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Marital Status and HIV Risk in Kenya: An Epidemiological Analysis of the 2003 Kenya Demographic Health Survey

presented by

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has been accepted towards fulfillment
of the requirements for the

MS degree in Epidemiology

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May 11, 2006

Date

MARITAL STATUS AND HIV RISK IN KENYA: AN EPIDEMIOLOGICAL ANALYSIS OF THE 2003 KENYA DEMOGRAPHIC HEALTH SURVEY

By

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A Thesis

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Department of Epidemiology

2006

Abstract

MARITAL STATUS AND HIV RISK IN KENYA: AN ANALYSIS OF THE 2003 KENYA DEMOGRAPHIC HEALTH SURVEY

BY

Omotomilayo F Akinyemiju

In Sub-Saharan Africa, women are at a higher risk of contracting HIV than men (UNAIDS). Unfortunately, there is very little research focused on the sub-population of married women in order to highlight how different risk factors affect them specifically and may place them at increased risk for HIV infection. This is especially important in the context of low condom use, childbearing and the trust inherent within many marriages. A comprehensive literature review of peer reviewed articles from 1990-2005 was conducted and revealed that there is little known about the effect of marital status on HIV risk. The major factors in the transmission of HIV within marriage are low condom use, education, migration as well as extramarital affairs. In order to further understand this population, data from the 2003 Kenya Demographic and Health Survey (2003 KDHS) was analyzed. The results show that married women are not protected from HIV infection and had a slightly higher risk compared to never married couples (Odds Ratio=1.07, 95% CI=0.67-1.73) after controlling for age, place of employment, education and place of residence. Furthermore, working at home is associated with a significantly lower risk of HIV infection compared to working away from home (OR=0.70, 95% CI=0.52-0.96). There is an urgent need for follow-up studies of this population in order to further understand these risk factors. Education and HIV prevention programs need to be focused on this group, since they are not being protected by marriage.

Dedication

This thesis is dedicated to my brother, Bunmi Akinyemiju whose support has always been a source of encouragement and comfort. To him I say 'Thank you for everything'. To my Father who has instilled in me a sense of independence and strength that has and will continue to serve me well. And also to my fiancé who is a source of moral support and always a friend indeed.

Acknowledgements

Firstly I would like to acknowledge the guidance and support provided by my thesis committee at the Michigan State University Department of Epidemiology: Dr Michael Rip for his help in the development of this thesis project and continued support and encouragements; Dr Saeed for his critical and constructive feedback through all the numerous drafts; to Dr Kaneene for his suggestions, support and help even around his very busy schedule; and Dr Todem for his constant encouragements, support, guidance, critiques and advice.

Secondly, I would like to acknowledge organization that provided me with access to this dataset- Macro International. This thesis would have been impossible without the hard work and diligence with which the staff members engaged in a national survey of a highly sensitive issue such as HIV/AIDS.

Thirdly, I would like to acknowledge the role of all my instructors throughout my years of study at MSU specifically in the Epidemiology, Anthropology and Sociology departments. This thesis really could not have been possible without the background knowledge provided by every one of the classes I have taken so far.

I would like to acknowledge the advice, support and academic resources provided by my friend and mentor- Dr Sinead Younge. I am really grateful for her continued support even while hundreds of miles away. I also appreciate the patience and help given by Randal Fotiu at the MSU Computer center on the very complicated task of cleaning the dataset.

Table of Contents

List of Tables

List of Figures

Images in this thesis are presented in color

Key to Abbreviations

AIDS	Acquired Immunodeficiency Syndrome
AZT	Azidothymidine, Zidovudine or Retrovir; anti-retroviral drugs
CBS	Central Bureau of Statistics
CDC	Centers for Disease Control and Prevention
DHS	Demographic and Health Survey
ELISA	Enzyme Linked Immunoabsorbent Assay
FDA	Food and Drug Administration
HIV	Human Immunodeficiency Virus
HSV-2	Herpes Simplex Type 2 Virus
KDHS	Kenya Demographic and Health Survey
M+F+	Male Positive, Female Positive HIV Concordance
M+F-	Male Positive, Female Negative HIV Discordance
M-F+	Male Negative, Female Positive HIV Discordance
SDM	Socio-demographic
STD	Sexually transmitted Disease
UNAIDS	United Nations Program on AIDS
UNICEF	United Nations Children's Fund
VCT	Voluntary Counseling and Testing
WHO	World Health Organization

Chapter 1

INTRODUCTION

The institution of marriage is generally more complicated than an association between two individuals devoted to spending their lives together. Nowhere is this more obvious than in cultures where polygamy and polygyny is supported, and where extramarital affairs especially in men are encouraged. This is the case in many sub-Saharan African countries. In the field of HIV prevention, the institution of marriage has traditionally been considered as protective against risk of HIV. This is due mainly to the fact that there is a direct imputation of trust implied from marriage; a commitment to a lifetime of love and devotion. However, it is becoming increasingly clear that this is often not the case and despite (or in spite of) the love and dedication theoretically innate to marriage, married women are increasingly becoming exposed to and infected with HIV. This thesis is designed to firstly conduct a critical review of the literature to search for current research on this topic, and secondly to analyze a cross-sectional data from Kenya. The aim is to further understand if and how married women are becoming increasingly at risk for HIV.

The global epidemic of Human Immunodeficiency Virus (HIV) has continued to spread even faster than the most pessimistic estimates, for the past decade (Figure 1). Despite HIV prevention efforts such as education, condom use and abstinence campaigns, new cases are still developing each day and with that comes an increasing sense of helplessness. Different strata of the world population are being affected in varying intensity, and coping strategies are developed according to the availability of resources and support. These strategies vary by country and region, and in few cases are

actually effective in keeping the epidemic at low levels (e.g. in Senegal) or in drastically reducing the incidence rates (e.g. in Uganda). The HIV virus which causes the Acquired Immune deficiency syndrome (AIDS) has managed to navigate all contexts of human life- it takes advantage of low income, gender inequalities, lack of education, inefficient government and other societal ills that are often overlooked otherwise.

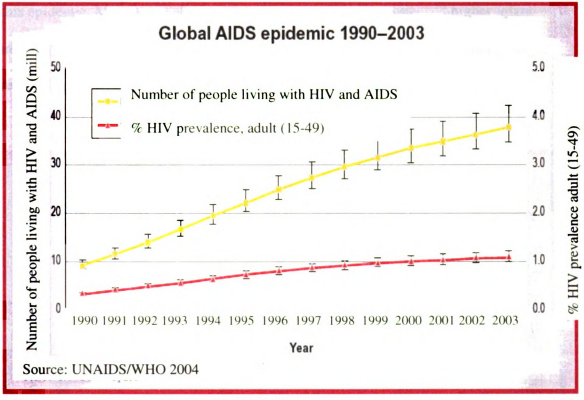


Figure 1: Global prevalence of HIV/AIDS in adults

The overwhelming majority of the HIV epidemic burden continues to lie within sub-Saharan Africa with prevalence rates constantly increasing (Figure 2). HIV prevalence rates ranges from 37% in Botswana, 21% in South Africa, to less than 1% in Senegal, showing that there are wide variations in the distribution of the epidemic [1].

According to the United Nations Program on AIDS, by 2000 about 36 million people had been infected with HIV or were living in AIDS; 17 million women and 1.4 million children below the age of 15. The result of this high HIV prevalence rate is a simultaneous increase in morbidity and mortality rates in all strata of the population. This increases the physical, financial as well as emotional burden on healthy individuals who have to care for sick relatives. Furthermore, population dynamics is greatly affected by this epidemic. Many sub-Saharan African countries have experienced higher infant mortality as well as adult mortality rates as a result of HIV and life expectancy has reduced dramatically (Figure 3).

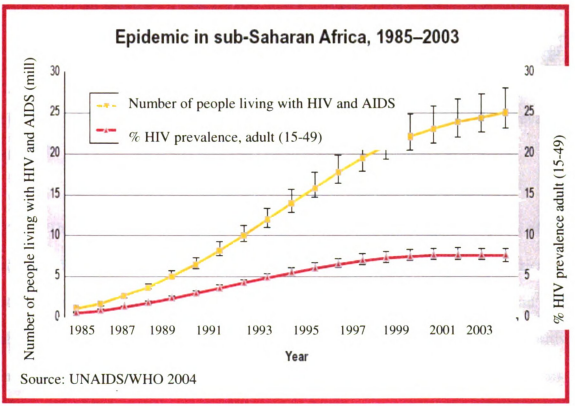


Figure 2: Percent HIV prevalence in adults residing in sub-Saharan Africa

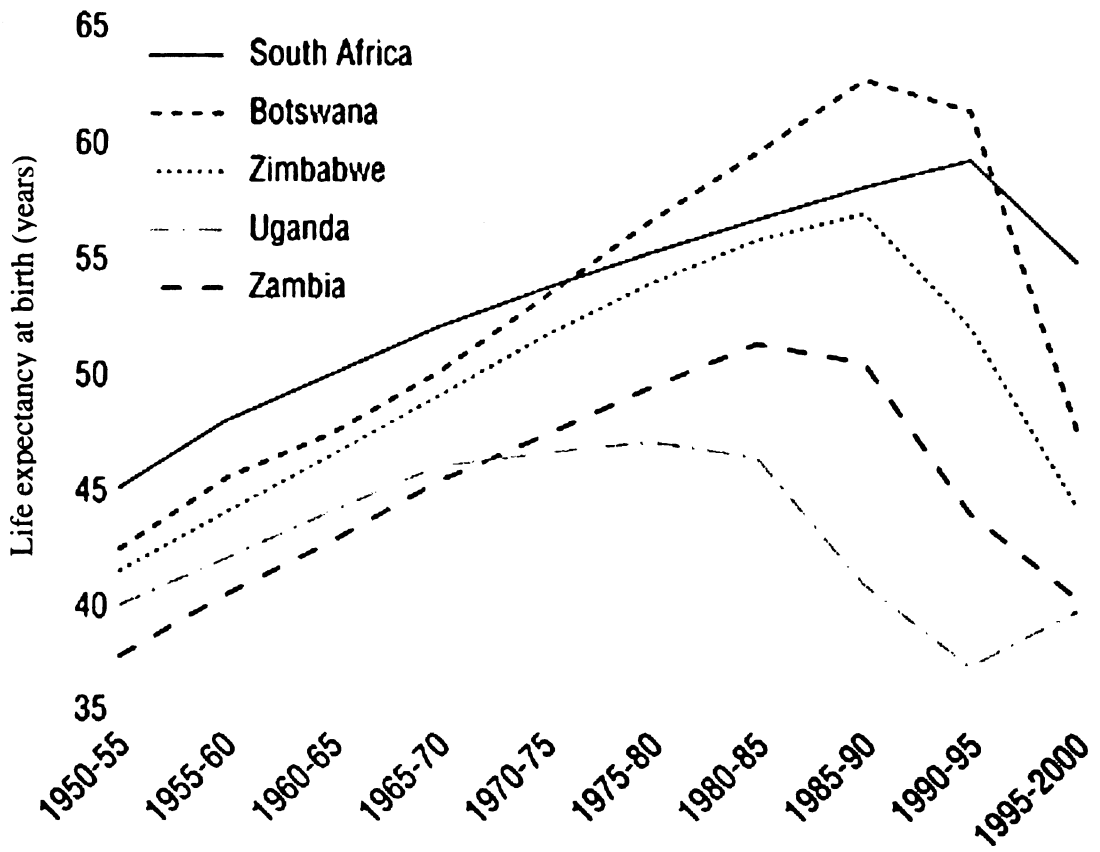


Figure 3: Life expectancy in some countries in sub-Saharan Africa with a high prevalence of HIV[2]

This epidemic has several characteristic features. Firstly, the vast majority of cases are found in areas of low social economic status. Globally, Sub-Saharan African countries (see Appendix A) have some of the lowest per capita income in the world[2] and about 10% of the world's population resides there, yet more than 60% of all HIV positive individuals live there. Secondly, the gender distribution reveals that the infection occurs predominantly among women (Table 1). This is quite evident in developing countries, for instance, in South Africa and Zimbabwe about 75% of young people living with AIDS are female.[1] Similarly in the Caribbean, females constitute nearly 50% of all adults

infected with HIV. Young females 15-24 years old in the Caribbean are almost twice as likely to be infected as young men in the same age group.[1] Young women in sub-Saharan Africa were also found to be 3-6 times more likely to be infected than their male counterpart. About 76% of all women affected with HIV reside in Sub Saharan Africa.

Table 1: Number of adults and children living with HIV (UNAIDS, 2004).

		Mean	Range
Number of people living with HIV	Total	37.8 million	34.6-42.3 million
	Adults	35.7 million	32.7-39.8 million
	Women	17 million	15.8-18.8 million
	Children <15 years	2.1 million	1.9-2.5 million
People newly infected with HIV in 2003	Total	4.8 million	4.2-6.3 million
	Adults	4.1 million	3.6-5.6 million
	Children<15 years	630,000	570,000-740,000
AIDS deaths in 2003	Total	2.9 million	2.6-3.3 million
	Adults	2.4 million	2.2-2.7 million
	Children <15 years	490,000	440,000-580,000

Another striking feature of the HIV epidemic in sub-Saharan Africa is the mainly heterosexual route through which it is transmitted.[1] It is estimated that about 80% of all HIV infections occur through heterosexual transmission, while vertical transmission from mother to child accounts for 5-15% of infections in the population.[1] Transfusion of infected blood makes up the route of transmission for the rest of infections. The high

prevalence of HIV transmitted through heterosexual routes as well as its rapid spread is attributed to several factors such as frequent change of sexual partners[1], unprotected sexual intercourse[3], presence of sexually transmitted diseases[4], lack of male circumcision[5] and so on. Since the most infections occur through heterosexual routes, it is therefore important to study several factors related to sexual relationships between men and women.

Unfortunately, most of the studies being conducted have focused on 'risk groups' such as commercial sex workers, adolescents, as well as single adults. Furthermore, prevention programs based on behavioral changes often focus on HIV transmission outside marriage. However, married men and women constitute a vulnerable group that should be studied and targeted because of the decreased likelihood to use condoms[5], and the culture in many societies that reacts favorably towards multiple partners for men, as well as extramarital affairs. Although there is widespread knowledge about male condoms (about 95%), according to the 1999 Demographic and Health Survey conducted in Nigeria, only about 6% of the women, and 15% of the men reported any condom use.[6] Additionally, monogamous men were found to be more likely to have extramarital sexual relations than polygamous men. This is due to reasons such as lack of sexual access during wife's pregnancy and postpartum sexual abstinence.[7]

Consistent condom use remains the most practical and efficient way of preventing HIV transmission.[5] However, most HIV prevention programs currently focus on promoting condom use mainly among single individuals as well as commercial sex workers.[7] Therefore, the prevalence of condom use within marriage remains dismally low. For instance, about 51% of married or cohabiting couples use any form of

contraception, while condom use accounts for only 2%.[5] Research has suggested that exclusive emphasis on condoms for non-marital sexual contacts may be counterproductive since it may reinforce an association with illicit sex.[5] This low prevalence of condom use attests to the need to complement current research and prevention efforts based on high risk groups with interventions focused on promoting protected sexual intercourse within marriage.

The study of HIV infection and its risk factors in married women has important and far reaching implications for the health of women and children. It also has direct economic implications in terms of lost work force and resources diverted to the care of increasing number of HIV positive individuals. The desire of married women to get pregnant implies less use of barrier protection such as condoms and this translates directly into increased risk. The increase in HIV infection in married women especially carries severe implications for babies born to such mothers. The inadequate supply and high cost of anti-retroviral drugs that may reduce mother-to-child transmission means that as more married women get infected, their unborn children also become increasingly at risk, and their older children become neglected as they cannot be cared for. The lack of direct intervention in this group based on the assumption that marriage is protective may be costing women their lives, and the health of their children.

Purpose of the study

The purpose of this study is to examine the distribution of HIV in married women in sub-Saharan Africa, and also to describe the risk factors associated with the incidence/prevalence of HIV/AIDS in married women in Africa.

Specific Aims:

- To assess the need for more detailed population based cohort studies, as well as HIV prevention programs focused on the population of married women.
- To determine if marriage is protective against HIV infection in a population of adult Kenyan women.
- To investigate the possible reasons for the increasing HIV incidence rates among married women in Kenya.

It is hoped that information from this analysis will contribute to planning further policies to help women become independent decision makers in matters affecting their health and HIV status. It is important to recognize these factors within the proper contexts. For instance, providing jobs to women in rural areas may help them to improve their financial situation, but if the culture prohibits women from working or from leaving their children with others, such program might not work. Although there are many risk factors responsible for the vulnerabilities towards HIV infection (Figure 4) and specifically in married women in Sub Saharan Africa, for the purpose of this study the risk factors that will be assessed include: Socio-economic status, urban/rural dwelling, age, education, and marriage type i.e. custom, certificate etc.

The descriptive analysis will highlight the importance of more current research focused on the sub-population of married women in sub-Saharan Africa. Furthermore, the statistical analysis will illustrate the need for developing proper public health interventions that will empower women to make decisions for themselves and their children. These decisions will hopefully help to reduce their probability of getting infected with HIV from their husbands or other partners. The analysis will also illustrate

the need to educate men to be more considerate and to develop a habit of condom use in extra-marital affairs if such were to occur. It is important to understand the reasons why the incidence of HIV infection in married women has been increasing in recent years. It is also important to describe the distribution of married women who are currently or may later be at risk of HIV infection. In order to achieve this purpose, some specific questions will be addressed through a review of the current literature and analysis of relevant data. Two specific hypotheses were formulated about the relationship between marital status and HIV risk in adult women in Kenya. They are:

Hypotheses:

1. Married women have higher HIV incidence rates than single women. It is widely assumed that this population is protected from infection but desire for children, low condom use as well as extramarital affairs may contribute to higher risk of HIV in married women. The lack of focus of HIV prevention campaigns in this demographic group may reduce awareness about risk and prevention in this population.
2. However, within married couples, traditional (custom) marriage increases married women's vulnerability to HIV. This might be because couples married by custom are more likely to engage in traditional behaviors such as extramarital affairs, low condom use as well as the subordinate role of women that reduces their ability to request condoms from their sexual partners.

A proper understanding of the dynamics affecting married women in terms of HIV risk factors will be highly beneficial by raising awareness about the vulnerability of this

sub-population and encouraging the design of proper prevention and intervention programs aimed at reducing the occurrence of unsafe sexual behavior.

This thesis is formatted thus: Chapter 1 provides a general introduction into the topic while Chapter 2 focuses on the basic biology of HIV. Section A is a comprehensive review of current literature and will be carried out using medical and non-medical databases such as Pubmed, Medline and Proquest as well as other resources related to HIV/AIDS; it includes Chapters 3 and 4. Section B is based on statistical analysis of data, and this will be carried out on a population based survey of adult Kenyan men and women- the 2003 Kenya Demographic Health Survey. This section includes Chapters 5, 6 and 7. Chapter 8 provides a summary and recommendation for future studies.

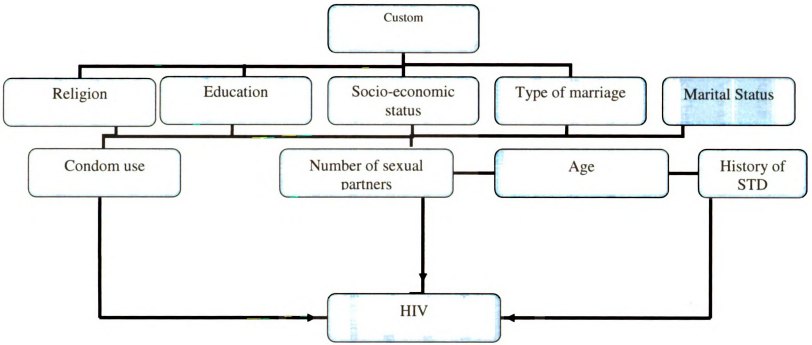


Figure 4: Conceptual Framework of risk factors and how they affect HIV infection

Chapter 2

BRIEF INTRODUCTION TO THE BASIC BIOLOGY OF HIV

HIV is a virus transmitted via blood and other body fluids such as semen, and breast milk. Therefore, the virus can be spread through injection needles if reused, blood transfusions, from mother to child through vertical transmission, from mother to child after birth through the breast milk, and through unsafe sexual practices such as lack of condom use. It is possible for the virus to remain within a person's blood stream for many years; AIDS is the final manifestation of HIV through opportunistic infections such as pneumonia, Tuberculosis, etc. The median survival time with HIV is about 10 years. A person with HIV may look and act normal without any outward sign of the disease and it is possible for an infected person not to be aware that they have the virus. This is very important because such individuals often have unprotected sex with other partner(s) and may transmit the virus to them. An HIV test is needed to confirm the presence of the virus. The virus is not transmitted by shaking hands, kissing or sharing clothes.

The HIV is very small in size; about 16,000 viruses can sit on the head of a pin.[9] The virus invades the T lymphocytes of the white blood cells and then reprograms the cell to reproduce the virus. One HIV virus has the capacity to make about 10 billion copies of itself a day, and mutates at the rate of 1 in 10,000. This random mutation rate makes HIV very resistant to drugs. A healthy adult has between 700 and 1500 CD4 cells per cubic milliliter of blood, but over a period of years in an HIV infected individual, the number falls to critical levels. Below 500 CD4 count implies a depressed immune system and below 200, opportunistic infections develop. The person-to-person spread of HIV relies on the reproduction rate- the number of people infected by one case. This in turn is

influenced by the attack rate of disease, frequency of contact, duration of infectivity, sub clinical infection such as STD's and the susceptibility of the population.

HIV causes a reduction in the T cell count of infected individuals. These are the cells needed to fight infections. A progressive degeneration of the T cell count is characteristic of HIV infections. As this happens, infections that would have been spontaneously destroyed by the body's immune system are left in the body and able to cause major damage. This is also associated with reduced appetite, loss of energy and inability to heal after injuries. As the disease progresses, the immune system becomes more compromised and vulnerable to attack by infections. These opportunistic infections predisposed by very low T cell counts are the basis for a diagnosis of AIDS.

One major risk factor for acquiring HIV is the presence of STD's. Most are associated with reduced immune system capacity and bruises along the genitalia of both men and women. When there are open sores on the genitalia, or whenever there is inadequate lubrication of the genital tract (such as with anal sex or forced sex), there is a greater opportunity for the HIV to be transmitted from one partner to the other. People with STD infections are about 2-5 times more likely to be infected with HIV.[9] Also, due to the biological make-up of the female genitalia (the sperm spends more time within the genital tract of the female), in heterosexual contacts females are more likely to be infected after having sex than men. The chances that a woman will be infected by having sex once with an HIV positive man are about 1 in 100; for a man, the chances are about 1 in 1000 of being infected after having sex once with an HIV positive woman.[9]

Another risk factor for men is the lack of circumcision due to some cultural and religious attitudes. Scientific research suggests that male circumcision provides

significant protection against HIV infections and other STD's such as syphilis and gonorrhea. A study found that circumcised males are about 2-8 times less likely to be infected with HIV compared to uncircumcised males. Also, there have been a lot of studies showing a correlation between high rates of HIV infection in some African populations that do not practice male circumcision.[9]

Some studies have focused on the role of the foreskin in HIV infection. It is believed that the stratified squamous epithelium that covers the penile shaft is keratinized and provides a protective barrier against infections. The inner mucosal surface is however not keratinized and is rich in cells of Langerhans' that make it susceptible to the HIV virus[11]. Therefore, it is highly recommended that males be circumcised especially at birth. The procedure is safe and has very low incidences of complications. For older males, circumcision is recommended at puberty before the young men become sexually active.

HIV genetic mapping

Based on genetic mapping, there are different strains of HIV in existence. HIV-1 has up to ten genetic subtypes with major categories labeled A, B, C, D and E. HIV-2 is another strain that is not as easily transmitted as in HIV-1; it is also less likely to cause AIDS in affected individuals.[9] In North America and Europe, HIV-1 subtype B is the predominant strain, but in Africa subtypes A and C are predominant. These strains have been described as being more aggressive and more easily transmittable.[9] Other identified subtypes of HIV-1 include subtypes O, J and I.

Within countries, there exist variations in the type and subtype of HIV prevalent. Ghana exhibits a higher prevalence of HIV-1 cases while Senegal and Guinea-Bissau have shown higher prevalence of HIV-2 cases.[9] The highest rates of HIV-2 infections have been reported among subgroups that are at considerably higher risk for HIV-1 infection such as commercial sex workers and patients with STDs.

Treatment Options for HIV Infection

There is currently no cure or vaccine for HIV/AIDS. Anti-retroviral are drugs that are capable of reducing an infected person's viral load by up to10 times in 8 weeks.[9] AZT (Azidothymidine, Zidovudine or Retrovir) was the first classes of drugs approved by the FDA for use in HIV positive patients. Due to the high mutation factor, however, the virus soon became resistant to AZT. Didanasine was approved in 1991 and added to the previous drug as a multidrug regimen. The third class of drug added to the treatment regimen was Protease Inhibitors. These block the protease enzyme in the HIV and prevent newly reproduced HIV cells from infecting new cells. A nucleoside analogue reverse transcriptase inhibitor and a non-nucleoside transcriptase inhibitor both act to prevent the HIV genes from integrating into the T cell lymphocyte and reprogramming it to producing HIV en masse.

An HIV positive patient taking the triple cocktail of drugs consistently will be able to delay the onset of AIDS and the opportunistic infections associated as well as keep their CD4 count at healthy levels.[9] Unfortunately, there are major side effects associated with taking the triple drug cocktail. They may include headaches, insomnia, nausea, weakness, and diarrhea. Also, some of the drugs have to be taken with special

diets such as high protein, high fat meals which for many people may not be affordable. Due to the toxic effects of the drugs, about 20-30% of HIV positive patients are unable to take the anti-retroviral therapy.[7] Also, due to the cost of the drugs, most HIV patients in developing countries such as Africa, Asia and Latin America are completely unable to afford taking the drugs in the correct regimen. This is compounded by all the associated secondary costs such as constant highly nutritional diets, loss of employment, and the presence of other family members to help with daily need- which results in loss of income on their part.

Herd immunity is the protection offered to a population given that the number of people immune in the population decreases the risk of infection to the susceptible by diminishing the probability of exposure. However, since there is currently no vaccine available for HIV, this concept is not applicable. Even when a vaccine does become available, the extremely high prevalence rates in many parts of sub-Saharan Africa will reduce the effect of herd immunity. Cultures that support men having multiple partners and visiting prostitutes will be more affected, as the probability of exposure due to one man will be increased. The transmission probability ratio (the measure of risk of transmission from infected to susceptible individuals during a contact) in these communities will increase and so will the incidence rates of HIV.

There are several factors affecting the surveillance of HIV/AIDS in communities. Medical care seeking patterns is an important one. Due to the huge disparities in socio-economic status of African populations, and lack of proper infrastructures in hospitals and clinics, many low-income individuals do not seek care at government or local hospitals. Many pregnant women prefer to give birth at home or visit local midwives to

attending government hospitals; others may decide to visit traditional medical doctors. This constitutes a bias in the surveillance which is mainly based on hospital records and prenatal clinic attendees especially since HIV infection is believed to be associated with decreased fertility. Another factor that may affect surveillance is the diagnostic methods used. Improvements in diagnostic technologies may account for a huge difference in the incidence rates observed currently versus ten years ago. The accuracy and completeness of reporting may also constitute a form of bias. Given the lack of adequate funding for most hospitals and regional laboratories, the lack of access to rural areas, and the general overpopulation of most testing facilities, it is not surprising that available data on HIV/AIDS are neither accurate nor complete.

Voluntary testing in many sub-Sahara African countries is dramatically low. This is due to the lack of resources for counselors, supportive services, and campaigns for the increase in HIV knowledge and attitudes about testing. The notion that HIV/AIDS is a death sentence and there is nothing that can be done about it has led to the concept that there is no value in learning about one's HIV status. It is important to promote the culture of voluntary testing because this would help in reducing the number of new infections, it would also hasten the potential to extend life through life saving anti-retroviral drugs. It is also important to make available funds for counselors and supportive services for HIV positive individuals. This will improve HIV positive individuals' state of mind by providing necessary information that will disabuse the many wrong notions learnt through gossip and peer networks.

The next section provides a review of the current literature on HIV in sub-Saharan Africa with a focus on South-Eastern Africa. In light of high prevalence rates, lack of

cure and ease of transmission of the disease, it is necessary to situate the current research within the framework of previously conducted research on the topic. This is necessary to provide a more complete picture about the factors that influence the distribution and transmission of HIV in this population.

Section A

MARRIAGE AND RISK OF HIV INFECTION: A REVIEW OF LITERATURE

Chapter 3

LITERATURE REVIEW

A comprehensive literature review was conducted using online databases such as Pubmed and Medline. The review was focused on peer reviewed published materials from 1990 to 2005. The main keywords used in the search include 'HIV in sub-Saharan Africa, HIV/AIDS in Africa, HIV/AIDS prevention, HIV/AIDS risk factors'. Also, key textbooks on HIV/AIDS and infectious disease epidemiology were used to provide the basic background and other relevant information. Reports from the UNAIDS, WHO, Republic of South Africa, UNICEF, CDC and so on were used as sources of current information on the HIV/AIDS epidemic. Various websites were also used as sources of current data and updates on the HIV/AIDS pandemic; the UNAIDS website, South African department of health, UNICEF, WHO, CDC, as well as numerous university websites. Reports and papers from international AIDS conferences also provided information about current research questions and results in the field from all over the world. The results of this review are presented next.

Global HIV Epidemiology

About 38 million people are living with AIDS world wide (range: 34-42 million).[1] In sub-Saharan Africa where over 65% of HIV patients reside, an estimated 4.8 million people become newly infected with HIV each year[1], this translates to about 14,000 new infections each day. Although there is virtually no country unaffected by HIV, there are variations in the severity of the epidemic (See Appendix B). While few countries have succeeded in keeping HIV incidence levels at low rates, many are still experiencing

increases in the number of people living with HIV. Others, such as some developing countries, are experiencing increases in HIV incidence rates due to several reasons, many of which are interconnected and highly complex. For instance, some people believe in some parts of Africa that the availability of anti-retroviral drugs indicates that AIDS has been defeated. This is highly correlated with low education and knowledge about the disease as well as low socio-economic status.[10] These reasons and other risk factors are diverse and varied, therefore there are large variations in infection levels for instance between rural and urban areas. This implies that the HIV epidemic is not one pandemic sweeping the world, but rather is made up of a series of micro-epidemics with their own distinct characteristics and dynamics.

Sub-Saharan Africa

The number of people living with HIV especially in sub-Saharan Africa has continued to increase worldwide despite increased funding for prevention and new organizations developing to reduce the numerous risk factors for HIV.[1] A partial explanation for this increase might be due to the difference in definitions, methodologies and assumptions used in estimating the prevalence and incidence rates of HIV. It may also be partly explained by increased awareness about the epidemic resulting in increased reporting of cases. Lower global HIV estimates were provided for 2003 and for previous years by the WHO and UNAIDS based on the results of more accurate data from national surveillance programs, household surveys, as well as modeling methods. However, the lower estimates indicate that the epidemic is still expanding and is not being reversed.

The expansion of the HIV epidemic is related to several factors as previously stated, however a major factor is condom use. It is fairly obvious especially to public

health and government officials that condom use is extremely important in the fight against rising HIV incidence rates, but the actual amount of condoms available for use is extremely low. Even if education and other HIV prevention programs are successful in convincing sexually active men and women to use condoms consistently, research conducted by the United Nations Population Fund reveals that this might not be physically possible.[14] They estimated that the number of condoms needed for HIV/STD prevention in developing countries ranges between 15 and 20 trillion in the years 2005-2015. Unfortunately, currently the actual amount of condoms available in these countries is nowhere near these numbers (Figure 5).

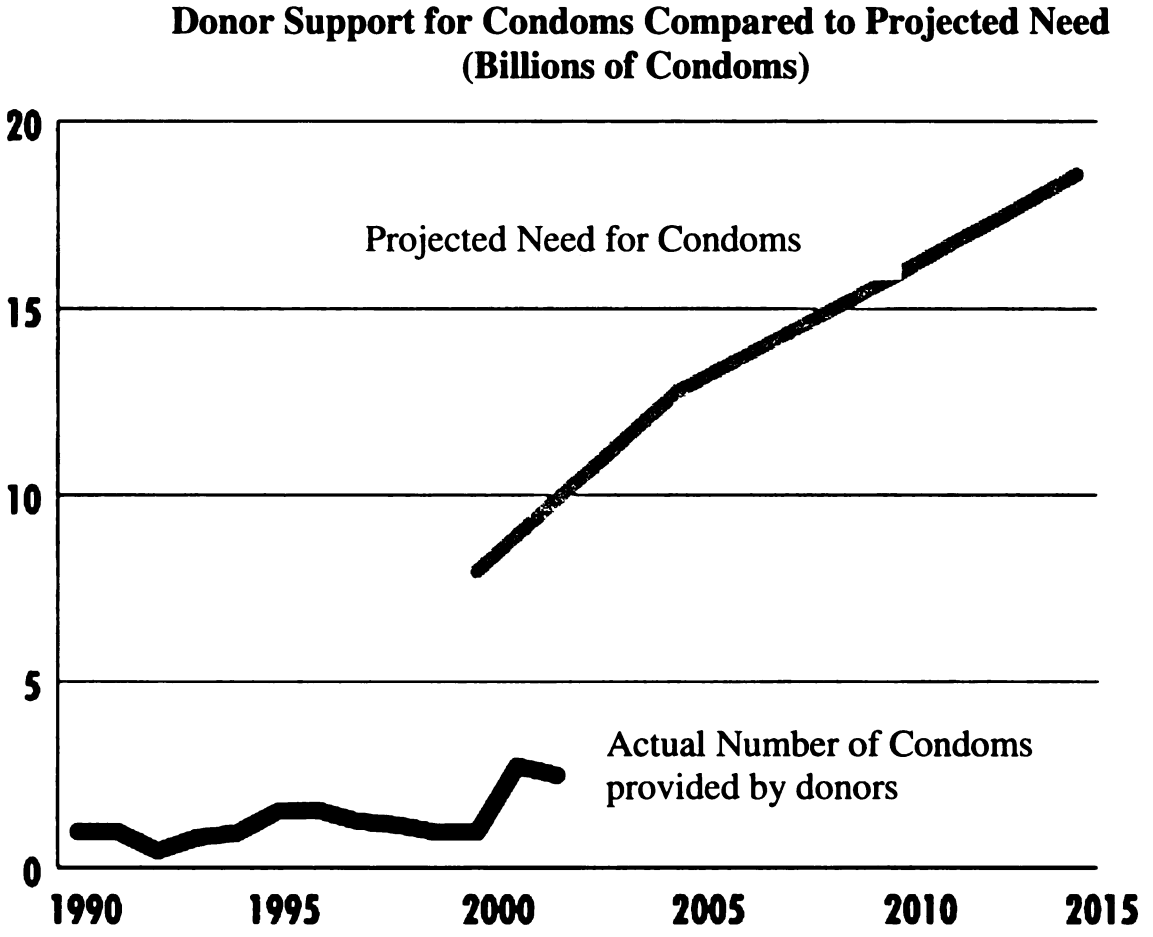


Figure 5: Projected need for condoms and number of condoms provided.
Sources: UNFPA, 2002. Global estimates of contraceptive commodities and condoms for STI/HIV prevention, 2000-2015. New York: UNFPA. UNFPA, 2004. Database on Donor Support for Contraceptives and Logistics Management. New York: UNFPA.

HIV Epidemiology in Kenya

Based on the 2003 KDHS, the adult prevalence of HIV in Kenya was estimated to be 6.7% (ranges from 4.7-9.6%). This corresponds to about 1.2 million adults and children infected with HIV. The majority of the infections occur in women with about 720,000 women infected in the entire country. Overall prevalence rate was 8.7% in

women compared with 5.4% in men; this trend is similar to those observed in other sub-Saharan African countries. Urban residents in Kenya have much higher HIV prevalence rates compared to rural residents; 10% and 5.6% respectively. Young women in Kenya are much more likely to be infected with HIV compared with their male counterpart; prevalence rate was 23% in young women compared to 3.5% in men of the same age.

Treatment and prevention of the HIV epidemic in Kenya is beset by several problems, as it is in several other African countries. For instance, of the 1.2 million Kenyans infected with HIV as of 2003, anti-retroviral drugs are available and used to treat only 11,000 adults.[15] Over 220,000 adults were in need of treatment in Kenya as of 2003. In the entire country of over 32 million individuals, there were only 304 public and non-governmental services that provide HIV testing and counseling services. Education and information about HIV/AIDS in Kenya is therefore quite low; only 26% of women were aware of two ways of preventing sexual transmission of HIV and were able to reject three misconceptions about HIV transmission. Prevalence of condom use among adults during sex with a non-regular partner was 43% in men and 14% in women. According to the UNAIDS, the proportion of young adults (15-24 years old) who reported having more than one sexual partner in the last year was 92% in men and 39% in women. These figures imply that the transmission of HIV in this population is likely to continue to increase in the nearest future.

HIV in Married Women

The initial plan was to conduct a literature review of married women in Kenya, however there has been very little research done in this area in this country. It was

therefore necessary to conduct a more general literature review of this topic based on South-Eastern Africa. It is assumed that the proximity of the countries to each other indicates a general similarity in cultures that. It is important to interpret the results of this review in light of this limitation.

Preliminary research has shown that women are not being protected by marriage.[16,22] A sample of 1,458 pregnant women interviewed in Rwanda showed that 86% had been married for an average of 8 years and two-thirds reported a single lifetime partner, yet about 25% were HIV positive. Overall prevalence was even higher at 32% while among women ages 19-24, the rate was 38%. A study of married women has shown that the greatest risk factor for women is an infected spouse.[17] Many men who might use condoms with prostitutes do not use them with long-term partners because of issues of trust and fidelity.[18] For the women, cultural and social constraints such as trust, gender relations, and desire for children may inhibit them from asking their husbands/partners to use condoms.

Married women generally view AIDS as a disease that they have no power to control or to run away from. Interviews conducted with married African women indicated that blame was directed at husbands or men in general for bringing death 'into the bedroom'.[9] They also believed that being women, there was nothing they could do to stop this occurrence since they could not control the men. This implies that women believe that the disease is spread through the behavior of men. In many societies, women have no power to question the sexuality of their husbands. The prevalent gender relations and power structure does not allow women to protect themselves from unsafe sex. The

decision to have or not to have sex is a man's decision to which a woman has very little to say.[9]

Marriage in sub-Saharan Africa is highly valued because it is considered as a legitimate source of children. Unfortunately this same institution exposes women and children to HIV infections. According to research conducted in Zimbabwe, both men and women desire children for economical, social as well as psychological values regardless of risks of HIV infection.[9] This is evident by the fact that HIV incident rates in antenatal clinic attendees have been steadily increasing since the 1990s (Figure 6). A recent study examined whether women in Zimbabwe who perceived themselves to be at risk for HIV will take measures to protect themselves and their fetuses from HIV infection or if they will still fulfill their utilitarian desire for children.[4] Health and HIV intervention programs in sub-Saharan Africa had usually been guided by the notion that women will stop childbearing or use barrier methods of protection if they perceive themselves to be at risk for HIV, are aware that there is no cure for AIDS, and are aware that the benefits of adopting such protective measures outweigh the risks of not doing so.

This study investigated the desire for children among married women in Zimbabwe in relation to self-perceived risk of HIV infection, experience of at least one child's death in the last 5 years, and experience of at least one spontaneous abortion in the last 5 years among 15-45 year old women in rural and urban Zimbabwe. A total of 2250 ever-married women were selected from 6828 randomly selected households in rural and urban Zimbabwe. The outcome measures were intention to get pregnant (yes/no), self-perceived risk of HIV infection (no risk/high risk), child less than 5 years mortality (no/yes), and spontaneous abortion in the last 5 years (yes/no).

The results of statistical analysis showed that overall, 54% of the study population desired to get pregnant in the future. Participants who desired to get pregnant in the future perceived themselves to be at higher risk of HIV infection, were more likely to report one child's death in the past 5 years and to report at least one spontaneous abortion in the last 5 years. They were also more likely to be married, unemployed or employed in informal/agricultural sectors, and earning lower incomes. The study concluded that there was no association between self-perception of risk of HIV infection and desire for more children. The authors observed that women would replace childhood deaths or spontaneous abortions with more children until they achieve their desired family size, regardless of self-perceived risk of HIV infection. Therefore, health intervention programs in these areas needs to be refocused away from their current assumptions and directed more towards the attitudes towards childbearing, as this may be the primary barrier to behavioral change among women who perceive themselves to be at risk for HIV.[4]

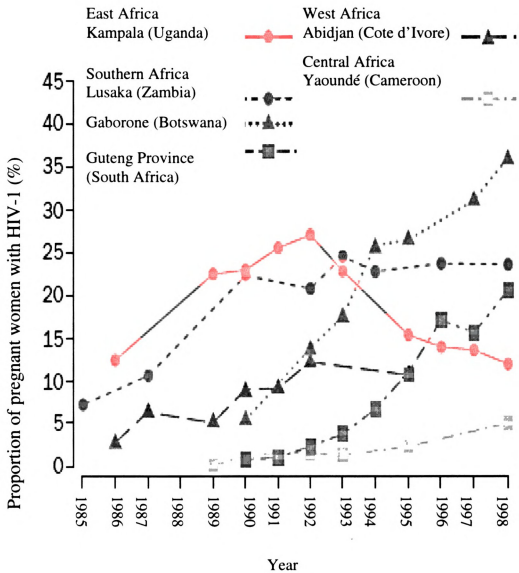


Figure 6: HIV-1 prevalence among pregnant women in selected cities in sub-Saharan Africa 1985-1998. Source: US census bureau, population division (2000)

The vulnerability of married couples, especially women is shown in a cohort study conducted in rural southwest Uganda.[17] This study was designed to study the efficacy of HIV-1 transmission within married couples according to the sero-status of

their partners. A cohort of married couples was followed for 7 years to compare male-to-female with female-to-male transmission within couples. The study reported that HIV incidence rate in women with infected spouses was twice that of men. Among those with HIV negative spouses, the incidence in women was less than half that of men. Furthermore, the incidence of infection among women with HIV-positive spouses was 105 times that of women with HIV-negative spouses. Incidence of infection among men with HIV-positive spouses was 11.6 that of men with HIV-negative spouses. This implies that women are more likely to be infected from their husbands, than husbands are from their wives. Also, men are twice as likely to bring HIV infection into the marriage presumably from extramarital affairs. This study provides evidence for the importance of studying and targeting married couples in order to reduce HIV incidence and transmission within married couples.

A more recent study of HIV DNA sequencing was conducted in Zambia where researchers found that about 87% of cohabiting couples shared related HIV strains, implying transmission.[19] Moreover, the transmission of HIV within a relationship is related to several direct risk factors such as the transmission probability per sex act, and the total number of such sex acts in a relationship.[18] The transmission probability per sex act is in turn determined by lack of male circumcision, lack of condom use, vaginal intercourse during menstruation, dry sex, and the presence of other STD such as the Herpes Simplex type 2 Virus (HSV-2). The number of sex acts is predicted by the frequency of sex acts, and the duration of marriage. The cross-sectional study conducted in four countries; Kenya, Zambia, Benin and Cameroon found that HSV-2 was found to

be a significant risk factor for positive HIV concordancy (F+M+) among couples with at least one member HIV positive.[18]

Univariate analyses of direct risk factors for HIV in the study revealed that lack of circumcision as well as duration of a marriage were also important risk factors.[18] Indirect risk factor such as husband having had extramarital sex in the past year was also a risk factor for HIV concordancy. In Kenya, marriages where the husband had had an extramarital sexual relationship in the past year were about 5 times more likely to be HIV positive concordant. Also in Kenya, marital condom use was found to be significantly protective against HIV concordancy. This study highlights the importance of the promotion of condom use within marriage as a means of reducing the incidence of HSV-2 and other STDs and thus HIV transmission.

Contemporary marriage systems in sub-Saharan Africa has several features that makes it important in the context of HIV infection; declining levels of polygamy, increasing levels of non-customary marriage and higher rates of marital dissolution especially in urban areas.[20] A population-based demographic surveillance survey of adults in Tanzania found that almost half of the ever married men and about a third of the ever married women had been divorced/separated at least once.[21]The current rates of marriage suggest that remarriage is also very common and occurs soon after divorce. The major reasons given by men for the break-up was unfaithfulness of their wife (55%), while those given by women was alcoholism of the husband (38%). Furthermore, at least 50% of the men in rural Tanzania reported extramarital affairs in the last year, while only 8% reported that they always used condoms.

The study found that the HIV prevalence rates in the major trading area under study was about twice the rate in surrounding towns, and about 3-4 times higher than in the rural villages. It was observed that the HIV prevalence level was related to the level of economic/social activity, number of female bar workers in the community, the mobility of the population and the proximity of the area to a major town. Due to the high poverty in the area, people move to search for jobs, leading to increased migration. Coupled with high marital instability, extensive sexual mixing during travels/migration as well as high STD rates, there is increased risk of HIV infection in the community.

Migration is a major factor in the transmission of HIV within marriage in sub-Saharan Africa. Circular migration occurs when men or women move to urban areas to work and then return home periodically, and happens in about 62% of South African adult men.[22] This phenomenon is important especially when it provides opportunities for extramarital affairs from both men who migrated and the women left at home. A study was designed to investigate the rates of HIV-1 infection in migrant and non-migrant workers in order to understand the risk factors that affect transmission dynamics in South Africa. Investigators linked information from migrant workers in urban areas with their partners' information in rural areas. 70% of the couples were HIV negative concordant, 9.5% were positive concordant while 20% were discordant.

The study revealed that migrants were twice as likely to be discordant as non-migrants. 71% of the discordant couples were male positive (M+F-) while 29% were female positive (F+M-). Migrant men in the study were 26 times more likely to be infected from outside their relationship than from inside, while non-migrant men were 10 times more likely to be infected from outside. This implies that extramarital affairs

constitute the main route of HIV infection to men, while infection from their partners constitutes the major route for non-migrant women. Periodical migration of the men away from the home greatly increases the occurrence of extramarital affairs, and thus increases HIV risk. Women whose partners were migrants were also found to be twice as likely to be infected from outside than from inside, implying that migration of their husband also increases opportunities and/or need for extramarital partners- also increasing their risk of HIV infection. The need for constant social, sexual, emotional and financial support is a major reason for the patterns of extramarital sexual partnerships observed. It is important to understand the complex social and sexual lives of migrants and their spouses as well as other rural women in order to design HIV prevention programs in this population.

Figure 7 provides a conceptual perspective on the pathways through which marriage partners may become HIV positive. This shows that although men are more likely to be engaged in extramarital affairs and contract HIV from outside the marriage, there are other possible situations. For instance, women may be infected through extramarital affairs and infect their husbands, or both parties may be infected from outside the marriage or before being married. Therefore, prevention programs should be focused on both men and women in order to effectively reduce marital transmission of HIV.

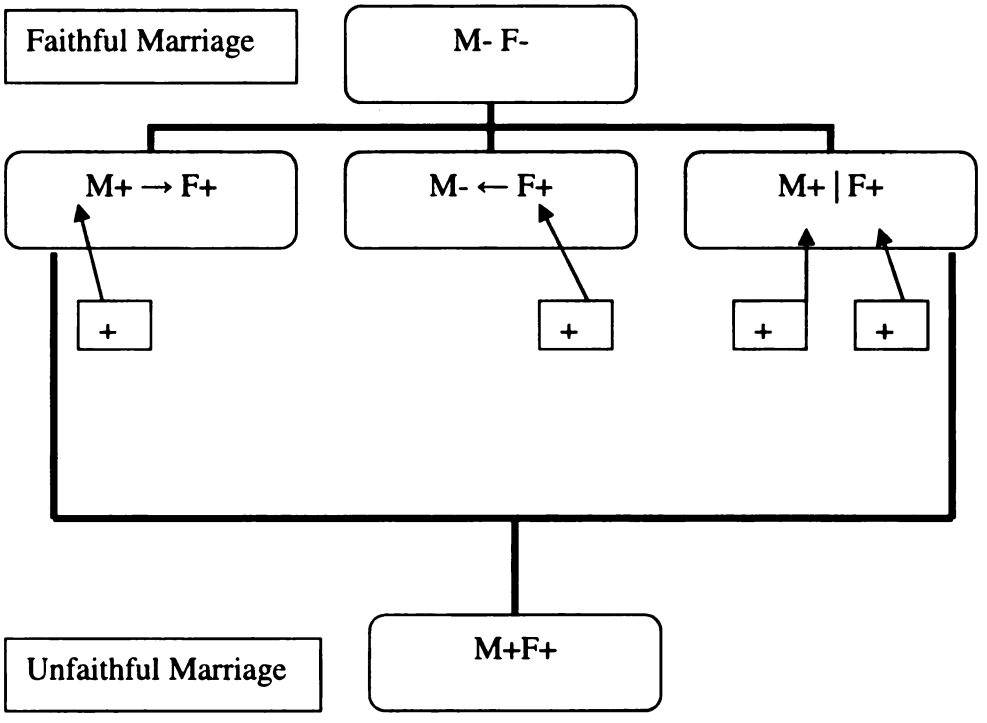


Figure 7: Conceptual perspective of the pathways for marriage partners to become HIV positive.

Basic understanding of the cultural characteristic of a community is crucial in designing appropriate interventions aimed at reducing HIV infection rates. The high incidence rate of HIV in sub-Saharan Africa conceals important community and individual level differences. However, the characteristics of marriage that may confer increased risk or protection are less diverse. The desire for children especially in sub-Saharan Africa where children are seen as a sign of prosperity reduces the possibility of marital condom use. Furthermore, the culture in many communities which supports extramarital affairs for men as well as the effect of poverty may induce women to exchange gifts/money for sex, increasing their vulnerability to getting infected considerably.

The importance of this review is that it highlights the need for more population based studies in this population and specifically in married couples. It suggests several variables which should be taken into account when designing a study in this area as well as pointing to important cultural factors innate in this population. A major limitation of this review is that the small amount of research conducted in Kenya makes it difficult to examine variables or risk factors specific to this area. Furthermore, most of the studies reviewed on the risk factors and variables affecting the transmission of HIV within the context of marriage were not focused directly on this topic. Analysis of married couples were usually not the main research topic and done as secondary analysis or as a sub-hypothesis.

Table 2 below provides a summary of the relevant literature, and highlights the important concepts contributed by each article. The following chapter summarizes the concepts discussed in the literature review and concludes this section.

Table 2: Summary Outline of Literature Review

Author (Year)	Population	Methods	Results	Criticisms
[19]Gangakhedkar et al, (1996)	Commercial sex workers and non-commercial sex workers attending an STD clinic in India	Prospective cohort study from 1993-1996	13.6% HIV prevalence in non-FSW, Risk factor for HIV-sexual contact with partner with history of STD. OR=2.6 History of 1 sexual partner not protective for women attending STD clinics.	Low external validity to general population.
[16]Mbu et al., (1998)	Women attending family planning/ STD/HIV VCT clinic in Cameroon	Cross sectional study with HIV and STD tests, and structured interviews.	9% HIV rate, 55% of women with at least 1 STD was married, 68% in monogamous marriages, 1% condom use. Increasing levels of STD and HIV in married women	Low external validity due to sample selection.

[7]Carpenter et al. (1999)	Adults >12 years old in rural Uganda	Population cohort study; 2200 married adults. HIV test and interview conducted each year. Marital information and sexual behavior obtained and linked with spouse. Data obtained from 8 survey rounds. Person years at risk, incidence rates and rate ratios were estimated. 7% discordant pairs analyzed.	88% were negative concordant, 5% positive concordant 7% discordant- similar in monogamous and polygamous marriages. HIV positive spouses were less likely to remain married to same spouse, more likely to be D/W/S especially in men. Men with HIV+ spouse 14 times more likely to seroconvert, women with HIV+ spouses 70 times more likely to seroconvert. RR=11.6 for men, 106 for women.	Cannot be sure seroconversion occurred due to transmission within marriage or outside. HIV DNA testing could have concluded if both husband and wife were affected by same strain

[19]Glynn et al. (2001)	Population based sampling of men and women in Kenya and Zambia	Cross sectional study	26% and 28% HIV prevalence in Kenya and Zambia resp. Higher risk of HIV in married s unmarried men in all age groups, in women <25 years only.	
[5]Ali et al. (2003)	Married couples in 16 developing countries	Cross-sectional analysis of secondary data from DHS. 21,791 women used for analysis	Median percentage of contraceptive use-51%, median percentage of condom use-2%. Condom users more likely to discontinue use, more likely to experience high failure rates. Annual coital frequency –70 acts	Assumes constant access to condoms, even in rural areas. Did not account for effect of SES on desire for more children, and the impact on condom use.

[22]Lurie et al. (2003)	South Africa-migrant workers in urban areas, and their spouses in the rural areas.	Cross-sectional behavioral, HIV seroprev ;urvey among 1 ›les. Detailed questionnaire and HIV test administered.	70% of couples were negatively concordant, 9% positively concordant, 21% discordant. Migrants were 2x more likely to be discordant versus non-migrants. 71% were male positive discordant, 29% female positive discordant. Similar Socio-demographic factors in both groups. Migrant men are 26x more likely to be infected from outside the relationship than from their spouse. Non-migrant men are 10x more likely to be infected from outside the relationship. Women whose partners are migrants are 2x more likely to be infected from outside than inside. Women with absent partners more likely to have additional partners. For everyone, risk of becoming infected from outside is greater than risk of becoming infected from inside.

[18]Freeman et al. (2004)	15-49 year old adults in each of Kenya, Zambia, Benin and Cameroon.	Cross-sectional, population based study. Analysis of discordant or positively concordant couples. Assessed circumcision, condom use, sex during period, dry sex, and Herpes simplex virus 2, frequency of sex in past week and duration of marriage. Age treated as a confounder.	293 couples in Kenya, 293 in Zambia, 288 in Benin, 205 in ;roon. Herpes simplex -2 only was significantly associated with HIV concordancy in couples in all countries. In Zambia, husband's extramarital affair, increased education and marital condom use protective.	Temporality unknown due to cross-sectional design. Not known for sure that spouse infected each other, and not contracted from outside.

[26]Shisana et al (2004)	Adult population in South Africa representative of age, race province and living area distribution	Cross-sectional study. Sample of 13,518 individuals. Questionnaire based interviews, oral fluid HIV tests for 8,824 individuals anonymously linked to questionnaire. Focus group with 291 adults	Higher risk of HIV in unmarried people. 69% overall and 72.2% narried people perceived nselves definitely not at risk for HIV. Significant association between marital status and HIV risk perception. 13.5% of adults HIV positive. Increased risk in single people, 1.50 higher odds in single people. No risk difference in single and married men. Married men at higher risk of infection than married women, unmarried men less likely to be infected than unmarried women. Poor married people have less HIV risk than poor unmarried people, rich married people have higher HIV prev. than rich unmarried people. Relationship btw marital status and HIV infection is confounded by socio-demographic factors and biomedical factors. Condom use at last intercourse assoc with increased HIV risk, married people less likely to use condom at most recent intercourse	51 self-reported virgins were HIV positive-socially desirable answers or other sources of infection? Did not assess if age was a confounder.

Chapter 4

Summary of Literature review

According to the review of the literature, it appears that there are several variables that influence the spread of HIV transmission in sub-Saharan Africa, specifically in South-Eastern Africa where this review is focused. However, only one study was designed specifically to address the research question of interest.[26] The main points and summary of results of the literature review are presented below:

- Marital status does not appear to be protective against HIV infection, contrary to previously held beliefs.
- Condom use is the major factor in HIV transmission within marriage; since abstinence is impractical in this case, condom use constitutes the most logical method of HIV prevention, however its use is very low.
    - This may be due to the desire for children within marriage, or the lack of focus on this subgroup for HIV prevention efforts.
- There is an urgent need for increased funding for condoms in order to increase the quantity and accessibility of condoms to sexually active individuals.
- The culture in this region of Africa supports multiple and extra-marital partners for men. This is revealed by the high proportion of men who have more than one partner within a year (about 92%), and the higher likelihood of men with extramarital affairs to be HIV positive.
- The transmission of HIV from infected men to uninfected women is much higher than the reverse i.e. the biology of the HIV supports transmission in this direction.

- Migration constitutes an important risk factor for HIV since it provides an opportunity for extramarital affairs.
    - This is especially important in the context of migration for the purposes of employment.
- Urban residents appear to have higher HIV infection rates than rural residents.

The review of literature provides important information about the factors affecting HIV transmission in South-Eastern Africa. The effect of marital status on HIV/AIDS is an area of research that has not been well researched; therefore the literature cited sheds useful light on the current state of the epidemic generally and in this population specifically. The review also points to the need for a current and comprehensive study of this topic. Most of the papers reviewed were based on cross-sectional studies of specific populations such as attendees at voluntary counseling and testing centers, or women at pre-natal clinics. Cross-sectional studies, while useful, are not optimal for the study of important questions because they only provide a snapshot of situations at one point in time. The results are correlational and causal inference cannot be drawn from such studies. However, a cohort study that follows subjects for longer periods may provide deeper insights into the actual dynamics at play. Studies of sensitive issues such as HIV and sexual behavior may also elicit socially desirable answers which may make the inferences from population based studies less valid. An area of potential further research would be to conduct cohort studies of married women in order to determine the factors affecting HIV seroconversion over time.

The next section discusses the methodology and results of data analysis conducted on a cross-section of adults in Kenya.

Section B

THE KENYA DEMOGRAPHIC HEALTH SURVEY (KDHS 2003)

AND ANALYSIS

Chapter 5

THE 2003 KENYA DEMOGRAPHIC HEALTH SURVEY

Part A of this thesis revealed some important information about marital status and HIV risk. Condom use appears to be a major issue and HIV prevention programs are not designed for married individuals, hence there is an assumption of protection once married. There is very little research done to date on married women in South-Eastern Africa, and the distribution and risk factors affecting this group remain largely unknown. To this end, Part B, through a statistical analysis of the data describes the risk factors that may affect HIV infection in married women.

The Survey

The data used was the 2003 Kenya Demographic and Health Survey (2003 KDHS). It was obtained from ORC Macro- an organization that provided financial and technical assistance for the survey through the MEASURE DHS+ program (www.orcmacro.com). The program is designed to assist developing countries to collect data on factors such as fertility, maternal and child health, family planning and HIV. The 2003 survey was designed in collaboration with the British Department of International Development, Center for Disease Control and Prevention, United Nations Population Fund, United Nations Development program, U.S. Agency for International Development, United Nations Children's fund and the Japan International Cooperation Agency.

Methodology and Sample Design

The 2003 MEASURE DHS+ survey was implemented by the Kenyan Central Bureau of Statistics (CBS). Data collection occurred from April to August 2003. The household sample size was 8,578. Respondents were women between the ages of 15-49; sample size for this population was 8,195, and men between the ages of 15-54; sample size was 3,578. Women who were either usual residents of the households in the sample or visitors present in the household on the night before the survey were eligible to be interviewed. Also, in every second household selected, men who were permanent residents or visitors present on the night before were eligible. Three types of questionnaires were used in the survey; the household questionnaire, the woman's questionnaire, and the man's questionnaire. The questionnaires included information about HIV protective behavior, knowledge and testing of HIV/AIDS, domestic violence, female genital cutting, maternal mortality, and malaria. (Samples provided in Appendix C and D).

The survey utilized a two-stage sample design. The first stage was selecting the sample points from a national master sample maintained by CBS. A total of 400 clusters (129 urban and 271 rural) were selected for the master frame. The second stage involved systematically sampling households from a list of all households compiled by the National Sample Survey and Evaluation Program. A representative probability sample of about 10,000 individuals was selected for the survey. Due to the difficulties in traveling and interviewing in sparsely populated and largely nomadic areas of the North Eastern Province, a smaller number of households were selected in this area; urban areas were over sampled.

Wealth Index: This is a measure of economic status and provides a more permanent picture than income or consumption. The DHS survey used a number of indicator variables collected for other purposes but which are thought to be correlated with economic status. For instance, possession of a refrigerator, television, bicycle and surface water source are correlated with increased wealth. Type of occupation and education were not used in compiling the wealth index because these variables may be associated with health status and use of health services. The construction of the DHS wealth index is based on a complicated set of procedures; determination of indicator variables, dichotomization, calculation of indicator weights and the index value, and calculation of distribution cut points. More detailed information about the construction of the wealth index variable can be found at the DHS website (www.measuredhs.com/pubs/pdf/CR6).

HIV Testing

In all households selected for the Men's questionnaire (every second household selected), all eligible men and women who were interviewed were requested to provide some blood for HIV testing. Health workers present with the field teams explained the procedures, confidentiality of the data and how respondents could obtain their HIV status from Voluntary Counseling and Testing Centers (VCT). The protocol for blood specimen collection and analysis was based on the anonymous linked protocol developed by the DHS program and approved by ORC Macro's Institutional Review Board. Identification codes were deleted from the data file and barcode labels and names of respondents were destroyed prior to merging HIV results with individual data file.

Blood samples were stored individually and transported to the CDC laboratory in Nairobi for HIV testing. The samples were assigned a laboratory number and kept frozen until testing was started. The samples were tested with an Enzygnost Anti-HIV-1/2 plus enzyme-linked immunoabsorbent assay (ELISA) test kit for verification purposes. All positive samples and 10 percent of negative samples were then tested with a Vironostika HIV-1 Micro ELISA system. 29 discrepant samples were tested by an INN-OLIA HIV confirmation western blot kit.

Response Rates

Of the 9,865 households selected in the sample, 8,889 were occupied and eligible for interview. 8,561 were successfully interviewed yielding a household response rate of 96%. 8,717 eligible women were identified and 8,195 of them completed the interviews, yielding a response rate of 94%. 4,183 eligible men were identified, 3,578 of whom completed the interviews yielding a response rate of 86%. Response rates were higher in rural areas compared with urban areas for both males and females.

HIV tests were conducted for 76% of the 4,303 eligible women and 70% of the 4,183 eligible men. Rural residents were more likely to be tested than their urban counterparts. In all provinces, women were more likely to be tested than men. 14% refused testing when asked for informed consent by the health worker, 3% were interviewed in the survey but absent when the health worker arrived for testing, 6% were not at home for testing and were never interviewed, 4% were missing test results for other reasons. A summary of the sampling framework is provided in Figure 8 below.

Weighted variables

The 2003 KDHS data were weighted to adjust for differences in probability of selection and interview in a sample. The different probability of selection and interview was designed on purpose because urban areas were over-sampled. Also, in certain demographic groups where more statistics and research is needed, it may be necessary to expand the number of cases selected in these areas. The individual weight of a respondent's case in this survey is the household weight multiplied by the inverse of the individual response rate of her individual response rate group. The sample weights were incorporated throughout this analysis through the use of a special command 'Weight indwght' in SAS.

The results and methods of statistical analysis of the 2003 KDHS are presented in the following chapter.

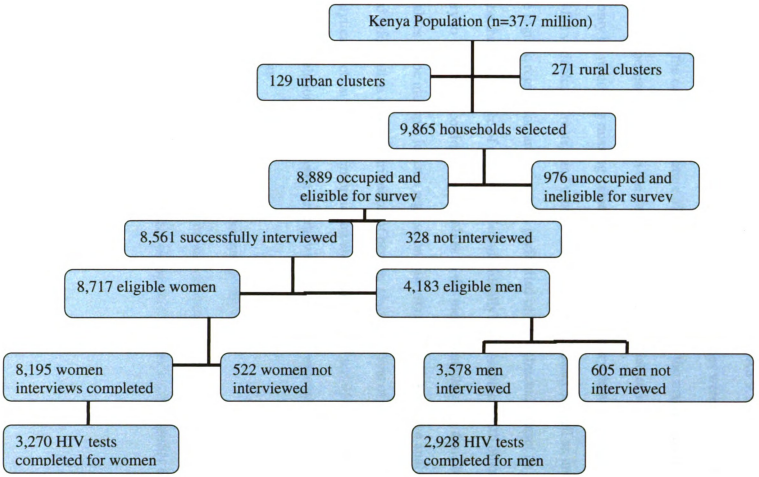


Figure 8: Sampling Framework for 2003 KDHS

Chapter 6

STATISTICAL ANALYSIS

Analysis was performed on the 2003 KDHS dataset collected from adult Kenyan women (15-49 year old). The software used for analysis was SAS 9.1 (SAS Institute, Cary). Simple as well as multiple Logistic regression techniques were used for the analysis due to the categorical nature of the responses. Due to the magnitude of the KDH Survey, it was necessary to clean the dataset by extracting variables relevant to this project only by removing missing values and merging necessary datasets (Appendix E outlines the variables extracted and used in this analysis). Adjusted as well as unadjusted multiple logistic regression analyses were performed on the extracted dataset to determine the significance of each variable individually and combined with others. It was necessary to control for confounding variables in the model, and this was done by placing the variables in the multiple logistic regression analysis model. Descriptive analysis provided information on the distribution of person, place and time of survey participants. The analytical section provided information about odds ratios and 95% confidence interval for the relationship between several variables and the outcome of interest which was HIV infection.

The specific hypotheses to be tested are presented below:

1. Married women have higher HIV incidence rates than single women
2. Traditional (custom) marriage increases married women's vulnerability to HIV

Descriptive Epidemiology

Table 3 provides a tabulated summary of the demographic characteristics of sampled women.

Age: The average age of women in the sample was 28 years (Table 4). The age distribution of the women sampled revealed that there were more women of ages 15-34 than women of ages 35-49 as shown in Table 3.

Residence: There were more women residing in rural areas compared to urban areas; about 66% compared to 33% ($P<0.05$).

Socio-economic status: The descriptive analysis also revealed that most of the women fell into the category of 'richest', i.e. were of high socio-economic status ($P<0.05$).

Place of employment: Roughly equal number of women worked at home or away from home; 45% versus 54% ($P<0.05$).

Education: About half of all sampled women (53%) had a primary school education, and about 24% had a secondary school education ($P<0.05$).

Marital Status: About 54% of all women sampled were married, less than 2% were divorced and about 30% had never been married ($P<0.05$).

Type of marriage: Forty percent of married women were married according to cultural custom (traditional marriage) while about 12% had marriage certificates issued by official authorities (certificate marriage) ($P<0.05$).

Religion: 61% of sampled women were affiliated with protestant/other Christian religions, while 12% were Muslim and 23% were catholic ($P<0.05$).

Marital status and age: As expected, most of the women between ages 15-19 (79%) had never been married compared with other age groups (Table 5) ($P<0.05$).

Table 3: Demographic characteristics of sampled women (2003 KDHS)

Variable	Levels	Frequency	Percentage
Age	15-19	1820	22.2
	20-24	1710	20.9
	25-29	1400	17.1
	30-34	1114	13.6
	35-39	859	10.5
	40-44	780	9.5
	45-49	510	6.2
Residence	Rural	5442	66.4
	Urban	2751	33.6
Wealth Index	Poorest	1376	16.8
	Poorer	1305	15.9
	Middle	1381	16.9
	Richer	1567	19.1
	Richest	2564	31.3
Education	No education/Presch	1291	15.8
	Primary	4347	53.1
	Secondary	1971	24.1
	Higher	581	7.1
Marital Status	Never married	2466	30.1
	Married	4448	54.3
	Living together	427	5.2
	Widowed	337	4.1
	Divorced	143	1.7
	Not living together	372	4.5
Type of Marriage	Certificate	1051	12.8
	Custom	3397	41.5
	Living together	427	5.2
	Not in Union	3318	40.5
Religion	Protestant/Other	5043	61.6
	Roman Catholic	1919	23.5
	Muslim	1025	12.5
	No religion	167	2.0
	Other	29	0.4

Table 4: Distribution of age

Number	Mean(yrs)	Std. Dev(yrs)	Minimum(yrs)	Maximum(yrs)
8193	28.06	9.31	15	49

Table 5: Distribution of Marital status by age among sampled women

	Age distribution(yrs)						
Marital Status	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Never Married	79.23	38.01	15.50	6.46	3.96	4.23	3.53
Married	14.45	48.42	69.29	73.52	75.55	71.41	70.89
Living together	3.79	6.96	6.71	6.19	3.26	4.87	1.96
Widowed	0.11	0.94	1.57	5.66	7.45	10.77	16.86
Divorced	0.44	1.17	1.79	2.51	3.14	3.08	2.16
Not living together	1.98	4.50	5.14	5.66	6.64	5.64	4.51

HIV cases

The descriptive analysis of the 2003 KDHS HIV test results revealed that of the 3271 individuals tested for HIV, 8.4% were infected by the virus (n= 275). When this proportion was stratified according to marital status (as shown in Table 6), it was observed that the prevalence of HIV infection was highest among widowed women, and higher among married women than single women ($P<0.05$) .

Table 6: Frequency of HIV infection by marital status

	Never married	Married	Living together	Widowed	Divorced	Not living together
Negative	95.54	92.57	89.01	69.85	86.67	80.61
HIV-1	4.46	7.44	10.99	30.15	13.33	19.39

When the HIV cases based on test results were stratified according to the type of marriage, it showed that the highest rate of HIV infection (10%) was among women living with their partners. Rates of infection were higher among women married through custom than women married by certificate (8.6% versus 3.4%) as shown in Table 7 ($P<0.05$).

Table 7: Frequency of HIV infection by type of marriage

	Certificate	**Custom**	**Living with man**	**Not in union**
Negative	96.57	91.39	89.01	90.60
HIV-1	3.43	8.61	10.99	9.40

Stratification of HIV cases by age revealed that the highest proportion of HIV infection was among women between the ages 25-29, and lowest among women of ages between 15-19 years. Stratification by religion revealed that rates of infection was higher among Christians (Catholics and Protestant/other Christians had rates of 9.1 and 9.5% respectively) than among women of Muslims and other religions (2.5 and 0% respectively) ($P<0.05$) . When the data was stratified according to the type of partner's occupation, almost 13% of partners with professional or technical occupations, 18% of partners in clerical occupations, and about 7% of partners in agriculture or self-employed occupations were HIV positive ($P<0.05$). Eleven percent of women who worked away from home were HIV positive, compared to 7.6% of women who worked at home ($P<0.05$). Stratification by education revealed that the rate of HIV infection was higher among uneducated women than educated women ($P<0.05$).

Seventy-two percent of women sampled were currently not using any method of contraceptive. Less than 2% of the women currently used condoms. When stratified

according to marital status, 91% of never married women and about 60% of married women did not use any form of contraceptive (P<0.05). However, never married women were more likely to use condoms as a form of contraceptive than married women; 45% versus 35% (P<0.05). Female sterilization as a form of contraceptive was highest among married women; 87%. When asked about their preferred future contraceptive method, only 3% of women indicated condom use as a preferred method, while 39% indicated injections as their preferred method (P<0.05). Only 1.3% of sampled women had a history of sexually transmitted diseases, and about 64% of all history of STD in the past 12 months occurred in married women (P<0.05) .

Analytical Epidemiology

Logistic regression techniques were utilized for this sample in order to obtain adjusted and unadjusted odds ratios for the relationship between marital status and HIV. The results are presented below.

Marital Status and HIV risk

There is a significant difference in marital status based on HIV status. The Likelihood ratio tests had significant P-value at the 1% level. Married women appeared to be at higher risk for HIV infection compared to never married (single) women (OR=1.65, 95% CI=1.18-2.32). This result was expected, but must be interpreted with caution because age plays an important role; never married women are more likely to be younger than married, widowed and divorced women. However, adjusting for age (continuous) by adding it to the model still shows a significantly higher risk of being never married on HIV infection risk (OR=1.84, 95% CI=1.25-2.72). Women living together with their

sexual partner showed a significantly higher risk of HIV infection compared to never married women (OR=2.59, 95% CI=1.53-4.43), this trend remained after controlling for age. Widowed women had a significantly higher risk of HIV infection compared to never married women as expected (OR=8.91, 95% CI=5.61-14.14). The odds ratio became larger after controlling for age and remained significant (OR=10.68, 95% CI=6.12-18.65). This is expected because it is assumed that in areas of high HIV incidence, widows are more likely to have husbands that died as a result of AIDS, and have thus been exposed to the virus by their husbands before his death. Divorced women had a higher risk of HIV infection compared with never married women (OR=4.11, 95% CI=1.76-9.61).

Type of marriage and HIV risk

There was a significant difference in type of marriage ceremony based on HIV risk; the likelihood ratio was significant at the 5% level. Custom marriage i.e. marriage by tradition significantly associated with an almost three-fold increase in risk of HIV infections (OR=2.91, 95% CI=1.57-5.38) compared with certificate marriage. Cohabitating or living with sexual partner with no ceremony was associated with a significant four-fold increase in risk for HIV infection (OR=3.93, 95% CI=1.88-8.21) compared with certificate marriage. Women who described themselves as being in no union also had a much higher significant risk of HIV infection (OR=3.37, 95% CI=1.82-6.23). After controlling for age, the Odds Ratio estimates remained about the same, but the P-values became more significant.

Unadjusted logistic regression analysis of marital status, type of marriage and other variables of interest are presented in Table 8.

Table 8: Unadjusted logistic regression analysis

Variable	Levels	Odds Ratio	Confidence Interval
Marital Status* (ref=Never married)	Divorced	4.11	1.76-9.61
	Living Together	2.59	1.53-4.43
	Married	1.65	1.18-2.35
	Not living together	5.09	3.16-8.24
	Widowed	8.91	5.61-14.14
Type of Marriage* (ref=Certificate)	Not in union	3.37	1.82-6.23
	Living with man	3.93	1.88-8.21
	Custom	2.91	1.57-5.38
Partner's Occupation (ref=Not working)	Agric/Self-employed	1.11	0.81-1.53
	Clerical	1.09	0.30-3.97
	Household/Domestic	2.20	1.36-3.57
	Services	3.63	1.91-6.92
	Unskilled manual	2.11	0.19-0.81
Wealth Index* (ref=middle)	Poorer	1.29	0.86-1.92
	Poorest	0.54	0.32-0.91
	Richer	1.45	0.98-2.13
	Richest	1.83	1.27-2.64
Type of residence (ref=rural)*	Urban	1.66	1.27-2.16
Religion (ref=roman catholic)	Muslim	0.32	0.14-0.74
	No religion	1.30	0.54-3.12
	Protestant	1.10	0.84-1.46
Education* (ref=no education)	Primary	2.39	1.45-3.89
	Higher	2.07	1.03-4.16
	Secondary	1.93	1.14-3.29
Place of Employment* (ref=at home)	Away	1.46	1.09-1.96

* indicates significance at the 5% level

Adjusted Analysis for Marital status and HIV risk

Based on the literature review, several variables appear to be important confounders that should be controlled for in this analysis. For instance, age is correlated

with both marital status and HIV infection; therefore a meaningful analysis should include this variable. Married women are more likely to be older, and risk of HIV infection is highest among age group 25-29. This might reflect the higher exposure of older women to sexual relationships and thus HIV infection. Other possible confounders are educational level, region of residence (rural/urban), religion, and place of employment (at home/away). Different criteria are often used to determine if a variable qualifies as a confounder. In this analysis a 10% or greater difference between the crude odds ratio estimates and the adjusted odds ratio estimate is taken as evidence of confounding.

When each of the possible confounders mentioned above were independently adjusted for in the model considering the relationship between marital status and HIV risk, most for the variables did not qualify as confounders i.e. the difference between the adjusted odds ratio and the crude odds ratio was less than 10%. However, place of employment appeared to be a powerful confounder. There was about a 28% reduction in odds ratio estimate when place of employment is included in the model compared to the crude odds ratio. For instance the crude odds ratio estimate for HIV risk in married women was 1.65 (95% CI=1.17-2.33) compared to never married women, and the place of residence adjusted odds ratio was 1.16 (95% CI=0.67-2.01).

However, these results must be interpreted with caution. Some variables may not qualify to be included in a logistic regression model as confounders but may still be very important variables to account for; a good example is age. Therefore, all the potential confounders mentioned above were placed into a multiple logistic regression model to determine if collectively they may explain the variability in the model. The results

showed that marital status, educational level, place of residence and place of employment were all significant at the 5% level. Age, religion and wealth index were not significant at the 5% level. The most parsimonious model therefore appears to include marital status, education, place of residence, place of employment and age. The odds ratio and confidence interval for each of these variables are presented below in Table 9.

Table 9: Adjusted Logistic regression analysis for Marital Status

Variable	**Levels**	**Odds Ratio**	**Confidence Interval**
Marital Status* (ref=Never married)	Divorced	2.98	1.11-8.03
	Living Together	1.88	1.01-3.51
	Married	**1.07**	**0.67-1.73**
	Not living together	2.82	1.56-5.09
	Widowed	9.04	4.63-17.63
Place of residence* (ref=urban)	Rural	0.58	0.41-0.83
Education* (ref=No education/preschool)	Higher	1.97	0.78-4.98
	Primary	3.43	1.78-6.64
	Secondary	2.38	1.16-4.85
Place of employment (ref=away)*	At home	0.70	0.52-0.96
Age		0.97	0.97-1.01

*indicates significance at the 5% level

Adjusted analysis for Type of Marriage and HIV Risk

Adjusting for age, educational level, region of residence (rural/urban), religion, place of employment (at home/away) and age revealed a marked increase in the odds ratio for HIV infection based on type of marriage. The results are presented in table 10.

Table 10: Adjusted logistic regression analysis for Type of Marriage

Variable	**Levels**	**Odds Ratio**	**Confidence Interval**
Type of marriage* (ref=certificate)	Custom	3.25	1.48-7.11
	Living Together	5.68	2.31-13.98
	Not in Union	6.95	3.16-15.29
Place of residence* (ref=urban)	Rural	0.67	0.47-0.94
Education* (ref=No education/preschool)	Higher	1.57	0.63-3.92
	Primary	3.02	1.58-5.70
	Secondary	2.03	1.02-4.04
Place of employment (ref=away)*	At home	0.73	0.54-0.98
Age		1.03	1.01-1.05

*indicates significance at the 5% level

Interactions

The interactions between marital status and place of residence, martial status and education as well as marital status and place of employment were not significant at the 5% level. This suggests that more complicated analysis is needed for better modeling.

Chapter 7

DISCUSSION

Marital status was not protective against HIV infection in the population of adult Kenyan women. Contrary to previously held beliefs about the protective effect of being in a marital relationship on risk of HIV, it appears that, at best, marriage does not protect against HIV and, at worst, it may actually increase vulnerability to the infection. Several variables may be responsible for this situation; condom use was very low in the population of Kenyan women sampled. This may be due to lack of access, lack of knowledge, gender relations (which prevents women from requesting their husbands to use condoms), or desire for children. 60% of married women reported not using any form of contraception, and condom use was reported by only 2% of women. The relationship between marital status and risk of contracting HIV may potentially be confounded by age because married women are more likely to be older than single women. However, after controlling for age the trend remained the same. The marriage category with the highest risk of HIV infection was widowed women. This was expected due to the increased likelihood that in areas of high HIV prevalence, widows are more likely to have husbands that died of AIDS and may have infected their wives.

Women who were married by custom had higher rates of HIV infection than women married by certificate. This is probably because custom marriage in Kenya may be associated with more traditional views and ideas that have implications for HIV protective behavior. For instance, in highly traditional marriages, the patriarchal gender relations that allows men to have extramarital affairs and prevent women from insisting on condom use when they suspect it is probably attenuated. Therefore the fact that

custom marriage is associated with increased risk in this population is a very interesting phenomenon which highlights the need for further studies of the underlying risk factors associated with custom marriage. For instance, men who decide to get married through custom may desire to do so because of their desire to have more wives, or because of low education or low socio-economic status.

Adjusting for several variables that affect marital status and/or HIV infection risk revealed that the relationship between the two variables of interest may depend on some particular variables. For instance, education level appeared to be an important variable; the risk of HIV infection in married women decreases as the level of education increases. This implies that higher education in married women may protect them against the risk of infection. It is possible that educated married women are more conscious about the risks and methods of transmission of HIV, as well as methods of preventing infection. They may also be aware of some social negotiation skills that help in ensuring safe sexual practices with their husband.

Married women who live in rural areas of Kenya appeared to be more protected against HIV infection compared to their urban counterparts. One reason for this may be the small population size of rural areas and the low prevalence of HIV infection in such small villages. Additionally, small rural areas are usually close knit social communities where casual sexual activities may be actively discouraged. Interestingly, women whose employment was in the home were also better protected against HIV infection compared with women whose employment was outside from home. It is possible that by leaving the house, married women have opportunities to engage in extramarital affairs and/or for their husbands to have other sexual partners in their absence. The recommendation here is

not to restrict married women to working at home, but to address the socio-economic factors that prompt migration for employment to other areas and creates opportunities for extra-marital affairs.

Sub-Saharan African cultures, like those of Kenya, place a high value on having children because children are considered insurance for parents in old age. Also having specific number and gender of children establishes a woman's place in her husband's household. Therefore even while aware of their risk of contracting HIV, some married women may be willing to have more children until they achieve their desired objective. This explanation along with the pervasive gender inequality might explain the observation that condom use by married Kenyan women was practically non-existent. Naturally, this increases their vulnerability to HIV infection.

The susceptibility of married women to increased risk of HIV infection is not necessarily through their husbands only. It is possible that the women themselves engage in extramarital affairs and infect their husbands. It is also possible that both were already infected before getting married. These do not detract from the premise of this study, but rather provides a conceptual framework with which the risk of HIV infection within marriage may be better understood. Uninfected women are not being protected by being married; men may also be at increased risk of HIV infection if their wives engage in extramarital affairs. Further epidemiological studies are needed to understand the pathways through which these evolve, and to influence the development of appropriate health policies.

The contribution of this thesis to the field of HIV/AIDS epidemiology in Kenya is providing insights into the descriptive epidemiology of risk factors responsible for the

relationship between marital status and HIV. This has not been done in this population before. Only one study conducted in South Africa focused on this topic and found similar results. This thesis highlights the necessity for conducting more detailed community based research programs in this part of Africa in order to further understand the possible reasons for the consistently high prevalence of HIV in this area. It also suggests need for a re-evaluation of HIV prevention programs in Kenya.

A limitation of the KDHS is the sensitivity of the topic which may prompt response bias; study participants may provide socially desirable answers especially given the interview format of the survey. Fear of testing HIV positive might have resulted in participation bias; sexually active adults may have been discouraged from participating in this survey even though they may have contributed highly valuable information. Selection bias is not a major factor in the survey because the study was based on a nationally representative sample from specific clusters of the population. Furthermore, this study is based on cross-sectional survey data which by itself is subject to several limitations. Cross-sectional designs do not allow for causal inference to be drawn from survey results but creates a baseline for further longitudinal studies to be designed. Another limitation is the very important role played by men in the increased risk factors for HIV in women. Further studies should aim to analyze risk factors for HIV infection in women while taking into account the characteristics of men such as education level, employment, migration and so on.

HIV prevention and education programs have often been focused on single individuals, commercial sex workers, truck drivers and other groups considered high risk while little attention has been paid to married women. Apart from mandatory prenatal

HIV testing to prevent vertical transmission from mother to child, there is very little intervention programs focused on this demographic group. As shown in the analysis, married women are just as at risk for HIV infection as single women, and they may in fact be at even higher risk. This shows that marriage is not the protective sanctuary as was surmised. Although resources are limited and it may be necessary to focus programs on certain areas only, it is of utmost public health importance to determine which, when and how specific strata of the population should be targeted for prevention and education programs.

A summary of the results from the literature review and statistical analysis are presented in the following chapter. Recommendations based on these results are also presented.

Chapter 8

SUMMARY AND RECOMMENDATIONS

The epidemiological study analyzed the 2003 KDHS and has established that the assumption that marriage protects Kenyan women against HIV infection is false, with potentially lethal consequences. After controlling for several potential confounders, marriage does not provide the levels of protection from infection that have been claimed. This is important in the context of limited resources where all strata of the population cannot be targeted appropriately and equally. Lack of focus on this population is harmful to the lives of married young adults as well as new babies when married women are being infected with HIV and are not targeted for HIV prevention education. More research is needed to further tease apart the relationship between marital status and HIV. There may be other variables not considered in the KDHS and analyzed here that may further explain the relationship between marital status and HIV.

Furthermore, more complicated statistical analysis taking into account the association within subjects in similar geographical areas may be useful. Sensitivity analyses to understand the influence of variable weights, as well as missing variables will be very useful in future analysis. Also, taking into account different order of time in the analysis of age such as linear, quadratic or cubic trends may shed more light on the distribution and influence of age on risk of HIV infection. A longitudinal analysis observing newly married women over time may provide invaluable information about the relationship between marital status and HIV infection over time.

It is recommended that the Kenyan Ministry of Health engage in an active campaign promoting condom use and faithfulness specifically in the population of

married adults. The socio-cultural environment which condones extra-marital affairs, especially by men, may be disastrous to the health of married women and their children. The ABC (Abstinence, Be Faithful, and Condom) campaign may be limited in its scope if direct emphasis is not placed on married people as many assume that HIV infections occur mainly in single and at risk individuals. Non-government organizations as well as hospitals should also engage in active promotion of awareness and education in their married clients; being married does not protect against risk of HIV infection. Deeper structural issues such as poverty, unemployment and illiteracy are major determinants of HIV infection which apply in the population of married adults as well as other sub-populations. National programs designed to reduce those variables as well as structural inequality between genders are very important in winning the fight against increased HIV incidence rates within the country.

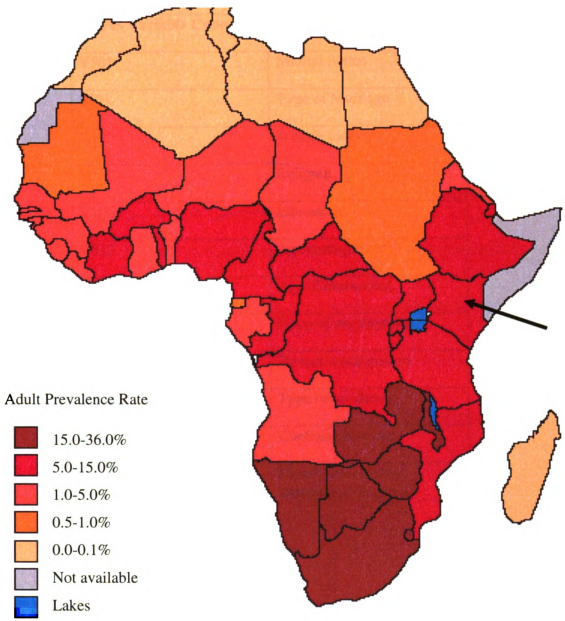
APPENDICES

Appendix A

Political map of Africa (World Atlas)

Appendix B

Map of Africa showing total HIV prevalence rates by region (1999)
UNAIDS



Appendix C

Variables extracted from the 2003 KDHS

KDHS Variable Code	Variable Name
V501	Marital Status
S501	Type of Marriage
V190	Wealth Index
V130	Religion
V106	Education
V013	Age (categorized)
V012	Age (Continuous)
V721	Place of employment
V705	Partner's occupation
V102	Type of residence
V312	Contraceptive use
V763a	History of sexually transmitted diseases

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