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Internal Migration and the Spread of HIV/AIDS in South Africa

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Abstract: The migratory labor system in South Africa draws large numbers of men away from rural areas and often places them in single sex hostels, prompting contacts with sex workers and the HIV-infection of their partners. As inadequate information exists on HIV/AIDS and internal migration's relationship, this study examines the quantitative impact of migrants' risky sexual behavior on HIV/AIDS prevalence of provinces. We found that an increase in the magnitude of risky sexual behavior of in-migrants, poor in-migrants and out-migrants results in an increase in HIV/AIDS prevalence, while that of non-poor in-migrants results in its decrease. We also found that the distances between the provinces of origin and destination matter in the spread of HIV/AIDS. The estimates indicate that HIV/AIDS prevalence in a province increases more with the increase in out-migration than that in in-migration or is more responsive to the former than to the latter. Therefore, we suggest some policy interventions to reduce the spread of HIV/AIDS related to South African internal migration.

Key words: HIV/AIDS, internal migration, HIV/AIDS responsiveness, infection, relationship

INTRODUCTION

In many parts of the world, migration in general and internal migration have been identified as significant risk factors in the transmission of HIV (Pison *et al*., 1993; Quinn, 1994; Nunn *et al*., 1995; Decosas *et al*., 1995; Lagarde *et al*., 1996; Decosas and Adrien, 1997; Sambisa *et al*., 2006). This hinges on the notion that the separation of sexual partners and marital couples renders both partners vulnerable for multiple partner behaviors and HIV infection. An overview of migration and HIV/AIDS, sexual behavior at origin and destination and socio-economic factors will shed some light on the issue.

It has been argued that the seasonal return to their families of men who migrated to the cities during decades of apartheid (Evian, 1995; Lurie *et al*., 1995, 1997; Lurie, 2000, 2002, 2003, 2006; Crush, 2002), the displacement of the rural poor to the towns after 1994 (Gelderblom and Kok, 1994; Peberdy, 1995) and the recruitment of cities' workers in rural areas who were often housed in hostels provide opportunities for risky sexual behaviors which fuel the HIV/AIDS epidemic (Ramphele and Heap, 1991).

However, in a study conducted in Senegal, Becker (1991), Lydié and Robinson (1998) found no history of high-risk sexual behavior among migrant women who had lived in urban areas. It is possible that Senegalese internal migrants created a social setting in their new environment that was similar to that of their place of origin in terms of social control and networks, which contained risky sexual behaviors, i.e., limited the number of sexual partners. This may have not been possible in South Africa due to its oscillating migration of male workers, while Senegalese migrants were mainly female workers. In the light of these two migrations, it could be argued that migration in itself does not result in the spread of HIV/AIDS but rather that it creates a socio-cultural context for the likely occurence of risky sexual behaviors.

The migrant labor system in particular contributes to a market for commercial sex work (Abdool Karim, 1998; Campbell, 2000). The lack of social pressure and control over unmarried or married in-migrants, i.e. migrants into a province of residence, who are isolated from their partners or wives result in anonymity which in turn provides in-migrants with a new sexual freedom and opportunities for risky sexual behaviors (Anarfi, 1993).

Out-migration, i.e., migration out of a province of residence, on the other hand could contribute in 2 ways to the spread of HIV/AIDS. HIV-infected out-migrants could infect their partners when they return home for a short visit and women partners left behind who might be infected by other men could infect non-infected partners. Out-migrants who engage in risky sexual behavior in the province of destination may infect their sexual partners when they return for a short visit in the province of origin (Mufune, 1999; Lurie, 2000). Out-migration could also contribute to the spread of HIV through the impact of poverty, uncertain economic support, disrupted family and sexual relations that could render sexual partners left behind, in most cases women, vulnerable to risky sexual behaviors (Lurie, 2002). Thus in-migration and out-migration are significant factors to be considered in strategies to reduce the spread of HIV/AIDS.

The economic dependence of women on men is further exacerbated by the migrant labor (Bouare, 2000-2001) from rural areas (Jochelson *et al.* 1991; Caldwell *et al.*, 1994; Strebel, 1995; Oucho, 2000). The migrant labor system significantly reduces the number of men in rural areas (Statistics South Africa, 1998, 2001) which could render rural women more vulnerable to HIV because of the greater possibility of exploitation due to the drive to gain the favor and material support of available men (Seidel, 1993; Gie *et al*, 1993; Meyer-Weitz and Steyn, 1998; Meyer-Weitz *et al.*, 1998; Ramjee *et al.*, 1998; Pettifor *et al.*, 1998; Simbayi, 1999; Mitton, 2000; Matchaba, 2000; Rees *et al.*, 2000). Thus, poverty needs to be taken into account in a strategy to reduce the spread of HIV/AIDS (Abdool Karim *et al.*, 1992; Evian, 1993; Strebel, 1995; Brockerhoff, 1995; Webb, 1997; Girdler-Brown, 1998; Oucho, 2000; Mitton, 2000; Colvin, 2000; Wall, 2001; Lebeau *et al.*, 2001; Halperin and Allen, 2001).

As limited information is available on the relationship of HIV/AIDS and internal migration, this study attempts to examine the quantitative impact of internal migration on the spread of HIV/AIDS and inform policy to reduce this impact.

MATERIALS AND METHODS

The methodology consists of 2 parts: The models and the empirical study.

We first set up 2 log linear models, in which the magnitude of risky sexual behavior is induced by the distances between the provinces of origin and destination. The first model intends to examine the impact of the magnitude of in-migrants and out-migrants' risky sexual behavior on HIV/AIDS prevalence of the provinces of destination and origin, respectively. In the second model, in-migrants are divided into non-poor and poor in-migrants so as to attempt an examination of the impact of the 2 groups' risky sexual behavior with that of out-migrants on HIV/AIDS prevalence of provinces.

In the empirical part, 4 hypotheses on the sign of the coefficients of the independent variables are stated. The Ordinary Least Squares (OLS) technique is used to run the regressions of the two models in order to test the hypotheses. A third OLS regression model, in which the distances are removed from the independent variables of the second model, is run and compared with the other models in order to determine whether the distances between the provinces of origin and destination matter in the spread of HIV/AIDS.

Models: In this study, we present the 2 log linear models:

$$\ln(P_j) = \alpha + \beta \ln \left[\sum_{i=1}^{8} a_{ij} d_{ij}\right] + \gamma \ln \left[\sum_{i=1}^{8} b_{ji} d_{ji}\right] \text{ and}$$

$$\ln(P_j) = \alpha' + \beta_1 \ln \left[\sum_{i=1}^{8} a_{1ij} d_{ij}\right] + \beta_2 \ln \left[\sum_{i=1}^{8} a_{2ij} d_{ij}\right] + \gamma' \ln \left[\sum_{i=1}^{8} b_{ji} d_{ji}\right]$$

For each j, j = 1, 2, ...9; i ≠ j, where

- ln (P_j), the dependent variable, is the logarithm of HIV/AIDS prevalence of province j;
- For the first equation,

a_{ij} is the number of in-migrants from province i to province j; b_{ji}, the number of out-migrants from province j to i; d_{ij}, the distance between province i and j, is equal to d_{ji} the distance between province j and i; α the constant; and β and γ the coefficients of the independent variables which will be estimated;

- For the second equation

a_{1ij} is the number of non-poor in-migrants from province i to j; a_{2ij}, the number of poor in-migrants from province i to j; b_{ji}, d_{ij} and d_{ji} remain the same as in the first equation; α' the constant; and β_1, β_2 and γ' the coefficients of the independent variables which will also be estimated.

The logarithm of the sum of in-migrants from other provinces to the province of destination j multiplied by the respective distances between provinces of origin and that of destination captures the magnitude of social isolation and loneliness of in-migrants of province j, which increase with the distance. The longer the distance the less likely it will be for migrants to often go back to their province of origin because of financial constraints. This means that the greater the social isolation and loneliness of an in-migrant, the greater the number of risky sexual encounters he or she may engage in. It should also be noted that this number of risky sexual encounters increases with an increase in the number of in-migrants coming from provinces that are far away from the province of destination. Thus, if we do not take into account the distance and suppose that the number of risky sexual encounters in which a_{ij} number of in-migrants engage in is x% of a_{ij}, i.e. [x%.(a_{ij})], then a proxy for the number of risky sexual encounters, taking into account the distance d_{ij}, may be [x%.(a_{ij})].d_{ij}. This is because the number of risky sexual encounters increases with the distance that separates the province of origin from that of destination, as the social isolation and loneliness increase with this distance. It follows that a proxy number of in-migrants

coming from province i who engage in [x%.($a_{ij}.d_{ij}$)] risky sexual encounters in province j may be ($a_{ij}.d_{ij}$). This is so because multiplying the distance between the province of origin and destination by the number of in-migrants coming from the province of origin magnifies the number of risky sexual encounters or behaviors.

In other words, this variable captures the impact of risky sexual behavior of in-migrants on HIV/AIDS prevalence and may be considered as a proxy for the magnitude of risky sexual behavior of in-migrants induced by the distances between other provinces and the province of destination. Even if the culture of migration has been changing since 1994 because migrants need not return home seasonally as in the past, as long as migrants are geographically separated from their partners or wives, ($a_{ij}.d_{ij}$) remains a proxy for the magnitude of risky sexual behavior of in-migrants induced by the distances between other provinces and the province of destination. Thus, sexual behavior is introduced in the model through the distances between provinces.

Similarly, the logarithm of the sum of the number of non-poor in-migrants, that of poor migrants and that of out-migrants multiplied by the respective distances between provinces of origin and the province of destination may be considered as proxies for the magnitude of the risky sexual behavior of these migrants, respectively.

Our study is only concerned with the interprovincial migration of South Africans. The aim of the models is to determine whether there is a relationship between interprovincial migration of South Africans and the spread of HIV/AIDS. A statistical test will confirm whether our proxies or independent variables are relevant.

The coefficients β, γ, β_1, β_2 and γ' represent the elasticities or the responsiveness of HIV/AIDS prevalence to a 1% change in the respective independent variables. As we have 9 provinces and 3 independent variables in the second model, the degree of freedom is 6. In other words, unless the model explains at least 55% of the variance it will not be statistically significant. This means that the independent variables we have chosen as proxies for the magnitude of risky sexual behavior will not be relevant if the model does not explain at least 55% of the variance.

Empirical study: The study was conducted in South Africa and started in 2003. In this study, we state four hypotheses which will be tested, present the data and report the results.

Hypotheses: The 4 hypotheses are as follows:

- It is expected that an increase in the magnitude of risky sexual behavior of in-migrants will result in an increase in HIV/AIDS prevalence of provinces of destination. This means that the coefficient (β) is expected to be positive.
- It is expected that an increase in the magnitude of risky sexual behavior of non-poor in-migrants will result in a decrease in HIV/AIDS prevalence of provinces of destination. This means that the coefficient (β_1) is expected to be negative.
- It is expected that an increase in the magnitude of risky sexual behavior of poor in-migrants will lead to an increase in HIV/AIDS prevalence of provinces of destination. That is, the coefficient (β_2) is expected to be positive.
- It is expected that an increase in the magnitude of risky sexual behavior of out-migrants will lead to an increase in HIV/AIDS prevalence of provinces. In other words, the coefficients (γ and γ') are expected to be positive.

Data: The HIV/AIDS prevalence rates for the nine provinces in South Africa were obtained from the Department of Health's Demographic and Health Survey (1998). The data were used with the population figures of the Department of Social Development (2000) to determine HIV/AIDS prevalence in the nine provinces. Although the HIV/AIDS data of the Department of Health have been extrapolated to have a national data set, they exhibit a trend which is good enough to justify their use in our study. The number of in- and out-migrants of the nine provinces were obtained from the 1996 census data (Statistics South Africa, 1998).

The distance from one province to another, which is called "distance between centroids of provinces" in cartography and the Geographical Information System (GIS), was obtained from the GIS mapping of South Africa and expressed in kilometer. A centroid is the center of mass of an object of uniform density, especially of a geometric figure. Although the migrant population could be spread throughout a province or located in specific areas in a province, we concentrated this population in the center of the province to carry out the study. The same technique is used in physics when one concentrates the mass of a solid at its center of gravity even though the mass is spread throughout the solid.

Of course the distance between provinces would be better expressed if the calculation of the centroid depended on the distribution of the population. However, given that the geographical centroid of most of the provinces are not much different from the centroid of the population distribution, except that of the Western Cape, this difference has little impact on the study.

Furthermore, there is no reliable data on the centroids of population distribution because the South African population has been moving very much within provinces and from provinces to provinces since 1994.

The number of internal in-migrants who are poor was obtained from the 1996 census data (Statistics South Africa, 1998). In the South African context in which the majority of the population is poor, we use as a cut off point the number of internal in-migrants who have an income of less than R1 000 per month because it corresponds to a pension most poor people get.

It should be noted that it is not 0 or 1 that was used in the computer as the representatives of the categories below or above R1 000, but the number of people who have less than R1 000. Therefore, a conclusion can be drawn on the role of poor in-migrants.

RESULTS

Estimates of the coefficients of the independent variables of Eq. (I), (II) and (III) after correcting for serial correlation, are in Table 1. In Eq.III, the dependent variable is the logarithm of HIV/AIDS prevalence of provinces. While the independent variables are respectively the logarithm of the number of non-poor and poor in-migrants of provinces and that of out-migrants of provinces.

All the coefficients of the independent variables of Eq. (I) have the expected positive sign and are statistically significant. Similarly, all the coefficients of the independent variables of Eq. (II) have also the expected sign and are statistically significant.

To verify whether the distance between the province of origin and that of destination induces risky sexual behavior among the bulk of internal migrants, an OLS regression of Eq. (III) was run in order to determine if the coefficients of its independent variables, which do not include the distance between the provinces of origin and destination, are statistically significant.

However, only the coefficient of the third variable, namely the logarithm of the number of out-migrants, is statistically significant at 5% level of significance; whereas the two other coefficients are not statistically significant.

The important findings and features are that this result indicates that Eq. (II) is a better specification than Eq. (III) because, in contrast to Eq. (III), the coefficients of all its independent variables, which include the distance between the province of origin and that of destination, are statistically significant. This confirms that the distance between the provinces of origin and destination induces risky sexual behavior among the bulk of internal migrants which in turn results in an increase in HIV/AIDS prevalence. Additionally, the magnitude of risky sexual behavior of out-migrants is highly significant for the 3 equations.

Table 1: Estimation of log linear HIV/AIDS prevalence models

	(I)	(II)		(III)
Constant	1.65	0.19	Constant	-1.17
magnitude of risky sexual behavior of in-migrants	0.36* (1.86)	------	------	------
Magnitude of Risky sexual behavior of non-Poor in-migrants	------	-0.25* (1.83)	ln (No. of non-poor in-migrants)	-0.02 (0.04)
Magnitude of risky sexual behavior of poor in-migrants	------	0.73** (2.70)	ln (No. of poor in-migrants)	0.29 (0.75)
Magnitude of risky sexual behavior of out-migrants	0.86** (4.65)	0.82** (5.15)	ln (No. of out-migrants)	1.18** (5.51)
Adjusted R^2	0.74	0.80	Adjusted R^2	0.86
DW	2.94[nc]	2.87[nc]	DW	2.47[nc]

Source of in- and out-migration data: Census 1996.[35] HIV/AIDS prevalence data: Demographic and Health Survey;[57] and population data: Department of Social Development.[58] N.B.: the t-statistics are in parentheses, (*) means statistically significant at 10%, (**) means statistically significant at 5%, (nc) means the Durbin Watson (DW) indicates no serial correlation, For simplicity, the sign "ln" is not put in front of the magnitude of risky sexual behavior of migrants in Table 1

Table 2: Responsiveness of HIV/AIDS prevalence to the magnitude of risky sexual behavior

Independent variables	(I)	(II)
Magnitude of risky sexual behavior of in-migrants	0.36	-----
Magnitude of risky sexual behavior of non-poor in-migrants	-----	-0.25
Magnitude of risky sexual behavior of poor in-migrants	-----	0.73
Magnitude of risky sexual behavior of out-migrants	0.86	0.82

Source: The responsiveness of HIV/AIDS prevalence to the magnitude of risky sexual behavior or the elasticities are the coefficients of the independent variables of models I and II in Table 1

The estimates of the responsiveness of HIV/AIDS prevalence to the magnitude of risky sexual behaviors of models I and II are depicted in Table 2.

In Eq. (I), a 1% increase in the magnitude of risky sexual behavior of in-migrants in provinces and that of out-migrants from provinces result, respectively in a 0.36% and a 0.86% increase in HIV/AIDS prevalence of provinces. In Eq. (II), a 1% increase in the magnitude of risky sexual behavior of non-poor in-migrants of provinces results in a 0.25% decrease in HIV/AIDS prevalence of provinces. Whereas a 1% increase in the magnitude of risky sexual behavior of poor in-migrants of provinces and that of out-migrants from provinces result respectively in a 0.73 and a 0.82% increase in HIV/AIDS prevalence of provinces.

The important findings and features in Table 2 are as follows:

An increase in the number of non-poor in-migrants of provinces contributes to a decrease in HIV/AIDS prevalence of provinces. Thus, in contrast to non-poor in-migrants, poor in-migrants contribute to an increase in HIV/AIDS prevalence of provinces. Furthermore, in Eq. (I) and (II) the level of responsiveness of the dependent variable to the change in each independent variable is slightly less than 1, indicating that HIV/AIDS prevalence in provinces is responsive to in- and out-migration, i.e. to internal migration. However, it is more responsive to out-migration than to in-migration. These results call for a discussion.

DISCUSSION

The discussion evolves around the following 5 issues.

First, as far as the responsiveness is concerned, the result that the spread of HIV/AIDS prevalence is more responsive to the quantitavive impact out-migration from a province than to that of in-migration into a province is intriguing. Out-migrants no longer reside in the province of origin nor often visit the province. They are therefore, likely to have less sexual encounters in that province. On the other hand, in-migrants reside in the province of destination and are therefore, likely to have more sexual encounters in that province. A possible explanation may be that, in contrast to in-migration, as we have seen, there are two sources of the spread of HIV/AIDS in out-migration.

Whereas in-migrants' risky sexual behavior may be confined in the environment of sex workers as they may have difficulties having casual sex with non-sex workers in their new province of residence. The reason is that they are unknown in this province and may not be able to have easy contact with sexual partners in that province. This is so, except when they live in a community in which the proportion of destitute women having casual sex in exchange for money is high.

In addition, it was found that coefficient β_1 is negative. The reason is that an increase in the magnitude of risky sexual behavior of non-poor in-migrants, holding constant the magnitude of risky sexual behavior of poor in-migrants and out-migrants, prevents HIV/AIDS prevalence from reaching the level it would have reached otherwise. It should be recalled that the analysis of an OLS regression is based on a ceteris paribus assumption. Here, this means that an increase in the risky sexual behavior of non-poor in-migrants holding the other independent variables constant results in a decrease in HIV/AIDS prevalence. It could be argued that this is due to a better HIV/AIDS awareness which enabled non-poor in-migrants to better protect themselves from HIV/AIDS infection. Moreover, their financial position would allow them to travel to the clinics to get condoms but also to buy them.

Furthermore, the influence of the magnitude of risky sexual behavior of poor in-migrants is so strong that this trend is imposed on the general population of in-migrants. This stems from the fact that the bulk of internal migrants are poor economic migrants. This is so because the sign of the coefficient of the magnitude of risky sexual behavior of poor in-migrants (model II) is the same as that of the general population (model I), i.e., positive; whereas that of non-poor in-migrants is negative (model II).

Second, the technique used in the study can be applied to study the spread of other sexually transmitted diseases.

Third, the difficulties for further investigation in the areas of urbanization and public health for instance rest on the availability of migration data at a city level.

Fourth, the fact the out-migrant variable is statistically significant in model III, is also supported by Lurie who found that migrant couples are more likely to be HIV discordant than non-migrant couples, meaning that one partner is infected and the other is not. He reported that in 30% of the time it was the woman, who was left behind, who was HIV-positive and not her migrant partner (Lurie, 2000, 2002; Lurie *et al*. 2003, 2006). Lurie *et al*. (2003) stated that migration (i.e., out-migration) is an independent risk factor for HIV infection. The out-migrant variable in which the distance is not used (model III) and that in which the distance is used (models I and II) are all statistically significant. Again, this may be due to the fact that destitute women who are left behind in the province of origin and their out-migrant partners contribute both to the spread of HIV/AIDS in the province of origin in the three models. As a result, even if the distance is not introduced in model III, the out-migrant variable remains statistically significant.

Fifth, the significant findings of the research is that the model with the distance was thus a better specification than the model without the distance factor. In other words, our proxy variables are relevant. As previously discussed, this is possibly due to the fact that the distance between the provinces of origin and destination is at the root of risky sexual behavior as it limits the possibility of frequent visits to one's partner in the province of origin due to financial and time constraints.

CONCLUSION

The high levels of responsiveness of HIV/AIDS to internal migration still remain a cause of concern. Therefore, in the light of the results, to reduce the spread of HIV/AIDS related to internal migration one needs:

- To identify products for which there is a great demand in each province and create economic poles for their production and sale in order to decrease the number of internal migrants from province to province so that the distances between provinces are no longer serious engines of the spread of HIV/AIDS;
- To implement sustainable economic development programs in rural communities in order to economically empower women and men so that the need to engage in migrant labor will be reduced;
- To renovate one-person hostels for migrant labor system's workers in order to transform them into houses or apartments for these workers and their partners or families so that migrants are no longer separated from their families with the distances between the provinces of origin and those of destination;
- To give preference, among married applicants of migrant labor system's workers, to the hiring of those who bring their wives or partners with them in order to avoid the separation of families with the distances between the provinces of origin and those of destination. This does not imply that unmarried applicants would be excluded from being hired;
- To implement effective HIV/AIDS intervention programs in communities in which out- migrants' women partners or wives are left behind in order to reduce the impact of the distances separating the provinces of origin and destination of their partners on their potential risky sexual behaviors.

These policy strategies compatible with the free movement of people within South Africa could assist in reducing the spread of HIV/AIDS related to internal migration of the country.

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