UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

SCHOOL OF PUBLIC HEALTH

SOCIO ECONOMIC PREDICTORS OF HIV INFECTION AMONG 14-35 YEARS OLD IN RURAL SOUTH AFRICA

A RESEARCH PROTOCOL SUBMITTED TO THE SCHOOL OF PUBLIC HEALTH, FACULTY OF HEALTH SCIENCES UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG IN PARTIAL FULFILMENT OF THE MASTER OF SCIENCE IN THE FIELD OF EPIDEMIOLOGY AND BIOSTATISTICS FOR THE YEAR 2008

OLUWAFOLAJIMI FADAHUN

STUDENT NUMBER: 0710792J

SUPERVISOR: MR EDMORE MARINDA

DECLARATION

I, Oluwafolajimi Fadahun declare that this research report work is my own work. It is being submitted for the degree of Master of Science in Medicine in the field of Epidemiology and Biostatistics in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

Signature.....

Full Name: Oluwafolajimi Fadahun

18th day of September, 2009

DEDICATION

I dedicate this work to Almighty God who remains faithful to His word through the years.

My loving wife Jumoke Fadahun for her unwavering support and daughter Anuoluwapamimo Fadahun for the joy she brings each day.

ABSTRACT

Focus in public health research is shifting to the role of socio-economic factors in the promotion of health. Hence, an understanding of the roles socio-economic factors plays in improving health and health-seeking behaviour is important for public health policy.

This study examined the relationship between socio-economic factors and HIV infection in rural Limpopo Province South Africa, an area characterized by poverty differentials and migration. Various possible social and economic risk factors (such as nationality, education status, marital status, employment status, migration status and socio-economic status) for HIV infection are analysed and discussed.

This is secondary data analysis was carried out during the period June 2001 to March 2005 among 2345 14-35 year old residents in eight (8) villages in rural Limpopo.

Married participants (OR 0.53 [95%CI 0.28 – 1.00]), those from poor (OR 0.49 [95%CI 0.28-0.85]) and less poor households (0.38 [95%CI 0.21-0.70]) are less likely to contract HIV infection. Noteworthy from these analyses also is the increased risk for HIV infection seen among female participants, those not currently schooling (OR 1.9 [95%CI 1.2 – 3.3]) and non-South African citizens (OR 5.18 [95%CI 1.04-25.8]).

Conclusion: Women, out-of school youths and non South African citizens are shown to be high-risk population groups for HIV infection. HIV prevention programs that target identified vulnerable population groups and increased social support for the family may contribute to mitigating the spread of HIV in rural South Africa.

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DEFINITION OF TERMS

1. Wealth Index: Proxy measure of the wealth of households which is based on household characteristics, ownership of assets (house ownership, source of drinking water, electricity, sanitation facility (toilet), floor material type, roof material type etc.)

2 Household: This is a social group of one or more individual members. They are usually but not always related.

LIST OF ACRONYMS AND ABBREVIATIONS

AIDS:	Acquired Immune Deficiency Syndrome
ASSA:	Actuarial Society of South Africa
CSW:	Commercial sex workers
DOH:	Department of Health
HIV:	Human Immunodeficiency Virus
IDU:	Intravenous drug users
ILO:	International Labor Organization
IMAGE:	Intervention with Microfinance for AIDS and Gender Equity
MDG:	Millennium Development Goals
PCA:	Principal Component Analysis
RADAR:	Rural AIDS and Development Action Research
STI:	Sexually transmitted infections
UNAIDS:	United Nations Joint Programme on AIDS
USAID:	United States Agency for International Development
WHO:	World Health Organisation

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CHAPTER ONE: INTRODUCTION AND LITERATURE REVIEW

1.1 Introduction

Globally, about 33.2 million people were living with HIV at the end of 2007 with an estimated 2.5 million new HIV infections occurring during the same period. In addition about 2.1 million deaths were attributed to AIDS in 2007. Noteworthy is the fact that young people (aged 15-24 years) who are in prime of their lives accounted for 40% of new infections (1).

Southern Africa remains the region worst-affected by the HIV/AIDS epidemic where nearly one in three people infected globally live and national HIV prevalence range from 15% to 40% for countries in this region(1).

This region also accounted for about one third of all new HIV infections and AIDS deaths globally in 2007 (1). South Africa has one of the highest prevalence of HIV in the world; about 5.5 million people are believed to be living with the virus in South Africa (2). An estimated 1500 new HIV infections occurred daily in 2005 of which 30% were South African young people aged 15-24 years (3).

HIV prevalence vary between and within regions and countries; suggesting that diverse factors are responsible for the spread of the disease in different communities. In India the country with the second highest number of HIV infected people after South Africa, commercial sex workers (CSW) and intravenous drug users (IDU) are the main drivers of the spread of HIV(4,5), and in Nigeria CSW, poverty and ignorance are put forward as the factors fuelling the spread of HIV infection(6). Studies from Southern Africa have implicated migration, poverty and patterns of sexual contact as some of the key factors influencing the spread of HIV in Southern Africa (7,8). In South Africa,

disparities have also been noted in prevalence and incidence rates across provinces, social and ethnic groups (2,9,10,11).

The proportion of people living in extreme poverty (less than 1 dollar/day) in sub Saharan Africa was 314million in 2001 which translates to about 47% of the region's population (12). According to the Human Sciences Research Council about 57% of the populace in South Africa are living below poverty line. Poverty has often been associated with migration, sex work, polygamy, teenage marriages, disease, constrained choices and various forms of inequalities (13).

The high level of poverty and income inequality in South Africa creates an enabling environment for workers to migrate and seek better economic opportunities. Migrant workers and those engaged in mobile forms of work are prevalent in South Africa and usually travel away from their homes for long periods of time. This category of workers includes long distance truck drivers, travelling sales persons, mine workers, seasonal agricultural workers, and sex workers. They are considered drivers of the HIV epidemic due to increased possibility to having multiple sexual partners and to engage in transactional sex hence higher vulnerability to HIV. Studies have also shown that migration increases the vulnerability of the communities sending and receiving migrant labour to HIV infection (14).

Women are disproportionately more affected by the HIV epidemic accounting for over half of those living with the virus in South Africa (2). The patriarchal system which exists in most sub-Saharan societies place women in relationships where power and control are skewed in favor of the men and thus believed to further increase the vulnerability of women to HIV infection(15,16). Women have been shown to remain in relationships considered as risky due to their low economic status and the need to

depend on their male partners for economic support (17). Feeding also into women's low social and economic status is their relatively lower literacy level with almost two thirds of the world's illiterate people being women; this limits women's access to health information, job opportunities and credit thus further increases risk for HIV infection (16, 18,19).

Sexually transmitted infections (STIs) are major public health challenges worldwide and are in the top 5 category for which adults seek medical attention in the developing world (20). It is estimated that 340 million new cases of STIs occur annually in people aged 15-49. Over 70% of these infections which are curable bacterial and protozoal such as syphilis, gonorrhea and trichomoniasis occur in the developing world (20). There exist a strong link between the transmission of HIV and presence of other STIs, studies have shown that in the presence of STI whether ulcerative or non-ulcerative there is an increased risk for the spread of HIV (21, 22). Individuals with STIs have increased vulnerability to spread or acquire HIV through sexual contact. Prompt and effective treatment of STI can however reduce the sexual transmission of HIV as evidenced by a study from rural Tanzania (23). It is suggested that the high STI prevalence in sub Saharan Africa as compared to North America could be a contributory factor to the high heterosexual spread of HIV in sub Saharan Africa (22).This is corroborated by the South African Medical research Council study which suggests that low treatment rate in addition to high levels of population mobility and migration, sex work as been responsible for the high STI prevalence rates (24). These findings further elucidate the interrelationship between poverty which predisposes to risky behavior such as transactional sex, migration and increased vulnerability to HIV infection.

Socio economic inequalities create an enabling environment for the spread of HIV infection having been identified as non-biological drivers of the epidemic. (8,10, 11).

The influence exerted on an individual's risk of HIV infection by socio-economic markers such as income, education and employment status is a complex one. An individual's HIV risk is determined by their socio-economic status, and the socio-economic profile of the community they reside.

A number of arguments explaining why higher rates of infection are to be expected among the poor show that the poor are exposed to greater dangers in the course of their everyday living which makes the threat of HIV/AIDS seem relatively remote and as a result may not take necessary precautions to avoid infection. Also the poor are less educated, they are less likely to know what AIDS is and how HIV is transmitted (25, 26). This argument is strengthened by another study which reveals a higher HIV prevalence levels in the unemployed and unskilled or semi-skilled group (27). To the extent that skill levels are likely to be correlated with income levels, low HIV prevalence may thus be expected at high income levels. The individual's socio-economic status determines their ability to attract sexual partners, as well as their ability to protect themselves from HIV infection (28). While men may be able to pay for sex as their income increases, poor women on the other hand engage in sex as a means of survival or take on extra partners for financial support due to their desperate economic situations thereby exposing themselves to HIV infection(28,29).

Contrary to the foregoing are the findings from a study which reveal that the odds of infection among antenatal clinic attendees are lowest in districts with an annual income of between R15 000 and R30 000 and higher both in wealthier and poorer districts. This

demonstrates a non-linear relationship between average annual income and HIV prevalence among antenatal clinic attendees (30).

The socio economic profile of the community on the other hand is related to its level of urbanisation, level of conflicts and migration it experiences. Migration increases the extent of social networking and thus encourages the fast spread of HIV infection (14). Migrant labour has been shown to be strongly associated with high-risk sexual behaviour thereby making migrants and migrant workers at a higher risk of HIV infection (14,31). A study among migrant workers in Carletonville, South Africa reported that among males, over 50% had at least one casual partner in the last year while 53% of the migrant female admitted to accepting money for sex (31). The study further revealed that higher HIV prevalence's among migrants compared to non migrants in Carltonville: 29% vs. 19% and 51% and 39% for males and females respectively (31). Another study carried out in Rural Kwazulu-Natal revealed that individuals who had recently changed residences were thrice more likely to be HIV positive than those that had not (32). Levels of migrant labour are high in South Africa particularly among men; rates of up to 60% in males have been reported in some rural communities (33, 34). Migrant workers who become infected in urban areas then pass the virus to their partners when they return to the rural areas (14).

Armed conflicts have also been implicated in the spread of HIV epidemic in South Africa. The incorporation of former revolutionary cadres who were based in areas of high HIV prevalence into the national defence force coupled with the casual sexual relationships around military bases may have contributed to the spread of the epidemic (30,).

Inadequate consideration of the socio economic factors aiding the spread of HIV could lead to worsening of the current HIV/AIDS epidemic in sub- Saharan Africa. The risk for HIV transmission can be mitigated with implementation of appropriate interventions with a socio-economic focus (10).

1.2 RESEARCH QUESTION

Is socio-economic status associated with HIV infection?

1.3 JUSTIFICATION FOR THE STUDY

HIV/AIDS remains a leading cause of death in South Africa; HIV/AIDS was the eighth reported leading cause of mortality in South Africa in 2005 (35).

Studies have shown that poverty and HIV/AIDS are related (36,37), poverty plays an important role in leading people to behaviours such as exchanging sex for money which increase their risk of HIV infection (38). Furthermore, occurrence of HIV/AIDS has been shown to lead to an intensification of poverty and can push some non-poor into poverty (39). A study comparing countries at different levels of per capita income, revealed high rates of HIV infection to be strongly correlated to low income, also the highest HIV prevalence rates have been observed in poor countries(18). This research report would focus on identifying socio economic factors that best predict risk for new HIV infection from a rural perspective.

1.4 Hypothesis

Alternative Hypothesis

There is no association between socio-economic status and HIV infection.

Null Hypothesis

There is an association between socio-economic status and HIV infection.

CHAPTER TWO: AIM AND SPECIFIC OBJECTIVES

2.1 Aim of the study

To determine factors associated with HIV infection among 14-35 years olds in rural South Africa.

2.2 SPECIFIC OBJECTIVES

2.2.1 To describe socio-economic characteristics in 14-35 year olds in rural South Africa.

2.2.2 To estimate HIV incidence among 14-35 year olds in rural South Africa.

2.2.3 To investigate the association between HIV incidence and socio-economic status.

2.2.4 To investigate other factors associated with HIV infection.

CHAPTER THREE: METHODOLOGY

This study is a secondary data analysis of the IMAGE study.

3.1 Primary Data Source

The primary study which was a prospective, community-matched cluster randomized trial carried out between June 2001 & March 2005 in 8 villages of rural Limpopo Province, South Africa. The IMAGE study aimed to assess a structural intervention that combined a microfinance programme with a gender and HIV training curriculum on the vulnerability of women to intimate-partner violence; it also aimed to assess the vulnerability of community members to HIV infection as a result of the introduction of the structural intervention.

The two arms (intervention & comparison groups) of the trial had three cohorts each as follows:

1. Cohort one: were direct programmme participants who received microfinance with a gender and HIV training.

2. Cohort two: 14-35 year old co-residents of direct programme participants.

3. Cohort three: community residents of trial sites.

The primary outcomes were experience of intimate-partner violence in the past 12 months by a spouse or other sexual intimate (cohort one), unprotected sexual intercourse at last occurrence with a non-spousal partner in the past 12 months (cohort two & three), and HIV incidence (cohort three).

Participants from both arms (the intervention and comparison groups) of Cohort three of the IMAGE study form the study sample for secondary data analysis.

The choice of eight villages selected for the primary data was influenced by the operational feasibility of delivering the intervention over a wide geographical area, the time required for cohort recruitment and follow-up, the ethical considerations about withholding participation from comparison villages. The eight selected villages were pair-matched on estimated size and accessibility, one village from each pair was randomly assigned to receive the intervention. Villages in the intervention and comparison groups were much the same in terms of size, unemployment rates, level of migrancy, distance to nearest town and availability of social amenities such as electricity. Access to tap water was reported to be limited in one intervention village. In addition, there were no significant baseline differences between intervention and comparison groups in three which is the source of data for this analysis.

3.2 Study Design for Secondary Data Analysis

Using the HIV sero-status of participants which was determined at the beginning and at the end of the three year study period; association between HIV incidence and selected socio-economic factors were examined in this study.

This analysis is based on data from the questionnaires administered to randomly selected community members of the intervention and comparison villages in the IMAGE study. In order to assess the socio economic status of participants, data on quality of housing type, access to water and electricity and ownership of assets such as cell phones, bicycle, and livestock contained in household questionnaires administered was used to construct an index of household economic status. This was constructed using Principal Component Analysis (PCA) described below.

3.3 Measuring Socio-economic status

Socioeconomic status was measured using the asset index approach. This method uses asset indicators to estimate wealth levels in households and can serve as a proxy for wealth (40). The asset index method has been applied to the South African setting in order to quantify differences in socio-economic status where data on income and expenditure are not available and has been found to be internally coherent, robust and a comparable indicator of poverty. (41).

Asset index can be developed by performing Principal Component Analysis (PCA) using data on durable asset ownership, access to utilities and infrastructure, and housing characteristic variables.

PCA is a statistical technique used to cut down the number of variables in a data set into a smaller number of 'dimensions'. The technique involves breaking down assets (e.g. cell phones, bicycle) or household service access (e.g. water, electricity) into categorical or interval variables. Weighted linear functions of the variables give principal components. The results obtained from the first principal component (explaining the most variability) are usually used to develop an index based on the formula: $A_{j=}f_1$ x $(a_{ji-}$ $a_{i)}/(S_1)_{+.....+}$ f_N $x(aj_N - a_{N)}/(S_N)$. Where f_1 is the scoring factor or weights for the first asset (or service), and a_1 and s_1 are the mean and the standard deviation of the first assets (or service) variable over all households respectively.

Based on this wealth index, SES of households are assigned to the residents of those households, and the resulting households will be divided into quintiles (i.e. poorest, very poor, poor, less poor, and least poor) that represent the proxies for SES.

The following household characteristics and assets were included in the PCA model for this study: number of rooms in household, wall type of the room; whether they were locally made with mud or with modern material such as cement, source of power; firewood, kerosene/biogas or electricity; means of transportation available to household whether bicycle, car, motorbike. Animal possessions; whether household had animals or not.

The model was based on the presence or absence of each asset or the nature of the housing materials .i.e. each asset was dummied with the response, 1 and 0. . Variables with more than two categories were reparameterized to generate binary variables to signify presence or absence of a variable. Using the "pca" command in STATA soft ware, indices for all listed assets were generated. The generated indices were then used to categorise participants into five socio-economic groups or quintiles; most poor, very poor, poor, less poor, and least poor.

3.4 Study Sample

The study sample comprises community residents aged between 14-35 years who participated in the IMAGE study in Limpopo Province South Africa. Study participants from the intervention and comparison groups of Cohort three of the IMAGE study were included. The original design was a cluster randomized controlled matched intervention in 8 villages, 4 of which received the IMAGE intervention while the remaining 4 were matched controls. Since HIV incidence is the primary outcome in this study, only participants who have HIV results and are linked to a household of the IMAGE intervention and comparison groups are included for the secondary analysis.

Eligible participants were 14-35 year olds of either sex who were residents of intervention or comparison communities of the IMAGE study. Of the 3881 community residents aged 14-35 years at baseline, only 2345 had HIV test results hence form the sample size for this analysis. In addition to interviews at baseline and follow up, HIV testing was also done using oral fluid specimen collected with OraSure collection device (UCB group,Hoeilaart,Belgium) and tested with the Vironostika HIV Uni-form II assay (bioMerieux,Lyon,France). Interviews, specimen collection and HIV testing were carried out by trained facilitators.

3.5 Study Variables for secondary data analysis

The study variables include:

1. Demographic variables:

    a. Study participants' characteristics i.e. sex, age, marital status, education, employment, nationality and occupation type.
    b. Household characteristics of study participants i.e. dwelling type, household income and assets.

2. Exposure variable: socio economic status of participants.

3. Outcome variable: HIV sero-status of study participants.

4. Possible Confounders: sex, age, educational status, marital status.

3.6 Poverty Measures

The primary data source (IMAGE study) captured characteristics of the living conditions and assets of each household in the study population. The questionnaire

included variables such as building materials used for dwelling place, number of rooms available for dwelling, access to ablution facilities, electricity and water. Household ownership of assets such as livestock, household appliances as well as mode of transport was also ascertained in the questionnaire.

These variables were combined to construct a wealth (economic) index of the household using PCA (42). The economic index was divided into quintiles: "Poorest" "Poorer" "Poor" "Less poor" "Least poor".

3.7 Data Analysis Plan

In order to describe the socio-economic characteristics of participants, frequency, means and standard deviations were used.

T-tests, ANOVA or their non-parametric equivalent tests were used to compare continues variables such as age at baseline, while chi-square test or Fishers tests were use to compare categorical factors as sex, marital status and employment status across HIV groups at baseline.

Principal Component Analysis (PCA) was used to construct a wealth index which estimates the household economic status of participants as described in section 3.3 (40). Households were then categorized into five equal groups (i.e. poorest, poorer, poor, less poor and least poor) that represent the proxies for SES.

Both univariate and multiple logistic regression models where used to determine the association between SES, baseline characteristics and HIV infection. The logistic model

considers HIV sero-conversion as the outcome variable of interest and SES, baseline characteristics as independent factors. Multiple logistic models were also fitted while controlling for possible confounders such as age, sex, educational status and marital status.

In investigating the association between SES and HIV sero-conversion, a new variable "cases" was created. This new variable represents participants who were HIV negative at baseline and had HIV test result at follow up. They were coded as 0 "HIV-negative at follow up" 1 "HIV- positive at follow up". A total of 1353 participants were HIV negative at baseline and had a HIV test results at follow up. Analysis to determine association between SES and HIV sero-conversion at follow-up was limited to the 1353 participants classified as "cases".

Corresponding p-values were calculated to test for statistical significance at 5% level.

Data analysis was done using STATA version 10 statistical software (StataCorp, 2008, Texas, USA).

3.8 Ethical Clearance

Ethical clearance was obtained from the University of Witwatersrand Committee for Research on Human Subjects (medical) for permission to carry out this study (Protocol number R14/49, approved 25/07/2008), see Appendix 1.The Rural AIDS and Development Action Research (RADAR) also granted approval for the use of the primary datasets.

The IMAGE study has ethical clearance from the University of the Witwatersrand, Johannesburg, South Africa (Protocol number M991108, approved 31/01/00) and the

London School of Hygiene and Tropical Medicine (reference number 598, approved 06/09/00).

Permission to carry out the primary study was sought from community leaders of the intervention and comparison sites. Furthermore study progress and results were reported to the participating communities through the community liaison boards established at the commencement of the study.

CHAPTER FOUR: RESULTS

4.1 Background Characteristics

Table 4.1 below gives a description of study participants according to selected background characteristics.

A total of 2345 participants were included in this study; community residents aged 14-35 years who participated in the IMAGE study and had been tested for HIV at baseline. Females (57.4 %, 1345) accounted for the majority of participants in this study. The mean age of participants was 21.7 years (std 5.57 years). Participants less than 20 years old accounted for 46.9 % (1101), those aged 20-24years old 25.5% (599), those aged 25-29years 16.4% (384) , and those aged 30-35 years were the least 261 (11.1%). Only 297 (12.7%) of participants were married, and the rest were either never married 2014 (85.9%), divorced 25 (1.1%) or widowed 9 (0.4%).

At the time of this study, out of 1176 participants who were not attending school, 1025 (87.2 %) had some form of formal education i.e. completed primary education or more while 151 (12.84%) had no formal education at all or had less than four years of schooling. However, just below half of the participants 1168 (49.8 %) were still schooling at the time of this study.

Of the 1159 participants eligible to work, 245 (21.14%) were formally employed while the others 914 (78.86%) were unemployed. Those eligible to work are defined as participants not currently schooling and not less than 16 years. Based on this classification, some 1183 (50.4%) of the participants were not eligible to work at the time of this study.

Some 1580 (67.52%) of the participants had been living in the study village since birth, 418 (17.86%) had been permanently resident in the study village for less than 10 years and the rest 342 (14.62%) had been living in the study village for more than 10 years.

About 90% of the participants resided in the study village for greater than six months in the last year with 234(10.00%) resided in the study village for less than six months in the last year.

Table 4.1: Descriptive summary of study participants

Variable	N= 2345 Frequency (%)
Age in years	(mean= 21.72, std= 5.58)
Nationality	
South African	2333 (99.49)
Non South African	12 (0.51)
***Education Status**	
None	18 (1.53)
Some primary (Standard 1-4)	133 (11.31)
Completed primary (Standard 5)	58 (4.93)
Some secondary (Standard 6-9)	697 (59.27)
Completed secondary (Standard 10)	214 (18.20)
Tertiary	56 (4.76)
Still schooling	
Yes	1168 (49.83)
No	1176 (50.17)
Marital Status	
Never married	2014 (85.88)
Currently married	297 (12.67)
Divorced/separated	25 (1.07)
Widowed	9 (0.38)
****Employment Status**	
Unemployed	914 (78.86)
Employed/ Self employed	245 (21.14)
Length of Stay in Village	
Since birth	1580 (67.52)
1-10 years	418 (17.86)
>10 years	342 (14.62)
Duration of stay in the village in the last year (Migration)	
1-6 months	234 (10.00)
>6 months	2105 (90.00)
Socio-economic Status(SES)	
Poorest	445 (20.25)
Poorer	413 (18.79)
Poor	454 (20.66)
Less poor	442 (20.11)
Least poor	444 (20.20)

*Represents participants who were not currently in school at the time of the study.

**Represents only participants eligible to work

Figure 1: Distribution of study participants by gender

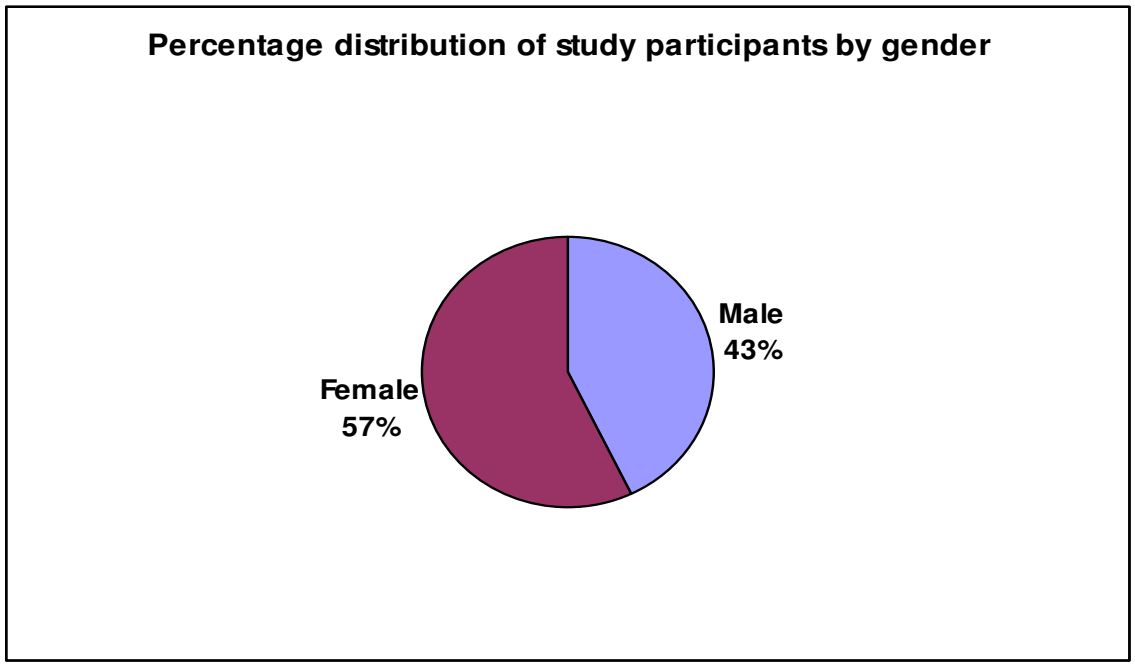
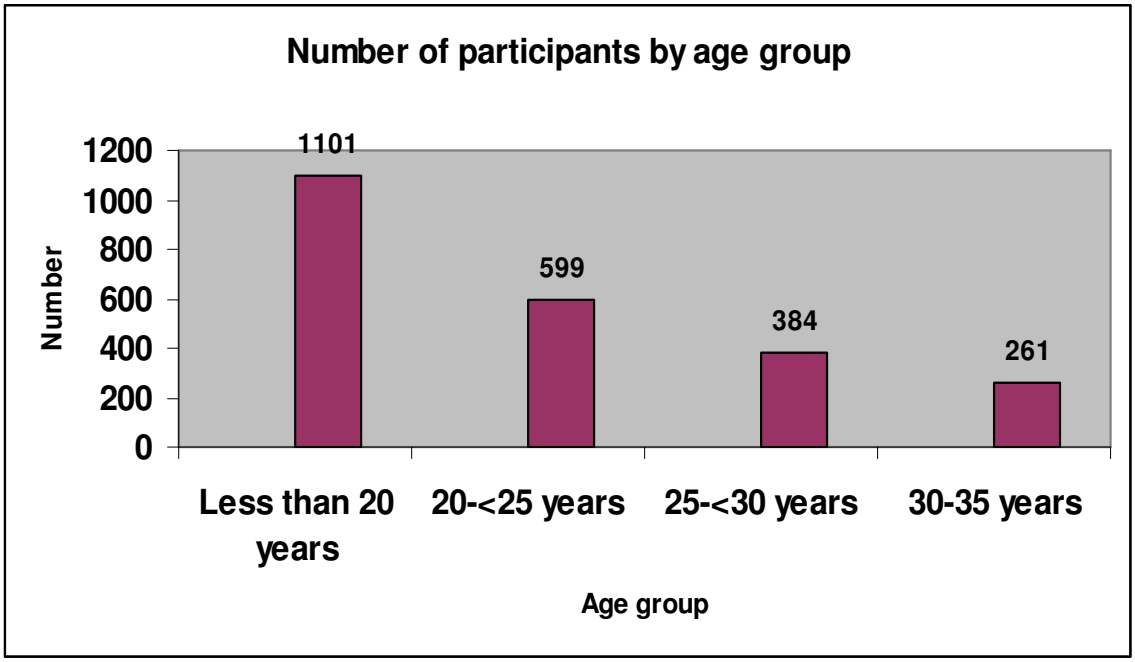


Figure 2: Distribution of study participants by age group



4.2 HIV Incidence

At baseline, of the 2345 study participants, 253 tested HIV positive, giving an estimated 10.8% HIV prevalence. The HIV prevalence at baseline is similar to the National prevalence (10.8%) but higher than the Provincial HIV prevalence (8.0%). Out of the 2092 participants who were initially HIV negative at baseline, 1353 were followed-up and re-tested. 152 (11.2%) became HIV sero-positive over the three year follow-up period. This gives a three year cumulative HIV incidence of 11.2% or an annual average HIV incidence of 3.7 per 100 person years assuming uniform rate of infection over the three years.

4.3 Comparison of Background Characteristics by HIV Status

Associations were examined for a number of participants' baseline factors and HIV status, Table 4.2. shows that participants aged 25-29 years had the highest proportion of new HIV infections over the three year period 19.7% (35) followed by those aged 20-24years at 14.8% (44), then those aged 30-34 years 11.1% (16); the lowest proportion of new HIV cases of 7.6% (54) was seen in participants less than 20 years.

There were 6.7% (36) and 14.4% (116) new cases among males and females respectively; indicating higher HIV-1 infection proportion among females.

Among those not currently in school at the time of this study, results shows that the proportion of HIV sero-positive cases was highest in those who had completed primary education and those who had no formal education, 20% (2) and 21.9% (7) respectively. Others were 16.8% (61) in those with some secondary education and 16.2% (12) in those with some primary education, while the proportion of new cases was between 11% and 13% for those who completed secondary education and those who attended tertiary education.

Among those who were currently schooling at the time of the study the proportion of new HIV cases was 7.4% (56) compared to 16.6% (96) among those not schooling.

The proportion of new HIV cases was 16.1% (19) among those employed and 15.9% (75) among those unemployed.

The proportion of new HIV cases was 10.8% among those who had never married and among those who were married. Others were 75% among widowed participants and 25% among those divorced.

Table 4.2: COMPARING BASELINE FACTORS ACROSS HIV STATUS

N=1353	HIV POSITIVE	HIV NEGATIVE	P value
	Number (%)	Number (%)	
Age group (years)			
Less than 20	54 (7.56)	660 (92.44)	
20-<25	44(14.81)	253 (85.19)	<0.001
25-<30	35 (19.66)	143 (80.30)	
30-35	16 (11.11)	128 (88.89)	
Sex			
Males	36 (6.56)	513 (93.44)	<0.001
Females	116(14.43)	688(85.57)	
Nationality			
South African	149 (11.08)	1196 (88.92)	0.018
Non South Africans	3 (37.50)	5 (62.50)	
***Educational Status**			
None	2 (20.00)	8 (80.00)	
Some primary (Standard 1-4)	12 (16.22)	62 (83.78)	
Completed primary (Standard 5)	7 (21.88)	25 (78.13)	0.715
Some secondary (Standard 6-9)	61(16.80)	302 (83.20)	
Completed secondary (Standard 10)	11(11.34)	86 (88.60)	
Tertiary	3 (12.50)	21(87.50)	
Still schooling			
Yes	56 (7.44)	697 (92.56)	<0.001
No	96 (16.00)	504 (84.00)	
Marital Status			
Never married	125 (10.84)	1028 (89.16)	
Currently married	19 (10.80)	157 (89.20)	<0.001
Divorced/separated	5 (25.00)	15 (75.00)	
Widowed	3 (75.00)	1 (25.00)	
****Employment Status**			
Employed	19 (16.10)	99 (83.90)	0.962
Unemployed	75 (15.92)	396 (84.08)	
Length of Stay in Village			
Since birth	99 (10.68)	828 (89.32)	
1-10 years	25 (11.21)	198 (88.79)	0.403
More than 10 years	28 (14.00)	172 (86.00)	
Duration of stay in the village in the last year(Migration)			0.649
1-6 months	13 (12.62)	90 (87.38)	
>6 months	139 (11.15)	1108 (88.85)	
Socio-economic Status(SES)			
Poorest	41 (15.53)	223 (84.47)	
Poorer	29 (11.98)	213 (88.02)	
Poor	26 (9.89)	237 (90.11)	0.035
Less poor	17 (6.85)	231 (93.15)	
Least poor	30 (11.63)	228 (88.37)	

*Represents participants who were not currently in school at the time of the study.
**Represents only participants eligible to work

4.4 Univariate and Multiple Logistic Analyses

Table 4.3 presents unadjusted and adjusted odds ratios with 95% confidence interval for background characteristics and socio-economic status associated with HIV sero-status at follow-up.

Age, sex, nationality, marital status, schooling status and socio-economic status were associated with new HIV infection at the 5% level of significance in univariate models. Educational status, employment status, length of stay in study village and migration were not associated with HIV sero-conversion.

Using the poorest group as the reference group, the odds of sero-converting in the follow-up period was lower for all other groups. The odd of HIV infection was 33% lower (OR 0.67 [95% CI 0.38 – 1.23]), 51% lower (OR 0.49 [95% CI 0.28 – 0.85]), 62% lower (OR 0.38 [95% CI 0.21 – 0.70]) and 32% lower (OR 0.68 [95% CI 0.40 – 1.15]) comparing poorer, poor, less poor and least poor respectively compared to the poorest group in an adjusted multiple logistic regression model.

The odds of HIV infection increased by 5% (OR 1.05 [95%CI 1.02 - 1.07]) for every one year increase in the study participants' age. Female participants were about twice as likely to have sero-converted during the three year period compared to males (OR 2.2 [95%CI 1.4 – 3.4]) in an adjusted logistic model.

The odds of being HIV infected in the three years of follow-up was 5.2 times [95%CI 1.0 – 25.8] among non-South African citizens compared to South African citizens. The wide confidence intervals indicate relatively low numbers of migrants.

Adults (those not in schools) were more likely to be infected than school going participants (Adjusted OR 1.9 [95%CI 1.2 – 3.3]). Marriage provided a protective effect: those married were 47% (OR 0.53 [95%CI 0.28 – 1.00]) less likely to have tested HIV positive in the 3 years of follow-up in adjusted models.

Age, education, employment status and length of stay in study site were not statistically associated with HIV sero-conversion in multiple logistic regression models. We tested possible effect modification between a number of factors such as education and wealth index, age and wealth index, but these were found to be non-significant.

Table 4.3: Univariate and Multivariate regression models for HIV status

Variable	Univariate model	Multivariate model
	Odds ratio 95% CI p-value	**Odds ratio 95% CI p-value**
Participants Age (years)	1.05 (1.02-1.08) <0.001	
Age group (years)		
Less than 20	1	
20-<25	2.13 (1.40-3.25) <0.001	
25-<30	2.99 (1.88-4.85) <0.001	
30-35	1.53 (0.85-2.75) 0.159	
Sex		
Males	1	1
Females	2.40(1.62-3.55)<0.001	2.20(1.43-3.37)<0.001
Nationality		
South African	1	1
Non South Africans	4.81(1.14-20.36)0.033	5.18 (1.04-25.8) 0.045
***Education Status**		
None	1	
Some primary (Standard 1-4)	0.56 (0.11-2.79) 0.481	
Completed primary (Standard 5)	0.52 (0.10-2.78) 0.448	
Some secondary (Standard 6-9)	0.48 (0.10-2.30) 0.359	
Completed secondary (Standard 10)	0.54 (0.10-2.80) 0.460	
Tertiary	0.55 (0.09-3.58) 0.533	
Still schooling		
Yes	1	1
No	2.37(1.67-3.36)<0.001	1.92(1.14-3.26)0.015
Marital Status		
Never married	1	1
Currently married	0.99(0.60-1.66)0.985	0.53 (0.28-1.00) 0.051
Divorced/separated	2.74(0.98-7.67)0.055	1.69 (0.54-5.21) 0.361
Widowed	24.67(2.55-239)0.006	
****Employment Status**		
Unemployed	1	
Employed	0.99(0.57-1.71)0.962	
Length of Stay in Village		
Since birth	1	
1-10 years	1.06(0.66-1.68)0.818	
More than 10 years	1.36(0.87-2.14)0.179	
Duration of stay in the village in the last year(Migration)		
1-6 months	1	
>6 months	0.87(0.47-1.59)0.649	
Wealth Index		
Poorest	1	1
Poorer	0.74 (0.44-1.23) 0.250	0.67 (0.38-1.13) 0.126
Poor	0.60 (0.35-1.01) 0.054	0.49 (0.28-0.85) 0.012
Less poor	0.40 (0.22-0.82) 0.003	0.38 (0.21-0.70) 0.002
Least poor	0.72 (0.43-1.19) 0.195	0.68 (0.40-1.15) 0.154

*Represents participants who were not currently in school at the time of the study.

**Represents only participants eligible to work

CHAPTER FIVE: DISCUSSION

5.1 Socio-economic Status

Using the poorest household as a reference, participants from poorer, poor, less poor and least poor were respectively 43% (p-value 0.13), 51% (p-value 0.01), 62% (p-value 0.002), and 32% (0.15) less likely to sero-convert during the three years of follow-up. Though two of the groups (the first and last comparison groups) are not statistically significant, the trend is from reduced risk is evident in the first 4 groups. The risk is still lower for the least poor group compared to the reference, thought this risk appears high than the less poor group. It is not clear from this comparison if this is a genuine non-linear (curve-linear trend) since there could be sample size issues with these comparisons.

Another study in South Africa, reveal that low and high SES was associated with a lower HIV risk compared with those with medium SES (43). On the contrary, results from a study in Kenya showed that positive HIV status was associated with lower SES among women aged 15-24 and higher SES among women aged 25-49 (44).

Of the 36 studies used for a systematic review that looked at SES and risk of HIV infection, 12 found an association between high SES and HIV infection; eight found an association between low SES and HIV infection; one study revealed mixed results and 15 found no association between low SES and HIV infection. The review showed that increasing SES may reduce risk for HIV infection in parts of Sub-Saharan African where income is high and within-country inequalities wealth are great (45). Furthermore, findings from another study by USAID of 8 population-based nationally represented surveys involving HIV testing in sub-Saharan Africa did not show HIV prevalence to be higher among adults with lower SES (46).

Understanding the relationship that exist between SES and risk for HIV infection may be obscured by factors such as education status, employment status which contribute to SES of an individual/households. Interactions between SES and education/employment, SES and gender, SES and age were not shown to play any significant role in the risk for HIV infection in this study (see appendix 2).

Furthermore, due to homogeneity of households in rural settings, socio-economic groups may be difficult to differentiate i.e. not being able to distinguish between the poor and the very poor in rural communities using asset based method. This arises when households have similar housing characteristics, similar access to utilities and infrastructures which is a potential limitation in testing association between SES and risk for HIV infection in this study (42).

5.2 Gender

Women are biologically more susceptible than men to HIV infection (47). Women were 2.2 times more likely to contract HIV compared to men in this study in adjusted models. The age limit of participants in our study is 14-35 years which covers the 20-29 year age group when the peak of HIV infection is usually seen in women and excludes males greater than 35 years when HIV infection has been shown to be higher in men than women (43). This may partly account for the increased risk of new HIV infection seen among female participants in this study. In 2005, while the national HIV prevalence was 10.8%., HIV prevalence for females was high among young females ranging between 9% - 34% with the highest prevalence (33.3%) seen in females aged 25-29 years (48). In contrast, lower prevalence was recorded among young males (3% - 23.3%), however

from age group 35-39, higher HIV prevalence were recorded in males compared to females (48).

Possibly contributing to the disparity in the HIV prevalence between male and female in this study may be the economic vulnerability of women who are in the majority (57.4 %) but constitute only 47.8% of those employed.

5.3 Marital Status

This study shows that individuals who are married were 47% less likely to contract HIV compared to those who had never been married. Marriage is expected to confer some protection against HIV infection since those married are less likely to have multiple sexual partners. Moreover, the study was carried out in a rural setting where traditional values of marital fidelity are expected to be higher. The proportion of married participants was however relatively small.

In a study in Carltonville, Johannesburg however marital status was not found to be associated with HIV prevalence, while other studies have reported that marriage no longer confers any protection against HIV infection because partners may already be infected before they marry (31,47).

5.4 Education attainment/Schooling status

Education which could determine the employment opportunities and subsequently income of an individual is considered an important proxy for socio-economic status in this study.

Results from this study show that the highest level of education attained is not associated with HIV infection. However, those who were not attending school at the time of this study were 1.9 times more likely to contract HIV than those who were schooling at the time of this study. Being in school may have been an opportunity for emphasizing HIV prevention methods thereby enabling the students to protect themselves against HIV infection.

A review of studies assessing the relationship between educational attainment and HIV risk that was carried out at the onset of the HIV epidemic in sub-Saharan Africa, show that higher educational attainment was associated with a greater risk of HIV infection(49,50). A recent study however reveals that in countries with low prevalence rates educational attainment is negatively correlated with HIV infection, suggestive that education has a significant effect on decreasing HIV risks as the epidemic worsens (51).

5.5 Nationality

Non South African participants were 5.2 times more likely to contract HIV infection than their South African counterparts, though the wide confidence intervals indicate small numbers among non-South Africans. The non-South Africans were likely immigrants with limited immigration status which restricts their employment opportunities and access to social services like health and education. This could increase their vulnerability to HIV as the importance of preventing HIV may be less significant to other life threatening conditions like poverty, discrimination in the hierarchy of needs. In addition, migration could lead to increased social networking and engaging in high risk sexual behaviour which may lead to HIV infection (14, 31).

5.6 LIMITATIONS

1. Since HIV infection is the primary outcome in this study, only participants who were HIV negative at baseline were considered for analysis at follow up. A total of 2092 participants were HIV negative at baseline; of this number only 1353 were re-tested at follow-up. This represents a loss to follow up of 35.3%.

Apart from the three year study period which may have contributed to a change in the age distribution of participants with an increase in the mean age to 24.31 years from 21.72 years; there were no significant differences in baseline characteristics between those re-tested (followed up) and those lost to follow-up (appendix-3). Although participants re-tested (followed up) and those lost to follow-up did not show any significant differences, the proportion of loss to follow-up limits the generalisability of this study.

2. PCA as a method of asset-based measure to derive SES index overcomes problems such as recall bias, data collection challenges and high cost outlay usually encountered with income-based and consumption-based methods, hence PCA is being increasing being used. There are however limitations with PCA which relates to its interpretation. PCA like other asset-based measures are more reflective of longer-run household wealth or living standard, this fails to take account of short-term or temporary economic setbacks to the household. In this study we are unable to clearly ascertain the role of possible changes in SES during the study period and risk for HIV infection. This is because the SES index used, only accounts for the SES of the participants at the beginning of the study which may not have remained so during the study period.

In addition, ownership of an asset (which is employed in constructing PCA) does take into account the quality of the asset i.e. while two households may own bicycles, the bicycle owned by one household may be newer and of a higher quality than the bicycle owned by the other household hence, may reflect a wealthier household. Such information about quality, age of the asset is not considered in determining SES index using PCA.

3. At the beginning of the primary study both the intervention and comparison villages were pair-matched and one intervention village was randomly selected from each pair. The pooling of participants from both the intervention and comparison villages into a single group for secondary data analysis after only the intervention villages had received microfinance programme and gender & HIV training may alter the true picture of the association between socio-economic factors and HIV infection in the study population. It may not be possible to determine the extent of this alteration.

4. The 11.1% HIV incident reported in this study was cumulative for the 3 year study period. This translates to an average incident of 3.7% per year. Non estimation of annual HIV incident cases during the study period limits the possibility to assess the trend of HIV incidence in the study population.

CHAPTER 6: CONCLUSION AND RECOMMENDATION

From this study it can be concluded that gender, socio-economic status (SES), marital status, schooling status and nationality are factors that were associated with an individual's risk of new HIV infection.

The HIV & AIDS and STI Strategic Plan for South Africa 2007- 2011 aims to reduce new HIV infections by 50% by 2011(52). Behaviour Change Communication programmes that encourage safe sexual practices, HIV testing could be implemented among young people, and this will contribute to achieving the HIV & AIDS and STI goal. Furthermore poverty alleviating strategies especially for women may also reduce the vulnerability of women to HIV infection.

HIV prevalence in this study population was 10.8%; this is similar to the National HIV prevalence but higher than the Limpopo provincial HIV prevalence of 8.8% in 2005 (52). This finding suggests that the study population may be a high-risk population for HIV infection; and calls for intensified HIV prevention efforts at the vulnerable groups identified in this study i.e. females, out of school youths and non South African citizens.

Increased support for the family is needed, as being married was shown to offer protection against new HIV infection from this study. Provision of social support in form of grants to meet family needs, subsidized school fees for children may encourage establishment and sustenance of marriage relationships.

These strategies if implemented will contribute to achieving the goals of HIV & AIDS and STI Strategic Plan for South Africa 2007- 2011 and the MDG Goal 6: to combat HIV/AIDS, malaria and other diseases.

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Appendix 1: Ethical clearance certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R1-6-49 Fadahunsi

CLEARANCE CERTIFICATE	PROTOCOL NUMBER M070722
PROJECT	Socio-Economic Predicators of Human Immunodeficiency Virus (HIV) Infection among 14-35 Year Old in rural South Africa
INVESTIGATORS	Dr OO Fadahunsi
DEPARTMENT	School of Public Health
DATE CONSIDERED	08.07.25
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 08.07.28 CHAIRPERSON (Professor P E Cleaton-Jones)

*Guidelines for written "informed consent" attached where applicable

cc: Supervisor : Mr E Marinda

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. I agree to a completion of a yearly progress report.

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix 2: Interactions between SES and selected background characteristics and risk for new HIV infection

Interaction Variable	Univariate model
	Odds ratio 95%CI
Participants Age (years)	
Age	1.04 (0.97-1.10)
SES	0.78 (0.46-1.31)
Sex	
Sex	3.20 (1.33-7.66)
SES	1.06 (0.64-1.74)
***Education Status**	
Education status	0.85 (0.35-2.03)
SES	0.69 (0.49-0.98)
Still schooling	
Still schooling	2.12 (0.95-4.72)
SES	0.84 (0.55-1.29)
Marital Status	
Marital status	0.89 (0.56-1.40)
SES	0.86 (0.40-1.86)
****Employment Status**	
Employment status	1.56 (0.43-5.68)
SES	1.23 (0.61-2.50)

Appendix 3: Descriptive summary comparing study participants at baseline and at follow-up

Variable	Study participants tested at baseline but not tested at follow-up Frequency (%)	Study participants tested at follow-up Frequency (%)
Age in years (mean= 21.72, std= 5.58)	(mean=22.24,std=5.58)	(24.31, std=5.89)
Less than 20	313 (41.18)	714 (53.56)
20-<25	223 (29.34)	297 (22.28)
25-<30	138 (18.16)	178 (13.35)
30-35	86 (11.32)	144 (10.80)
Missing	0	20
Sex		
Male	386(51.18)	549(40.58)
Female	371 (48.82)	804(59.42)
Nationality		
South African	759 (99.87)	1345(99.41)
Non South African	1 (0.13)	8(0.51)
***Education Status**		
None	6 (1.46)	10 (0.77)
Some primary (Standard 1-4)	40 (9.76)	197 (15.19)
Completed primary (Standard 5)	16 (3.90)	91 (7.02)
Some secondary (Standard 6-9)	241 (58.78)	859 (66.23)
Completed secondary (Standard 10)	84 (20.49)	108 (8.33)
Tertiary	23 (5.61)	32 (2.47)
Missing	1	8
Still schooling		
Yes	349 (45.98)	753(55.65)
No	410 (54.02)	1176(44.35)
Missing	1	0
Marital Status		
Never married	659 (86.71)	1153(85.22)
Currently married	95 (12.50)	176(13.01)
Divorced/separated	5 (0.66)	20(1.48)
Widowed	1 (0.13)	4(0.30)
****Employment Status**		
Unemployed	299 (73.29)	471(79.97)
Employed/ Self employed	109 (26.71)	118(20.03)
Missing	1	0
Length of Stay in Village		
Since birth	511 (67.33)	927(68.67)
1-10 years	149 (19.63)	223(16.52)
>10 years	99 (13.04)	200(14.81)
Missing	1	3
Duration of stay in the village in the last year (Migration)		
1-6 months	111 (14.66)	103(7.63)
>6 months	646 (85.34)	1247(92.37)
Missing	3	3

* Represents participants who were not currently in school at the time of the study.

**Represents only participants eligible to work