

## **Circular migration and sexual networking in rural KwaZulu/Natal: implications for the spread of HIV and other sexually transmitted diseases\***



**Mark Lurie<sup>a,b</sup>, Abigail Harrison<sup>a</sup>, David Wilkinson<sup>a</sup> and**

**Salim Abdool Karim<sup>a</sup>**

*<sup>a</sup>South African Medical Research Council, Centre For Epidemiological Studies in Southern Africa (CERSA), Hlabisa, KwaZulu/Natal, South Africa*

*<sup>b</sup>Johns Hopkins University School of Hygiene and Public Health, Baltimore MD, USA*

### **Abstract**

**Patterns of migration do not simply arise out of chance. In South Africa, for example, migration patterns are a result of decades of legislation aimed at restricting the movements of the majority of the population and providing a steady flow of cheap black labour to the gold mines and other industries. In the new democratic South Africa, restrictive laws have been lifted, but circular migration remains a way of life for several million black South Africans.**

**This paper examines the social and epidemiological implications of widespread circular migration from the perspective of a rural South African Health District. In particular, we report our findings on the patterns and prevalence of migration into and out of the Hlabisa Health District in rural KwaZulu/Natal, and the patterns of sexual networking of migrants and their rural partners. We conclude by examining the implications of these patterns of migration and sexual networking for the spread of HIV and other STDs.**

The prevalence of HIV in KwaZulu/Natal, South Africa, is nearly double the national average, and is increasing rapidly. In 1995, the prevalence of HIV among women attending antenatal clinics was 18.2 per cent, up from 4.5 per cent in 1992 (Swanavelder 1996). Throughout South Africa, black people suffer much higher infection rates than any other group, and women aged 20-24 are most affected.

HIV in South Africa is not strictly an urban problem. In Hlabisa, a rural district of about 210,000 people in Northern KwaZulu/Natal where this study takes place, HIV prevalence in women attending antenatal clinics increased from 4.2 per cent in 1992 to 25.9 per cent in the first four months of 1997 (unpublished data). In addition, HIV prevalence in a small household sample of one defined geographical area was measured at 12 per cent (Wilkinson et al. 1997).

Importantly, all of the HIV cases detected in this pilot study were either migrants or partners of migrants. This highlights the fact that many of the people, males in particular, are extremely mobile and are therefore probably at increased risk for HIV and other STDs. More than 2.5 million black South Africans were registered as migrant labourers in 1986, although

---

\* We would like to thank Joel Gittelsohn and Mike Sweat for their valuable input from the time this research was conceptualized. We would also like to thank Marlies Craig for assistance in designing the maps. This research was funded in part by the South African Medical Research Council and the Fogarty International Centre, NIH.

the number is probably much higher (Jochelson, Mothibeli and Leger 1991:158). Migrant labour was a central tenet of apartheid, which sought to create a steady flow of cheap black labour to South Africa's mines, industries and farms. A myriad of laws prohibited black South Africans from settling permanently in 'whites only' areas, and as a result, migration patterns in South Africa tend to be circular, with men maintaining close links with their rural homesteads.

This paper explores the social and epidemiological implications of widespread circular migration from the perspective of a rural South African Health District.

### **Migration and sexually transmitted disease**

In several parts of the world, geographic mobility, migration and widespread population displacement have been identified as significant risk factors in the transmission of HIV, and 'migration has become a central theme in the discussion of AIDS' (Decosas et al. 1995:826). Migrants are particularly susceptible to HIV and other STDs, both in South Africa (Zwi and Bachmayer 1990; Jochelson et al. 1991; Department of Health 1995) and outside (Hunt 1989; Quinn 1994; Decosas et al. 1995; Nunn et al. 1995; Lurie, Hintzen and Lowe 1995; Decosas 1996). The argument that migration is a risk factor for HIV and other STDs rests on the assumption that migrants are more likely than non-migrants to have additional sexual partners.

Despite this growing body of work, there are still major limitations in the available literature. This section reviews some of the key findings about the relationship between migration and STD including HIV and concludes with a brief discussion highlighting the shortcomings of the studies that have been done.

**Table 1**  
**Summary of major migration and HIV/STD research**

<b>Location, year (authors)</b>	<b>Population</b>	<b>Main findings</b>
<b>Uganda, 1995</b> (Nunn et al.)	Rural Ugandan residents and migrants	People who moved within last 3 years were 3 times more likely to be infected with HIV than those who had stable residence for 10 years.
<b>Senegal, 1993</b> (Pison et al.)	Seasonal migrants in rural areas	HIV spread mostly first to men who became infected during seasonal migration, then to their rural partners when they returned.
<b>Zimbabwe, 1990</b> (Bassett et al.)	Urban male factory workers	HIV+ men more likely to live apart from their wives and to have multiple sex partners.
<b>South Africa, 1991</b> (Jochelson, Mothibeli and Leger)	Urban male mine workers	Migration disrupts family life and creates a market for prostitution in mining towns.
<b>South Africa, 1992</b> (Abdool Karim et al.)	Rural KwaZulu/Natal residents and migrants	HIV 3 times more likely among those who had recently changed their place of residence.

A recent study on HIV and migration in Uganda showed a strong correlation between HIV infection and migration status (Nunn et al. 1995). The lowest rates of HIV were found in those people whose place of residence was more permanent. People who had moved within the last five years, for example, were three times more likely to be infected with HIV than

those whose residence had been stable for more than ten years. The lowest infection rates were among those who had been living for the longest time in the same place. The study also documents that people who migrate have more sexual partners than non-migrants. However, since this study deals with one-way, long-term migration, it may have only limited applicability to South Africa's pattern of circular migration and its implications for potential repeated exposures.

In rural Senegal, a study of seasonal migration and HIV reported that HIV was 'mainly transmitted first to adult men through sexual contacts with infected women met during their seasonal migration and second to their wives or regular partners once they are back home' (Pison et al. 1993:196). Since this study concentrates on seasonal migration, in which men spend on average half a year or more away from their rural homes (Pison et al. 1993), the implications for South Africa may be important as the migration patterns in Senegal are somewhat similar to those of South Africa.

In a study of male factory workers in Zimbabwe, HIV-positive men were more likely to live apart from their wives and to have multiple sexual partners than HIV-negative men (Bassett et al. 1992). In Ghana, Anarfi has argued that migration 'acts to increase the extent of sexual networking' (Anarfi 1993:45).

In South Africa, high rates of STDs have been found in gold miners, although there have been no studies on prevalence of HIV or other STDs among returning migrants. Some estimate that the prevalence of HIV infection among migrants is 50 per cent higher than among non-migrants (Evian 1995). In a study of the seroprevalence of HIV in a rural KwaZulu/Natal community, people who had recently changed their place of residence were three times as likely to be HIV-infected (Abdool Karim et al. 1992).

While the argument that the migrant labour system encourages high-risk sexual behaviour in South Africa has not been proved in a statistical sense, it is clear that migrants' frequent and lengthy absences from home can 'disrupt their familial and stable sexual relationships' (Jochelson et al. 1991:157). Quinn argues that the migrant labour system created a market for prostitution in mining towns (Quinn 1994), and this is borne out in other research (Roets et al. 1996). This argument is not new. In 1949 Kark argued that the widespread prevalence of gonorrhoea and syphilis in both urban and rural areas of South Africa was due to the migrant labour system and that prostitution resulted from the separation of husbands from their wives and families (Kark 1949).

There are several limitations to the current literature, and this study is a modest attempt to begin to fill those gaps. First, most studies on migration tend to focus on migrants at their place of work. Consequently, they fail to document the effects of migrants' return to rural areas. The circular pattern of migration in South Africa may put people at risk of HIV and other STDs at both ends of the migratory movement. However, in part because of the emphasis of migration theory on the determinants of migration, and in part because most work in South Africa on migration has occurred on the gold mines, little if any work has been done to document the effects of circular migration in South Africa's rural areas.

More specifically, while there is some rudimentary understanding of the relationship between a person's migration pattern and susceptibility to HIV, little is known about that person's rural partner's susceptibility to HIV or other STDs. Studies that examine the social and epidemiological implications of migration at both ends of the migration spectrum are therefore needed.

A further limitation of the available literature is that it tends to classify 'migration status' as a dichotomous variable: one is considered either a migrant or a non-migrant. Relatedly, many studies look only at one-way, long-term migration. In reality, however, the situation is considerably more complex and fluid. For example, migration status can change several times within the course of a lifetime. Furthermore, there are many different types of migration, and

each may carry with it a different risk of sexually transmitted infection. A contextualized approach that seeks to refine our understanding of different types of migration is therefore urgently needed.

Finally, most work on the relationship between migration and HIV and other STDs has tended to ignore the implications for interventions. If indeed migrants are at increased risk for STDs, then it is imperative to develop appropriate targeted interventions.

### **Research questions and methods**

The formative phase of this rural-based research which we report here aimed to answer the questions: what are the patterns of migration into and out of the Hlabisa Health District? What are the patterns of sexual networking for migrants and their rural partners?

The majority of data were collected through repeat visits to 20 case-study households which were selected because they contain a male migrant. Permission was initially sought from the local Tribal Authority who identified several community health workers to work more closely with us and to facilitate entry into the selected households.

Each household has been visited an average of eight times over the course of the year. Data collection methods included both qualitative and quantitative techniques, which ranged from open-ended interviews to more structured monthly household censuses. The topics in open-ended interviews have ranged from the pros and cons of one's partner being a migrant, to health beliefs and health-seeking behaviour. Male migrants attached to the 20 case-study households have also been interviewed in Hlabisa where possible. Many of the interviews were conducted around Christmas time, when many male migrants return home.

Unfortunately, most censuses are inadequate for estimating the prevalence of migration since they tend not to ask specific questions about migration. Indeed, most temporary migrants in South Africa maintain close links with their rural homesteads. Therefore the census question 'Where do you live?' tends to be interpreted as 'Where is your permanent home?' since most migrants view their migration destination as only a temporary location. Without further probing, important information about migration does not get reported.

Therefore, in order to measure the prevalence and patterns of migration, we worked in five local schools situated in different parts of the District. There, Standard 5 students kept daily household composition logs over the course of one calendar month. Each morning they recorded who slept in their house on the previous night.

It should be acknowledged from the outset that the students themselves do not come from a random sample of households. Indeed, it could be argued that fathers of Standard 5 students are in the age group most likely to be migrants. However, given the wide range of ages over which men father children, as well as the wide range of ages of Standard 5 students themselves (ages 11-20 in this sample), we feel that this sample is adequate to make a reasonable estimate of both the prevalence of migration and the major migration destinations.

Furthermore, the school data have been supplemented with other data in an attempt to safeguard against the possible sampling bias mentioned above. In a recent community-based study on contraceptive practices among women in the district, we asked questions about the number of migrants in each household and their destinations. The findings were consistent with those of the school-based research, suggesting that there are no major biases in the school data.

Finally, we conducted structured observations at the local taxi rank in an effort to document patterns of movement into and out of the District.

## **Findings**

### ***Prevalence of migration and main migration destinations***

From the rural perspective of Hlabisa, we are clearly unable to measure and detect one-way, permanent migration to urban areas in which people essentially leave the district for ever. However, it is clear that the predominant mode of migration in the district is that of circular or oscillating migration undertaken by men between the ages of 20 and 50.

We estimate that approximately 60 per cent of households have a male who is a migrant. People in Hlabisa, particularly those in the more rural parts of the District, live in kraals which are essentially a collection of households located on the same property and inhabited by members of the same family. We estimate that 50 per cent of kraals have one male migrant<sup>1</sup>, and an additional 30 per cent have more than one male migrant. One-third of kraals had a female migrant, and another 15 per cent had two or more female migrants.

**Table 2**  
**Prevalence of migration in Hlabisa: school and household surveys**

<b>Measurement</b>	<b>School-based data</b>	<b>Household study</b>
Sample size	120 Standard 5 children	112 kraals; 138 women aged 16-49
Prevalence of male migration	62.5 per cent Std 5 students had a father who is a migrant	55 per cent women had partners who are migrants, 50 per cent of kraals had 1 male migrant; 30 per cent of kraals had 2 or more male migrants
Prevalence of female migration	Not measured	33 per cent of kraals had a female migrant; 15 per cent of kraals had 2 or more female migrants

The main migration destinations for males from Hlabisa are shown in Figure 1 (Map with arrows out of Hlabisa). The three most common destinations are Johannesburg (32%), Durban (20%) and Empangeni (20%). Most of the rest of the male migrants from Hlabisa are scattered along the coastline between Hlabisa and Durban.

The main migration destinations for female migrants from Hlabisa District are shown in Figure 2. Female migrants live and work much closer to home than male migrants. One third of female migrants from Hlabisa were in Nongoma, which at 50 km is essentially the closest town; 22 per cent were in Durban, and all of the rest, 45 per cent, spread out along the coastline between Durban and Hlabisa, no more than a two-hour drive away. Interestingly, no women migrated to Johannesburg or its environs, despite the fact that the Johannesburg area is the most common migration destination for males from Hlabisa.

### ***Number and duration of migrants' visits home***

Not surprisingly, there is a relationship between the distance a migrant travels from Hlabisa and the number of nights he or she is able to return home each month. Since women migrate much shorter distances than do their male counterparts, they are able to return home more

---

<sup>1</sup> A migrant is defined here simply as someone who spends most nights away.

often and maintain closer links to their families. Some women are able to return home every weekend, others less often; but the majority of female migrants return to Hlabisa at least a few times a month.

Johannesburg, being about the furthest recorded migration destination from Hlabisa, and the most common destination for men, is about 600 km away, 100 km being on dirt roads. It takes between six and seven hours to travel there in a taxi. Most Hlabisa migrants working in the Johannesburg area are able to return home every 2-4 months for a long weekend, and somewhat longer over the Christmas holidays, depending on the nature of their work contracts. However, given the cost and time it takes to travel back to Hlabisa, more frequent visits are generally not feasible.

By contrast, Hlabisa migrants in Durban can and do come home at least once a month for a weekend. With the new road the journey can take as little as three hours and costs R50 (about US \$11.25 at current exchange rates). Empangeni is about an hour and a half from Hlabisa and costs R20. Many Hlabisa migrants in Empangeni return home several times a month. Several of the large companies there have special buses that travel on Fridays and Sunday evenings between Empangeni and Hlabisa.

### *Changing patterns of migration*

The most significant change in migration patterns reported by informants is the fact that those migrants who live far away are able to return home much more often. For example, a decade ago, a Hlabisa migrant working in Johannesburg was able to return home only once a year over the Christmas holidays. Now, however, with the lifting of laws restricting the movement of the majority of South Africa's population, more flexible work contracts and improved transport systems, including a significantly developed taxi network, these same migrants can return home much more often: up to five or six times a year.

Another indication of the change in migration patterns is the fact that increasingly female partners of male migrants visit their husbands at their work places. A decade ago, with strict 'influx control' laws, such visits were strictly prohibited: all black South Africans carried with them 'passbooks' which stipulated whether or not they could legally travel in 'whites only' areas. Obtaining the correct stamps in the passbook was difficult indeed and consequently few female partners visited migrants at their workplace. Out of the 20 case-study households eight men returned home over Christmas 1996 and another three women visited their husbands at their place of work.

### *Sexual networking among migrants*

In his excellent ethnography of gold miners in South Africa, Moodie begins a chapter on sexual activity by stating that 'miners had three main preoccupations in the compound after work - drinking, the seduction of town women, and homosexual encounters' (Moodie and Ndatshe 1994). The availability of a wide range of prostitutes in and around the gold mines has also been well documented (Roets et al. 1996). However, it is impossible at this point to estimate the number, type and duration of miners' sexual contacts.

Female partners of male migrants clearly recognize that their partners are anything but monogamous while away. On the contrary, female partners of migrants are so certain that their partners take additional sexual partners while away that they often laugh at the idiocy of such a question. This assumption is so central to the context of migration that it is barely discussed since it is recognized by all, females as well as males, as being a truism.

This brief excerpt from an interview with a key informant serves as an illustration:

ML: What is the worst thing about your husband being away?

A: It happens that when a man is away he gets lonely and then he fails to stay alone. It happens to our husbands all the time. We can't trust them to stay alone.

ML: Do you think that your husband is staying alone while he is away?

A: NO! (Loudly) Man fails to stay alone for a long time.

ML: Why do men have other partners?

A: It is because of the distances between us.

Indeed male migrants themselves readily admit that they take additional sexual partners while away. This excerpt from a focus group with four returned male migrants in Hlabisa illustrates the point:

ML: What is the most difficult thing about being away?

A1: You don't see your wife, children, cattle or property.

A2: You think about your wife, children and your home all the time, but there is no phone, so I must write a letter and it takes a long time to reach my wife. You think about your home and your family all of the time, but if something goes wrong there, there is nothing you can do because you are so far away.

ML: Some other people have told me that if a man is away he automatically has other girlfriends. Is that true?

A1: (All laugh) Yes, it is true. You must have other girlfriends as you are a human being.

ML: What is it about being a human being?

A2: You have needs for a woman.

ML: Do you all have girlfriends where you are staying?

All: Yes (all laugh), of course!

Migrant men report a wide range of relationships while they are away. At one extreme, some men have set up 'parallel families' at their work place: they live with women they call their wives and have children with them. Many men report having lived with the same woman for 5-6 years. Sometimes their rural wives know or find out about the existence of a second, urban wife, but generally this is kept a secret. At the other end of the spectrum are prostitutes who are readily available at the mines and other employment centres. There are certainly many gradations in between.

### *Sexual networking among rural partners of migrants*

Women are much more reluctant than men to admit that they have been involved in sexual relationships outside marriage. Some women express fear that if their husbands found out that they were in another relationship ‘he would beat me’. While this may certainly be responsible for significant under-reporting of additional partners, it is also possible that in reality women are less likely than men to have additional partners in their husbands’ absence. One reason for this is simply space. In a rural community it is difficult to conceal a male visitor; most neighbours know what is going on next door and consequently it is difficult to hide:

ML: Does it ever happen that a woman has partners when her husband is away?

A: It happens that a husband is away and a woman falls in love - it happens many times. But we would never tell one another if we had someone else. I have heard secretly that a woman has fallen in love with someone else, but we don’t talk about it.

However, the existence of a Zulu word, *ishende* or ‘man on the side’, suggests that it is a common enough practice to warrant its own label. *Ishende* has also been translated as ‘roll-on’ because, like a deodorant, it is something that goes on under the arms and is therefore kept well hidden.

### **Discussion**

Large-scale circular migration, predominantly among men, but among a smaller proportion of women as well, has been documented in rural KwaZulu/Natal. In addition, we have presented preliminary data on the patterns of sexual networking among migrants and their rural partners. In this section, we discuss some of the possible implications of these migration patterns and patterns of sexual networking on the further spread of STDs including HIV in this population.

We presented two potentially important changing patterns of migration that may have important implications for the spread of STD. First, long-distance migrants are now able to return home more often than they could in the past. Second, it appears that more rural-based wives of migrants are visiting their husbands at their migration destinations. Both these findings have the probable effect of increasing the frequency of visits between migrants and their rural partners. The increased frequency of contact may well mean that rural partners are more often exposed to sexually transmitted infections. It is possible that a U-shaped curve describes the relationship between frequency of contact and likelihood of HIV infection. At the extremes—when a partner is always home, and when a partner is never home—the chances of STD transmission are probably low since there are few opportunities for transmission. But in situations where migrants are coming and going with greater frequency, it is possible that the chances of transmission are greater because of the increased frequency of potential exposure. Clearly, this hypothesis needs more testing, and this will be done in the next phase of this study.

The directionality of STD spread also needs further examination. There is a common, and unproven, assumption that it is returning male migrants who infect their rural partners, and not the other way around. However, it is possible that some of the spread may be from rural partners to returning migrants. There is insufficient information at this time to warrant any conclusions. However, this is clearly an important area of research since it has clear implications for the design of targeted interventions.

## A way forward

Interventions aimed at returning migrants and their rural partners may well be needed, and will be further justified by the HIV and STD incidence and prevalence data that will be collected in the next phase of the study. The possibility of selected mass treatment for some returning migrants has also been discussed, although prevalence data are urgently needed to make an informed recommendation. Other prevention efforts, like microbicides, male and female condom promotion and health education are also needed.

Interventions aimed at migrants should ideally occur both at the workplaces and at home. Concentrating interventions exclusively at one place misses important opportunities. Sweat and Denison (1995) have argued that HIV interventions can occur at several levels: individual, environmental, structural and superstructural. However, prevention efforts have been dominated by interventions aimed almost exclusively at the individual (Sweat and Denison 1995:S251).

At least two structural interventions should be considered. Employers should be encouraged to provide, instead of single-sex hostels, more family-friendly housing arrangements. The mining industry, for example, has moved at a painfully slow pace in this direction: in 1993, only 2.1 per cent of miners employed by the Anglo-American Mines lived in married quarters; the vast majority, 89 per cent, lived in single-sex hostels (Crush 1995).

A second, and perhaps more significant structural intervention is that of encouraging rural development. This has the potential to alter the conditions that force large numbers of young men to seek temporary employment in urban areas and may well be as effective an intervention as we have. Indeed, these kinds of interventions need to be discussed not only for this particular rural health district, but for all of Sub-Saharan Africa, where large-scale population movement is the norm, not the exception.

## References

- Abdool Karim, Q., S. Abdool Karim, B. Singh, R. Short and S. Ngxongo. 1992. Seroprevalence of HIV infection in rural South Africa. *AIDS* 6:1535-1539.
- Anarfi, J. K. 1993. Sexuality, migration and AIDS in Ghana - a socio-behavioural study. Pp. 45-67 in *Sexual Networking and HIV/AIDS in West Africa*, ed. J.C. Caldwell et al. Supplement to *Health Transition Review* 3. Canberra: Australian National University.
- Bassett, M.T., A.S. Latif, D.A. Katzenstein and J.C. Emmanuel. 1992. Sexual behavior and risk factors for HIV infection in a group of male factory workers who donated blood in Harare, Zimbabwe. *Journal of Acquired Immune Deficiency Syndromes* 5, 6:556-559.
- Crush, J. 1995. Mine migrancy in the contemporary era. In *Crossing Boundaries: Mine Migrancy in a Democratic South Africa*, ed. J. Crush and W. James. Cape Town: IDASA/IDRC
- Decosas, J. 1996. HIV and development. *AIDS* 10 (Suppl. 3):S69-74.
- Decosas, J., F. Kane, J.K. Anarfi, K.D.R. Sodji and H.U. Wagner. 1995. Migration and AIDS. *Lancet* 346 (8978): 826-828.
- Department of Health, South Africa. 1995. *A New Struggle: HIV/AIDS and STD Programme. Strategy, Business and Structure Plans, 1995/1996*. Pretoria.
- Evian, C. 1995. AIDS and social security. *AIDS Scan* 7, 3:8-11.
- Hunt, C. 1989. Migrant labor and sexually transmitted disease: AIDS in Africa. *Journal of Health and Social Behavior* 30:353-373.
- Jochelson, K., M. Mothibeli and J. P. Leger. 1991. Human Immunodeficiency Virus and migrant labor in South Africa. *International Journal of Health Services* 21, 1:157-173.

- Kark, S.L. 1949. The social pathology of syphilis in Africans. *South African Medical Journal* 23:77-84.
- Lurie, P., P. Hintzen and R. A. Lowe. 1995. Socioeconomic obstacles to HIV prevention and treatment in developing countries. *AIDS* 9:539-546.
- Moodie, T. D. and V. Ndatshe. 1994. *Going For Gold: Men Mines and Migration*. Berkeley: University of California Press.
- Nunn, A. J., H.U. Wagner, A. Kamali, J.F. Kengeya-Kayondo and D.W. Mulder. 1995. Migration and HIV-1 seroprevalence in a rural Ugandan population. *AIDS* 9:503-506.
- Pison, G., B. Le Guenno, E. Lagarde, C. Enel and C. Seck. 1993. Seasonal migration: a risk factor for HIV in rural Senegal. *Journal of Acquired Immune Deficiency Syndromes* 6:196-200.
- Quinn, T. C. 1994. Population migration and the spread of Types 1 and 2 Human Immunodeficiency Virus. *Proceedings of the National Academy of Sciences* 91:2407-2414.
- Roets, L., M. Lurie, C. Mini and M.L. Field. 1996. Health seeking behaviors for sexually transmitted diseases and the social context of commercial sex in a gold mining community: a case study of Welkom, South Africa. Poster presented at Eleventh International Conference on AIDS, Vancouver, July.
- Swanavelder, R. 1996. Sixth national HIV survey of women attending antenatal clinics of the public health service in the Republic of South Africa, October/November 1995. *Epidemiological Comments* 23,1:3-17.
- Sweat, M.D. and J.A. Denison. 1995. Reducing HIV incidence in developing countries with structural and environmental interventions. *AIDS* 9, A:s251-s257.
- Wilkinson, D., F. Cutts, N. Ntuli and S.S. Abdool Karim. 1997. Maternal and child health indicators in a rural South African Health District. *South African Medical Journal* 87,4:456-459.
- Zwi, A. and D. Bachmayer. 1990. HIV and AIDS in South Africa: what is an appropriate public health response? *Health Policy and Planning* 5, 4:316-326.