

## HIV Susceptibility Among Migrant Miners in Chokwe: A Case Study

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# **HIV susceptibility among migrant miners in Chokwe:**

## **A case study**

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## Biographic sketch

**Emilia Martins-Fonteyn** is enrolled in a PhD program in Sociology through the University of Antwerp, has received a Masters in Evaluation and Management of Development Policies, in Institute of Development Policy (IOB), University of Antwerp, and a Masters in Rural Development in University Eduardo Mondlane. Also she has more than ten years of research experience in Mozambique, with a particular emphasis on HIV and AIDS. At the Ministry of Science and Technology, she oversees all operational research conducted under the Multi-sectorial National Strategic Plan to Fight HIV/AIDS (PEN III).

**Oswaldo Loquiha** is PhD candidate in Biostatistics from University of Hasselt, with research mainly focused on statistical methodology for Epidemiology and Public Health with emphasis on HIV/AIDS. He has a master in Biostatistics from University of Hasselt and holds a lecturer position at Universidade Eduardo Mondlane since 2008, with interest in courses such as Operational Research, Regression Analysis and Multivariate Statistic.

**Edwin Wouters** is assistant professor in Medical Sociology at the Faculty of Political and Social Sciences of the University of Antwerp (Belgium). His research mainly focuses on the social aspects of health and illness. More specifically, he has published on HIV/AIDS, mental health, tuberculosis, health systems and health policy in the developed world as well as in countries in development (South Africa, India, Ethiopia, etc.).

**Ines Raimundo** is in charge of the Post-Graduate studies as the Deputy-Dean at the Faculty of Arts and Social Sciences of Eduardo Mondlane University (UEM). She holds a PhD in Forced Migration and a Master in Human Geography from the University of Witwatersrand, Johannesburg, South Africa. She has experience with qualitative data analysis as well as some skills on quantitative analysis. In the past 19 years at UEM, she has been involved in projects on population mobility, sexual reproductive health, poverty, HIV/AIDS, urbanization and food security. Recently she used census data to analyse migration trends and orphanage. Furthermore, her research includes an analysis of the socio-economic and cultural factors leading to miners' vulnerability to HIV infection. She has worked as co-researcher with several institutions across Southern Africa such as SAMP (Southern African Migration project), AFSUN (African Food Security Urban Network). Under SAMP, she coordinated the Women Cross Border Traders and HIV/Risk study. She was co-coordinator of the project Men's Migration and Women's HIV/AIDS Risks in Mozambique (NIH/NICHD 1R21HD048257-01A1) with Arizona State University and the former Centre for Population Studies of UEM.

**Niel Hens** is associate professor and Holder of the Scientific Chair in Evidence-based Vaccinology at the University of Antwerp and assistant professor at Hasselt University (CENSTAT). After completing his Ph.D. entitled 'Non- and Semi-parametric Techniques for Handling Missing Data' in 2005, Niel Hens developed interest in modelling infectious diseases. He has participated in an EU FP6 project called POLYMOD on collecting social contact data relevant for the spread of infectious diseases in Europe. Using social contact data and serological data he has led the development of statistical methodology to estimate important infectious disease parameters. This has led to the publication of a monograph (Hens et al. Modelling Infectious Disease Parameters Based on Serological and Social

Contact Data, Springer-Verlag, New York, 2012). More recently, his main interest has been to exploit multivariate serological data to estimate infectious disease parameters, which includes estimating within-host mechanisms of passive and vaccine-acquired antibodies, estimating risks of the re-emergence of measles and mumps in Europe, estimating incidence from serial seroprevalence, identifying determinants of antibiotic use.

He is currently (co-)supervising over 10 Ph.D. students working on a variety of topics in infectious diseases including HIV, influenza, malaria, vaccine-preventable diseases etc. It is his goal is to develop statistical methods that can be readily applied by epidemiologists and people working in public health.

**Marc Aerts** is professor of biostatistics, director of the Center for Statistics at Hasselt University and co-director of the Interuniversity Institute for Biostatistics and statistical Bioinformatics (Hasselt University & KU Leuven) in Belgium. He published methodological work on mathematical and statistical models relevant for epidemiology and public health, infectious diseases, microbial risk assessment and food safety, dose response modelling, toxicological and teratology experiments, non and semi-parametric methods in estimation, bootstrap inference, missing data, model selection and goodness-of-fit. He serves as Associate Editor for Biometrics and Statistical Modelling. He is chairman of the Master of Statistics program, and teaches courses on modelling infectious diseases, advanced regression, computer intensive methods, data mining, categorical data modelling, and microbial risk assessment. He is co-author of the recently published textbook Hens, N., Ziv, S., Aerts, M., Faes, C., Van Damme, P., and Beutels, P. (2012). *Modelling Infectious Disease Parameters Based on Serological and Social Contact Data*. Springer, New York.

**Herman Meulemans** studied at the University of Antwerp, Belgium, where he obtained his bachelor in sociology, bachelor in economics, master of arts and PhD in sociology. He was research associate at Boston University and received the GLAXO Award for Science Journalism. Now he is professor in quantitative research methods and medical sociology at the Faculty of Social and Political Sciences, chair of the Master Programme in Social Work, University of Antwerp, and research associate at the CHSR&D, University of the Free State, South Africa. He is author and co-author of more than two hundred journal articles, research reports and books on social policy, social engineering, services in the social/health sectors, professions, organizations and global health. He has been chair of the department of sociology, vice-dean of the faculty of social and political sciences, chair of the educational commission and of the VLIR-visitation commission socio-medical sciences and gerontology. He is member of the board of several non-profit organizations.

**Abstract**

This article examines the association between risky sexual behaviour and HIV risk perception among miners. A cross-sectional survey (N=293) was conducted with miners who worked in South African mines and lived in the Chokwe district of Gaza province in southern Mozambique. The paper used ordinary logistic and cumulative logistic models to understand what drives miners to HIV susceptibility.

The study revealed most miners were at risk of HIV infection given their risky sexual behaviour. However, there was a strong negative association between risky sexual behaviour and HIV risk perception. Seventy per cent of the miners practicing risky sexual behaviour reported low HIV risk perception. This demonstrates miners tend to underestimate their HIV risk which in turn, makes them more susceptible to contracting HIV.

Risk perception among miners is related to a range of factors both individual as well as environmental. Informed risk awareness is essential for these men to adopt preventive measures against HIV/AIDS. Therefore, it is important to consider cultural beliefs, as they influence the understanding of HIV risk perception.

## Introduction

In Mozambique, HIV is spreading fastest in the southern region, where the number of migrant workers is highest. For instance, Gaza province has the country's highest prevalence of HIV, with more than twice the national average of 12% (1). In 2008, the estimated demographic impact of AIDS upon Mozambique was approximately 440 new infections per day. At that time, an estimated 1, 6 million people lived with the HIV virus and over a quarter of new HIV infections in Mozambique were attributed to the Most-At-Risk-Population (MARPs) (2).

Although information is scarce concerning MARPs, study results concerning miners' health, conducted in the south of Mozambique, confirmed high HIV prevalence among them (3). It revealed 22% of the miners who participated in the study are HIV positive and 79% of these did not know their health status. Generally, the level of risky sexual behaviour was very high among miners. In addition, the study revealed multiple sexual partnerships was the norm. Sexually transmitted infections (STIs) are extremely high among Mozambican miners and use of condoms is very low.

According to the National Strategic Plan to combat HIV/AIDS (PEN III), miners are one of the groups most susceptible to HIV/AIDS due to their risky sexual behaviour (2). Risky sexual behaviour is considered the main driver of the HIV/AIDS epidemic (4).

The literature shows migrant labours are more likely to engage in risky sexual behaviour than non-migrants, see e.g. Saggurti et al. (5). It also reveals risky sexual behaviour among miners can be attributed to their infrequent returns home – which is imposed by the migratory system. Therefore, being parted from their partners over extended periods, migrant miners often turn to casual affairs and/or intercourse with sex workers.

Undoubtedly, such activity makes them more susceptible to HIV/AIDS (6; 7; 8; 9). Campbell, (10) also asserts the social construction of masculinity, gender norms and cultural

beliefs, in African societies as one of the factors driving miners to risky sexual behaviour, which in turn, makes them susceptible to HIV infection.

In Mozambique, the main strategy to combat HIV/AIDS is AIDS risk reduction, centred in the following individual behavioural approaches: reduction of multiple sexual partners, increased consistent use of condoms and treatment of STIs. This assumption has been applied based upon the recognition that one's perception of being at risk is the first step to change sexual behaviour.

However, it seems the link between risky sexual behaviour and risk perception is more complex, not well understood and can work both ways. Individuals may perceive their risk of acquiring HIV/AIDS to be high or low depending on their previous sexual behaviour or that of their partners. In this case, risky sexual behaviour is the influencing factor governing the perception of risk. On the other hand, a person's perception of risk may be passive and not necessarily based on his or her previous sexual behaviour (11).

Literature shows high-risk perception might lead to a modification of sexual behaviour – for example “refusal to have sexual intercourse with a partner” (11, p.388). Other authors such as Collision et al.(6) revealed that in general, people who have practised high-risk sexual behaviour have low to no personal HIV risk perception. Interestingly, low HIV risk perception is only slightly more often reported by migrants than by non-migrants. Therefore, research to better understand factors influencing both risky sexual behaviour and cognitive factors, such as HIV risk perception, among miners, remains limited.

Furthermore, despite the logic of the assumptions of such behavioural models, it is important to understand additional factors influencing rational decision-making regarding risky sexual behaviour such as individual and environmental factors. Tenkorang et al. (12) emphasises that models of health behaviour have limited relevance when they focus only upon cognitive and interpersonal influences. In the context of “real life”, individual cognitive factors –

awareness, perception, reasoning, and judgment – are shaped by culture, tradition and socio-economic environment.

The paper presented here seeks to understand the latency of HIV susceptibility among miners. Specifically, this work will examine the association between risky sexual behaviour and risk perception of HIV infection. Secondly, these factors will be related to socio-demographic, psychosocial and job-related factors to help explain miners' susceptibility to HIV/AIDS.

## **Methodology**

### *Description and data*

A cross-sectional study was performed in Chokwe, a district of the Gaza Province in the south of Mozambique. It focused on risky sexual behaviour and HIV risk perception of Mozambican miners. Other factors also considered were working and living conditions as well as knowledge regarding HIV/AIDS or knowing someone who lives with or died because of HIV/AIDS as well as the cultural environment.

Chokwe was chosen as a study area because of its numerous migratory workers as well as high levels of HIV/AIDS. The 2012 Chokwe district level report shows Chokwe itself has a 42% infection rate (13). However, in some administrative posts such as Macarretane, the level jumps to 53%. Fieldwork took place during a three-week period between December 2012 and January 2013. It was conducted at that time because many miners had returned to Mozambique to be with their families over the Christmas holiday.

The survey included demographic variables, scales and indices measuring work and living conditions at the mines. Topics included income, gender violence, alcohol consumption, risk-related leisure-time activities and culturally specific indicators related to risky sexual behaviour. Participants were also queried on sexual outcome measures such as their knowledge about HIV. Data was also collected regarding their age at the time of their first



sexual contact, types and number of sexual partners they've ever had, as well as HIV testing and male circumcision. Participants were also asked to list all sexual contacts in the previous 12 months.

#### *Sample size*

The sample was calculated assuming 5% of the miners would have the desired characteristics. Data gathered included the number of Mozambican workers in service in South African mines, contracted by the Employment Bureau for Africa, TEBA segregated by origin. In 2012, the number of miners contracted by TEBA in the Chokwe (Limpopo) region was 1,719. From this figure, we estimated the need for a sample of 315.

In order to compensate for questionnaires lost due to errors and other eligibility deviations, the sample size was augmented by 15%, yielding a total of 362 miners to be interviewed.

From the initial sample of 362, only 293 miners were located because in many households, the miners were not at home. Some miners had not returned to Mozambique while others were at the TEBA office in Xai-Xai looking to be paid the balance of their wages. Some were home but drunk and in no condition to participate in the study.

From those 293 miners, about 4% of the respondents declared they were HIV+ and were therefore disqualified, since technically, they were no longer susceptible of contracting HIV. So, after removal of HIV+ miners and cases with missing values, there remained in total 233 miners with complete values for risky sexual behaviour and perceived risk of HIV included in our analysis.

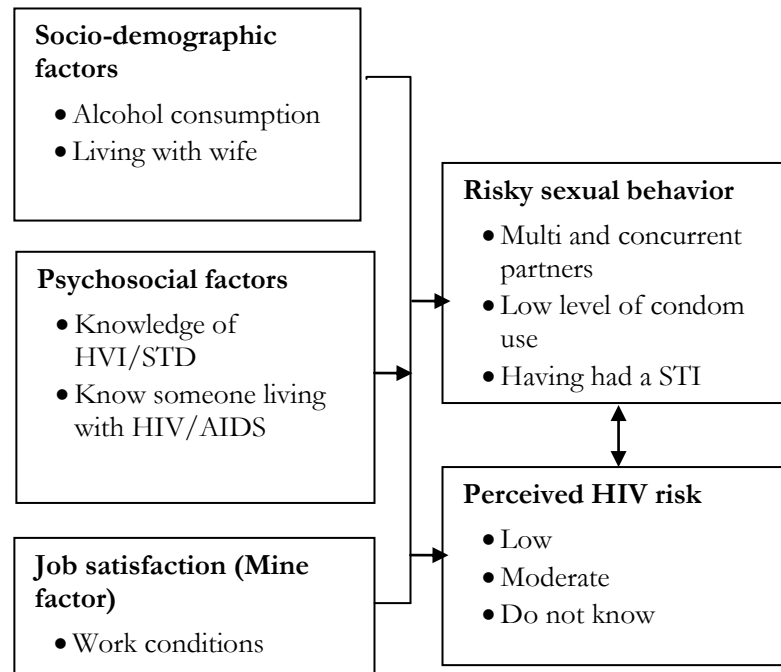
#### *Sample selection*

It was not possible to select the sample randomly, with the ideal statistical profile, e.g. a list of miners' households, but rather a convenience sample. Therefore, a calculation of the proportion of men in each area was used to determine how many miners should participate in the study by area.

The main strategy for selecting candidates was to determine the number of miners by area and then contact the communitarian leaders of each area to show where the miners lived. All available miners were selected to participate in the study.

### *Data Analysis and Measures*

#### *Conceptual Framework*



The conceptual framework proposes to investigate two outcome variables: risky sexual behaviour and the perception of risk regarding HIV infection.

Risky sexual behaviour can be viewed in the context of the number and types of sexual partners as well as sexual orientation (11). In this case, risky sexual behaviour is a binary variable derived from information on whether the respondents had recently engaged in risky sexual behaviour. Risky sexual behaviour included: reporting multiple sexual partners, little or no condom use during previous sexual encounters with permanent or/and casual sexual partners, and ever having had an STI, which is a co-factor for HIV infection.

This definition is in line with other studies on the same topic, such as Institute National of Health (1). The rationale behind “having/had any STI” is not only because it is a co-factor,

but also because it shows the history of individual sexual behaviour, for instance if someone reported an STI, it means he had sometime not used condom, which is considered risky sexual behaviour.

Typically, the history of individual sexual behaviour is largely used in countries with a generalized HIV/AIDS epidemic, little condom use and high levels of multi and concurrent sexual partners. Mozambique is such a country. Therefore, if a respondent reported any of the above risky behaviours, the variable for risky sexual behaviour was coded as 1, otherwise, it was coded as 0.

The second variable, the perceived risk of contracting HIV, was defined for this paper as individuals' subjective perceptions of their own likelihood of contracting the HIV-virus (14). This variable showed a strong negative association with risky sexual behaviour. It was set up on a 6-point scale variable in which miners were asked to grade their own risk of contracting HIV. The levels were as follows: not knowing the risk, no risk, low risk, moderate risk, high risk or whether they were HIV positive.

HIV status was one of categories included in the measurement of risk perception, we did not test our respondents, because we did not have permission from the Mozambican Health authorities and because our main goal was to measure HIV susceptibility among Mozambican miners, defined here as the association between risky sexual behaviour and risk perception. So the HIV test could be a complement to the present analysis, but it was not crucial to it.

For this reason, as we mentioned above, only 4% (around 12 respondents) answered that they were HIV+ and were therefore disqualified, since technically, they were no longer susceptible of contracting HIV. Maybe we could argue that they are still at risk to new HIV infections (re-infections), but that was not the scope of the present study, and we did not have elements to make such kind of analysis. We could also use this sample to analyse their risky sexual behaviour but the sample was too small for any kind of statistical tests. Apart from that, this

group is not included in any of the abovementioned categories of “risk perception”, so we could also not evaluate their risk perception regarding HIV.

Furthermore, only 0.3% of the respondents perceived their risk of contracting HIV as high, so this group was combined with the moderate risk group. We also combined the “no” and “low” risk groups, to create a 3 level category outcome variable called perceived risk of HIV infection: “do not know the risk”, “low risk” and “moderate risk”.

This study also shows the possible association between the two outcome variables and a range of factors or covariates: alcohol consumption, whether the miner is living with spouses in Mozambique or South Africa, knowledge of HIV/STI, knowledge of people living with HIV/AIDS and working conditions. The factor knowledge of HIV and STI is an index variable derived from a series of 30 questions on beliefs about the transmission and prevention of HIV and STIs. If a respondent only correctly answered 9 questions, he is considered as having low knowledge of HIV and STI. A score of 10-19 is deemed moderate while more than 20 correct answers being considered as having high knowledge.

#### *Statistical methods*

For this study, we used the Pearson Chi-square test as well as ordinary logistic and cumulative logistic regression models to understand the susceptibility of miners to HIV infection.

While the Pearson Chi-square test is used to test for independence between two categorical variables, the (multiple) logistic model is a common choice for the analysis of the dependence of a binary outcome on a set of explanatory variables. The advantage of this model is that it allows for direct estimation of the odds ratio and association measures relevant for retrospective or cross-sectional studies.

In the baseline logistic model, a set of  $m-1$  ordinary logistic models is defined comparing the odds of a specific category to a pre-defined reference category,  $m$  being the number of

categories/levels in the outcome variable. Here, we used 'moderate risk' as the reference category.

Ordinary logistic models are the most commonly used techniques to analyze binary categorical outcomes. However, they are not appropriate for ordinal outcomes since they ignore the natural order of the categories or levels of the variable, hence resulting in a considerable loss of statistical power.

Since one can view the study outcome (perception of risk of HIV infection) as a semi-ordered categorical variable because of the "do not know" category, a multinomial logistic model such as the baseline logistic regression with "moderate risk" as reference category was used, with the advantage of allowing for a simple odds ratio interpretation. Inference was based on 95% confidence intervals for odds ratio and p-values to test the significance of the effects.

## **Results**

### *Profile of active miners in Chokwe*

From the 293 active Mozambican miners who were interviewed, 74% of them live in Chokwe and 25% in the administrative post of Macarretane.

The mean age was 42 ( $\pm 8.8$ ) years old. As to marital status, 66% lived with a partner but were not legally married; 32% were married and only 2% were single. In terms of the number of wives, 75% had one wife while 23% declared two or more wives. 80% of the miners lived with their wives in Mozambique. 9% revealed they had a wife in both Mozambique and South Africa. And finally, only 6% lived with their wives in South Africa.

In terms of education, 11% did not go to school, 78% of miners had completed primary and secondary school, while 11% had pre-university or other levels.

The majority of miners, 59%, worked in the gold mines in South Africa and approximately 38% in other kinds of mines such as platinum and coalmines. 75% of the miners from the Chokwe district worked in the deep of the mines whereas 25% worked on the surface.

Some 36% of the miners earned less than 710<sup>i</sup> Euros monthly, after discounts. The majority earned the equivalent of 710 to 1,292 Euros. Only 9% earned more than 1,292 Euros.

In Mozambique, almost all miners had their own house. However, in South Africa, 53% lived in rented houses/rooms outside of mine property. 21% lived in single rooms in mine site compounds. The majority of miners, 44%, had private bedrooms. 32% shared their accommodation with two or more people and 22% shared with only one person.

**“Table 1 about here”**

*Miners’ high sexual risk behaviour*

Miners in Chokwe presented a high level of risky sexual behaviour. They reported high levels of multi sexual partnerships, low levels of condom use and high levels of STIs.

Roughly 33% of the respondents said they had 2-4 sexual partners in their life. 19% said they had 5-9 sexual partners and 15% reported 10 or more sexual partners. 28% reported they did not remember how many sexual partners they’d had in their entire lives.

Participants were asked how many sexual partners they had had in the last 12 months. 38% reported 2-4 sexual partners, 3% from 5-9 and 12% reported 10 or more sexual partners in the year preceding the study. In addition, 44% reported to have had 2 or more sexual partners at the same time during the 12 months preceding the study (Table 1).

They also were asked if they had engaged in sex outside of their marriage in the previous 12 months. 35% responded in the affirmative and of those, 70% said they had had sex with their girlfriend or occasional sexual partner. And finally, 12% revealed they had sex with sex workers in the previous 12 months.

The data shows 37% of the miners reported having at least one STI in their life. Even though 22% of the respondents reported they often used condoms, consistent condom use was only reported by 9%. And, 46% of the miners surveyed never used condoms (Table 1).

It is important to highlight that miners do not use condoms consistently even with a non-regular sexual partner. 33% said they use condoms but not consistently. Condom use ranged from often, to sometimes, to seldom. Almost one out of four respondents (24%) reported they never used condoms with non-regular sexual partners.

Reasons for not using condoms with a non-regular sexual partner were varied. “I trust her”; was cited by 41% of the respondents. 19% said condoms “reduces sexual pleasure”. And, 18% said “I did not have a condom [at the time]”. However, nearly all respondents reported they did not have any problems getting condoms in Mozambique or South Africa.

#### *Risky sexual behaviour and perceived risk of HIV*

We start this section looking to the association between risky sexual behaviour and perceived risk of HIV infection. After removal of HIV+ miners and cases with missing values, there were in total, 233 miners with complete values for risky sexual behaviour and perceived risk of HIV.

Of the 233 surveyed, about 80% revealed they had been involved in risky sexual behaviour. However at the same time, the majority (70%) believed there was low risk of contracting HIV (Figure 1). Clearly, this shows it is more likely for a miner practicing high risk behaviour to underestimate his risk of HIV (with respect to their sexual behaviour) which in turn, makes them more susceptible of contracting HIV. This is because there is no perceived reason for them to change their sexual behaviour.

#### **“Figure 1 about here”**

In fact, the odds of reporting risky sexual behaviour opposed to non-risky sexual behaviour were almost 3 times higher for miners who perceived their risk of contracting HIV as low when compared to those who perceived it as a moderate risk (Table 2). When asked why they believed their risk of HIV was low, 30% said they were faithful to their partner. 27% believed

they and their partner were HIV negative. Conversely, those who perceived a moderate risk said so because they had undergone a blood transfusion (38%) or shared needles (14%).

From these results, it is clear a strong association exists between risky sexual behaviour and perceived risk of contracting HIV.

**“Table 2 about here”**

On one hand, there is a tendency for miners to underestimate their risk of contracting HIV when compared to their sexual behaviour. However, the data failed to find any other factor which could be related to this risky sexual behaviour.

This might have been because low risk perception is intrinsic of people/miners with risky sexual behaviour, or can be the other alternative. People with low risk perception have a tendency of practicing high-risk sexual behaviour. Therefore, questions on susceptibility of HIV infection should not be made based only upon the scale of risky sexual behaviour, but also on the perception of that risk.

Because of this result, in order to look more closely at this association, we analysed the sub sample of miners with risky sexual behaviour as having a dependent variable of their risk perception of HIV infection. Table 3 shows the distribution of perceived risk for HIV infection among miners practising risky sexual behaviour across a set of explanatory variables.

We can clearly see some patterns in this table. For example, there seems the probability for low perception of HIV infection risk decreases with increased/frequent alcohol consumption. It also increases with knowledge of HIV/STIs or knowledge of people/relatives living with the disease. Furthermore, it is more likely for a miner working in the deep mines to not know his risk of HIV infection, rather than knowing their chances are low or moderate.

**“Table 3 about here”**



Results of the baseline logistic model, conditional upon the event of risky sexual behaviour, are shown in Table 4. There were differences in the estimates when comparing the *do not know* and *low* categories versus the *moderate risk* category. Compared to those who did not consume any alcohol, those who drank alcohol excessively, the odds of not knowing HIV infection risk versus moderate risk was doubled. The odds of low versus moderate risk perception were 47% lower for the same comparison.

Alcohol consumption was not a statistically significant effect for perceived risk of HIV infection. However these results indicated miners who reported risky sexual behaviour and high levels of alcohol consumptions were more likely to perceive some risk of HIV infection.

**“Table 4 about here”**

Furthermore, miners with spouses in Mozambique and South Africa were 98% more likely to not know their level of risk. However, the odds of perceiving it as low risk versus moderate risk of HIV infection were 55% lower, compared to those with spouses in only one of these countries. The latter result shows miners with spouses in both countries were more aware of their risk of HIV infection compared to those with spouses in only one of these countries.

Cognitive factors such as knowledge of HIV/STI and the number of people one personally knows who are living with AIDS, have significant effect upon the perceived risk of HIV infection. In fact, the odds of low opposed to moderate risk were roughly 2 times higher for miners with moderate to high knowledge of HIV/STI when compared to those with low knowledge. Moreover, risk knowledge is about 3 times higher for miners who know more than 5 persons living with HIV/AIDS. These results imply the more knowledge and contact with the disease the miner had, the more likely he would perceive his risk of HIV infection as low.

However, the odds of a no risk perception were as much as 17 to 60 times higher for miners with 10 to 20 years and 20 years or more of service, respectively, when compared to those

with less than 10 years. This trend is also observed for the odds of low risk perception for service time greater than 10 years – although the odds were lower. This is indicative that the longer people worked as miners, the higher the odds of perceiving their risk of HIV infection was low.

Regarding working conditions, miners labouring in underground mines were approximately 4 times more likely to not know their HIV risk level. Miners who had some awareness most often perceived themselves as being at low risk of HIV infection – opposed to moderate risk – than those working on the surface.

## **Discussion**

This work examined the association between risky sexual behaviour and perception of HIV infection. It found 80% of miners were engaged in high-risk sexual behaviour and highly involved in sexual networks, both in Mozambique and South Africa. Predominantly, they do not use protective measures and the level of STIs among them is very high. This course of action is exactly what we have defined as “risky sexual behaviour”.

However, measuring risky sexual behaviour has its limitations. We have defined risky sexual behaviour as having multiple and concurrent sexual partners. This also included: (i) the number of sexual partners the respondent had in the last 12 months; (ii) having had more than one sexual partner at the same time in the last 12 months; (iii) inconsistent or no use of condoms; (iv) contraction of STI's or exhibiting symptoms of STIs in the last 12 months.

Nevertheless, individuals reporting more than one sexual partner are not necessarily at risk of contracting HIV if they consistently use condoms. Conversely, someone who reports having only one sexual partner may still be at risk of contracting HIV if he does not consistently use condom and his partner is infected by HIV.

Multivariate analysis was applied in order to understand factors driving miners to risky sexual behaviour. Interestingly, only HIV risk perception was found to have a strong

association with risky sexual behaviour. 70% of miners practicing high-risk sexual behaviour reported no or a low HIV risk perception. 22% reported a “do not know” status, which was classified as not having any HIV risk perception. One query of this study was: “who do you think is at risk of contracting HIV?” The majority, of miners, 33%, answered “people who are not faithful for their partners”. And, 24% said “people who do not use condoms”. At the same time, miners do not consider themselves and their spouses as belonging to groups at higher risk of contracting HIV.

Notwithstanding, risk perception is not static it varies with circumstances and over time. Individuals may perceive different levels of HIV risk in different stages of their life, or depending of the type of sexual partners (11). Also, the statistical model used in this study failed to incorporate the natural ordering within risk perception of HIV infection, hence reducing the power for the statistical tests.

It is also important to stress that in this study, the definition of risk perception is based on a self-evaluation of the HIV risk of the miners, and so many factors can influence the answers. For low risk perception may be due to the “knowledge” of the HIV status of their sexual partners, or miners might report their risk perception as low because it is “politically correct” to tell people that they are “good boys” so they are not at risk.

Similarly, Bandura (15) demonstrates that most people in steady relationships see little need for protective measures because they believe in their partners’ monogamy and negative serostatus. But he also states that youth often go through a series of relationships resulting in exposure to multiple partners, usually of unknown serostatus. That seems to be the case of our miners’ sample.

Although our study did not find the exact nature of the relation between risky sexual behaviour and risk perception, it shows that in the group of miners with high risk sexual

behaviour, the majority perceives their risk as low. It seems that miners dissociate themselves from the type of people who are at risk of contracting HIV. Among miners, there is a sense of *not belonging* to a high risk group while they actually *are* a high risk group – and this is the main cause of their susceptibility to HIV.

The same finding is supported by Anderson et al. (16); Ndola et al. (17); Puri & Cleland (18). All highlight that usually people who are engaged in high-risk sexual behaviour perceive themselves as at low risk of contracting HIV. A personal dissociation from the type of people susceptible to HIV, as well as self-assessment based on previous behaviour not resulting in HIV/AIDS are the main justifications for this inverse relationship between risky sexual behaviour and HIV risk perception (12).

Furthermore, in the case of a generalized HIV epidemic, risk perception is related to a sense of controllability, where less risk is perceived in situations that are under personal control (19). And in this case, in the village where more than 50% of the population are HIV infected, it seems that there is little or no individual control to avoid HIV infection.

Our study also indicate the primary reason for miners to engage in high-risk sexual behaviour and yet perceive themselves at low risk was “faithfulness”. For example, 41% of the miners who reported to not use condoms, and 30% who perceived their risk as low believed in the faithfulness of their sexual partners. Even married miners who reported having occasional casual sexual partners used this reason to not use a condom.

It seems excessive confidence is one of the main causes of low HIV risk perception among miners. Perhaps because of social norms in the southern Mozambique, they assume both their sexual partners are trustworthy. Faithfulness is expected in marriage or in co-habitation relationships – especially for women. Therefore, these migrant men feel confident there is no need to use a condom. They perceive themselves to be at no risk at all.

However, a study conducted in Maputo and Gaza indicates where large numbers of men migrate, women are susceptible to HIV because of their poor financial situation. In the absence of their husbands, wives can and do exchange sex for money or other goods in order to survive (18). This, of course, makes them and their husbands susceptible to HIV infection.

A similar finding was revealed by Puri & Cleland (17). Young migrants in Nepal, engaging in high-risk behaviour show a tendency to underestimate their risk regarding HIV/STIs. This is because they trust their sexual partners having the mistaken belief village girls cannot be infected. This, in turn makes them believe they are safe/not at risk of contracting diseases.

The same authors stressed that widespread misinformation is one reason why people have low risk perceptions while they engage in high-risk sexual behaviour. Perhaps further studies are needed in order to better understand the concept of “faithfulness” among miners. This seems to be a crucial element in their belief system which allows them to engage in sexual intercourse without proper HIV protection.

Gender norms, as well as cultural beliefs offer an explanation for why Mozambican miners who engage with multiple sexual partners also have unwarranted belief in the reliability of their sexual partners – both at home and when they are away working.

In southern Mozambique, having multiple sexual partners is socially accepted for men but condemned for women. Men who engage in multiple sexual partnerships are considered manly and this is generally associated with uncontrollable desire. Conversely, women who have many sexual partners get a bad reputation. It is important to highlight that in Mozambique, the cultural concept of masculinity places men in a dominant position and is perpetuated by both men and women.

In this context, women are placed in a subordinate, passive position and are expected to always please their sexual partners (20). However, an alternative explanation comes from a study of Bernardi (21), which indicates men are in the position of power to impose sexual and

behavioural changes. However, the high cost of admitting their current conduct is unsafe can/will produce denial of the risk itself, rather than institute behavioural change.

Moreover, some cultural practices in southern Mozambique, such as polygamy and levirate marriage, where the dead man's widow is remarried to one of his male relatives, seems also to override concerns about HIV infections. Akwara et al. (11) also shows the socio-cultural environment influences people's perception through the internalisation of specific sexual beliefs, norms and practices.

As well, our analysis reveals that low HIV risk perception among miners with risky sexual behaviour is related to a range of factors at the socio-demographic, cognitive and working conditions levels.

For instance, results of this study imply knowledge is one of many variables influencing HIV risk perception. The literature shows there is no clear link between knowledge and risk perception, e.g. Akwara et al. (11). Our study indicates the more knowledge of and contact with people living with AIDS, the miner has, the more likely he would perceive his risk of HIV infection as low. Consequently, this means miners who have high HIV/STI knowledge or know someone who has AIDS, does not necessary imply they are, in point of fact, aware of their own HIV risk.

Bernardi (21) substantiates that applying correct information regarding HIV/STIs does not necessary eliminate the possibility of holding false beliefs. It simply means that correct and incorrect information consistently overlap. Individuals get and interpret new information in the light of their previous local level and social constructed conceptions, attitudes and ideas.

Our analysis also reveals miners who work in deep underground mines are more likely to underestimate their risk of HIV, than miners who work on the surface. Perhaps dangerous working conditions can be offered as a possible explanation. For instance, Campbell, (10) points out working conditions in the deep mines are dangerous and highly stressful. Miners

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working underground report limited access to food and water during their day. They endure tremendous heat and poor air quality, very noisy machinery as well as the fear of fatal accidents.

So why should miners worry about HIV infection if they face greater risks in their daily work activities? Campbell (10) argues this sense of helplessness is an important feature in which a miner's sexual identity is negotiated. Self-efficacy – the degree to which a person feels he/she controls their life – is also an important determinant of health-related behaviour.

### **Limitations of the study**

This study has highlighted risk perception of miners engaging in high-risk sexual behaviour, as well as the association between socio-demographic, cognitive and job-related variables with HIV.

One challenge of the present study was the sampling process. According to the information gathered by TEBA (The Employment Bureau for Africa) in 2012, there were 34,727 migrant miners from the whole of Mozambique. This is the cumulative number of miners who worked in South Africa in 2012.

However there was no information regarding provincial or local levels. Therefore, we did not obtain information of how many of the 34,727 miners belong to Gaza Province or Chokwe district. A viable means to get desegregate information regarding the number of miners by area was through the central office of TEBA in South Africa. However, South Africa is outside the jurisdiction of the study.

Another way to gather such data would be to sift through the individual codes of the miners, which contain their personal information such as place of origin. Unfortunately, this alternative would have been impractical since the only way to obtain these individual codes would have been through those 34,727 individual miners themselves, because only they have access to their personal codes.

Although TEBA in Mozambique does not have the cumulative information in a desegregate way, they have information regarding the number of miners contracted in the current year segregated by origin, in this case, 2012. For this reason, the calculation of the sample was based upon Mozambican workers contracted by TEBA in 2012, segregated by origin. The number of miners contracted by TEBA in the Chokwe (Limpopo) region was 1,719. From that figure, we estimated the need for a sample of 362 miners.

Even though we managed to reach out to approximately 300 miners, the sample was not randomly selected but rather a convenience sample. Therefore, this may in fact not constitute a representative sample of the population and may introduce a selection bias to our result, thus affecting the inferences from such data. Although it may not allow generalising our findings, it can provide a springboard for further research and allow links to be forged with existing findings in the area.

This study also failed to differentiate cause or effect conclusions from the associations observed. This is because of the cross-sectional nature of the data. For instance, high HIV risk perception could lead individuals to either safe sex or fatalism and still not change their high risk sexual behaviour even though these individuals perceive their risk level as high (11).

Moreover, the evaluation of risk perception was based on the self-evaluations of the miners, which is a subjective assessment of the probability of a specified type of accident happening and how concerned people are with the consequences (19). Hence, the context in which the survey was held (Chokwe is a small and rural village, where the majority of people knows each other; and the recruitment of the sample was done in collaboration with TEBA, the institution responsible for the miners recruitment of Mozambican miners for South Africa, and with the local authorities) could cause some bias on the answers given by the miners, e.g. the fear of disclosure of their serostatus and/or their risky sexual behaviour could drive



miners to state that they are at low risk to contract HIV, while they perceive themselves at high risk due to their risky sexual behaviour.

Despite all these limitations, this analysis is important because it examines the association of risky sexual behaviour and risk perception. It also examines factors which influence risk perception among miners that will have significant implications on HIV prevention programs in Mozambique.

### **Conclusion and Recommendations**

Miners, as a group, are susceptible to HIV/AIDS due their risky sexual behaviour coupled with their low risk perception. Results of the present study point to the importance of considering individual characteristics and environmental factors. These are influential factors in the understanding of miners' HIV risk perception, their willingness/ability to address effective strategies and to design more integrated interventions to combat HIV/AIDS among this group.

Campaigns for behavioural changes are needed as well as strategies to enable informed risk awareness is essential to make positive decisions about adopting preventive measures against HIV/AIDS.

Therefore, more effective preventive HIV programs should take into consideration the range of local knowledge and beliefs in which the target demographic is inserted. For instance, concepts such as the faithfulness of sexual partners seem to drive miners to sexual behaviours putting them at risk of contracting HIV. Therefore, further studies must be considered in order to understand cultural beliefs driving miners to HIV susceptibility.

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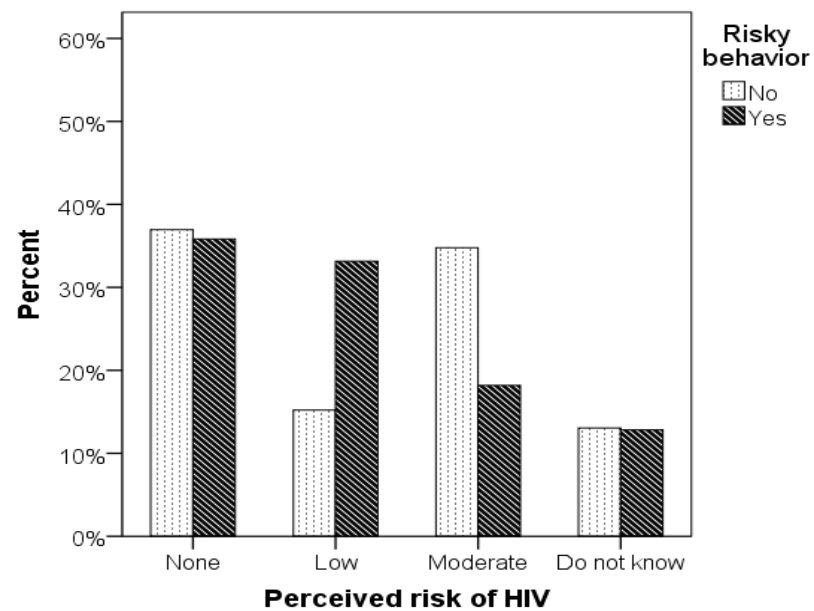
**Tables and figures**
**Table 1****Socio- demographic characteristics of the miners**

		Count	%
Location			
	Chokwé	218	74.4
	Macarretane	75	25.6
Age			
Average (42.02)	20 -- 29 years	26	8.9
S.D (8.82)	30 -- 39 years	102	34.8
	40 -- 50 years	113	38.6
	> 50 years	51	17.4
	Missing	1	0.3
Education			
	Not in School	33	11.3
	Primary/Secondary	228	77.8
	Pre-University/Other	31	10.6
	Missing	1	0.3
Marital status			
	Single	6	2.0
	Married	93	31.7
	Living together	192	65.5
	Widow	2	0.7
Salary level			
	<5500 R\$	104	35.5
	5500 -- 10000 R\$	157	53.6
	> 10000 R\$	27	9.2
	Missing	5	1.7
Accommodation			
	Shared room in the mine	32	10.9
	Unshared room in the mine	62	21.2
	House in the compound	27	9.2
	Other	171	58.4
	Missing	1	0.3
Type of mine			
	Gold	171	58.4
	Platinum	103	35.2
	Coal/Silver/Chromium	19	6.5
Number of sexual partners (last 12 months)			
	None	11	3.8
	1	125	42.7
	2 – 4	109	37.2
	5 – 9	7	2.4
	> 10	35	11.9
	Do not know	1	0.3
	Missing	5	1.7
Multi and concurrent partners (last 12 months)			
	No	150	51.2
	Yes	120	41.0
	Missing	27	7.8
Frequency of condom use			
	Always	21	7.2

	Many times	53	18.0
	Sometimes	45	15.4
	Rarely	11	3.8
	Never	112	38.2
	Missing	51	17.4
STI's in lifetime	No	170	58.0
	Yes	100	34.1
	Missing	23	7.9

**Figure 1**

**Percentage of miners with/without risky sexual behaviour perceiving different levels of risk of contracting HIV.**



**Table 2****Risky sexual behaviour and perceived risk of HIV**

		Risky sexual behaviour		Total
		No	Yes	
Perceived risk of HIV*	Do not know	6	24	30
	None	17	67	84
	Low	7	62	69
	Moderate	16	34	50
	<b>Total</b>	46	187	233

\*The Pearson  $\chi^2$  statistic for independence equals 8.767 with  $df=3$  and  $p\text{-value}=0.032$ .



**Table 3**

**Miners reporting risky sexual behaviour, levels of HIV risk perception by various characteristics**

		Perceived risk of HIV infection (%)			
		Low	Moderate	Do not know	Total
<b>Alcohol consumption</b>	None	53 (41%)	11 (32%)	9 (38%)	73 (39%)
	Low	12 (9%)	3 (9%)	6 (25%)	21 (11%)
	Moderate	44 (34%)	16 (47%)	4 (17%)	64 (34%)
	High	19 (15%)	4 (12%)	5 (21%)	28 (15%)
<b>Living with spouse</b>	Mozambique or South Africa	112 (88%)	25 (76%)	17 (71%)	154 (83%)
	Both countries	16 (13%)	8(24%)	7 (29%)	31(17%)
<b>Knowledge of HIV and STD</b>	Low	45 (35%)	12 (35%)	15 (63%)	72 (39%)
	Moderate/High	84 (65%)	22 (65%)	9 (38%)	115 (61%)
<b>Know people living with HIV/AIDS</b>	None	39 (30%)	15 (44%)	6 (25%)	60 (32%)
	1-4 people	25 (20%)	10 (29%)	10 (42%)	45 (24%)
	More than 5 people	64 (50%)	9 (26%)	8 (33%)	81 (44%)
<b>Work Conditions</b>	Deep in the mine	101 (78%)	18 (53%)	20 (83%)	139 (74%)
	Surface of the mine	28 (22%)	16 (47%)	4 (17%)	48 (26%)

**Table 4****Odds ratio for a logistic model for miners who do not perceive their HIV risk**

Effects	Odds ratio (95% C. I.)		p-value
	Do not know	Low	
<b>Alcohol consumption</b>			0.2954
None	1.000	1.000	
Low	0.922 (0.13 – 6.43)	0.408 (0.08 – 2.01)	
Moderate	0.353 (0.07 – 1.72)	0.416 (0.15 – 1.17)	
High	1.830 (0.29 – 11.52)	0.527 (0.12 – 2.25)	
<b>Living with spouse</b>			0.0371
Mozambique or South Africa	1.000	1.000	
Both countries	1.978 (0.52 – 7.54)	0.455 (0.16 – 1.31)	
<b>Knowledge of HIV and STD</b>			0.0223
Low	1.000	1.000	
Moderate/High	0.388 (0.11 – 1.42)	1.824 (0.72 – 4.61)	
<b>Know people living with HIV/AIDS</b>			0.0259
None	1.000	1.000	
1-4 people	2.307 (0.44 – 12.18)	0.618 (0.19 – 1.98)	
More than 5 people	2.151 (0.40 – 11.70)	2.660 (0.85 – 8.31)	
<b>Work conditions</b>			0.0351
Surface of the mine	1.000	1.000	
Deep in the mine	3.596 (0.74 – 17.51)	3.643 (1.33 – 9.96)	