Highly skilled support staff	**Scenario 32**	**Scenario 33**	**Scenario 34**	**Scenario 35**	**Scenario 36**	**Scenario 37**	**Scenario 38**	**Scenario 39**
	Direct costs per hire 50% lower	Direct costs per hire 50% higher	Other staff time per hire 50% lower	Other staff time per hire 50% higher	Time position vacant decreased by 50% for each job band	Time position vacant increased by 50% for each job band	Direct training costs decreased by 50% for each job band	Direct training costs increased by 50% for each job band
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	707,267	710,479	707,945	709,801	703,225	714,521	708,441	709,304
Average cost as a multiple of average salary	3.9	3.9	3.9	3.9	3.9	4.0	3.9	3.9
Annual aggregate cost (2004)	1,061,837	1,066,470	1,062,815	1,065,492	1,056,007	1,072,300	1,063,531	1,064,776
Aggregate cost as % of wages	5.6	5.6	5.6	5.6	5.6	5.7	5.6	5.6
(b) Composition of costs (%):								
Total indirect costs	32.6	32.5	32.5	32.7	32.0	33.1	32.6	32.5
Total direct costs	67.4	67.5	67.5	67.3	68.0	66.9	67.4	67.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	165,778	166,620	165,955	166,442	164,718	167,680	166,086	166,312
Return (%)	841	845	842	845	836	851	843	844
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	978,358	982,628	979,260	981,726	972,985	988,001	979,919	981,067
NPV of 10-year intervention	16,111	16,111	16,111	16,111	16,111	16,111	16,111	16,111
x fold return on averting 40% of HIV infections	23.3	23.4	23.3	23.4	23.2	23.5	23.3	23.4
x fold return on averting one HIV infection	42.9	43.1	42.9	43.1	42.6	43.4	43.0	43.0

APPENDIX F: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (BLOEMFONTEIN)(CONT.)

Sensitivity analysis: Highly skilled support staff	Scenario 40	Scenario 41	Scenario 42	Scenario 43	Scenario 44	Scenario 45	Scenario 46	Scenario 47
	OJT trainer days = 0.5 day and OJT trainer salary = R175/day	OJT trainer days = 1.5 days and OJT trainer salary = R525/day	Time in orientation = 0.5 days and time in training = 1.5 days	Time in orientation = 1.5 days and time in training = 4.5 days	Time to full productivity 50% lower for each job band	Time to full productivity 50% higher for each job band	Productivity during start-up = 31.25%	Productivity during start-up = 93.75%
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	708,641	709,259	707,562	710,184	692,892	724,854	735,508	682,237
Average cost as a multiple of average salary	3.9	3.9	3.9	3.9	3.8	4.0	4.1	3.8
Annual aggregate cost (2004)	1,063,819	1,064,712	1,062,263	1,066,045	1,041,103	1,087,205	1,102,572	1,025,735
Aggregate cost as % of wages	5.6	5.6	5.6	5.6	5.5	5.8	5.8	5.4
(b) Composition of costs (%):								
Total indirect costs	32.5	32.6	32.4	32.7	31.0	34.1	35.0	29.9
Total direct costs	67.5	67.4	67.6	67.3	69.0	65.9	65.0	70.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	166,138	166,300	165,855	166,543	162,008	170,390	173,184	159,214
Return (%)	843	844	842	845	822	865	879	808
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	980,185	981,007	978,750	982,236	959,250	1,001,736	1,015,898	945,088
NPV of 10-year intervention	16,111	16,111	16,111	16,111	16,111	16,111	16,111	16,111
x fold return on averting 40% of HIV infections	23.3	23.4	23.3	23.4	22.8	23.9	24.2	22.5
x fold return on averting one HIV infection	43.0	43.0	42.9	43.1	42.0	44.0	44.7	41.3

APPENDIX F: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (BLOEMFONTEIN)(CONT.)

Sensitivity analysis: Total all staff	**Baseline costing scenario**	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**	**Scenario 7**
	Use mean salaries all staff	Use mean salaries permanent staff	Use median salaries all staff	Use median salaries permanent staff	Probability that in medical aid = 80%, that in pension or provident fund = 68%, and that in group life insurance scheme = 80%	Probability that in medical aid, that in pension or provident fund, and that in group life insurance scheme = 100%	32.5% of AIDS cases die in service	97.5% of AIDS cases die in service
(a) Average annual aggregate costs of HIV infections								
Annual aggregate cost (2004)	5,786,733	7,025,342	6,062,514	6,925,944	6,917,017	10,330,502	5,343,891	6,229,576
Total payroll	167,319,978	215,566,119	174,190,300	212,531,249	167,319,978	167,319,978	167,319,978	167,319,978
Aggregate cost as % of wages	3.5	3.3	3.5	3.3	4.1	6.2	3.2	3.7
Aggregate cost as % of annual operating expenses	1.5	1.8	1.5	1.7	1.7	2.6	1.3	1.6
NPV of average annual aggregate cost of new HIV infections (2004-13)	5,546,301	6,735,020	5,809,236	6,639,769	6,634,544	9,906,010	5,122,786	5,969,815
Average % of annual salaries and wages	3.3%	3.1%	3.3%	3.1%	4.0%	5.9%	3.1%	3.6%
Average annual cost of HIV/AIDS in year incurred	2,274,355	2,924,084	2,338,910	2,875,745	2,342,949	2,411,124	1,951,474	2,597,237
Average % of annual salaries and wages	1.4%	1.4%	1.3%	1.4%	1.4%	1.4%	1.2%	1.6%
(b) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	5,365,232	6,516,251	5,618,580	6,424,128	6,421,437	9,585,930	4,956,201	5,774,262
NPV of 10-year intervention	347,864	347,864	347,864	347,864	347,864	347,864	347,864	347,864
x fold return on averting 40% of HIV infections	5.2	6.5	5.5	6.4	6.4	10.0	4.7	5.6

APPENDIX F: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (BLOEMFONTEIN)(CONT.)

Sensitivity analysis: Total all staff	**Scenario 8**	**Scenario 9**	**Scenario 10**	**Scenario 11**	**Scenario 12**	**Scenario 13**	**Scenario 14**	**Scenario 15**
	Discount rate = 0%	Discount rate = 2%	Discount rate = 4%	Discount rate = 6%	Discount rate = 8%	Discount rate = 10%	Discount rate = 12%	Use mean number of days of sick leave taken before death or ill-health retirement
(a) Aggregate costs of HIV infections								
Annual aggregate cost (2004)	7,148,740	6,406,287	5,959,599	5,701,534	5,571,343	5,533,076	5,564,649	5,984,775
Total payroll	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978
Aggregate cost as % of wages	4.3	3.8	3.6	3.4	3.3	3.3	3.3	3.6
Aggregate cost as % of annual operating expenses	1.8	1.6	1.5	1.4	1.4	1.4	1.4	1.5
NPV of average annual aggregate costs of new HIV Infections (2004-13)	6,851,867	6,140,189	5,712,008	5,464,627	5,339,813	5,303,110	5,333,347	5,736,195
Average % of annual salaries and wages	4.1%	3.7%	3.4%	3.3%	3.2%	3.2%	3.2%	3.4%
Average annual cost of HIV/AIDS in year incurred	2,274,355	2,274,355	2,274,355	2,274,355	2,274,355	2,274,355	2,274,355	2,325,604
Average % of annual salaries and wages	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%
(b) Prevention programme								
Present value of aggregate costs of AIDS in 2013	6,628,278	5,939,784	5,525,546	5,286,215	5,165,454	5,129,930	5,159,164	5,548,984
Present value of 10-year intervention	465,520	414,179	370,743	333,773	302,121	274,871	251,283	347,864
x fold return on averting 40% of HIV infections	4.7	4.7	5.0	5.3	5.8	6.5	7.2	5.4

Sensitivity analysis: Total all staff	Scenario 16	Scenario 17	Scenario 18	Scenario 19	Scenario 20	Scenario 21	Scenario 22	Scenario 23
	Average number of sick leave days for entire workforce = 1.8 days	Average number of sick leave days for entire workforce = 5.4 days	Average number of other leave days for entire workforce = 15 days	Average number of other leave days for entire workforce = 36 days	Average number of other leave days for entire workforce = 38 days	Productivity loss in 0-365 days = 20% and productivity loss in 0-365 days = 17% (50% lower than baseline)	Productivity loss in 0-365 days = 60% and productivity loss in 0-365 days = 50% (50% higher than baseline)	Productivity loss in 0-365 days = 100% and productivity loss in 0-365 days = 100%
(a) Aggregate costs of HIV infections								
Annual aggregate cost (2004)	5,802,581	5,770,886	5,750,635	5,565,743	5,548,134	4,837,055	6,755,368	9,145,316
Total payroll	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978
Aggregate cost as % of wages	3.5	3.4	3.4	3.3	3.3	2.9	4.0	5.5
Aggregate cost as % of annual operating expenses	1.5	1.5	1.4	1.4	1.4	1.2	1.7	2.3
NPV of average annual aggregate costs of new HIV Infections (2004-13)	5,561,490	5,531,112	5,511,703	5,334,498	5,317,622	4,636,108	6,474,661	8,765,242
Average % of annual salaries and wages	3.3%	3.3%	3.3%	3.2%	3.2%	2.8%	3.9%	5.2%
Average annual cost of HIV/AIDS in year incurred	2,278,045	2,270,666	2,265,952	2,222,907	2,218,808	2,051,931	2,501,617	3,071,674
Average % of annual salaries and wages	1.4%	1.4%	1.4%	1.3%	1.3%	1.2%	1.5%	1.8%
(b) Prevention programme								
Present value of aggregate costs of AIDS in 2013	5,379,924	5,350,539	5,331,765	5,160,350	5,144,024	4,484,777	6,263,260	8,479,002
Present value of 10-year intervention	347,864	347,864	347,864	347,864	347,864	347,864	347,864	347,864
x fold return on averting 40% of HIV infections	5.2	5.2	5.1	4.9	4.9	4.2	6.2	8.7

APPENDIX F: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (BLOEMFONTEIN)(CONT.)

Sensitivity analysis: Total all staff	**Scenario 24**	**Scenario 25**	**Scenario 26**	**Scenario 27**	**Scenario 28**	**Scenario 29**	**Scenario 30**	**Scenario 31**
	Supervisor's time to manage illness = 1 day	Supervisor's time to manage illness = 3 days	Supervisor's time to manage illness = 5 days	Medical aid benefit ceiling = R35,000	100% of staff members with benefits in pension fund	100% of staff members with benefits in provident fund	90% hires internal	80% hires internal
(a) Aggregate costs of HIV infections								
Annual aggregate cost (2004)	5,760,192	5,813,275	5,866,357	5,912,620	5,623,513	6,076,902	5,803,768	5,820,802
Total payroll	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978
Aggregate cost as % of wages	3.4	3.5	3.5	3.5	3.4	3.6	3.5	3.5
Aggregate cost as % of annual operating expenses	1.4	1.5	1.5	1.5	1.4	1.5	1.5	1.5
NPV of average annual aggregate costs of new HIV Infections (2004-13)	5,520,780	5,571,821	5,622,863	5,667,413	5,389,955	5,824,249	5,562,672	5,579,043
Average % of annual salaries and wages	3.3%	3.3%	3.4%	3.4%	3.2%	3.5%	3.3%	3.3%
Average annual cost of HIV/AIDS in year incurred	2,267,903	2,280,808	2,293,713	2,308,373	2,161,935	2,474,214	2,280,734	2,287,112
Average % of annual salaries and wages	1.4%	1.4%	1.4%	1.4%	1.3%	1.5%	1.4%	1.4%
(b) Prevention programme								
Present value of aggregate costs of AIDS in 2013	5,340,485	5,389,978	5,439,471	5,482,716	5,214,054	5,633,993	5,381,100	5,396,968
Present value of 10-year intervention	347,864	347,864	347,864	347,864	347,864	347,864	347,864	347,864
x fold return on averting 40% of HIV infections	5.1	5.2	5.3	5.3	5.0	5.5	5.2	5.2

Sensitivity analysis: Total all staff	**Scenario 32**	**Scenario 33**	**Scenario 34**	**Scenario 35**	**Scenario 36**	**Scenario 37**	**Scenario 38**	**Scenario 39**
	Direct costs per hire 50% lower	Direct costs per hire 50% higher	Other staff time per hire 50% lower	Other staff time per hire 50% higher	Time position vacant decreased by 50% for each job band	Time position vacant increased by 50% for each job band	Direct training costs decreased by 50% for each job band	Direct training costs increased by 50% for each job band
(a) Aggregate costs of HIV infections								
Annual aggregate cost (2004)	5,744,147	5,829,320	5,766,401	5,807,066	5,735,792	5,838,171	5,777,309	5,796,158
Total payroll	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978
Aggregate cost as % of wages	3.4	3.5	3.4	3.5	3.4	3.5	3.5	3.5
Aggregate cost as % of annual operating expenses	1.4	1.5	1.4	1.5	1.4	1.5	1.5	1.5
NPV of average annual aggregate costs of new HIV Infections (2004-13)	5,505,373	5,587,228	5,526,773	5,565,828	5,497,517	5,595,568	5,537,248	5,555,353
Average % of annual salaries and wages	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%
Average annual cost of HIV/AIDS in year incurred	2,258,410	2,290,301	2,266,935	2,281,775	2,257,818	2,291,193	2,270,894	2,277,817
Average % of annual salaries and wages	1.3%	1.4%	1.4%	1.4%	1.3%	1.4%	1.4%	1.4%
(b) Prevention programme								
Present value of aggregate costs of AIDS in 2013	5,325,561	5,404,902	5,346,314	5,384,150	5,318,072	5,412,867	5,356,461	5,374,003
Present value of 10-year intervention	347,864	347,864	347,864	347,864	347,864	347,864	347,864	347,864
x fold return on averting 40% of HIV infections	5.1	5.2	5.1	5.2	5.1	5.2	5.2	5.2

Sensitivity analysis: Total all staff	Scenario 40	Scenario 41	Scenario 42	Scenario 43	Scenario 44	Scenario 45	Scenario 46	Scenario 47
	OJT trainer days = 0.5 day and OJT trainer salary = R175/day	OJT trainer days = 1.5 days and OJT trainer salary = R525/day	Time in orientation = 0.5 days and time in training = 1.5 days	Time in orientation = 1.5 days and time in training = 4.5 days	Time to full productivity 50% lower for each job band	Time to full productivity 50% higher for each job band	Productivity during start-up = 31.25%	Productivity during start-up = 93.75%
(a) Aggregate costs of HIV infections								
Annual aggregate cost (2004)	5,780,527	5,797,077	5,771,451	5,802,016	5,632,787	5,940,680	6,043,311	5,530,156
Total payroll	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978	167,319,978
Aggregate cost as % of wages	3.5	3.5	3.4	3.5	3.4	3.6	3.6	3.3
Aggregate cost as % of annual operating expenses	1.5	1.5	1.5	1.5	1.4	1.5	1.5	1.4
NPV of average annual aggregate costs of new HIV Infections (2004-13)	5,540,327	5,556,256	5,531,633	5,560,968	5,398,802	5,693,799	5,792,132	5,300,469
Average % of annual salaries and wages	3.3%	3.3%	3.3%	3.3%	3.2%	3.4%	3.5%	3.2%
Average annual cost of HIV/AIDS in year incurred	2,271,904	2,278,441	2,268,924	2,279,787	2,223,292	2,325,419	2,359,461	2,189,249
Average % of annual salaries and wages	1.4%	1.4%	1.4%	1.4%	1.3%	1.4%	1.4%	1.3%
(b) Prevention programme								
Present value of aggregate costs of AIDS in 2013	5,359,436	5,374,891	5,351,029	5,379,434	5,222,587	5,507,876	5,602,973	5,127,491
Present value of 10-year intervention	347,864	347,864	347,864	347,864	347,864	347,864	347,864	347,864
x fold return on averting 40% of HIV infections	5.2	5.2	5.2	5.2	5.0	5.3	5.4	4.9

APPENDIX G: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (QWAQWA CAMPUS)

Sensitivity analysis: Academic staff	**Baseline costing scenario**	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**	**Scenario 7**
	Use mean salaries all staff	Use mean salaries permanent staff	Use median salaries all staff	Use median salaries permanent staff	Probability that in medical aid = 80%, that in pension or provident fund = 68%, and that in group life insurance scheme = 80%	Probability that in medical aid, that in pension or provident fund, and that in group life insurance scheme = 100%	32.5% of AIDS cases die in service	97.5% of AIDS cases die in service
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	205,020	275,692	225,726	261,503	303,222	443,615	198,881	211,160
Average cost as a multiple of median salary	2.0	2.0	2.0	1.9	3.0	4.4	2.0	2.1
Annual aggregate cost (2004)	462,189	636,541	498,033	602,666	695,635	1,008,660	449,238	475,140
Aggregate cost as % of wages	4.3	4.3	4.4	4.1	6.5	9.5	4.2	4.5
(b) Composition of costs (%):								
Total indirect costs	71.1	73.0	72.3	71.8	48.1	32.9	75.5	67.0
Total direct costs	28.9	27.0	27.7	28.2	51.9	67.1	24.5	33.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	34,060	52,594	39,491	48,873	59,814	96,633	32,450	35,670
Return (%)	173	267	200	248	304	490	165	181
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	1,016,770	1,431,347	1,118,070	1,349,176	1,554,981	2,265,025	994,854	1,038,686
NPV of 10-year intervention	17,262	17,262	17,262	17,262	17,262	17,262	17,262	17,262
x fold return on averting 40% of infections	22.6	32.2	24.9	30.3	35.0	51.5	22.1	23.1
x fold return on averting one HIV infection	10.9	15.0	12.1	14.1	16.6	24.7	10.5	11.2

Sensitivity analysis: Academic staff	**Scenario 8**	**Scenario 9**	**Scenario 10**	**Scenario 11**	**Scenario 12**	**Scenario 13**	**Scenario 14**	**Scenario 15**
	Discount rate = 0%	Discount rate = 2%	Discount rate = 4%	Discount rate = 6%	Discount rate = 8%	Discount rate = 10%	Discount rate = 12%	Use mean number of days of sick leave taken before death or ill-health retirement
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	261,866	231,350	212,558	201,167	194,744	191,852	191,611	214,952
Average cost as a multiple of median salary	2.6	2.3	2.1	2.0	1.9	1.9	1.9	2.1
Annual aggregate cost (2004)	593,994	523,408	479,782	453,149	437,897	430,725	429,603	484,480
Aggregate cost as % of wages	5.6	4.9	4.5	4.3	4.1	4.0	4.0	4.5
(b) Composition of costs (%):								
Total indirect costs	72.6	72.0	71.4	71.0	70.5	70.2	69.9	72.5
Total direct costs	27.4	28.0	28.6	29.0	29.5	29.8	30.1	27.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,820	19,777	19,734	19,690	19,647	19,604	19,561	19,707
Net savings (Rand) in extending life by 5 years	-19,820	6,141	24,837	39,662	52,375	63,953	74,974	36,665
Return (%)	-100	31	126	201	267	326	383	186
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	1,319,373	1,157,893	1,057,554	995,653	959,436	941,395	936,926	1,065,900
NPV of 10-year intervention	23,100	20,552	18,397	16,562	14,992	13,640	12,469	17,262
x fold return on averting 40% of infections	21.8	21.5	22.0	23.0	24.6	26.6	29.1	23.7
x fold return on averting one HIV infection	10.3	10.3	10.6	11.1	12.0	13.1	14.4	11.5

APPENDIX G: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (QWAQWA)(CONT.)

Sensitivity analysis: Academic staff	Scenario 16	Scenario 17	Scenario 18	Scenario 19	Scenario 20	Scenario 21	Scenario 22	Scenario 23
	Average number of sick leave days for entire workforce = 1.8 days	Average number of sick leave days for entire workforce = 5.4 days	Average number of other leave days for entire workforce = 15 days	Average number of other leave days for entire workforce = 36 days	Average number of other leave days for entire workforce = 38 days	Productivity loss in 0-365 days = 20% and productivity loss in 0-365 days = 17% (50% lower than baseline)	Productivity loss in 0-365 days = 60% and productivity loss in 0-365 days = 50% (50% higher than baseline)	Productivity loss in 0-365 days = 100% and productivity loss in 0-365 days = 100%
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	205,725	204,315	203,414	195,186	194,402	162,795	248,126	354,484
Average cost as a multiple of median salary	2.0	2.0	2.0	1.9	1.9	1.6	2.5	3.5
Annual aggregate cost (2004)	463,772	460,606	458,584	440,118	438,360	367,427	558,930	797,622
Aggregate cost as % of wages	4.4	4.3	4.3	4.1	4.1	3.4	5.2	7.5
(b) Composition of costs (%):								
Total indirect costs	71.2	71.0	70.9	69.7	69.6	63.6	76.1	83.3
Total direct costs	28.8	29.0	29.1	30.3	30.4	36.4	23.9	16.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	34,245	33,875	33,639	31,481	31,276	22,987	45,365	73,258
Return (%)	174	172	171	160	159	117	230	372
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	1,020,259	1,013,282	1,008,824	968,124	964,248	807,906	1,229,994	1,756,089
NPV of 10-year intervention	17,262	17,262	17,262	17,262	17,262	17,262	17,262	17,262
x fold return on averting 40% of infections	22.6	22.5	22.4	21.4	21.3	17.7	27.5	39.7
x fold return on averting one HIV infection	10.9	10.8	10.8	10.3	10.3	8.4	13.4	19.5

APPENDIX G: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (QWAQWA)(CONT.)

Sensitivity analysis: Academic staff	Scenario 24	Scenario 25	Scenario 26	Scenario 27	Scenario 28	Scenario 29	Scenario 30	Scenario 31
	Supervisor's time to manage illness = 1 day	Supervisor's time to manage illness = 3 days	Supervisor's time to manage illness = 5 days	Medical aid benefit ceiling = R35,000	100% of staff members with benefits in pension fund	100% of staff members with benefits in provident fund	90% hires internal	80% hires internal
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	204,055	205,986	207,917	207,767	201,814	210,721	205,663	206,305
Average cost as a multiple of median salary	2.0	2.0	2.1	2.1	2.0	2.1	2.0	2.1
Annual aggregate cost (2004)	459,856	464,522	469,188	468,182	455,247	474,531	463,741	465,293
Aggregate cost as % of wages	4.3	4.4	4.4	4.4	4.3	4.5	4.4	4.4
(b) Composition of costs (%):								
Total indirect costs	71.0	71.3	71.5	70.2	72.3	69.2	70.9	70.7
Total direct costs	29.0	28.7	28.5	29.8	27.7	30.8	29.1	29.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	33,807	34,314	34,820	34,781	33,219	35,555	34,229	34,397
Return (%)	172	174	177	176	169	180	174	175
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	1,011,098	1,022,443	1,033,788	1,030,452	1,003,504	1,040,355	1,020,544	1,024,318
NPV of 10-year intervention	17,262	17,262	17,262	17,262	17,262	17,262	17,262	17,262
x fold return on averting 40% of infections	22.4	22.7	23.0	22.9	22.3	23.1	22.6	22.7
x fold return on averting one HIV infection	10.8	10.9	11.0	11.0	10.7	11.2	10.9	11.0

APPENDIX G: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (QWAQWA)(CONT.)

Sensitivity analysis: Academic staff	Scenario 32	Scenario 33	Scenario 34	Scenario 35	Scenario 36	Scenario 37	Scenario 38	Scenario 39
	Direct costs per hire 50% lower	Direct costs per hire 50% higher	Other staff time per hire 50% lower	Other staff time per hire 50% higher	Time position vacant decreased by 50% for each job band	Time position vacant increased by 50% for each job band	Direct training costs decreased by 50% for each job band	Direct training costs increased by 50% for each job band
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	203,414	206,626	204,098	205,942	201,618	208,422	204,561	205,479
Average cost as a multiple of median salary	2.0	2.1	2.0	2.0	2.0	2.1	2.0	2.0
Annual aggregate cost (2004)	458,309	466,069	459,961	464,417	453,970	470,409	461,080	463,299
Aggregate cost as % of wages	4.3	4.4	4.3	4.4	4.3	4.4	4.3	4.3
(b) Composition of costs (%):								
Total indirect costs	71.7	70.6	71.0	71.3	70.6	71.6	71.3	71.0
Total direct costs	28.3	29.4	29.0	28.7	29.4	28.4	28.7	29.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	33,639	34,481	33,818	34,302	33,168	34,953	33,940	34,181
Return (%)	171	175	172	174	168	177	172	173
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	1,007,336	1,026,204	1,011,353	1,022,187	996,784	1,036,756	1,014,072	1,019,468
NPV of 10-year intervention	17,262	17,262	17,262	17,262	17,262	17,262	17,262	17,262
x fold return on averting 40% of infections	22.3	22.8	22.4	22.7	22.1	23.0	22.5	22.6
x fold return on averting one HIV infection	10.8	11.0	10.8	10.9	10.7	11.1	10.9	10.9

Sensitivity analysis: Academic staff	**Scenario 40**	**Scenario 41**	**Scenario 42**	**Scenario 43**	**Scenario 44**	**Scenario 45**	**Scenario 46**	**Scenario 47**
	OJT trainer days = 0.5 day and OJT trainer salary = R175/day	OJT trainer days = 1.5 days and OJT trainer salary = R525/day	Time in orientation = 0.5 days and time in training = 1.5 days	Time in orientation = 1.5 days and time in training = 4.5 days	Time to full productivity 50% lower for each job band	Time to full productivity 50% higher for each job band	Productivity during start-up = 31.25%	Productivity during start-up = 93.75%
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	204,788	205,407	204,230	205,810	195,394	214,646	221,064	188,977
Average cost as a multiple of median salary	2.0	2.0	2.0	2.0	1.9	2.1	2.2	1.9
Annual aggregate cost (2004)	461,629	463,124	460,281	464,097	438,932	485,446	500,951	423,428
Aggregate cost as % of wages	4.3	4.3	4.3	4.4	4.1	4.6	4.7	4.0
(b) Composition of costs (%):								
Total indirect costs	71.1	71.2	71.0	71.2	69.7	72.4	73.2	68.7
Total direct costs	28.9	28.8	29.0	28.8	30.3	27.6	26.8	31.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	33,999	34,162	33,853	34,267	31,536	36,585	38,268	29,853
Return (%)	173	173	172	174	160	186	194	151
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	1,015,407	1,019,042	1,012,131	1,021,410	960,220	1,073,321	1,111,021	922,519
NPV of 10-year intervention	17,262	17,262	17,262	17,262	17,262	17,262	17,262	17,262
x fold return on averting 40% of infections	22.5	22.6	22.5	22.7	21.3	23.9	24.7	20.4
x fold return on averting one HIV infection	10.9	10.9	10.8	10.9	10.3	11.4	11.8	9.9

APPENDIX G: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (QWAQWA)(CONT.)

Sensitivity analysis: Unskilled support staff	Baseline costing scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
	Use mean salaries all staff	Use mean salaries permanent staff	Use median salaries all staff	Use median salaries permanent staff	Probability that in medical aid = 80%, that in pension or provident fund = 68%, and that in group life insurance scheme = 80%	Probability that in medical aid, that in pension or provident fund, and that in group life insurance scheme = 100%	32.5% of AIDS cases die in service	97.5% of AIDS cases die in service
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	104,313	105,201	108,287	108,445	78,301	104,313	95,205	113,421
Average cost as a multiple of average salary	3.4	3.3	3.3	3.3	2.5	3.4	3.1	3.6
Annual aggregate cost (2004)	83,019	83,826	87,648	87,761	62,255	83,019	75,680	90,358
Aggregate cost as % of wages	4.2	4.2	4.2	4.1	3.2	4.2	3.8	4.6
(b) Composition of costs (%):								
Total indirect costs	28.8	29.0	29.5	29.5	38.4	28.8	32.7	25.6
Total direct costs	71.2	71.0	70.5	70.5	61.6	71.2	67.3	74.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	7,649	7,882	8,692	8,733	827	7,649	5,261	10,038
Return (%)	38.8	40.0	44.1	44.3	4.2	38.8	26.7	50.9
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	141,813	143,208	151,648	151,954	106,296	141,813	129,208	154,419
NPV of 10-year intervention	5,754	5,754	5,754	5,754	5,754	5,754	5,754	5,754
x fold return on averting 40% of HIV infections	8.9	9.0	9.5	9.6	6.4	8.9	8.0	9.7
x fold return on averting one HIV infection	17.1	17.3	17.8	17.8	12.6	17.1	15.5	18.7

Sensitivity analysis: Unskilled support staff	**Scenario 8**	**Scenario 9**	**Scenario 10**	**Scenario 11**	**Scenario 12**	**Scenario 13**	**Scenario 14**	**Scenario 15**
	Discount rate = 0%	Discount rate = 2%	Discount rate = 4%	Discount rate = 6%	Discount rate = 8%	Discount rate = 10%	Discount rate = 12%	Use mean number of days of sick leave taken before death or ill-health retirement
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	122,875	112,427	106,443	103,359	102,275	102,657	104,175	106,776
Average cost as a multiple of average salary	3.9	3.6	3.4	3.3	3.3	3.3	3.3	3.4
Annual aggregate cost (2004)	97,776	89,469	84,712	82,261	81,402	81,709	82,920	85,004
Aggregate cost as % of wages	5.0	4.5	4.3	4.2	4.1	4.1	4.2	4.3
(b) Composition of costs (%):								
Total indirect costs	29.2	29.0	28.9	28.8	28.7	28.6	28.5	30.4
Total direct costs	70.8	71.0	71.1	71.2	71.3	71.4	71.5	69.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,820	19,777	19,734	19,690	19,647	19,604	19,561	19,707
Net savings (Rand) in extending life by 5 years	-19,820	-7,182	2,586	10,805	18,177	25,106	31,836	8,295
Return (%)	-100.0	-36.3	13.1	54.9	92.5	128.1	162.8	42.1
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	167,009	152,825	144,704	140,520	139,056	139,582	141,652	145,223
NPV of 10-year intervention	7,700	6,851	6,132	5,521	4,997	4,547	4,156	5,754
x fold return on averting 40% of HIV infections	7.7	7.9	8.4	9.2	10.1	11.3	12.6	9.1
x fold return on averting one HIV infection	15.0	15.4	16.4	17.7	19.5	21.6	24.1	17.6

Sensitivity analysis: Unskilled support staff	Scenario 16	Scenario 17	Scenario 18	Scenario 19	Scenario 20	Scenario 21	Scenario 22	Scenario 23
	Average number of sick leave days for entire workforce = 1.8 days	Average number of sick leave days for entire workforce = 5.4 days	Average number of other leave days for entire workforce = 15 days	Average number of other leave days for entire workforce = 36 days	Average number of other leave days for entire workforce = 38 days	Productivity loss in 0-365 days = 20% and productivity loss in 0-365 days = 17% (50% lower than baseline)	Productivity loss in 0-365 days = 60% and productivity loss in 0-365 days = 50% (50% higher than baseline)	Productivity loss in 0-365 days = 100% and productivity loss in 0-365 days = 100%
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	104,488	104,138	103,914	101,873	101,679	93,839	115,005	141,386
Average cost as a multiple of average salary	3.4	3.3	3.3	3.3	3.3	3.0	3.7	4.5
Annual aggregate cost (2004)	83,160	82,878	82,698	81,053	80,897	74,580	91,634	112,891
Aggregate cost as % of wages	4.2	4.2	4.2	4.1	4.1	3.8	4.7	5.7
(b) Composition of costs (%):								
Total indirect costs	28.9	28.7	28.5	27.1	27.0	20.9	35.4	47.5
Total direct costs	71.1	71.3	71.5	72.9	73.0	79.1	64.6	52.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	7,695	7,603	7,545	7,009	6,958	4,902	10,453	17,372
Return (%)	39.0	38.6	38.3	35.6	35.3	24.9	53.0	88.1
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	142,055	141,571	141,262	138,437	138,168	127,318	156,611	193,123
NPV of 10-year intervention	5,754	5,754	5,754	5,754	5,754	5,754	5,754	5,754
x fold return on averting 40% of HIV infections	8.9	8.8	8.8	8.6	8.6	7.9	9.9	12.4
x fold return on averting one HIV infection	17.2	17.1	17.1	16.7	16.7	15.3	19.0	23.6

APPENDIX G: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (QWAQWA)(CONT.)

Sensitivity analysis: Unskilled support staff	**Scenario 24**	**Scenario 25**	**Scenario 26**	**Scenario 27**	**Scenario 28**	**Scenario 29**	**Scenario 30**	**Scenario 31**
	Supervisor's time to manage illness = 1 day	Supervisor's time to manage illness = 3 days	Supervisor's time to manage illness = 5 days	Medical aid benefit ceiling = R35,000	100% of staff members with benefits in pension fund	100% of staff members with benefits in provident fund	90% hires internal	80% hires internal
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	104,015	104,610	105,206	111,031	97,603	116,241	104,377	104,441
Average cost as a multiple of average salary	3.3	3.4	3.4	3.6	3.1	3.7	3.4	3.4
Annual aggregate cost (2004)	82,786	83,252	83,717	88,270	77,612	92,630	83,069	83,119
Aggregate cost as % of wages	4.2	4.2	4.2	4.5	3.9	4.7	4.2	4.2
(b) Composition of costs (%):								
Total indirect costs	28.6	29.0	29.4	27.1	30.8	25.9	28.8	28.8
Total direct costs	71.4	71.0	70.6	72.9	69.2	74.1	71.2	71.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	7,571	7,727	7,883	9,411	5,889	10,777	7,666	7,683
Return (%)	38.4	39.2	40.0	47.8	29.9	54.7	38.9	39.0
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	141,419	142,207	142,996	150,709	132,527	158,323	141,898	141,983
NPV of 10-year intervention	5,754	5,754	5,754	5,754	5,754	5,754	5,754	5,754
x fold return on averting 40% of HIV infections	8.8	8.9	8.9	9.5	8.2	10.0	8.9	8.9
x fold return on averting one HIV infection	17.1	17.2	17.3	18.3	16.0	19.2	17.1	17.2

APPENDIX G: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (QWAQWA)(CONT.)

Sensitivity analysis: Unskilled support staff	Scenario 32	Scenario 33	Scenario 34	Scenario 35	Scenario 36	Scenario 37	Scenario 38	Scenario 39
	Direct costs per hire 50% lower	Direct costs per hire 50% higher	Other staff time per hire 50% lower	Other staff time per hire 50% higher	Time position vacant decreased by 50% for each job band	Time position vacant increased by 50% for each job band	Direct training costs decreased by 50% for each job band	Direct training costs increased by 50% for each job band
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	104,152	104,473	104,218	104,407	104,313	104,431	104,192	104,433
Average cost as a multiple of average salary	3.3	3.4	3.3	3.4	3.4	3.4	3.3	3.4
Annual aggregate cost (2004)	82,893	83,144	82,945	83,093	83,019	83,111	82,925	83,113
Aggregate cost as % of wages	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
(b) Composition of costs (%):								
Total indirect costs	28.9	28.8	28.7	28.9	28.8	28.9	28.8	28.8
Total direct costs	71.1	71.2	71.3	71.1	71.2	71.1	71.2	71.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	7,607	7,691	7,624	7,674	7,649	7,680	7,618	7,681
Return (%)	38.6	39.0	38.7	38.9	38.8	39.0	38.7	39.0
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	141,601	142,026	141,688	141,939	141,813	141,970	141,654	141,973
NPV of 10-year intervention	5,754	5,754	5,754	5,754	5,754	5,754	5,754	5,754
x fold return on averting 40% of HIV infections	8.8	8.9	8.8	8.9	8.9	8.9	8.8	8.9
x fold return on averting one HIV infection	17.1	17.2	17.1	17.1	17.1	17.1	17.1	17.2

Sensitivity analysis: Unskilled support staff	Scenario 40	Scenario 41	Scenario 42	Scenario 43	Scenario 44	Scenario 45	Scenario 46	Scenario 47
	OJT trainer days = 0.5 day and OJT trainer salary = R175/day	OJT trainer days = 1.5 days and OJT trainer salary = R525/day	Time in orientation = 0.5 days and time in training = 1.5 days	Time in orientation = 1.5 days and time in training = 4.5 days	Time to full productivity 50% lower for each job band	Time to full productivity 50% higher for each job band	Productivity during start-up = 31.25%	Productivity during start-up = 93.75%
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	104,127	104,622	104,136	104,489	104,134	104,492	104,611	104,014
Average cost as a multiple of average salary	3.3	3.4	3.3	3.4	3.3	3.4	3.4	3.3
Annual aggregate cost (2004)	82,874	83,261	82,881	83,157	82,879	83,159	83,252	82,786
Aggregate cost as % of wages	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
(b) Composition of costs (%):								
Total indirect costs	28.7	29.0	28.7	28.9	28.7	28.9	29.0	28.6
Total direct costs	71.3	71.0	71.3	71.1	71.3	71.1	71.0	71.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	7,600	7,730	7,603	7,695	7,602	7,696	7,727	7,571
Return (%)	38.6	39.2	38.6	39.0	38.6	39.1	39.2	38.4
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	141,567	142,224	141,580	142,047	141,576	142,050	142,208	141,418
NPV of 10-year intervention	5,754	5,754	5,754	5,754	5,754	5,754	5,754	5,754
x fold return on averting 40% of HIV infections	8.8	8.9	8.8	8.9	8.8	8.9	8.9	8.8
x fold return on averting one HIV infection	17.1	17.2	17.1	17.2	17.1	17.2	17.2	17.1

APPENDIX G: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (QWAQWA)(CONT.)

Sensitivity analysis: Skilled support staff	**Baseline costing scenario**	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**	**Scenario 7**
	Use mean salaries all staff	Use mean salaries permanent staff	Use median salaries all staff	Use median salaries permanent staff	Probability that in medical aid = 80%, that in pension or provident fund = 68%, and that in group life insurance scheme = 80%	Probability that in medical aid, that in pension or provident fund, and that in group life insurance scheme = 100%	32.5% of AIDS cases die in service	97.5% of AIDS cases die in service
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	112,959	144,828	107,733	137,895	130,550	192,030	104,558	121,361
Average cost as a multiple of average salary	2.8	2.4	2.9	2.4	3.2	4.7	2.6	3.0
Annual aggregate cost (2004)	123,591	158,479	113,306	149,878	139,570	200,614	113,843	133,339
Aggregate cost as % of wages	1.5	1.5	1.6	1.5	1.7	2.5	1.4	1.7
(b) Composition of costs (%):								
Total indirect costs	40.1	44.7	38.5	44.1	34.7	23.6	44.7	36.2
Total direct costs	59.9	55.3	61.5	55.9	65.3	76.4	55.3	63.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	9,917	18,275	8,546	16,456	14,530	30,654	7,714	12,120
Return (%)	50.3	92.7	43.4	83.5	73.7	155.5	39.1	61.5
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	203,827	256,909	187,263	243,195	227,712	325,956	187,277	220,377
NPV of 10-year intervention	10,686	10,686	10,686	10,686	10,686	10,686	10,686	10,686
x fold return on averting 40% of HIV infections	6.6	8.6	6.0	8.1	7.5	11.2	6.0	7.2
x fold return on averting one HIV infection	9.6	12.6	9.1	11.9	11.2	17.0	8.8	10.4

Sensitivity analysis: Skilled support staff	Scenario 8	Scenario 9	Scenario 10	Scenario 11	Scenario 12	Scenario 13	Scenario 14	Scenario 15
	Discount rate = 0%	Discount rate = 2%	Discount rate = 4%	Discount rate = 6%	Discount rate = 8%	Discount rate = 10%	Discount rate = 12%	Use mean number of days of sick leave taken before death or ill-health retirement
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	138,533	124,537	116,167	111,395	109,067	108,501	109,278	116,178
Average cost as a multiple of average salary	3.4	3.1	2.9	2.7	2.7	2.7	2.7	2.9
Annual aggregate cost (2004)	151,602	136,273	127,106	121,876	119,323	118,699	119,544	126,889
Aggregate cost as % of wages	1.9	1.7	1.6	1.5	1.5	1.5	1.5	1.6
(b) Composition of costs (%):								
Total indirect costs	41.2	40.7	40.3	40.0	39.7	39.4	39.2	41.8
Total direct costs	58.8	59.3	59.7	60.0	60.3	60.6	60.8	58.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,820	19,777	19,734	19,690	19,647	19,604	19,561	19,707
Net savings (Rand) in extending life by 5 years	-19,820	-5,825	4,625	13,176	20,689	27,651	34,354	10,761
Return (%)	-100.0	-29.5	23.4	66.9	105.3	141.1	175.6	54.6
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	249,679	224,568	209,567	201,032	196,894	195,926	197,374	209,215
NPV of 10-year intervention	14,300	12,723	11,389	10,253	9,281	8,444	7,719	10,686
x fold return on averting 40% of HIV infections	6.0	6.1	6.4	6.8	7.5	8.3	9.2	6.8
x fold return on averting one HIV infection	8.7	8.8	9.2	9.9	10.8	11.9	13.2	9.9

APPENDIX G: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (QWAQWA)(CONT.)

Sensitivity analysis: Skilled support staff	Scenario 16	Scenario 17	Scenario 18	Scenario 19	Scenario 20	Scenario 21	Scenario 22	Scenario 23
	Average number of sick leave days for entire workforce = 1.8 days	Average number of sick leave days for entire workforce = 5.4 days	Average number of other leave days for entire workforce = 15 days	Average number of other leave days for entire workforce = 36 days	Average number of other leave days for entire workforce = 38 days	Productivity loss in 0-365 days = 20% and productivity loss in 0-365 days = 17% (50% lower than baseline)	Productivity loss in 0-365 days = 60% and productivity loss in 0-365 days = 50% (50% higher than baseline)	Productivity loss in 0-365 days = 100% and productivity loss in 0-365 days = 100%
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	113,188	112,731	112,439	109,773	109,519	99,276	126,928	161,394
Average cost as a multiple of average salary	2.8	2.8	2.8	2.7	2.7	2.4	3.1	4.0
Annual aggregate cost (2004)	123,825	123,357	123,058	120,326	120,066	109,572	137,903	173,215
Aggregate cost as % of wages	1.5	1.5	1.5	1.5	1.5	1.4	1.7	2.2
(b) Composition of costs (%):								
Total indirect costs	40.2	40.0	39.8	38.4	38.2	31.8	46.7	58.1
Total direct costs	59.8	60.0	60.2	61.6	61.8	68.2	53.3	41.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	9,977	9,857	9,780	9,081	9,014	6,328	13,580	22,619
Return (%)	50.6	50.0	49.6	46.1	45.7	32.1	68.9	114.8
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	204,210	203,445	202,956	198,493	198,068	180,924	227,208	284,898
NPV of 10-year intervention	10,686	10,686	10,686	10,686	10,686	10,686	10,686	10,686
x fold return on averting 40% of HIV infections	6.6	6.6	6.6	6.4	6.4	5.8	7.5	9.7
x fold return on averting one HIV infection	9.6	9.5	9.5	9.3	9.2	8.3	10.9	14.1

APPENDIX G: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (QWAQWA)(CONT.)

Sensitivity analysis: Skilled support staff	Scenario 24	Scenario 25	Scenario 26	Scenario 27	Scenario 28	Scenario 29	Scenario 30	Scenario 31
	Supervisor's time to manage illness = 1 day	Supervisor's time to manage illness = 3 days	Supervisor's time to manage illness = 5 days	Medical aid benefit ceiling = R35,000	100% of staff members with benefits in pension fund	100% of staff members with benefits in provident fund	90% hires internal	80% hires internal
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	111,988	113,931	115,874	117,607	109,873	118,447	113,602	114,244
Average cost as a multiple of average salary	2.8	2.8	2.9	2.9	2.7	2.9	2.8	2.8
Annual aggregate cost (2004)	122,524	124,659	126,793	128,815	120,069	129,853	124,297	125,002
Aggregate cost as % of wages	1.5	1.5	1.6	1.6	1.5	1.6	1.5	1.6
(b) Composition of costs (%):								
Total indirect costs	39.6	40.6	41.6	38.5	41.2	38.2	39.9	39.7
Total direct costs	60.4	59.4	58.4	61.5	58.8	61.8	60.1	60.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	9,662	10,172	10,681	11,136	9,107	11,356	10,085	10,254
Return (%)	49.0	51.6	54.2	56.5	46.2	57.6	51.2	52.0
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	202,117	205,538	208,959	212,365	197,876	214,407	204,958	206,089
NPV of 10-year intervention	10,686	10,686	10,686	10,686	10,686	10,686	10,686	10,686
x fold return on averting 40% of HIV infections	6.6	6.7	6.8	6.9	6.4	7.0	6.7	6.7
x fold return on averting one HIV infection	9.5	9.7	9.8	10.0	9.3	10.1	9.6	9.7

Sensitivity analysis: Skilled support staff	**Scenario 32**	**Scenario 33**	**Scenario 34**	**Scenario 35**	**Scenario 36**	**Scenario 37**	**Scenario 38**	**Scenario 39**
	Direct costs per hire 50% lower	Direct costs per hire 50% higher	Other staff time per hire 50% lower	Other staff time per hire 50% higher	Time position vacant decreased by 50% for each job band	Time position vacant increased by 50% for each job band	Direct training costs decreased by 50% for each job band	Direct training costs increased by 50% for each job band
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	111,354	114,565	112,341	113,578	112,570	113,349	112,722	113,197
Average cost as a multiple of average salary	2.7	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Annual aggregate cost (2004)	121,827	125,355	122,912	124,271	123,163	124,019	123,331	123,852
Aggregate cost as % of wages	1.5	1.6	1.5	1.5	1.5	1.5	1.5	1.5
(b) Composition of costs (%):								
Total indirect costs	40.7	39.5	39.8	40.4	39.9	40.3	40.2	40.0
Total direct costs	59.3	60.5	60.2	59.6	60.1	59.7	59.8	60.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	9,496	10,338	9,755	10,079	9,815	10,019	9,855	9,979
Return (%)	48.2	52.5	49.5	51.1	49.8	50.8	50.0	50.6
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	201,000	206,654	202,738	204,916	203,141	204,513	203,410	204,245
NPV of 10-year intervention	10,686	10,686	10,686	10,686	10,686	10,686	10,686	10,686
x fold return on averting 40% of HIV infections	6.5	6.7	6.6	6.7	6.6	6.7	6.6	6.6
x fold return on averting one HIV infection	9.4	9.7	9.5	9.6	9.5	9.6	9.5	9.6

Sensitivity analysis: Skilled support staff	Scenario 40	Scenario 41	Scenario 42	Scenario 43	Scenario 44	Scenario 45	Scenario 46	Scenario 47
	OJT trainer days = 0.5 day and OJT trainer salary = R175/day	OJT trainer days = 1.5 days and OJT trainer salary = R525/day	Time in orientation = 0.5 days and time in training = 1.5 days	Time in orientation = 1.5 days and time in training = 4.5 days	Time to full productivity 50% lower for each job band	Time to full productivity 50% higher for each job band	Productivity during start-up = 31.25%	Productivity during start-up = 93.75%
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	112,774	113,269	112,670	113,249	111,193	114,726	115,903	110,016
Average cost as a multiple of average salary	2.8	2.8	2.8	2.8	2.7	2.8	2.9	2.7
Annual aggregate cost (2004)	123,387	123,932	123,273	123,910	121,651	125,531	126,825	120,358
Aggregate cost as % of wages	1.5	1.5	1.5	1.5	1.5	1.6	1.6	1.5
(b) Composition of costs (%):								
Total indirect costs	40.0	40.3	39.9	40.3	39.2	41.0	41.6	38.5
Total direct costs	60.0	59.7	60.1	59.7	60.8	59.0	58.4	61.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	9,868	9,998	9,841	9,993	9,454	10,380	10,689	9,145
Return (%)	50.1	50.7	49.9	50.7	48.0	52.7	54.2	46.4
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	203,500	204,373	203,317	204,337	200,718	206,936	209,009	198,645
NPV of 10-year intervention	10,686	10,686	10,686	10,686	10,686	10,686	10,686	10,686
x fold return on averting 40% of HIV infections	6.6	6.7	6.6	6.6	6.5	6.7	6.8	6.4
x fold return on averting one HIV infection	9.6	9.6	9.5	9.6	9.4	9.7	9.8	9.3

APPENDIX G: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (QWAQWA)(CONT.)

Sensitivity analysis: Highly skilled support staff	Baseline costing scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
	Use mean salaries all staff	Use mean salaries permanent staff	Use median salaries all staff	Use median salaries permanent staff	Probability that in medical aid = 80%, that in pension or provident fund = 68%, and that in group life insurance scheme = 80%	Probability that in medical aid, that in pension or provident fund, and that in group life insurance scheme = 100%	32.5% of AIDS cases die in service	97.5% of AIDS cases die in service
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	523,033	523,643	502,943	507,659	444,833	660,288	432,188	613,878
Average cost as a multiple of average salary	2.7	2.8	2.7	2.8	2.3	3.5	2.3	3.2
Annual aggregate cost (2004)	103,129	103,197	98,960	99,970	84,577	127,227	84,979	121,278
Aggregate cost as % of wages	4.4	4.4	4.3	4.4	3.6	5.4	3.6	5.1
(b) Composition of costs (%):								
Total indirect costs	46.3	46.4	46.1	46.8	54.4	36.7	52.5	41.9
Total direct costs	53.7	53.6	53.9	53.2	45.6	63.3	47.5	58.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	117,461	117,621	112,192	113,429	96,953	153,457	93,637	141,286
Return (%)	596	597	569	576	492	779	475	717
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	99,614	99,696	95,755	96,732	81,497	121,966	82,035	117,193
NPV of 10-year intervention	1,973	1,973	1,973	1,973	1,973	1,973	1,973	1,973
x fold return on averting 40% of HIV infections	19.2	19.2	18.4	18.6	15.5	23.7	15.6	22.8
x fold return on averting one HIV infection	264.1	264.4	253.9	256.3	224.5	333.7	218.1	310.2

Sensitivity analysis: Highly skilled support staff	Scenario 8	Scenario 9	Scenario 10	Scenario 11	Scenario 12	Scenario 13	Scenario 14	Scenario 15
	Discount rate = 0%	Discount rate = 2%	Discount rate = 4%	Discount rate = 6%	Discount rate = 8%	Discount rate = 10%	Discount rate = 12%	Use mean number of days of sick leave taken before death or ill-health retirement
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	640,201	576,007	537,682	515,908	505,389	502,988	506,777	524,428
Average cost as a multiple of average salary	3.3	3.0	2.8	2.7	2.6	2.6	2.6	2.7
Annual aggregate cost (2004)	125,956	113,433	105,972	101,751	99,735	99,310	100,101	103,398
Aggregate cost as % of wages	5.3	4.8	4.5	4.3	4.2	4.2	4.2	4.4
(b) Composition of costs (%):								
Total indirect costs	49.1	47.9	46.9	46.0	45.2	44.5	44.0	46.5
Total direct costs	50.9	52.1	53.1	54.0	54.8	55.5	56.0	53.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,820	19,777	19,734	19,690	19,647	19,604	19,561	19,707
Net savings (Rand) in extending life by 5 years	-19,820	44,752	93,011	132,523	167,261	199,461	230,467	117,827
Return (%)	-100	226	471	673	851	1,017	1,178	598
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	121,635	109,553	102,355	98,285	96,344	95,939	96,707	99,872
NPV of 10-year intervention	2,640	2,349	2,103	1,893	1,713	1,559	1,425	1,973
x fold return on averting 40% of HIV infections	17.4	17.7	18.5	19.8	21.5	23.6	26.1	19.3
x fold return on averting one HIV infection	241.5	244.2	254.7	271.6	294.0	321.7	354.6	264.8

Sensitivity analysis: Highly skilled support staff	Scenario 16	Scenario 17	Scenario 18	Scenario 19	Scenario 20	Scenario 21	Scenario 22	Scenario 23
	Average number of sick leave days for entire workforce = 1.8 days	Average number of sick leave days for entire workforce = 5.4 days	Average number of other leave days for entire workforce = 15 days	Average number of other leave days for entire workforce = 36 days	Average number of other leave days for entire workforce = 38 days	Productivity loss in 0-365 days = 20% and productivity loss in 0-365 days = 17% (50% lower than baseline)	Productivity loss in 0-365 days = 60% and productivity loss in 0-365 days = 50% (50% higher than baseline)	Productivity loss in 0-365 days = 100% and productivity loss in 0-365 days = 100%
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	524,188	521,879	520,403	506,934	505,651	453,912	593,597	767,703
Average cost as a multiple of average salary	2.7	2.7	2.7	2.6	2.6	2.4	3.1	4.0
Annual aggregate cost (2004)	103,352	102,905	102,620	100,016	99,768	89,764	116,772	150,436
Aggregate cost as % of wages	4.4	4.4	4.3	4.2	4.2	3.8	4.9	6.4
(b) Composition of costs (%):								
Total indirect costs	46.4	46.1	45.9	44.1	43.9	35.6	54.6	68.6
Total direct costs	53.6	53.9	54.1	55.9	56.1	64.4	45.4	31.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	117,764	117,158	116,772	113,239	112,903	99,334	135,967	181,627
Return (%)	598	594	593	575	573	504	690	922
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	99,828	99,400	99,126	96,631	96,393	86,806	112,689	144,950
NPV of 10-year intervention	1,973	1,973	1,973	1,973	1,973	1,973	1,973	1,973
x fold return on averting 40% of HIV infections	19.2	19.2	19.1	18.6	18.5	16.6	21.8	28.4
x fold return on averting one HIV infection	264.7	263.5	262.8	256.0	255.3	229.1	299.9	388.2

APPENDIX G: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (QWAQWA)(CONT.)

Sensitivity analysis: Highly skilled support staff	**Scenario 24**	**Scenario 25**	**Scenario 26**	**Scenario 27**	**Scenario 28**	**Scenario 29**	**Scenario 30**	**Scenario 31**
	Supervisor's time to manage illness = 1 day	Supervisor's time to manage illness = 3 days	Supervisor's time to manage illness = 5 days	Medical aid benefit ceiling = R35,000	100% of staff members with benefits in pension fund	100% of staff members with benefits in provident fund	90% hires internal	80% hires internal
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	522,200	523,866	525,532	527,033	499,438	564,980	523,584	524,134
Average cost as a multiple of average salary	2.7	2.7	2.7	2.8	2.6	3.0	2.7	2.7
Annual aggregate cost (2004)	102,972	103,285	103,598	103,917	98,389	111,554	103,232	103,336
Aggregate cost as % of wages	4.4	4.4	4.4	4.4	4.2	4.7	4.4	4.4
(b) Composition of costs (%):								
Total indirect costs	46.2	46.4	46.6	45.9	48.5	42.9	46.2	46.2
Total direct costs	53.8	53.6	53.4	54.1	51.5	57.1	53.8	53.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	117,243	117,680	118,116	118,510	111,273	128,462	117,606	117,750
Return (%)	595	597	599	601	565	652	597	597
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	99,463	99,764	100,065	100,382	95,015	107,788	99,713	99,813
NPV of 10-year intervention	1,973	1,973	1,973	1,973	1,973	1,973	1,973	1,973
x fold return on averting 40% of HIV infections	19.2	19.2	19.3	19.4	18.3	20.9	19.2	19.2
x fold return on averting one HIV infection	263.7	264.5	265.4	266.2	252.2	285.4	264.4	264.7

Sensitivity analysis: Highly skilled support staff	Scenario 32	Scenario 33	Scenario 34	Scenario 35	Scenario 36	Scenario 37	Scenario 38	Scenario 39
	Direct costs per hire 50% lower	Direct costs per hire 50% higher	Other staff time per hire 50% lower	Other staff time per hire 50% higher	Time position vacant decreased by 50% for each job band	Time position vacant increased by 50% for each job band	Direct training costs decreased by 50% for each job band	Direct training costs increased by 50% for each job band
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	521,657	524,410	522,238	523,828	518,192	527,874	522,663	523,403
Average cost as a multiple of average salary	2.7	2.7	2.7	2.7	2.7	2.8	2.7	2.7
Annual aggregate cost (2004)	102,870	103,387	102,979	103,278	102,219	104,038	103,059	103,198
Aggregate cost as % of wages	4.4	4.4	4.4	4.4	4.3	4.4	4.4	4.4
(b) Composition of costs (%):								
Total indirect costs	46.4	46.2	46.2	46.4	45.6	46.9	46.3	46.3
Total direct costs	53.6	53.8	53.8	53.6	54.4	53.1	53.7	53.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	117,100	117,822	117,253	117,670	116,192	118,731	117,364	117,558
Return (%)	594	598	595	597	590	602	596	597
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	99,365	99,862	99,470	99,757	98,740	100,488	99,547	99,681
NPV of 10-year intervention	1,973	1,973	1,973	1,973	1,973	1,973	1,973	1,973
x fold return on averting 40% of HIV infections	19.1	19.2	19.2	19.2	19.0	19.4	19.2	19.2
x fold return on averting one HIV infection	263.4	264.8	263.7	264.5	261.7	266.6	263.9	264.3

Sensitivity analysis: Highly skilled support staff	**Scenario 40**	**Scenario 41**	**Scenario 42**	**Scenario 43**	**Scenario 44**	**Scenario 45**	**Scenario 46**	**Scenario 47**
	OJT trainer days = 0.5 day and OJT trainer salary = R175/day	OJT trainer days = 1.5 days and OJT trainer salary = R525/day	Time in orientation = 0.5 days and time in training = 1.5 days	Time in orientation = 1.5 days and time in training = 4.5 days	Time to full productivity 50% lower for each job band	Time to full productivity 50% higher for each job band	Productivity during start-up = 31.25%	Productivity during start-up = 93.75%
(a) Average cost per HIV infection (Rand)								
NPV of average cost per infection	522,834	523,365	521,909	524,157	509,335	536,731	545,863	500,203
Average cost as a multiple of average salary	2.7	2.7	2.7	2.7	2.7	2.8	2.9	2.6
Annual aggregate cost (2004)	103,091	103,191	102,918	103,340	100,555	105,703	107,419	98,839
Aggregate cost as % of wages	4.4	4.4	4.4	4.4	4.3	4.5	4.5	4.2
(b) Composition of costs (%):								
Total indirect costs	46.3	46.3	46.1	46.4	44.4	48.1	49.2	43.1
Total direct costs	53.7	53.7	53.9	53.6	55.6	51.9	50.8	56.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(c) Treatment								
NPV of cost of treatment	19,707	19,707	19,707	19,707	19,707	19,707	19,707	19,707
Net savings (Rand) in extending life by 5 years	117,409	117,548	117,166	117,756	113,869	121,054	123,449	111,474
Return (%)	596	596	595	598	578	614	626	566
(d) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	99,578	99,674	99,411	99,817	97,140	102,087	103,736	95,491
NPV of 10-year intervention	1,973	1,973	1,973	1,973	1,973	1,973	1,973	1,973
x fold return on averting 40% of HIV infections	19.2	19.2	19.2	19.2	18.7	19.7	20.0	18.4
x fold return on averting one HIV infection	264.0	264.3	263.6	264.7	257.2	271.1	275.7	252.6

APPENDIX G: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (QWAQWA)(CONT.)

Sensitivity analysis: Total all staff	**Baseline costing scenario**	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**	**Scenario 7**
	Use mean salaries all staff	Use mean salaries permanent staff	Use median salaries all staff	Use median salaries permanent staff	Probability that in medical aid = 80%, that in pension or provident fund = 68%, and that in group life insurance scheme = 80%	Probability that in medical aid, that in pension or provident fund, and that in group life insurance scheme = 100%	32.5% of AIDS cases die in service	97.5% of AIDS cases die in service
(a) Aggregate costs of HIV infections								
NPV of annual aggregate cost (2004)	771,928	982,043	797,947	940,275	982,037	1,419,520	723,741	820,115
Total payroll	23,037,931	29,594,112	22,897,988	28,857,026	23,037,931	23,037,931	23,037,931	23,037,931
Aggregate cost as % of wages	3.4	3.3	3.5	3.3	4.3	6.2	3.1	3.6
Aggregate cost as % of annual operating expenses	0.2	0.2	0.2	0.2	0.2	0.4	0.2	0.2
NPV of average annual aggregate cost of new HIV infections (2004-13)	1,307,410	1,717,489	1,383,561	1,638,335	1,748,067	2,532,082	1,243,107	1,371,712
Average % of annual salaries and wages	1.9%	1.9%	2.0%	1.9%	2.5%	3.7%	1.8%	2.0%
Average annual cost of HIV/AIDS in year incurred	800,986	1,108,534	837,161	1,064,081	829,706	854,388	692,758	909,215
Average % of annual salaries and wages	1.1%	1.1%	1.1%	1.1%	1.1%	1.2%	0.9%	1.2%
(b) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	1,462,024	1,931,160	1,552,736	1,841,056	1,970,487	2,854,760	1,393,374	1,530,675
NPV of 10-year intervention	35,674	35,674	35,674	35,674	35,674	35,674	35,674	35,674
x fold return on averting 40% of HIV infections	15.4	20.7	16.4	19.6	21.1	31.0	14.6	16.2

Sensitivity analysis: Total all staff	Scenario 8	Scenario 9	Scenario 10	Scenario 11	Scenario 12	Scenario 13	Scenario 14	Scenario 15
	Discount rate = 0%	Discount rate = 2%	Discount rate = 4%	Discount rate = 6%	Discount rate = 8%	Discount rate = 10%	Discount rate = 12%	Use mean number of days of sick leave taken before death or ill-health retirement
(a) Aggregate costs of HIV infections								
NPV of annual aggregate cost (2004)	969,327	862,584	797,572	759,037	738,358	730,443	732,168	799,771
Total payroll	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931
Aggregate cost as % of wages	4.2	3.7	3.5	3.3	3.2	3.2	3.2	3.5
Aggregate cost as % of annual operating expenses	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
NPV of average annual aggregate cost of new HIV infections (2004-13)	1,658,485	1,469,488	1,353,597	1,283,950	1,245,396	1,228,998	1,229,270	1,358,746
Average % of annual salaries and wages	2.4%	2.1%	2.0%	1.9%	1.8%	1.8%	1.8%	2.0%
Average annual cost of HIV/AIDS in year incurred	800,986	800,986	800,986	800,986	800,986	800,986	800,986	818,799
Average % of annual salaries and wages	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%
(b) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	1,857,696	1,644,839	1,514,179	1,435,491	1,391,730	1,372,842	1,372,659	1,520,210
NPV of 10-year intervention	47,740	42,475	38,020	34,229	30,983	28,189	25,770	35,674
x fold return on averting 40% of HIV infections	14.6	14.5	14.9	15.8	17.0	18.5	20.3	16.0

Sensitivity analysis: Total all staff	Scenario 16	Scenario 17	Scenario 18	Scenario 19	Scenario 20	Scenario 21	Scenario 22	Scenario 23
	Average number of sick leave days for entire workforce = 1.8 days	Average number of sick leave days for entire workforce = 5.4 days	Average number of other leave days for entire workforce = 15 days	Average number of other leave days for entire workforce = 36 days	Average number of other leave days for entire workforce = 38 days	Productivity loss in 0-365 days = 20% and productivity loss in 0-365 days = 17% (50% lower than baseline)	Productivity loss in 0-365 days = 60% and productivity loss in 0-365 days = 50% (50% higher than baseline)	Productivity loss in 0-365 days = 100% and productivity loss in 0-365 days = 100%
(a) Aggregate costs of HIV infections								
NPV of annual aggregate cost (2004)	774,109	769,747	766,960	741,514	739,090	641,342	905,240	1,234,164
Total payroll	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931
Aggregate cost as % of wages	3.4	3.3	3.3	3.2	3.2	2.8	3.9	5.4
Aggregate cost as % of annual operating expenses	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3
NPV of average annual aggregate cost of new HIV infections (2004-13)	1,311,256	1,303,564	1,298,649	1,253,778	1,249,505	1,077,142	1,542,484	2,122,491
Average % of annual salaries and wages	1.9%	1.9%	1.9%	1.8%	1.8%	1.6%	2.2%	3.1%
Average annual cost of HIV/AIDS in year incurred	802,268	799,705	798,067	783,116	781,692	723,821	879,901	1,077,710
Average % of annual salaries and wages	1.1%	1.1%	1.1%	1.1%	1.1%	1.0%	1.2%	1.5%
(b) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	1,466,352	1,457,697	1,452,168	1,401,685	1,396,877	1,202,954	1,726,503	2,379,060
NPV of 10-year intervention	35,674	35,674	35,674	35,674	35,674	35,674	35,674	35,674
x fold return on averting 40% of HIV infections	15.4	15.3	15.3	14.7	14.7	12.5	18.4	25.7

APPENDIX G: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (QWAQWA)(CONT.)

Sensitivity analysis: Total all staff	**Scenario 24**	**Scenario 25**	**Scenario 26**	**Scenario 27**	**Scenario 28**	**Scenario 29**	**Scenario 30**	**Scenario 31**
	Supervisor's time to manage illness = 1 day	Supervisor's time to manage illness = 3 days	Supervisor's time to manage illness = 5 days	Medical aid benefit ceiling = R35,000	100% of staff members with benefits in pension fund	100% of staff members with benefits in provident fund	90% hires internal	80% hires internal
(a) Aggregate costs of HIV infections								
NPV of annual aggregate cost (2004)	768,139	775,717	783,296	789,184	751,318	808,568	774,339	776,751
Total payroll	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931
Aggregate cost as % of wages	3.3	3.4	3.4	3.4	3.3	3.5	3.4	3.4
Aggregate cost as % of annual operating expenses	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
NPV of average annual aggregate cost of new HIV infections (2004-13)	1,300,422	1,314,397	1,328,372	1,335,974	1,277,067	1,361,352	1,311,891	1,316,371
Average % of annual salaries and wages	1.9%	1.9%	1.9%	1.9%	1.9%	2.0%	1.9%	1.9%
Average annual cost of HIV/AIDS in year incurred	798,606	803,367	808,129	812,655	763,455	867,709	803,361	805,735
Average % of annual salaries and wages	1.1%	1.1%	1.1%	1.1%	1.0%	1.2%	1.1%	1.1%
(b) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	1,454,097	1,469,952	1,485,808	1,493,908	1,428,922	1,520,873	1,467,113	1,472,202
NPV of 10-year intervention	35,674	35,674	35,674	35,674	35,674	35,674	35,674	35,674
x fold return on averting 40% of HIV infections	15.3	15.5	15.7	15.8	15.0	16.1	15.5	15.5

APPENDIX G: STAFF MODEL SENSITIVITY ANALYSIS RESULTS SUMMARY (QWAQWA)(CONT.)

Sensitivity analysis: Total all staff	**Scenario 32**	**Scenario 33**	**Scenario 34**	**Scenario 35**	**Scenario 36**	**Scenario 37**	**Scenario 38**	**Scenario 39**
	Direct costs per hire 50% lower	Direct costs per hire 50% higher	Other staff time per hire 50% lower	Other staff time per hire 50% higher	Time position vacant decreased by 50% for each job band	Time position vacant increased by 50% for each job band	Direct training costs decreased by 50% for each job band	Direct training costs increased by 50% for each job band
(a) Aggregate costs of HIV infections								
NPV of annual aggregate cost (2004)	765,900	777,956	768,797	775,059	762,371	781,577	770,394	773,462
Total payroll	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931
Aggregate cost as % of wages	3.3	3.4	3.3	3.4	3.3	3.4	3.3	3.4
Aggregate cost as % of annual operating expenses	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
NPV of average annual aggregate cost of new HIV infections (2004-13)	1,296,208	1,318,611	1,301,461	1,313,358	1,288,571	1,326,390	1,304,478	1,310,342
Average % of annual salaries and wages	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%
Average annual cost of HIV/AIDS in year incurred	795,051	806,921	797,949	804,024	792,217	809,852	799,504	802,469
Average % of annual salaries and wages	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%
(b) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	1,449,302	1,474,747	1,455,249	1,468,800	1,440,479	1,483,727	1,458,682	1,465,367
NPV of 10-year intervention	35,674	35,674	35,674	35,674	35,674	35,674	35,674	35,674
x fold return on averting 40% of HIV infections	15.3	15.5	15.3	15.5	15.2	15.6	15.4	15.4

Sensitivity analysis: Total all staff	**Scenario 40**	**Scenario 41**	**Scenario 42**	**Scenario 43**	**Scenario 44**	**Scenario 45**	**Scenario 46**	**Scenario 47**
	OJT trainer days = 0.5 day and OJT trainer salary = R175/day	OJT trainer days = 1.5 days and OJT trainer salary = R525/day	Time in orientation = 0.5 days and time in training = 1.5 days	Time in orientation = 1.5 days and time in training = 4.5 days	Time to full productivity 50% lower for each job band	Time to full productivity 50% higher for each job band	Productivity during start-up = 31.25%	Productivity during start-up = 93.75%
(a) Aggregate costs of HIV infections								
NPV of annual aggregate cost (2004)	770,981	773,507	769,353	774,503	744,017	799,839	818,446	725,410
Total payroll	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931	23,037,931
Aggregate cost as % of wages	3.3	3.4	3.3	3.4	3.2	3.5	3.6	3.1
Aggregate cost as % of annual operating expenses	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
NPV of average annual aggregate cost of new HIV infections (2004-13)	1,305,670	1,310,309	1,302,505	1,312,314	1,252,824	1,361,995	1,398,386	1,216,434
Average % of annual salaries and wages	1.9%	1.9%	1.9%	1.9%	1.8%	2.0%	2.0%	1.8%
Average annual cost of HIV/AIDS in year incurred	800,054	802,541	798,563	803,410	775,211	826,762	843,946	758,027
Average % of annual salaries and wages	1.1%	1.1%	1.1%	1.1%	1.0%	1.1%	1.1%	1.0%
(b) Prevention programme								
NPV of annual aggregate costs of AIDS (2013)	1,460,052	1,465,312	1,456,439	1,467,610	1,399,654	1,524,394	1,565,974	1,358,074
NPV of 10-year intervention	35,674	35,674	35,674	35,674	35,674	35,674	35,674	35,674
x fold return on averting 40% of HIV infections	15.4	15.4	15.3	15.5	14.7	16.1	16.6	14.2

APPENDIX H: ASSUMPTIONS IN BEST AND WORST CASE STUDENT COSTING MODELS

A. HIV/AIDS parameters	Best case scenario	Worst case scenario
1. Proportion of new HIV cases not completing their studies	0.050	0.150
2. Proportion of new AIDS cases not completing their studies	0.400	1.000
3. Proportion of AIDS deaths not completing their studies	1.000	1.000
4. Proportion of affected students deregistering following enrolment	0.250	0.750
B. Student body composition parameters		
1. Proportion of undergraduate students in the humanities	0.649	0.531
2. Proportion of undergraduate students in the natural sciences	0.351	0.469
3. Proportion of honours students in the humanities (natural sciences)	0.968 (0.032)	0.792 (0.208)
4. Proportion of masters students in the humanities (natural sciences)	0.616 (0.384)	0.504 (0.496)
5. Proportion doctoral students in the humanities (natural sciences)	0.539 (0.461)	0.441 (0.559)
6. Proportion of postgraduate students enrolled at honours level	0.462	0.416
7. Proportion of postgraduate students enrolled at master's level	0.455	0.485
8. Proportion of postgraduate students enrolled at doctoral level	0.083	0.099
9. Proportion of enrolled students completing their studies (undergraduate)	0.750	0.950
10. Proportion of enrolled students completing their studies (honours)	0.700	0.900
11. Proportion of enrolled students completing their studies (masters)	0.500	0.700
12. Proportion of enrolled students completing their studies (doctoral)	0.200	0.300
C. Government subsidy parameters		
1. Subsidy per undergraduate humanities student (Rand)	10,131	12,383
2. Subsidy per undergraduate natural science student (Rand)	27,508	33,620
3. Subsidy multiple for honours students	1.800	2.200
4. Subsidy multiple for master's students	2.700	3.300
5. Subsidy multiple for doctoral students	3.600	4.400
6. Average annual increase in subsidy (%)	-10%	+10%
D. Class fee parameters		
1. Average annual undergraduate class fee (Rand)	6,310	7,712
2. Class fee multiple for honours students	1.200	1.500
3. Class fee multiple for master's students	1.200	1.500
4. Class fee multiple for doctoral students	1.200	1.500
5. Proportion of subsidy paid on completion of studies	0.500	1.000
6. Proportion of class fees paid at registration (undergraduate)	0.583	0.477
7. Proportion of class fees paid at registration (honours)	0.429	0.351
8. Proportion of class fees paid at registration (masters)	0.275	0.225
9. Proportion of class fees paid at registration (doctoral)	0.264	0.216
10. Average annual increase in class fees (%)	0.0	0.0
11. Credit at deregistration (%)	40%	50%
12. Cancellation fee (Rand)	720	720
13. Average annual increase in cancellation fee (%)	5.0	0.0
E. Financial parameters		
1. Discount rate	12.0	4.0
2. Mortality adjustment factor (MAF)	0.840	0.840

APPENDIX I: RESULTS OF STUDENT MODEL SENSITIVITY ANALYSIS

	Baseline costing scenario	**Scenario1**	**Scenario2**	**Scenario3**	**Scenario4**	**Scenario5**	**Scenario6**	**Scenario7**	**Scenario8**	**Scenario9**
	See assumptions in model (Table 6)	HSRC model with 1% incidence of HIV (lowest prevalence estimates)	ASSA model with 2% incidence of HIV (highest prevalence estimates)	Non-completion assumptions are 50% lower than in baseline	Non-completion assumptions 50% higher than in baseline	Lower success rates than in baseline	Higher success rates than in baseline	Subsidies 10% lower than in baseline	Subsidies 10% higher than in baseline	Proportion of students in the humanities 10% higher than baseline
Total discounted costs:										
2004	2,810,835	2,631,274	6,277,263	1,405,417	3,648,215	2,507,557	3,163,454	2,578,114	3,043,556	2,649,228
2005	4,401,732	4,134,645	9,885,720	3,010,415	5,224,494	3,925,411	4,955,339	4,036,385	4,767,079	4,147,967
2006	4,364,937	3,959,589	9,234,590	2,992,765	5,170,704	3,895,224	4,913,552	4,002,602	4,727,271	4,114,032
2007	4,308,088	3,795,280	8,676,168	2,961,284	5,093,933	3,846,584	4,849,277	3,950,433	4,665,742	4,061,037
2008	4,230,345	3,634,863	8,165,158	2,914,658	4,993,863	3,778,873	4,761,541	3,879,111	4,581,578	3,988,230
2009	4,134,194	3,476,633	7,683,576	2,854,061	4,873,600	3,694,395	4,653,129	3,790,917	4,477,472	3,897,978
2010	4,023,805	3,321,385	7,230,096	2,782,564	4,737,831	3,596,922	4,528,726	3,689,670	4,357,939	3,794,224
2011	3,902,666	3,169,729	6,803,165	2,702,740	4,590,477	3,489,616	4,392,257	3,578,572	4,226,761	3,680,272
2012	3,773,705	3,022,135	6,401,257	2,616,745	4,434,820	3,375,125	4,247,008	3,460,304	4,087,106	3,558,890
2013	3,639,366	2,878,956	6,022,930	2,526,387	4,273,602	3,255,664	4,095,728	3,337,108	3,941,624	3,432,391
Annual average	3,958,967	3,402,449	7,637,992	2,676,704	4,704,154	3,536,537	4,456,001	3,630,322	4,287,613	3,732,425
Composition of costs:										
New HIV cases	10.7	8.4	6.2	8.3	13.4	10.8	10.7	10.8	10.7	10.8
New AIDS cases	55.1	56.2	57.2	42.2	57.6	55.1	55.1	55.1	55.1	55.1
AIDS deaths per year	34.2	35.4	36.6	49.5	29.0	34.1	34.2	34.1	34.2	34.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Cost per HIV infection	***1,646***	***1,108***	***1,841***	***862***	***2,447***	***1,482***	***1,847***	***1,514***	***1,779***	***1,557***

APPENDIX I: RESULTS OF STUDENT MODEL SENSITIVITY ANALYSIS (CONTINUED)

	Scenario10	Scenario11	Scenario12	Scenario13	Scenario14	Scenario15	Scenario16	Scenario17	Scenario18	Scenario19
	Proportion of students in natural sciences 10% higher than in baseline	Subsidy multiples for postgraduate students 10% greater than in baseline	Subsidy multiples for postgraduate students 10% smaller than in baseline	Discount rate=4%	Discount rate=6%	Discount rate=8%	Discount rate=10%	Discount rate=12%	Average class fees 10% lower and fee multiples lower for postgraduate students are smaller than in baseline	Average class fees 10% higher and fee multiples for postgraduate students greater than in baseline
Total discounted costs:										
2004	2,972,442	2,946,159	2,675,511	2,843,268	2,789,621	2,737,961	2,688,180	2,640,177	2,737,790	2,909,616
2005	4,655,497	4,614,521	4,188,943	4,503,896	4,335,541	4,176,453	4,025,962	3,883,462	4,288,511	4,554,962
2006	4,615,841	4,571,519	4,158,354	4,517,781	4,266,852	4,034,167	3,818,098	3,617,188	4,253,377	4,515,319
2007	4,555,138	4,508,447	4,107,728	4,510,390	4,179,497	3,878,399	3,603,933	3,353,323	4,198,561	4,455,248
2008	4,472,459	4,424,207	4,036,483	4,480,101	4,073,101	3,709,673	3,384,473	3,092,889	4,123,270	4,373,817
2009	4,370,411	4,321,264	3,947,125	4,428,792	3,950,482	3,531,366	3,163,219	2,839,077	4,029,947	4,273,550
2010	4,253,385	4,203,895	3,843,715	4,360,273	3,815,979	3,347,964	2,944,410	2,595,499	3,922,668	4,158,727
2011	4,125,061	4,075,677	3,729,656	4,277,802	3,673,165	3,162,986	2,731,152	2,364,521	3,804,848	4,032,933
2012	3,988,521	3,939,610	3,607,800	4,184,172	3,524,981	2,979,174	2,525,663	2,147,570	3,679,348	3,899,169
2013	3,846,341	3,798,197	3,480,534	4,081,781	3,373,840	2,798,630	2,329,465	1,945,373	3,548,561	3,759,944
Annual average	4,185,509	4,140,350	3,777,585	4,218,826	3,798,306	3,435,677	3,121,456	2,847,908	3,858,688	4,093,328
Composition of costs:										
New HIV cases	10.7	10.7	10.8	10.7	10.7	10.7	10.7	10.7	10.7	10.8
New AIDS cases	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1
AIDS deaths per year	34.2	34.2	34.1	34.2	34.2	34.2	34.2	34.2	34.2	34.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Cost per HIV infection	***1,736***	***1,710***	***1,583***	***1,755***	***1,580***	***1,429***	***1,298***	***1,184***	***1,601***	***1,706***

APPENDIX I: RESULTS OF STUDENT MODEL SENSITIVITY ANALYSIS (CONTINUED)

	Scenario20	**Scenario21**	**Scenario22**	**Scenario23**	**Scenario24**	**Scenario25**	**Scenario26**	**Scenario27**	**Scenario28**	**Scenario29**
	Proportions of postgraduate students studying at different levels favours honours students (10% increase)	Proportions of postgraduate students studying at different levels favours master's students (10% increase)	Proportions of postgraduate students studying at different levels favours doctoral students (10% increase)	Subsidy increases 10% per annum	Subsidy declines 10% per annum	Class fees increase 6% per annum	Proportion of subsidy paid on completion of studies = 50%	Proportion of subsidy paid on completion of studies = 80%	Proportion of class fees paid at registration declines by 10%	Proportion of class fees paid at registration increases by 10%
Total discounted costs:										
2004	2,787,234	2,843,747	2,807,532	3,043,549	2,578,121	2,841,852	1,647,264	2,345,406	2,834,625	2,787,045
2005	4,364,675	4,453,529	4,396,482	4,767,068	4,036,396	4,449,751	2,575,051	3,671,059	4,438,495	4,364,969
2006	4,328,960	4,415,222	4,359,841	4,727,260	4,002,613	4,412,549	2,553,318	3,640,289	4,401,728	4,328,145
2007	4,273,195	4,356,857	4,303,146	4,665,732	3,950,444	4,355,072	2,519,867	3,592,800	4,344,665	4,271,510
2008	4,196,584	4,277,531	4,225,564	4,581,568	3,879,122	4,276,474	2,474,229	3,527,898	4,266,478	4,194,212
2009	4,101,616	4,179,727	4,129,581	4,477,462	3,790,926	4,179,269	2,417,855	3,447,659	4,169,684	4,098,704
2010	3,992,442	4,067,638	4,019,364	4,357,930	3,689,680	4,067,670	2,353,180	3,355,555	4,058,496	3,989,114
2011	3,872,537	3,944,776	3,898,401	4,226,752	3,578,581	3,945,207	2,282,240	3,254,496	3,936,437	3,868,896
2012	3,744,813	3,814,085	3,769,615	4,087,097	3,460,313	3,814,837	2,206,744	3,146,921	3,806,464	3,740,947
2013	3,611,705	3,678,023	3,635,450	3,941,615	3,337,116	3,679,030	2,128,118	3,034,866	3,671,045	3,607,686
Annual average	3,927,376	4,003,114	3,954,497	4,287,603	3,630,331	4,002,171	2,315,786	3,301,695	3,992,812	3,925,123
Composition of costs:										
New HIV cases	10.7	10.7	10.7	10.7	10.8	10.8	10.9	10.8	10.8	10.7
New AIDS cases	55.1	55.1	55.1	55.1	55.1	55.1	55.0	55.1	55.1	55.1
AIDS deaths per year	34.2	34.2	34.2	34.2	34.1	34.2	34.1	34.1	34.2	34.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Cost per HIV infection	***1,635***	***1,662***	***1,645***	***1,779***	***1,514***	***1,667***	***982***	***1,381***	***1,663***	***1,630***

APPENDIX I: RESULTS OF STUDENT MODEL SENSITIVITY ANALYSIS (CONTINUED)

	Scenario30	**Scenario31**	**Scenario32**	**Scenario33**	**Best case costing scenario**	**Worst case costing scenario**
	Proportion of students deregistering = 25%	Proportion of students deregistering = 75%	Cancellation fees increase 5% per annum	Refund at deregistration = 40%	See notes regarding assumptions (Appendix H)	See notes regarding assumptions (Appendix H)
Total discounted costs:						
2004	2,787,817	2,833,853	2,809,172	2,794,975	469,860	12,296,324
2005	4,366,431	4,437,033	4,399,135	4,377,223	962,115	17,872,459
2006	4,329,536	4,400,337	4,362,345	4,340,409	866,524	16,895,252
2007	4,272,836	4,343,339	4,305,517	4,283,703	781,369	16,056,770
2008	4,195,475	4,265,214	4,227,810	4,206,256	704,068	15,282,021
2009	4,099,907	4,168,482	4,131,708	4,110,534	633,463	14,543,695
2010	3,990,258	4,057,352	4,021,378	4,000,677	569,181	13,840,683
2011	3,869,983	3,935,350	3,900,306	3,880,153	510,815	13,171,416
2012	3,741,980	3,805,431	3,771,418	3,751,866	457,946	12,534,303
2013	3,608,667	3,670,065	3,637,156	3,618,246	410,155	11,927,828
Annual average	3,926,289	3,991,646	3,956,594	3,936,404	636,550	14,442,075
Composition of costs:						
New HIV cases	10.7	10.8	10.7	10.7	6.7	7.9
New AIDS cases	55.1	55.1	55.1	55.1	42.6	60.7
AIDS deaths per year	34.2	34.1	34.2	34.2	50.7	31.5
Total	100.0	100.0	100.0	100.0	100.0	100.0
Cost per HIV infection	***1,630***	***1,663***	***1,645***	***1,635***	***164***	***4,396***

APPENDIX J: AVERAGE ANNUAL PERCENTAGE CHANGE IN PROJECTED NUMBER OF SCHOOL-LEAVERS ELIGIBLE FOR ENROLMENT AT UNIVERSITY (2005-2014): SENSITIVITY ANALYSIS

Assumption regarding calculation of attrition rates between grades	Average annual change in projected number of school-leavers from Free State province eligible for university enrolment (%)			Average annual change in projected number of school-leavers from other provinces in South Africa eligible for university enrolment (%)			Average annul change in projected number of school-leavers eligible for enrolment at UFS (%)		
	2005-14	**2005-10**	**2010-14**	**2005-14**	**2005-10**	**2010-14**	**2005-14**	**2005-10**	**2010-14**
A. AIDS scenario									
3-year moving averages	-3.3	-1.1	-6.0	-0.8	+0.8	-2.8	-2.2	-0.3	-4.6
5-year moving averages (baseline)	-3.3	-0.1	-7.2	-1.1	+0.9	-3.6	-2.4	+0.3	-5.7
7-year moving averages	-2.2	+1.1	-6.3	-1.7	+0.7	-4.7	-2.1	+1.0	-5.7
9-year moving averages	-3.6	-0.1	-7.7	-1.7	+1.0	-4.9	-2.8	+0.8	-6.2
B. no-AIDS scenario									
3-year moving averages	-2.9	-0.6	-5.6	-0.3	+1.3	-2.4	-1.8	+0.2	-4.2
5-year moving averages (baseline)	-2.9	+0.3	-6.8	-0.7	+1.4	-3.2	-2.0	+0.8	-5.3
7-year moving averages	-1.8	+1.6	-5.9	-1.3	+1.2	-4.3	-1.6	+1.4	-5.3
9-year moving averages	-3.1	+0.4	-7.3	-1.2	+1.4	-4.5	-2.4	+0.8	-6.2

Note: In the case of the projected number of school-leavers eligible for enrolment at UFS, non-Free State numbers of matriculation exemptions were weighted by 3.4% as non-Free State school-leavers are much less likely to enter UFS compared with matriculants from the Free State province.

7. BIBLIOGRAPHY

Abt Associates, 2001. *Impending catastrophe revisited: An update on the HIV/AIDS epidemic in South Africa*. Parklands: Henry J Kaiser Family Foundation.

Alexander, P. & Ichharam, M., 2002. Spitting for science at RAU: quality in quantitative research on HIV/AIDS. *Society in Transition* 33(3): 347-362.

Ambert, C., 2002. Economic impact of HIV/AIDS on the construction sector: Supply side implications for housing policy. *South African Journal of Economics* 70(7): 1235-1261.

ASSA, 2003. Models and actuarial projections of the HIV/AIDS epidemic. Available: http://www.assa.org.za.

Aventin, L. & Huard, P., 2000. Cost of AIDS to three manufacturing firms in Côte d'Ivoire. *Journal of African Economies* 9(2): 161-188.

Babcock-Walters, P., 2001. School level impact of HIV/AIDS in KwaZulu-Natal. *AIDS Analysis Africa* 2 (1).

Barnett, T. & Whiteside, A., 1998. *Guidelines for preparation and execution of studies of the social and economic impact of HIV/AIDS*. Geneva: UNAIDS.

Barnett, T. & Whiteside, A., 2001. *AIDS in the twenty first century: Disease and globalisation.* Hampshire: Palgrave Macmillan.

Bollinger, L. & Stover, J., 1999. *Economic impact of AIDS in South Africa.* Johannesburg: Futures Group International.

Booysen, F. le R. & Molelekoa, J., 2002. Benefits of HIV/AIDS intervention in the workplace: A case study. *South African Journal of Economic and Management Sciences* 5(1): 180-202.

Chetty, D., 2000. *'Institutionalising the response to HIV/AIDS in the South African university sector: A SAUVCA Analysis.'* SAUVCA Occasional Report No 2.

Cohen, D., 1999. *The HIV epidemic and the education sector in Sub-Saharan Africa*. Issues Paper No. 22. HIV and Development Programme, UNDP.

Coombe, C., 2000a. Keeping the education system healthy: Managing the impact of HIV/AIDS on education in South Africa. *Current Issues in Comparative Education*.

__________, 2000b. *Managing the impact of HIV/AIDS on the education sector.* Centre for the Study of AIDS, University of Pretoria, South Africa.

Coombe, C. & Kelly, M., 2001. Education as a vehicle for combating HIV/AIDS. *UNESCO prospects* XXXI (3): 435-45.

Council for Medical Schemes, 2004. *Annual report 2003-04*. Pretoria: Council for Medical Schemes.

Decosas, J. & Finlay, J., 1993. International AIDS aid: the response of development aid agencies to the HIV/AIDS pandemic. *AIDS* 7: 281-286.

Dorrington, R., Bourne, D., Bradshaw, D., Loubscher, R. & Timaeus, I.M., 2001. *The impact of HIV/AIDS on adult mortality in South Africa*. Cape Town: Medical Research Council.

Dorrington, R.E., Bradshaw, D., Johnson, L. & Budlender, D., 2004. *The demographic impact of HIV/AIDS in South Africa: national indicators for 2004*. Cape Town: Centre for Actuarial Research, South African Medical Research Council and Actuarial Society of South Africa.

Gachuhi, D., 1999. *The impacts of HIV/AIDS on education systems in the Eastern and Southern Africa region and the response of education system to HIV/AIDS: Life Skills Programmes*. Paper presented to the All Sub-Saharan Africa Conference on Education for All 2000, Johannesburg, 1999.

Geffen, N., 2002. Costs and benefits of treatment and prevention strategies. In Kelly, K., Parker, W. & Gelb, S. (eds). *HIV/AIDS, Economics and Governance in South Africa: Key Issues in Understanding Response*. Johannesburg: CADRE.

Guinness, L. & Alban, A., 2000. *The eonomic impact of AIDS in Africa: A review of the literature*. UNAIDS Background Paper for ADF.

Haldenwag, B.B., 2001. A demographic profile of South Africa's provinces, 1996-2031. Stellenbosch: Institute for Futures Research.

HEARD, 2000. *Aids toolkits: HIV/AIDS and education*. Available: http://www.und.ac.za/und/heard [accessed 25 April 2002].

Ichharam, M. & Martin, L., 2002. Explaining the low rate of HIV prevalence at RAU. *Society in Transition* 33(3): 363-381.

Jordan, R., Gold, L., Cummins, C. & Hyde, C., 2002. Systematic review and meta-analysis of evidence for increasing numbers of drugs in antiretroviral combination therapy. *British Medical Journal* 324: 1-10.

Kelly, M. J., 1999. *The impact of HIV/AIDS on schooling in Zambia*. Paper Presented at the Sixth International Conference on AIDS and STDs in Africa, Lusaka, Zambia.

__________, 2000a. *Planning for education in the context of HIV/AIDS*. UNESCO. International Institute for Educational Planning: Paris.

__________, 2000b. Standing education on its head: Aspects of schooling in a world with HIV/AIDS. *Current Issues in Comparative Education 3(1).* Available at: www.tc.columbia.edu/cice/vol03nrl/mkart.htm.

__________, 2000c. *The encounter between HIV/AIDS and education*. Harare Zimbabwe: UNESCO, Sub Regional Office for Southern Africa.

__________, 2000d. *HIV/AIDS and education in Eastern and Southern Africa: The leadership challenge and the way forward*. Report for the African Development Forum.

__________, 2001a. *Challenging the challenger: Understanding and expanding the response of universities in Africa to HIV/AIDS*. ADEA and World Bank. A synthesis Report for the Working Group on Higher Education (WGHE), Association for the Development of Education in Africa (ADEA). Washington, DC: World Bank.

__________, 2001b. *The response of information technology to the challenge of HIV/AIDS in higher education institutions in Africa*. Paper Presented to the Ad Hoc Expert Group Meeting on Reforms in Higher Education and the use of Information technology in Africa, 19-21 November, Nairobi, Kenya.

__________, 2002a. *The AIDS epidemic: Why must the education system respond?* Paper Presented to the University of West Indies and the Association of Caribbean Universities and Research Institutes.

__________, 2002b. *Crafting the response of a university to HIV/AIDS*. Paper presented to the University of the West Indies and the Association of Caribbean Universities and Research Institutes.

__________, 2002b. HIV/AIDS and institutions of higher learning in SADC countries: Theological, ethical, indigenous and socio-economic perspectives. Keynote Address to Conference on Commitment to Combat HIV/AIDS, July 2-4, 2002. Swaziland, University of Swaziland.

Lickindorf, E., 2004. HIV/AIDS and academia. *Mail & Guardian* November 12-18: 9.

Martin, L. & Alexander, P., 2002. Getting up to speed: South Africa's tertiary institutions and HIV/AIDS. *Society in Transition* 33(3): 330-346.

Morgan, D., Mahe, C., Mayanja, B., Okongo, J.M., Lubenga, R. & Whitworth, J.A.G., 2002. HIV-1 infection in rural Africa: is there a difference in median time to AIDS and survival compared to that in industrialized countries? *AIDS* 16: 597-603.

Morris, C.N., Burdge, D.R. & Cheevers, E.J., 2000. Economic impact of HIV infection in a cohort of male sugar mill workers in South Africa. *South African Journal of Economics* 68(5): 933-946.

Parker, W., Kistner, U., Gelb, S., Kelly, K. & O'Donovan, M., 2000. *Economic impact of HIV/AIDS in South Africa and its implications for governance: A bibliographic review*. Johannesburg: Centre for AIDS Development, Research and Evaluation (CADRE) and USAID.

Rosen, S.M., 2004. Personal communication.

Rosen, S.M., Simon, J., Vincent, J.R., MacLeod, W., Fox, M. & Thea, D.M., 2003. "AIDS is your business". *Harvard Business Review* February: 81-85.

Rosen, S.M., Vincent, J.R., MacLeod, W., Fox, M., Thea, D.M. & Simon, J., 2004. The cost of HIV/AIDS to businesses in southern Africa. *AIDS* 18: 317-324.

Shaeffer, S., 1994. *The impact of HIV/AIDS on education: A review of literature and experience*. UNESCO. Paris.

Sishana, O. & Simbayi, L., 2002. *Nelson Mandela/HSRC study of HIV/AIDS: South African national HIV prevalence, behavioural risks and mass media: Household survey 2002*. Cape Town: Human Sciences Research Council Publishers.

Simkins, C., 2002. *The jagged tear: Human capital, education, and AIDS in South Africa, 2002-2010*. Centre for Development and Enterprise Occasional Paper No 7. Available: http://www.cde.org.za

Stremlau, J. & Nkosi, N., 2001. So much learning but so little wisdom. *Sunday Times* January 28.

UNAIDS, 2002. AIDS Epidemic Update, December, 2002. Available at: http://www.unaids.org/worldaidsday/2002/press/update/epiupdate_en.pdf.

UNPD, 2005. World population prospects. Available at: http://esa.un.org/unpp.

University of Benin, 2000. *Universities and HIV/AIDS in Sub-Saharan Africa: The case of Benin*. Benin.

Uys, T., Ichharam, M., Martin, L. & Alexander, P., 2001. *HIV/AIDS and students at RAU*. Rand Afrikaans University: Centre for Sociological Research.

Uys, T., 2002. Students, sex and AIDS: A methodological controversy. *Society in Transition* 33(3): 382-402.

Whiteside, A., O'Grady, M. & Alban, A., 1999. *How will AIDS impact on your business?* 1998 Southern Africa Economic Summit, Update Session, 4 July.

Whiteside, A. & Sunter, C., 2000. *AIDS: The challenge for South Africa*. Cape Town: Human & Rousseau Tafelberg.

World Bank, 1992. *Aids assessment and planning study*. A World Bank Country Study (Tanzania).Washington, DC: World Bank.

__________, 1999. *Confronting AIDS: Public priorities in a global epidemic*. A World Bank Policy Research Report. New York: Oxford University Press.

__________, 2000. *Exploring the implications of the HIV/AIDS epidemic for educational planning in selected African countries: The demographic question*. ACTAfrica, World Bank. Washington, DC: World Bank.

__________, 2002. Education and HIV/AIDS: A window of hope. Washington, DC: World Bank.