A COMPARISON OF HIV STATUS AMONG WOMEN WHO VISIT ANTENATAL CLINICS WITH THOSE WHO DO NOT.

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Declaration

I declare that this report is my own, unaided work. It is being submitted for the degree of Master of Arts to the University of the Witwatersrand, Johannesburg.

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(Signature of candidate)

20day of October 2008

Abstract

For monitoring the spread of HIV epidemic, both national population-based surveys and antenatal clinics (ANC) are used. However, in all cases, there are potential biases. Bias associated with ANC data includes whether the pregnant women who attend public ANC are representative of all pregnant women. Reduced fertility among HIV-infected women, selection for sexual activity and under-representation of smaller rural sites in surveillance systems are other factors that may be source of biases (Boerma et al. 2003 & Walker et al. 2003). So, the question arising is how women who attend ANC could be representative of the general female population. Evidently, not all women become pregnant and not all pregnant women attend ANC.

This research project has been designed to address those biases especially in Rwanda and Malawi. It focused on investigating the significance of this bias by doing a comparative analysis of sero prevalence between both those using ANC and those who do not. This study, therefore, intends to test whether women attending ANC may be representative to the general female population of both Rwanda and Malawi using respectively 2004 MDHS and 2005 RDHS.

Using statistical techniques with the aid of STATA software program, univariate, bivariate and logistic regression (bivariate and multivariate) were performed for 11321 women in Rwanda and 11698 in Malawi aged between 15 and 49. However, among them, those who had live birth in last five years prior to the surveys were the most interested on in this study; that is especially, 5390 in Rwanda and 7304 in Malawi. Besides, HIV status of respondents was an important variable.

Considering both women who had live birth and those who did not have live birth, I find that women who had live birth in Rwanda are 0.62 times less likely to be HIV positive and 0.48 times less likely to be infected for those who had live birth in Malawi. When controlling for women who had live birth, I find that in both countries women who use

ANC are less likely to be infected compared to those who do not (0.53 times less likely in Rwanda and 0.58 times less likely in Malawi).

Based on these findings, relying only on data from ANC may lead to biases in HIV prevalence estimates; particularly referring to 2004 MDHS and 2005RDHS. Besides, considering the level of significance of the difference between HIV status between those who use ANC and those who do not, I find that this is not identical in Rwanda (5% level of significance) and in Malawi (10% level of significance). Thus, these results suggest, briefly, that not only the degree of ANC data representativeness is changing depending on various stages of HIV epidemic as Fylkesnes said (1998), but also is affected by the amount of women who had live birth and their respective HIV status. In fact, this difference may be based on the fact that in Malawi, HIV prevalence is high compared to Rwanda and those who had live birth were in high percentage comparing to Rwanda.

Dedication

To my husband Dr Hermogène Nsengimana and our God's Love Gift

To My mother Rosette Marifaye

To my late father Grégoire Hategekimana

To my late mother-in-low Agenesta Bashemera

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Abbreviations

AIDS -Acquired Immunodeficiency Syndrome

ANC-Ante-Natal Clinic

DHS- Demographic and Health Survey

HIV- Human Immunodeficiency Virus

IDA- International Development Association

MDHS- Malawi Demographic and Health Survey

P- P-value

RDHS- Rwandan Demographic and Health Survey

STI- Sexually Transmitted Infections

TRAC- Treatment and Research Aids Center

UNAIDS -Joint United Nations Programme on HIV/AIDS

USAID- United States Agency for International Development

WHO- World Health Organization

CHAPTER I: Introduction

1.1 Problem statement

For more than two decades after its outbreak, HIV/AIDS epidemic is still a serious threat for many of world's countries. In 2005, around 40 million of people were living with HIV/AIDS worldwide, and women represented 17.5 million (UNAIDS, 2005). Recently, the UNAIDS (2007) has attested that Sub-Saharan Africa remains the most affected region. Between 1.4 and 2.4 million people were newly infected with HIV in 2007, bringing the total number of people living with the virus to 22.5 million [20.9 million-24.3 million]. In addition, more than half (61%) of infected persons in this region are women. While HIV/AIDS has increased over the last two decades, no vaccine or cure has been found. Thus, reliable information about its prevalence is important for monitoring its progress as well as influencing and improving plans of intervention. In fact, reliable information should come from community-based sero-survey (Zaba 2000). Although, many countries (especially developing countries) are still relying on HIV prevalence data collected from sentinel surveillance like antenatal clinics (ANC) or blood bank (Changalucha 2002) because in resource poor countries, health infrastructure is not developed to a level that can provide reporting at a level of entirety that makes AIDS or HIV cases a reliable measure of the epidemic (Glynn 2001).

However, considering the acknowledgement of United Nations' top AIDS scientists (UNAIDS 2007), both the size and the course of the epidemic have been long overestimated. On the other hand, researchers no longer doubt that sero-prevalence data collected from different sentinel surveillance systems are useful for monitoring HIV infection in general population (Walker, N. et al.2001 a,b). Therefore, national HIV estimates in most developing countries with generalized epidemics (defined as a prevalence of at least 1% in the general population) are based on data generated by surveillance systems that focus on pregnant women attending a selected number of antenatal clinics (Bignami 2005).

According to Zaba B. (2000), data from ANC are subjected to biases which include the self-selection of women who use them, the purposive selection of clinics for participation in the surveillance program and the structural bias associated with testing only women in the general female population who become pregnant. This study focuses on the latter.

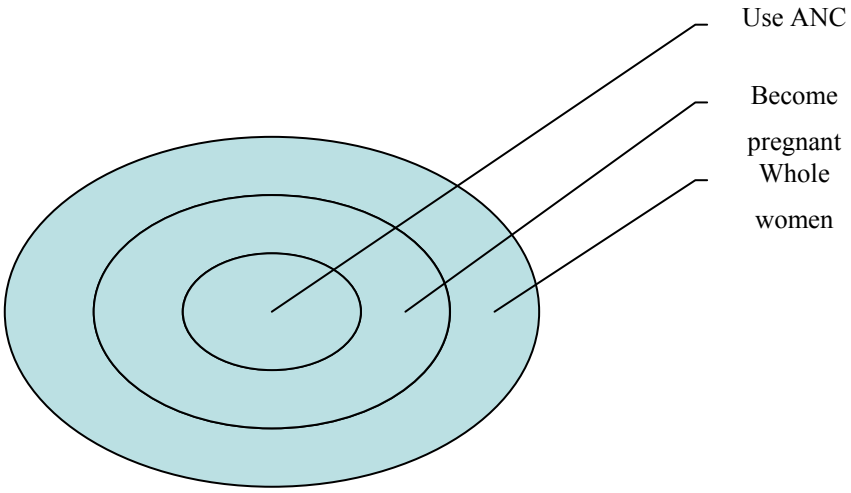

Figure 1. 1: ANC representativeness

Not all women become pregnant and not all pregnant women attend ANC (see figure 1.1). So, the use of ANC data to draw a general conclusion about sero prevalence may be questionable. In all cases, the question arising is how data from a tiny portion of women who attend ANC could be representative of the entire female population. In fact, this portion may under represent or over represent HIV prevalence in all women depending on whether women who use ANC are more or less exposed to HIV infection.

As far as Rwanda and Malawi are concerned, they have long been considered as countries most affected by HIV/AIDS. Firstly, even though HIV prevalence is lower than the average of Eastern and Southern Africa (5.1%), Rwanda is severely affected by the HIV epidemic (World Bank 2007). According to 2005 RDHS, the HIV prevalence was 3.6% among women and 2.3% among men. To monitor the spread of HIV, Rwanda established its HIV sentinel surveillance system, in 1988, among ANC attendees and patients with sexually transmitted infections (STIs) at selected sites throughout the country (there was anonymous HIV test). The first three sentinel surveillance rounds were conducted in 1988, 1991, and 1996. Gradually (especially in 2002) the number of rural sites in the system increased from three to 12, and the number of ‘‘other urban’’ sites increased from five to nine (Kayirangwa et al. 2006).

Secondly, in Malawi, HIV prevalence is higher than in Rwanda. The 2004 MDHS indicates that 12 percent of the population aged 15-49 in Malawi is living with HIV/AIDS (13% of women and 10% of men). HIV seroprevalence information among antenatal clinic attendees has been available since the mid-1980s (2004-MDHS*)*. HIV surveillance has been conducted at Queen Elizabeth Central Hospital in Blantyre since 1985. In 2001, median HIV prevalence outside major urban areas fell to 16 percent and was 17.5 percent in 2003. In 2003, 18 percent of women aged 15- 24 attending antenatal clinics were HIV positive (UNAIDS 2004).

Table 1. 1: UNAIDS, DHS/AIS and ANC estimates of HIV prevalence among adults aged 15-49 in Rwanda and Malawi, 2003-2005.

Country		UNAIDS estimates			DHS estimates (2004MDHS/2005RDHS)	ANC estimates	
		2001	2003	2005	2001-2005	2003	2005
Malawi	Male				10.2	*na	
	Female				**13.3**	na	
	Total	15.0	14.2	14.1	11.8	17	16.9
Rwanda	Male				2.3	na	
	Female				**3.6**	na	
	Total	8.9	5.1	3.1	3.0	4.6	*nd

Computed from 2005 in addition to 2007 UNAIDS 2005 and MDHS2004 with 2005RDHS

*nd; no data available

*na; not applicable because ANC estimates deals with only pregnant women.

Table 1.1 presents HIV prevalence estimates for Rwanda and Malawi. A comparison of UNAIDS, DHS and ANC prevalence estimates is showing that for both UNAIDS (which estimates HIV prevalence from ANC) and ANC, the prevalence is higher than the one from DHS (supposed to be a direct estimates of national and regional HIV sero prevalence among general population). More precisely, for example, taking into account Rwandan case, we observe a huge difference between HIV prevalence data throughout successive years due to the change in HIV estimation methodology.

In fact, when comparing HIV prevalence from ANC and in general female population, we found that in Malawi 2004 ANC and UNAID prevalence estimates were 16.9 and 14.1 respectively. However, considering 2004 MDHS, HIV prevalence in general female

population represents 13.3 %. This drives on questioning the use of ANC data to monitor HIV prevalence in the general female population.

This research project has been designed to address biases in the use of ANC prevalence to monitor the spread of HIV specifically in Rwanda and in Malawi. It is an investigation into the significance of these biases and consists in doing a comparative analysis of sero prevalence between both those using ANC and those who do not. This study therefore intends to test whether women attending ANC, may be representative to the Rwandan and Malawi population in estimating sero-prevalence using the 2004 MDHS and 2005 RDHS.

1.2 Research questions

This study is mainly based on the two following primary questions:

1. Are women who just gave birth more/less likely to be HIV+ than women of comparable age who did not give birth?

2. Among women who give birth, are women who visit ANC more or less likely to be HIV+ compared to those who do not?

1.3 Objectives

1.3.1 General objectives

The overall objective of the study is to find out the likelihood of being HIV+ for women who visit ANC compared to those outside ANC who just give birth or do not give birth.

1.3.2 Specific objectives

i. Finding out the probability of HIV infection between women who give birth and those with comparable age who do not [15-49]

ii. Finding out the HIV prevalence among women who attend ANC compared to those who do not.

1.4 Study justification

In Sub-Saharan Africa, HIV surveillance data from ANC are an important source of information to assess the HIV prevalence in a population, to monitor trends in HIV infection over time and place, to provide baseline estimates for future projections and for the planning of health care services (WHO/UNAIDS, 2003).

Therefore, HIV prevalence among pregnant women is a good indicator of the spread of the epidemic in the general population, if only the level of HIV infection among pregnant women is close to the prevalence in the general population of men and women aged between 15 and 49 (UNAIDS 2003). However, several studies have proven the biases in the use of ANC data to estimate HIV prevalence among the general population. Considering Zambian case, Fylkesnes (1998) reported that surveillance of ANC tended to underestimate the overall HIV prevalence of the general population. More importantly, according to Hunter et al. (2003), one of the reasons of this underestimation is related to the fertility differential between infected and uninfected women. According to him, recent studies in Sub-Saharan Africa have shown that in HIV-infected women, fertility is reduced. In fact, this has an implication for antenatal clinic-based surveillance.

Lower fertility among HIV-infected women has been, as well, observed in women in Democratic Republic of Congo, Uganda and Rwanda (Ryder et al. 1991; Allen et al. 1993; Sewankambo et al. 1994) although the studies have generally been too small to yield statistically significant results. Significantly reduced rates of pregnancy were, also observed in HIV-infected women in a cross-sectional study carried out in Rakai district, Uganda (Serwadda et al. 1997).

Yet again, studies done in Tanzania, Uganda, Zambia, Ethiopia, Zimbabwe, Malawi and other countries in Sub-Saharan Africa have shown that HIV prevalence in pregnant

women attending ANC underestimates the HIV prevalence in the general female population (Bignami 2005).

Conversely, by comparing HIV prevalence at the national level using recent nationally representative, population-based surveys in Burkina Faso, Burundi, Dominican Republic, Ghana, Kenya, Mali, Niger, South Africa, Zambia, and Zimbabwe, it has been found that in general, HIV prevalence at the national level estimated from the population-based surveys is significantly lower than that inferred from ANC data (Bignami 2005).

Considering this controversial issue, it will be interesting to focus on Rwanda and Malawi using especially data from DHS because they have anonymously linked the HIV result with key behavioural, social and demographic factors in their respective 2004 MDHS and 2005 RDHS. In fact, it has been recognised that population-based surveys can provide reliable, direct estimates of national and regional HIV sero prevalence among general population (Mishra V. 2006). Considering that women who had live birth in last five years prior to the survey are supposed to be the ones captured/included in ANC surveillance data, there is a need to test this overestimation of ANC and UNAIDS estimates. This will be a bit different from some of other studies because they often use data from both ANC and from other surveys. It gives, therefore, the opportunity of comparing, straightaway, HIV status of women who use ANC and that of women outside ANC for testing the findings above.

1. 5 Definition of terms

1. *Birth history* is referring to all women who had reported having live birth or not in last five years prior to the survey.

2. *Fertility* refers to the ability to produce live birth

3. *Usage of ANC* refers to women among those who had live birth in last five years that reported using or not Ante-Natal Clinics

4. *HIV status* used in this study is the one that has been included in DHS. In fact, the same sample has been used and those who accepted have been tested.

In this study, HIV status is the most important variable because the issue addressed is whether the use of ANC as sentinel surveillance is representative to the whole population. The test was done during RDHS 2005 and during MDHS 2004 and it is done voluntary.

1. 6 Study limitations

This study is a secondary data analysis of the Rwandan and Malawian Demographic Survey carried out in 2005 and 2004 respectively. The 2004 MDHS and 2005 RDHS were nationally representative survey of women aged 15-49. The available data offer a good opportunity to explore HIV status among women who use ANCs and those who do not by demographic factors chosen. However, it is important to mention, as demographer, that, in this study we used a secondary data and HIV status and ANC visits as main variables reflect 'observed HIV statuses' and 'reported ANC visits'.

Besides, as HIV status is the main variable in this study, the barrier of respondents who were not tested, either because they refused or missed during HIV test, will highly infer in the findings and it will be complex to confirm or reject our hypothesis. In addition, some important variables that would help in the comparison of HIV status among women who use ANCs and those who do not use ANCs are not available. This refers, for example, to the fact that some details on the reason of use or no use of ANC for women who have given birth because in-depth questions were not asked.

1.7 Presentation of study areas (2004 MDHS and 2005 RDHS)

Geography and economy

Malawi, on the one hand is a landlocked country south of the equator in sub-Saharan Africa with around 11 Million inhabitants. It is bordered to the North and Northeast by

the United Republic of Tanzania; to the East, South, and Southwest by the People's Republic of Mozambique; and to the West and Northwest by the Republic of Zambia. The country is 901 kilometres long and ranges in width from 80 to 161 kilometres.

The total area is 118,484 square kilometres of which 94,276 square kilometres is land area. The remaining area is mostly composed of Lake Malawi, which is about 475 kilometres long and runs down Malawi's Eastern boundary with Mozambique.

On the other hand, Rwanda is situated in central Africa right beneath the equator between 1°4' and 2°51' south latitude and 28°63' and 30°54' east longitude. Its total area of 26,338 square kilometres is bordered by Uganda to the north, Tanzania to the East, the Democratic Republic of Congo to the West, and Burundi to the South. Landlocked, Rwanda lies 1,200 km from the Indian Ocean and 2,000 km from the Atlantic Ocean.

Due to its elevation, Rwanda enjoys a temperate, sub-equatorial climate with average yearly temperatures of around 18.5°C. The average annual rainfall is 1,250 millimetres and occurs in two rainy seasons of different lengths, alternating with one long and one short dry season. The climate varies somewhat from region to region, depending on the altitude, the volcano range and northern highlands being generally cooler and wetter, with average temperatures of 16°C, and average rainfall of above 1,300 millimeters. The maximum rainfall is 1,600 millimeters, above the Divide and the volcanic range. Besides, both countries have a predominantly agricultural economy.

Fertility

Considering the fertility level in Malawi, compared with other eastern and southern African countries that have participated in the DHS programme, Malawi still has one of the highest fertility rates. Kaphuka J. (MDHS 2004) is reporting that a woman in Malawi would, on average, bear 6.0 children in her lifetime if fertility were to remain constant at the current age-specific rates measured in the survey. In addition, urban women have

lower fertility than their rural counterparts (4.2 children per woman compared with 6.4 children per woman), and lower urban fertility is observed across all age groups.

According to 2005 RDHS, the fertility of Rwandan women remains very high: at the end of her childbearing years, a Rwandan woman has an average of 6.1 children.

However, the 1994 genocide seems to have had the effect of slowing the significant decline in fertility observed since the National Fertility Survey of 1983 (TFR of 8.5). In addition, it has been shown that women in urban areas have lower fertility than those in rural areas.

Women who remain childless voluntarily are relatively rare in Rwanda, where the population is still very pro-natal. For this reason, zero parity among married women aged between 35 and 49 would be an indicator of total or primary infertility. In Rwanda, only 1.2 percent of married women aged between 35 and 49 (when the arrival of a first child is unlikely) have never had a child and can be considered infertile. In fact, it should be noted that the level of primary infertility observed in Rwanda in 2005 (2005 RDHS) is lower than the level found in some sub-Saharan countries such as Cameroon (3.6 percent in the 2004 EDSC), but is similar to that of other countries in this region such as Burkina Faso (1 percent in the 2003 EDSBF).

ANC usage

As reported in 2004 MDHS in Malawi, urban women are more likely to have seen a health professional for antenatal services than women living in rural areas, though rural women are slightly more likely to have seen a doctor. Beside, the use of antenatal services is strongly associated with level of education and wealth. While 8 percent of women with no education had no antenatal care, the proportion among women with some secondary or higher education is only 2 percent. However, women with no education are slightly more likely than women with secondary education to receive antenatal care from a doctor/clinical officer (10 percent compared with 8 percent).

According to 2005 RDHS, it should be noted that Rwandan women seek their first prenatal visit late in pregnancy. In fact, half of the women did not have an ANC visit until their sixth or seventh month of pregnancy; 27 percent had their first visit between the fourth and fifth month; and 9 percent did not receive antenatal care until the eighth month or later. The lateness of the first ANC visit can be explained by a Rwandan tradition whereby women do not speak of their pregnancy until it is visible. Also, referring to 2005 RDHS, it may be that women wait until the sixth month of pregnancy to have their first prenatal visit in order to receive a tetanus vaccination.

Culture and HIV

It seems that, according to pioneering work by anthropologists, the cultural systems is an important factor in shaping sexual practices that are relevant to HIV transmission and prevention (Parker 2001). In fact, *"… culture determines people's actions by providing them with blueprints of how things ought to be conducted. Individuals learn the norms of their social environment and internalize them and conform, actively comply, or rebel against them after they have taken into account the opportunity costs of their conduct…*"(Bernardi 2007:547P.)

Considering a study done by Kondowe (1999) in Malawi, many of the cultural factors have an impact on HIV in Malawi. This is for example, according to the author, widow inheritance whereby under this custom a widow is inherited usually by the brother of the deceased thus exposing either of them to HIV infection should one or the other be infected. In addition, polygamy is practiced in a number of communities in Malawi. It is a practice, continues the author, which is believed to curb infidelity because the man has more than one wife and so would see no reason to go out with other women. Teenagers are also concerned through the traditional initiation. That is about the counselling, he said, of boys and girls by elders on acceptable code of behaviour. This marks the end of childhood and the beginning of adolescence or, in some cases, adulthood. He said that even in some cases the initiates are encouraged to have sex upon graduation as a way of putting into practice the knowledge they have acquired.

Previously, in Rwandan traditional practices such as, polygamy (having multiple wives) and the belief that a woman belonged to the family of her husband and not the husband alone, would be described as easy channels of HIV transmission (Lindan1991). However, considering the study done by the Rwandan ministry of education in 2002, the major problem remaining in Rwandan population is the issues of taking sexuality as taboo especially for females who, because of the culture, are relatively shy and thus easily involved in unprotected sexual behavior.

1.8 Outline of the report

An overview of HIV sentinel surveillance especially ANC-based prevalence estimates and its challenges will be discussed in chapter 2. As the study was centered to the comparison of HIV status between women who use ANC and those who do not, studies that look at demographic variables that hold back the use of ANC will form part of the literature review in chapter 2. In chapter3, the research methodology will be explored. The results as well as the discussion will follow thereafter in chapter 4, before I conclude.

CHAPTER II: Review of related literature

Introduction

In this chapter, HIV sentinel surveillance will be discussed including its challenges. This will, particularly, be centered on ANC-based HIV prevalence estimates. Besides, some of demographic variables that may play a role in the use or no use of ANC will be explained. This will be based on studies done in some of other Sub-Saharan countries.

2.1 HIV Sentinel surveillance

HIV sentinel surveillance is one of the basic instruments for monitoring HIV spread. By definition, Sentinel surveillance is "the collection and analysis of data by designated institutions selected for their geographic location, medical specialty, and ability to accurately diagnose and report high quality data" (USAID 2005).

According to UNAIDS/WHO (2000), as the HIV epidemic development varies across countries, there are different systems of surveillance according to the severity of the epidemic. That is, in countries where HIV is rare, biomedical surveillance and behavioral data can offer an early warning of a possible epidemic. Where HIV is intense in subgroups with high-risk behavior, surveillance system can present important information for scheming focused interventions. In countries where the epidemic is generalized, sentinel HIV surveillance among the general population can provide essential information for curative and preventive planning and support (UNAIDS/WHO 2000).

The population-based survey which include HIV testing and the antenatal clinic surveillance are two methods used for monitoring HIV trends. The first one covers women and men of reproductive age (women 15-49, men 15-54). The second one focus on women in reproductive age (considered as being on high risk) but it has itself some barriers (UNAIDS 2000). In all cases, the UNAIDS proposes a combination of those two methods above. However, in most of countries, the ANC is advisable because it is less

costly. This is particularly in sub-Saharan African countries where HIV estimates are based on data generated by surveillance systems that focus on pregnant women who attend public-sector ANC (Boerma et al. 2003).

2.2 Women, ANC and HIV/AIDS estimates

At the beginning, ANC has long been accepted as an effective means of reducing risks of HIV infection to the mother or foetus during pregnancy. The evolution of antenatal care over the last two decades has been marked by an augment both clinical and laboratory tests. Some of those tests are screening programme which aim to pick from a larger population a subgroup of individual with high risk of pathology (Enkin and Chalmers 1982).

Women are the most infected persons in the world. At the end of 2006, women accounted for 48% of all adults living with HIV worldwide, and for 59% in sub-Saharan Africa (UNAIDS 2006). This proves why women are considered as the group which at high risk of infection and the basis of using among them pregnant women who use ANC as representative to the general population. As Zaba (2000) confirm, in Sub-Saharan Africa, in many countries, more than 90% of women attend ANC. As "they attend ANC and provide blood samples for other tests, it is easy to include them in sero prevalence studies" (Squire 1993:48). So, ANC is the easy way of accessing the sexually active women from the general population (UNAIDS 2003). Since, women constitute the majority of the total population (Zaba 2000a) and are often taken to be representative of both men and women in the child-bearing years (Nicoll et al. 1998); pregnant women are considered as important category for HIV sentinel surveillance.

Indeed, pregnant women, considered as 'sexually active' and then more exposed to HIV/AIDS are the basis to monitor the spread of HIV in the general population. As Zaba (2000a) points out, fecund mothers are defined as those who are "currently pregnant with a higher order birth and who are sexually active." Those using contraception and those who are not fertile are not interested in ANC usage and its services.

Hence, to use effectively the ANC data for checking the spread of HIV, some conditions are to be respected. Walker (2001b) highlighted that the frequency and timeliness of data collection; appropriateness of populations under surveillance; consistency of the sites/locations and groups measured over time (that is the fact that HIV prevalence data from pregnant women are primarily collected in urban or peri-urban sites and information on urban/ rural variations remains sparse); and coverage/representativeness of the groups for the adult populations are to be respected. The latter – representativeness - condition is very relevant because it is, in most cases, presented as the main bias for the HIV prevalence estimation.

2.3 Challenges in ANC-based HIV estimates

The ANC based estimates have been subject of contested debates. This was the reason that researchers were interested in identifying the effectiveness and representativeness of the data from ANC to the whole population from which it is drawn.

As we have seen, pregnant women are taken to be representative of the general population, however this is the case if and if only, ANC attendance is high (Zaba 2000b). In fact, amongst the biases there is the self-selection of women who attend them; and the structural bias associated with testing only those women who become pregnant (Zaba 2000a). In addition, according to Walker (2001b) the fact that HIV prevalence data from pregnant women are primarily collected in urban or peri-urban sites and information on urban/ rural variations remains sparse and leaves the data weak and questionable. Although adjustments for this have been made in the estimates, data from truly rural areas are lacking for many countries.

Beside, not only the rate of contraceptive use in a country may affect the number of pregnant women but also antenatal clinic surveillance does not provide information about HIV prevalence in men. Because these surveys are conducted among pregnant women, estimates for men are based on assumptions about the ratio of male-to-female prevalence

that are derived from community-based studies in the region (UNAIDS 2005). However, this ratio varies between countries and over time.

Indeed, as it is known, many women who are sexually active do not become pregnant because of the use of condoms, because of the infertility or because they manage to control their menstruation period. Moreover, if a huge proportion of pregnant women do not attend antenatal clinics, it is un-realistic to generalise the findings of the surveillance system to all pregnant women (tendency of underestimation).

In fact, the primary purpose of ANC-based surveillance is the estimation of trends in HIV prevalence. Therefore, consistency of methods and tools employed and especially the continuing participation of the same clinics is an essential feature of good surveillance systems (UNAIDS 2003). In fact, the major determinant of the quality of estimates is the availability of data which varies extremely (Walker 2001). However, since there are no other major sources of data to estimate the level of HIV prevalence in most countries, antenatal clinic-based surveillance data is also often used for this purpose.

Considering these inconsistencies, adjustment methods have been attempted to eliminate the barriers especially about ANC representativeness (Zaba 2000, Changalucha 2002,etc). However, those adjustment methods are not universally accurate and tend to overestimate or underestimate the HIV prevalence. This has been recognized by UNAIDS (2007), whereby their estimation methodology overestimated the HIV prevalence. In fact, methods used in HIV estimation should be updated considering the complexity of the HIV epidemic.

Over-estimation of HIV prevalence data

According to Boerma (2003), HIV estimates can lead to over-estimation of HIV prevalence among the general population. In fact, if pregnancy occurs in women who are more exposed to HIV infection not like it is in women who are not sexually active, the HIV prevalence based on ANC will tend to overestimation.

In addition, UNAIDS has been criticized about the over estimation of HIV prevalence estimates. In fact, considering the example of Zambia UNAIDS (2001) estimates that overall HIV prevalence (based on ANC surveys) was 21.5 percent in 2001. In the same year, a representative national sample of men and women was tested for HIV. Prevalence rates for women were 17.8 percent and 12.9 percent for men. This proves the eventual over-estimation.

To overcome those limitations, HIV seroprevalence has been collected in national population-based survey for a direct estimate of population HIV prevalence which, according to Mishra (2006), provides representative estimates for both men and women, by geographic regions and by age groups. He argues that whereas ANC prevalence provided by UNAIDS tended to overestimate HIV prevalence, HIV prevalence from DHS have led to revision of current HIV prevalence estimates.

2.4 Demographic variables that hold back the use of antenatal clinics

a. Fertility and ANC usage

One of the impacts of HIV/AIDS on individual women and populations in severely affected areas of sub-Saharan Africa is, according to UN (2002), change in fertility levels. HIV/AIDS has influenced fertility of individual women through proximate determinants of fertility, namely, marriage, contraception, pregnancy, abortion, breastfeeding, postpartum abstinence, pathological sterility and natural fecundity

Thackway (1997) discovered that, in Australia, fertility and birth rates among women with HIV-1 infection are lower than the general population and the rate of termination higher.

Recently some countries have experienced major fertility declines to total fertility rates below 5.0. The countries include: Botswana from 7.1 in 1981 to 4.4 in 1995-2000, Ghana

from 7.2 in 1960 to 4.5 in 1998, Kenya from 8.0 in 1975-77 to 4.6 in 1998, South Africa from 6.4 in 1960 to 3.1 in 1995-2000, Swaziland from 6.9 in 1966 to 4.8 in 1995-2000, and Zimbabwe from 8.3 in 1969 to 4.0 in 1996-99 (Ntozi 2002).

In sub-Saharan Africa, pregnancy prevalence and fertility are lower in women with symptomatic HIV infection compared with asymptomatic women, and fertility reduction is most pronounced during the terminal stages of disease. HIV infection has also been associated with spontaneous abortion and stillbirth (Ross 2004). In fact, the level of fertility is directly dependant on the pregnancy rate. Studies done in Cote d'Ivoire and Uganda have indicated that HIV infected women have fewer pregnancies than HIV negative women (Gray 1998).

Considering contraception use, the evidence shows that HIV/AIDS has increased the use of contraception. Glynn (2000) demonstrated that HIV infected women who had given one birth were more likely to have used contraceptives than HIV negative women. Also Ryder (1991) comparing 238 HIV positive and 315 sero negative women in Kinshasa, Democratic Republic of Congo found that 26.4% of the HIV infected was using modern contraceptives significantly higher than 16.3% of the uninfected. The proportion using a modern method increased with the progression to AIDS stage (42%).

b. Age and usage of ANC

The link between age and receiving ANC has been confirmed in the past. Young mothers, less than the age of 20, have been identified as late bookers or simply do not use ANC. This may be explained by the fact that they were humiliated because in most of the cases they were not married (Chisholm 1989). Thus, considering the case in Zambia, ANC surveillance clearly overestimated infection in teenagers aged 15–19 years and underestimated infection in the □30-year age-group. Several inherent biases are likely to be introduced when extrapolating any finding to the population at large (Fylkesnes 1998). Besides, there is a marked selection bias in higher age-groups due to lower pregnancy rates in HIV-positive than in negative women.

This appears to be the most important contributing factor explaining the revealed relatively low infection rates amongst ANC aged □30 years. Also women of an age greater than 35 or 40 have also been revealed to not use ANC (Goldenberg, Patterson& Freese 1992). One of the reasons explaining this case has much to do with the parity. This is especially the case for Rwanda whereby, a rural woman may give birth to more than 5 children at home because she knows that she didn't have any complication during previous births (William J. Cliton Foundation 2003).

c. Maternal education, socio-economic status and usage of ANC

Previously, studies have shown that the no use of ANC has been found in mothers who received less than 12years of education (Cooney 1985). That is women with higher education level were more likely to use ANC. In fact, the level of education is correlated with the income level. More empirically, this has been shown in the study done in Tanzania by Changalucha J. (2002). He clarifies that pregnant women attending ANC services may be more health-conscious and have different socio-economic characteristics from women who do not.

It is important to note that as Fylkesnes K. (1998) demonstrates in Zambia, women with higher educational achievement are likely to be underrepresented in ANC-based data, mainly because of their lower pregnancy rates. In fact, educated women tend not to have many children because of economic calculation and they often put long interval between births.

Recently, in a study done by Mekonnen Y. and Mekonnen A (2004) in Ethiopia, education continues to be an important determinant of antenatal care use. For women with at least secondary education, they were four times more likely to receive antenatal care from a health professional. Those with primary education were two and half times to receive ANC services.

Besides, unmarried women have been found to be more likely to receive antenatal care from a health professional than unmarried women. This may be explained by the culture aspect depending on beliefs and values regarding sexuality (including when to become sexually active and the number of sexual partners) and condom use (Shisana & Simbayi, 2002). This may, actually, according to a study done in Senegal by Niang et al.(2003), be related to the cultural definition of sexual orientation in the context of HIV/AIDS.

d. Place of residence and usage of ANC

Walker (2001a) and Changalucha (2002) in their studies have shown that rural areas are underrepresented in the collection of data. Data from pregnant women are primary collected in urban or peri-urban sites and then the information on urban/rural remain sparse and this refers to the idea that women from rural area do frequently not use ANC.

2.5 Conceptual framework

The conceptual framework (Figure 2.1) describes the relationship between demographic variables, the dependent variable and the independent one on the matter under study. Demographic variables measure such demographic characteristics as age of the respondent, place of residence, occupational status, marital status and educational status. In fact, among women who give birth (that are considered as at high risk), the assumption is that there is a self-selection (Zaba 2000); there are some who use ANC and others who do not. The assumption here is that those who decide not to use ANC are more likely to be HIV+ than those who use ANC because the latter may be more certain that they HIV infection-free. Besides, a recent meta analysis proves that HIV positive women have a higher incidence of stillbirths and foetal loss than women who are not infected (Zaba 2000).

Indeed, in attempting to measure the significance of the difference in the use of ANC by infected and uninfected women, this project will focus on explaining how HIV status of pregnant women may affect their use of ANC. In the first instance, there is a general

population of women among whom there are some who give birth. Giving birth or not is an important factor that interest this research because of its assumed correlation with HIV infection.

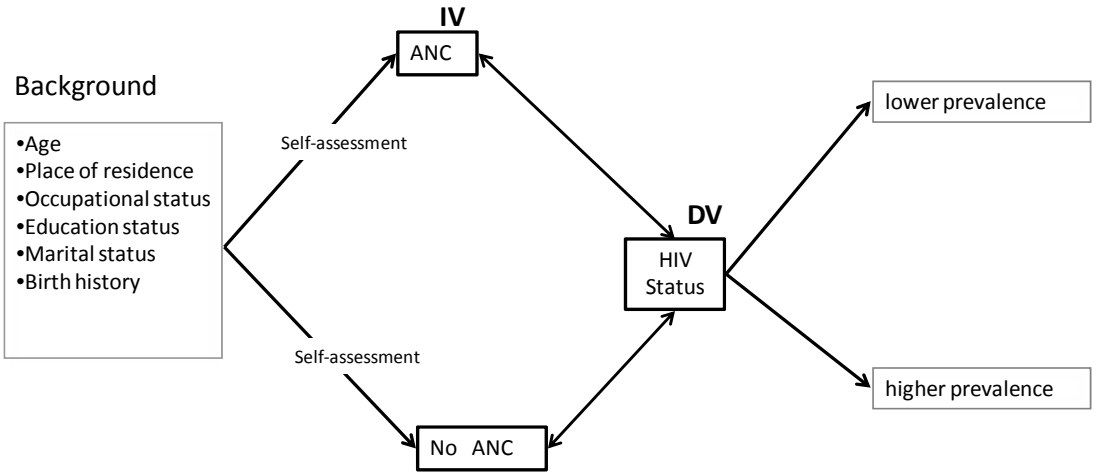

Figure 2. 1: Theoretical framework

2.6 Hypotheses

-The probability of being HIV positive for women who just give birth is higher compared to their counterparts who do not give birth

-The probability of being HIV positive for women who visit ANC is lower compared to their counterparts who did not.

CHAPTER III: Research methodology

Introduction

This section deals with the methodological aspects of this project. It presents the data sources, the sample design, the variables of interest of the study, and the data analysis technique.

3.1 Study design

This study is based on secondary data analysis. The 2005 Rwanda Demographic and Health Survey (RDHS) and the 2004 Malawi Demographic and Health Survey (MDHS) will be used. DHS is a project that assists countries worldwide in conducting survey to obtain information on key population and health indicator.

3.2 Sample design

The sample for DHS (for both countries) covered the population residing in ordinary households across the country. A representative probability sample of 10,644 households was selected nationwide in Rwanda and 15,041 household in Malawi. In the households interviewed in the survey, a total of 11,539 women age 15-49 years were identified as being eligible for the individual interview. The interview was completed with 11,321 of women in Rwanda, yielding a response rate of 98 percent whereas in Malawi 12,229 eligible women were identified of whom 96 percent were successfully interviewed with a response rate of 94%. This study will employ all the 11,321 respondents interviewed in the RDHS and 11 696 respondents interviewed in MDHS.

Since this project is interested in using DHS data, it will only extract questions that are relevant to the study in the questionnaire.

Three questionnaires were used in the RDHS-III: the Household Questionnaire, the Women's Questionnaire, and the Men's Questionnaire.

The women's questionnaire is appropriate for this study because it provides relevant information on the birth history and on the use of ANC. I t collects information on the following topic: background characteristics (e.g. age, education, employment status, religion, and place of residence), reproductive history, knowledge and use of contraceptive methods, fertility preferences, antenatal, childbirth, and postpartum care.

During data collection data on HIV status, the blood was drawn from women 15 to 49 who had voluntarily accepted the testing. This was done using a nationally representative sample of women [interviewed in the 2005 RDHS and in 2004 MDHS]. The tests result was linked to socio demographic and behavioral data on the individuals interviewed.

In actual fact, in Rwanda, the proportion of women who participated in the HIV testing varied from 96.1 percent among those ages 15 to 19 to 98.8 percent among that age 40 to 44 whereas in Malawi, the overall rate of survey participation was 96 percent for women and 12.70 percent of women consented to the HIV test.

3.3 Variables of interest

Dependent variable

There is only one dependent variable in this study, which is the HIV status of the respondents.

Independent variable

The variables are the usage of antenatal clinic (use or no use of ANC) and birth history.

Control variables

These are the age of respondents, place of residence, occupational status, marital status and educational status. These variables will be useful in determining the background characteristics of the respondents.

3.4 Data analysis

The unit of analysis for this study is a woman. Bivariate was performed for respondents' 'birth history', 'ANC usage' and 'HIV status'. Multivariate analyses (logistic regression) were carried out for two groups; all women and women who had live birth. For the multivariate analysis, the response category was collapsed to create a dichotomous variable on the basis of whether or not the woman had used ANC as well as on whether she had live birth or not. Two analyses were carried out; particularly, for women who had live birth in the five years preceding the surveys and for all respondents (including those with live birth and no live birth).

Bivariate regression was first carried out to find out variables which have significant relationship with dependent variable (HIV status) in order to be run in multivariate regression to investigate the relationship between ANC usage and birth history. In fact, the interest was, on one hand, to identify the likelihood of being infected in women who use ANC compared to those who do not and, on the other hand, to identify the likelihood of being infected with those who had live birth compared to those who had no live birth. Besides, the outcome variables were coded as 1 if the women used ANC or had live birth and O if women had used neither ANC nor had live birth. To determine the relationship between HIV status the use of ANC, and women birth history, the following equation was used:

$HIV= \beta_0+\beta_1$ ANC$+ \beta_2$ control variables (significant in single regression) +e

was used; where

β_0 denotes the log odds of the probability of being infected

β_1.β_2 denote the logit coefficients of the respective predictor variables

CHAPTER IV: RESULTS AND DISCUSSION

Introduction

Univariate and bivariate results are presented first, followed by results of the logistic regression model.The logistic regression model will control more confounding variables compared to bivariate analysis.

4.1 Respondents' profiles

This section presents a descriptive summary of the background characteristics of respondents (women aged between 15-49) sampled in Malawi Demographic and Health Survey of 2004 as well as those sampled in Rwandan Demographic and Health Survey of 2005.

Table 4. 1: Sociodemographic characteristics of respondents

	Rwanda(2005)		***Malawi(2004)***	
	(N=11321)		***(N=11698)***	
Variable	*F*	*%*	F	*%*
Age (years)				
<20	3,076	27.17	**3,079**	**26.32**
21-29	3,620	31.98	**4,288**	**36.66**
30-39	2,593	22.90	**2,621**	**22.4**
40-49	2,032	17.95	**1,710**	**14.62**
Marital status				
Married	6,405	56.58	**8,770**	**74.97**
Formerly married	588	5.19	**1,026**	**8.77**
Never married	4,328	38.23	**1,902**	**16.26**
Residence				
Urban	2,616	23.11	**1,640**	**14.02**
Rural	8,705	76.89	**10,058**	**85.98**
Education				
No education	2603	22.99	**2.731**	**23.35**
Primary	7497	66.22	**7282**	**62.25**
Secondary and over	1,221	10.79	**1685**	**14.40**
Occupation				
Working	8,162	72.10	**6,934**	**59.28**
Not working	3,144	27.77	**4,733**	**40.46**
Missing	15	0.13	**31**	**0.27**
Live births in last 5 years				
No births	5,931	52.39	**4,394**	**37.56**
Births	5,390	47.61	**7,304**	**62.44**
HIV status				
HIV-	5441	96.08	**2443**	**85.30**
HIV+	222	3.92	**421**	**14.70**
ANC usage				
No use	307	5.70	**353**	**4.83**
Use	5083	94.30	**6951**	**95.17**

Source: computed from 2004 MDHS and 2005 RDHS

*F: frequency

Table 4.1 shows the socio-demographic characteristics of the sample. Age of the sampled women is ranged from 15 to 49 years. The population in this study has a young age structure, the highest range is between 21-29 year age group (31.98% in Rwanda and 36.66% in Malawi), then teenagers (<20 years) comprising 27.17% in Rwanda and 26.32% in Malawi. For both countries, more than a half are married; Malawi is more represented in this category with 74.97 % and 56.58% in Rwanda. However, considering the category of 'never married' Rwanda is the most represented with 38.23% compared to 16.26% in Malawi.

Almost all respondents, in both countries reside in rural areas. That is inferred from the fact that Rwanda and Malawi are rural countries and consequently the DHS respondents were concentrated in rural areas. It must be noted that Malawi is more rural than Rwanda (85.98% versus 76.89%). Considering the birth history, respondents in Malawi have had births more than those in Rwanda. In fact, in Rwanda, 52.39% of respondents had no live births in last 5 years prior to the 2005 RDHS whereas in Malawi more than half (62.44%) had had live birth in last 5 years prior to the 2004 MDHS. These birth ratios are relevant to this study and help to determine differences in data for both countries because those who had live birth in last five years (prior to the survey) are the ones who were targeted by the question on the use and no use of ANC.

As far as education is concerned, for both sides, more than a half have primary education and those who are not educated represent the bigger number compared to those who have secondary education and above. About the occupational status of sampled women (mainly agriculture in both countries), more women are working in Rwanda than in Malawi (72.10 versus 59.28%). In relation to the HIV infection, women from Malawi are relatively more infected than those in Rwanda (14.7% versus 3.92%). The use of ANC in respondents is for both sides high compared to those who do not use ANC, but women from Malawi use more ANC than Rwandese women. However, it is important to mention that this difference may be caused by the higher percentage of women who had live birth in last five years in Malawi compared to Rwandese women.

4.2 HIV status distribution in respondents

Even though the percentage of infection is relatively lower in Rwanda (3.2%) compared to Malawi (14.7%), there is a need to know how this is distributed in respondents according to selected background characteristics. Table 4.2 shows the results of the bivariate analyses of the HIV status.

Table 4. 2: HIV status of respondents by selected background characteristics

Variable	Rwanda (N=11321) HIV+ (row%)	P	**Malawi (N=11698) HIV+ (row%)**	**P**
Age		0.000		**0.000**
<20	0.77 %		**5.71 %**	
21-29	3.43%		**16.48%**	
30-39	7.00%		**19.85%**	
40-49	5.45 %		**16.97%**	
Marital status		0.000		**0.000**
Married	4.70%		**14.49%**	
Formerly married	13.07%		**33.74%**	
never married	1.63%		**9.47%**	
Education		0.000		**0.515**
No education	3.55%		**15.43%**	
Primary	3.55%		**14.13%**	
Secondary/over	6.90%		**16.0%**	
Residence		0.000		**0.000**
urban	8.46%		**21.45%**	
Rural	2.60%		**13.69%**	
Occupation		0.015		**0.065**
Working	4.35%		**15.71%**	
Not working	3.00%		**13.22%**	
Birth history		0.200		**0.002**
No births in last 5yrs	3.61%		**17.42%**	
Births in last 5yrs	4.27%		**13.20%**	

Source: computed from 2004 MDHS and 2005 RDHS

The output in Table 4.2 shows that for both countries, there is a significant association between the age-group of respondents and their HIV status. As Figure 4.1 shows, according to HIV test results from MDHS and RDHS in both countries, the age group which has most infected women is 30-39.

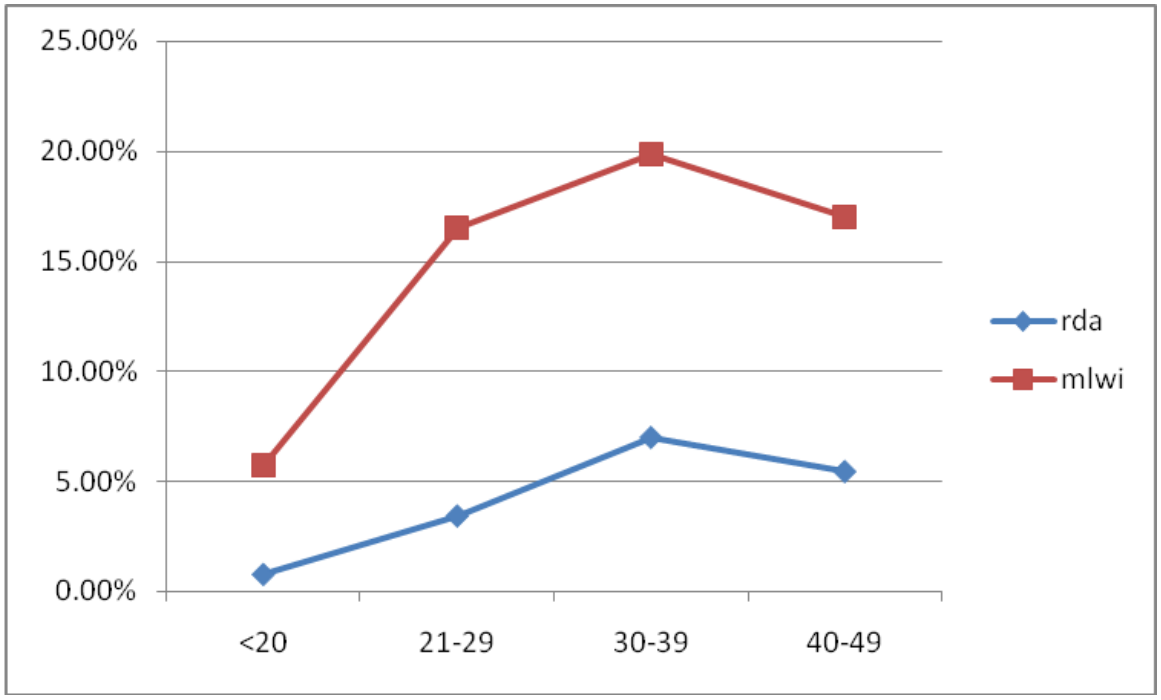

Figure 4. 1: HIV prevalence by age (2004 MDHS, 2005 RDHS)

*rda: Rwanda, *Mlwi:Malawi

From Table 4.2, the chi-square shows also that there is a significant relationship between respondents' marital status and their HIV status (P-value=0.000). The distribution of HIV status among married, formely married and never married in Rwanda is not different from that of Malawi. In both countries, considering Figure 4.2, the 'formerly married' category (that include divorced and widowed) is the one that contains the highest number of infected women. This may be related to the fact that this category of women is more

exposed to have multiple partners than other categories or they could have been divorced or widowed to the HIV positive partner.

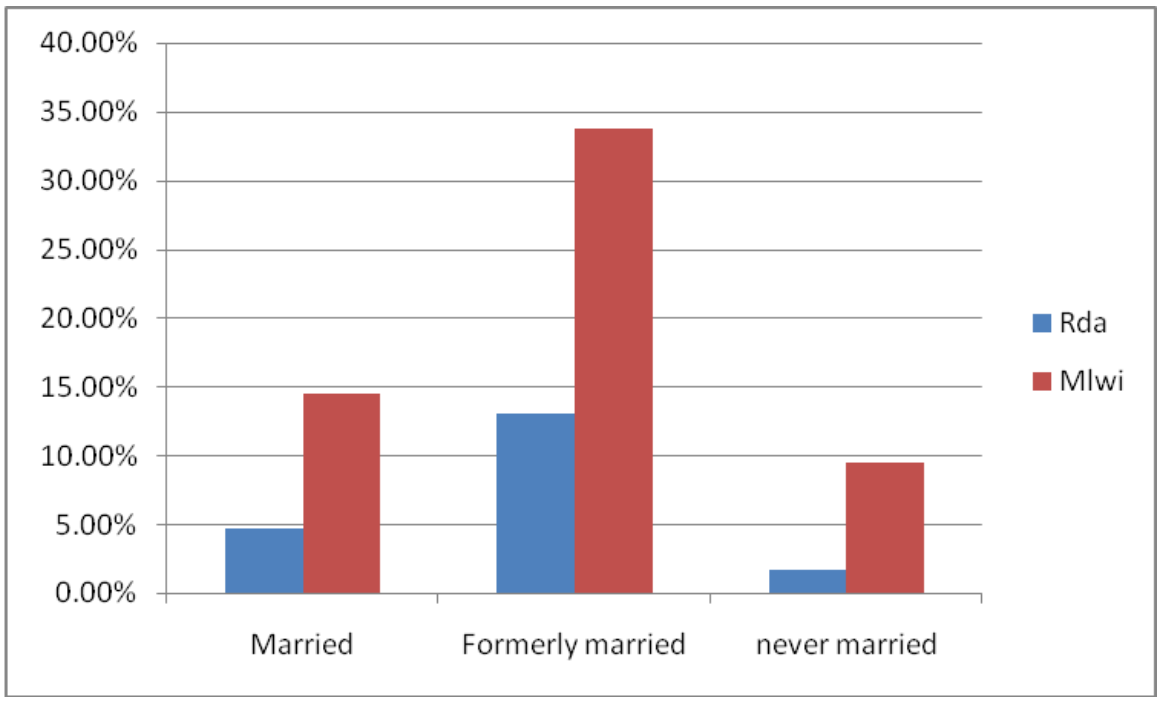

Figure 4. 2: HIV prevalence by marital status

*Rda: Rwanda, *Mlwi: Malawi

Concerning the level of education and the HIV status of respondents, Table 4.2 shows a significant association (p-values=0.000) in Rwanda but this is not the case in Malawi (P-value of 0.515). In fact, higher educational attainment has been associated with a greater risk of HIV infection in sub-Saharan Africa (Michelo 2006) but in Zambia, the author has found that there is a risk reduction among more educated. The evidence that education itself protects against HIV is strong, educated people are more likely to adopt safer behavior [World Bank, 2002]. However, for Rwanda, the infection is still most concentrated in those who are highly educated while in Malawi there is no significant difference among educated and non educated group.

Besides, the type of residence and the HIV status have been proven to have a significant relationship in both countries. For both countries, HIV is more current in urban areas. This may be explained by the fact that urban population is influenced by non safer behavior such as drug use (injecting) and alcohol abuse that may lead to non protected sex [McCoy, (2002)].

Furthermore, the output from Table 4.2 shows that there is no relationship between HIV status and occupational status of respondents for both countries. However, a significant association between birth history (those who had live birth in last five years or not) has been confirmed in respondents in Malawi and not in Rwanda. In fact, as Figure 4.3 shows, among those who are HIV positive in Rwanda, those who give birth are almost or approximately more exposed to HIV infection compared to those who do not (there is only a borderline significance). This is contrary in Malawi whereby those who do not give birth are the most infected.

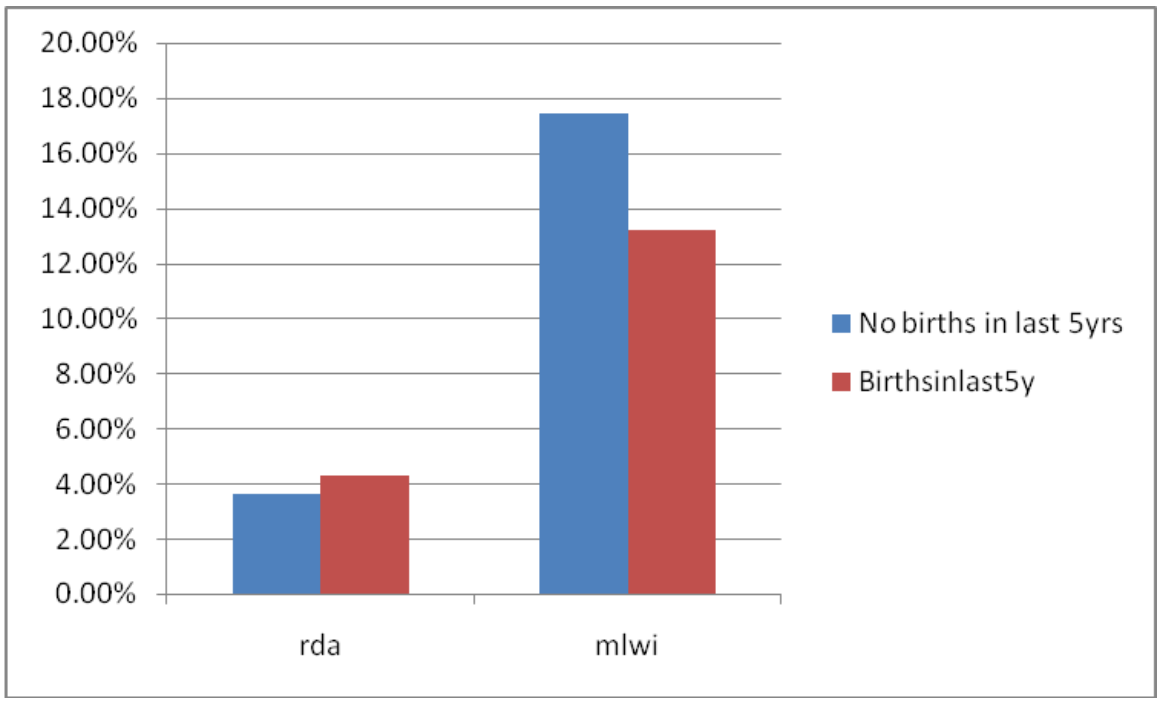

Figure 4. 3: HIV infection by women birth history

4.3 Birth history by respondents's background

The outputs from table 4.3 shows that there is a strong association between age, education, occupational status, the marital status and the type of residence of respondents and their birth history. In both countries, sampled women in 21-29 and 30-39 age groups represent the highest number of those who had had live births in last 5 years (prior to the survey). They are, actually, the most reproductive age group.

Table 4. 3: Live births in last five years by age, education and occupation level of respondents

	Rwanda		***Malawi***	
	(n=11321)		***(n=11698)***	
Variable	*Birth (row %)*	*P*	***Births (row%)***	***P***
Age		0.000		**0.000**
<20	6.83%		**35.66%)**	
21-29	62.79%		**85.61%**	
30-39	77.86%		**72.61%**	
40-49	43.70%		**36.96%**	
Education		0.000		**0.000**
No education	58.24%		**67.78%**	
Primary	47.75%		**63.54%**	
Secondary/abo ve	42.51%		**49.02%**	
Occupation		0.000		**0.000**
Working	53.14%		**66.04%**	
Not working	33.30%		**57.19%**	
Marital status		0.000		**0.000**
Married	77.03%		**74.93%**	
Formerly married	30.44%		**55.17%**	
Never married	6.40%		**8.78%**	
Residence		0.000		**0.000**
Urban	40.56%		**50.91%**	
Rural	49.73%		**64.32%**	

Source: computed from 2004 MDHS and 2005 RDHS

However, Figure 4.4 below is showing that specifically in Rwanda the age group that has a high number of women who had live birth in last five years is 30-39 and in Malawi the age group is 21-29.

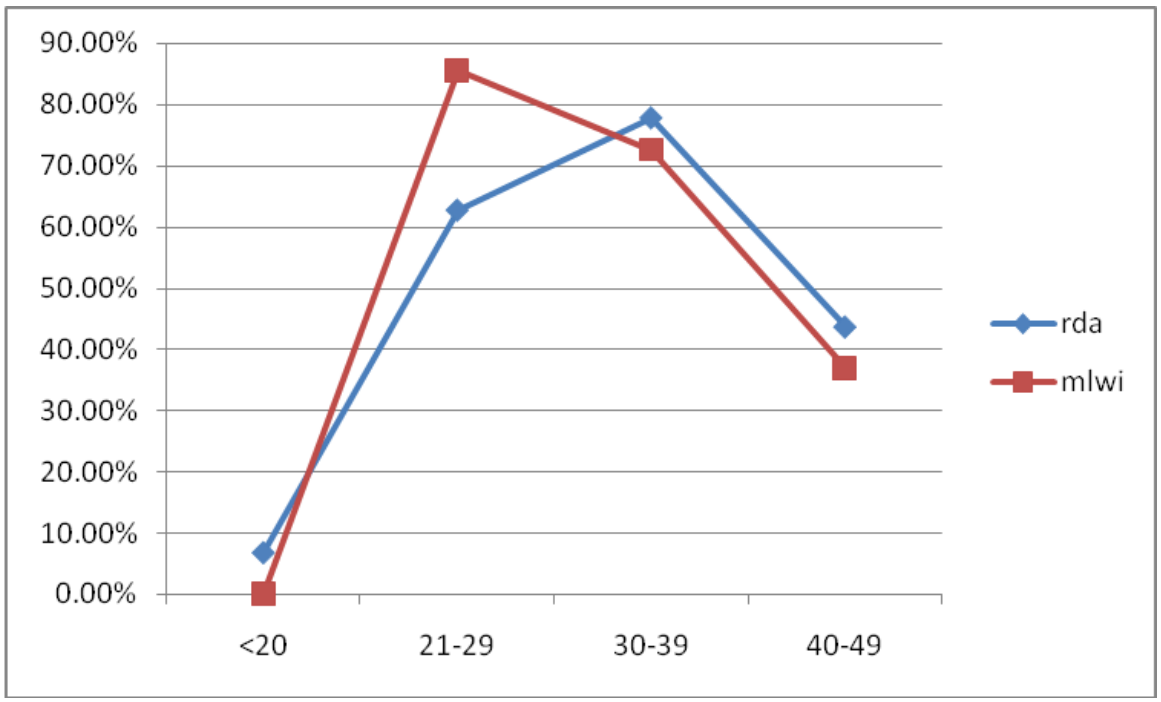

Figure 4. 4: % of women who had live birth in the last five years prior to the survey

4.4 Use of antenatal clinics and women's 'birth history'

Since the main focus of this study is to find out how the HIV status among women who use ANC could be representative for all population from which it is drown, the assumption is that those who use ANC are less likely to be HIV positive than those who do not use ANC.

For both countries, most of respondents are using ANC (94.38% and 95.17%). However our further analysis sought to see how this number is distributed in selected background characteristics. Subsequent to this, the results will be confronted with HIV status results to see whether those who use ANC most are those ones who are more HIV infected in order to value the utilization of those who use of ANC as representative of the whole

women in estimating HIV prevalence. In fact, the guess is that before using ANC a woman does a kind of self –selection (Zaba 2000) and decide to use ANC in case she feels that her sexual life is not doubtable.

Table 4. 4: Percentage of women who gave birth about the use of ANC by selected background characteristics.

	Rwanda		**Malawi**	
Variables	Use of ANC(row%)	P	**Use of ANC(row%)**	**P**
Age		0.009		**0.008**
<20	92.38%		**95.45%**	
21-29	95.34%		**95.67%**	
30-39	94.16%		**94.90%**	
40-49	92.45%		**92.56%**	
Marital status		0.000		**0.430**
Married	94.85%		**95.07 %**	
Formerly married	91.06 %		**96.29%**	
never married	13.36%		**95.21%**	
Residence		0.004		**0.014**
Urban	92.46 %		**96.89%**	
Rural	94.76%		**94.95%**	
Education		0.012		**0.000**
No education	91.89%		**91.90%**	
Primary	95.02%		**95.96%**	
Secondary/over	96.72 %		**98.06%**	
Occupation		0.167		**0.205**
Working	94.51%		**95.41%**	
not working	93.41%		**94.75%**	

Source: computed from 2004 MDHS and 2005 RDHS

Table 4.4 shows a significant association between marital status and ANC use in Rwanda (P-value=0.000) but not significant in Malawi (P-value=0.430). It should be noted that in Malawi, higher percentage of those who have never got married use the ANC. However, this is not the case for Rwanda whereby those who use ANC in that category represent only 13.36%. This may be associated with the fact that the stigma associated with out-of-marriage pregnancies could be severe in Rwandan societies (differences in culture). The assumption may be that such pregnancies are unwanted or unintended. As a result such women will be less motivated to seek antenatal care compared with their married counterparts. This is emphasized by Chandrasekhar (2007) whereby he is saying that "…in Rwanda… cultural and social factors may impede access…" on health services. In Malawi, on the contrary, as we have seen with Kondowe (1999) teenagers are encouraged to have sex upon graduation as a way of putting in practice the knowledge they have acquired. Thus, this doesn't hinder they access to health care (ANC) because the culture is, somewhat, accepting the behavior.

In Rwanda, the type of residence is significantly associated with the use of ANC contrary to Malawi where both residence categories are well represented. The education level and use of ANC have been proven to have a significant relationship in Malawi and non significant in Rwanda.

Even if not statistically significant, for both countries, considering the graph below, the high percentage of respondents that use ANC are in between 21-29 year age group ; age group considered as one of the most reproductive in Malawi (Table 4.3). Women in <20 age group are using more ANC in Malawi than in Rwanda. This may be explained by the fact that this particular age group in Malawi represents the highest percentage of those who had live birth in high percentage compared to Rwandan case.

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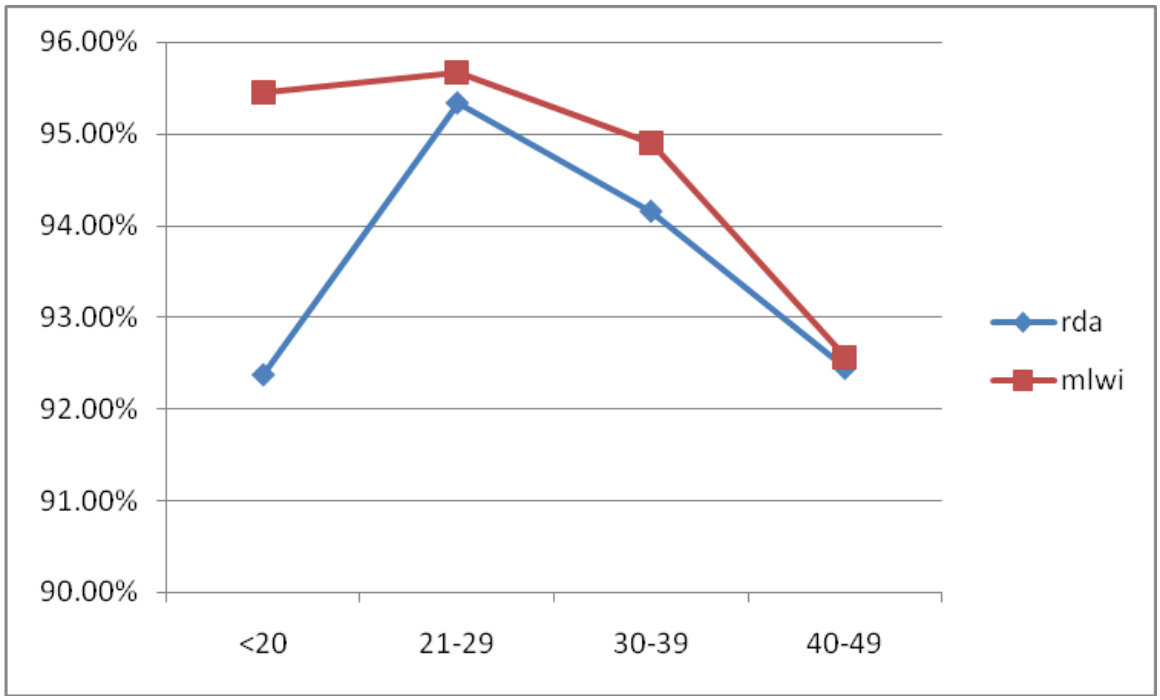

Figure 4. 5: % of women who use ANC by age groups

4.5 HIV status by birth history and by use of ANC

The present project is concerned with two important groups; all women (those who have been mothers in last five years and those who have not been) and the specific category of women who use ANC. It investigates, at the same time, the representativeness of HIV infection in women who use ANC in the total women (including those who do not use ANC).

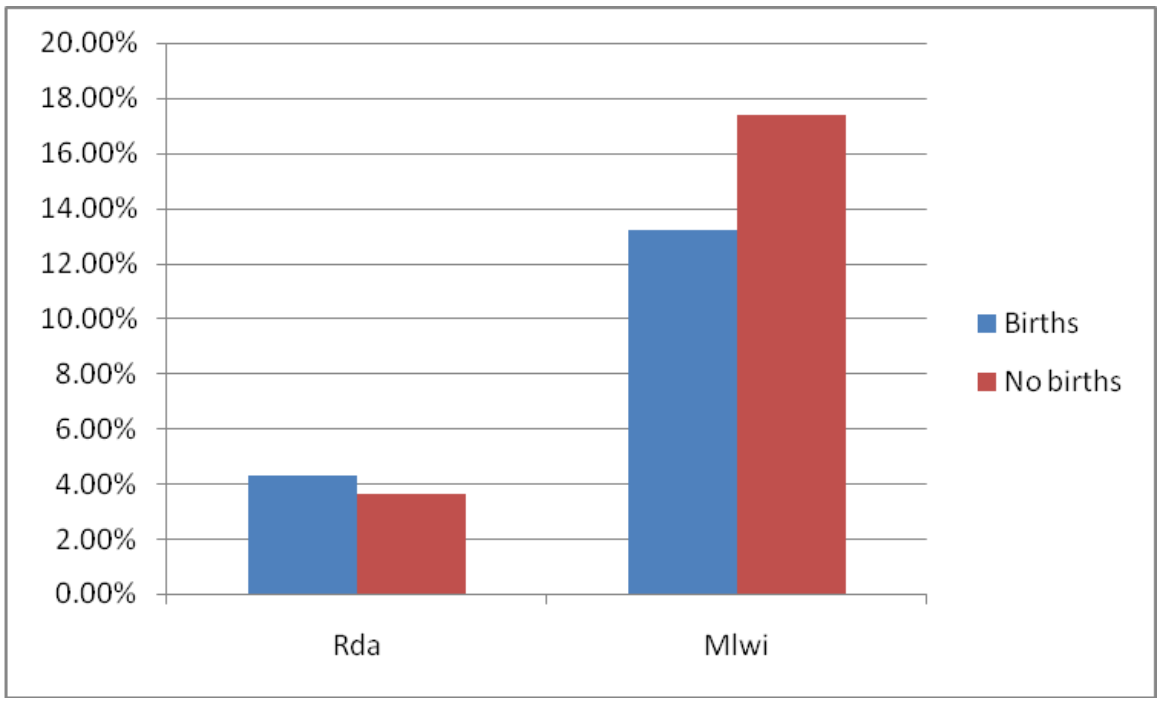

Figure 4. 6: HIV infection by birth history

When reading the figure 4.6 and Table 4.5, one notices that in Rwanda, even though not statistically significant, the high number of those who are HIV+ is among those who had live birth (4.27 versus 3.61%) whereas in Malawi the high number is among those who had no live birth in last 5 years (17.4 versus 13.2%). Indeed, for the case of Rwanda, there is an association between giving birth and the HIV infection obviously because being pregnant implies unprotected sexual intercourse.

When considering HIV status of those who had used ANC or not represented in Figure 4.7, we found that for both countries, those who use ANC are more likely to be HIV negative compared to those who do not use ANC.

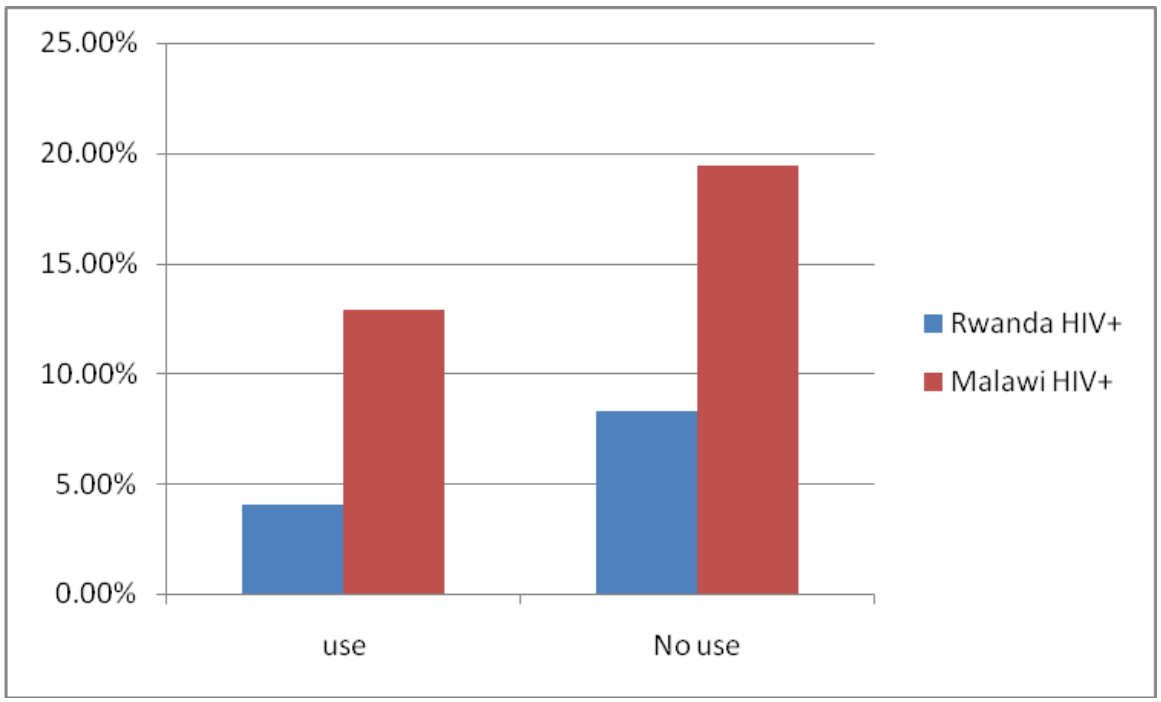

Figure 4. 7: HIV prevalence by ANC usage

4.6 Likelihood of being infected for women who use ANC

Considering Table 4.6 in this study, two models have been considered. On the one hand, there is a model that is considering 'all women' (Table 4.6) and that is the one which includes those who give or do not give birth. Both, bivariate regression and multivariate regression have been carried out.

First of all, in this model, bivariate regression has been run (results not different from bivariate analysis table 4.2). Only age, marital status, type of residence and birth history variables were identified as significant predictors of HIV status of respondents in Rwanda and Malawi. In fact, the model reinforces that, for Rwanda and Malawi those who give birth are less likely (0.6 and 0.4 times) to be HIV infected than those who do not give birth. This was different for Rwandan case whereby in bivariate regression those who give birth were more likely to be infected. This change may be due to the fact that there

was no significant difference in HIV prevalence between those who give birth and those who do not.

On the other hand, the model used specifically for women who had live birth (Table 4.7) was carried out. After running bivariate regression, only type of residence and birth history in Rwanda were identified as significant whereas in Malawi marital status is adding up to those identified in the Rwandan case. It shows that those who use ANC are respectively in Rwanda and in Malawi, 0.5 and 0.6 times less likely to be infected than those who do not use ANC (significant at 5% level for Rwanda and at 10% for Malawi).

Table 4. 5: Likelihood of being infected for women who had live birth in last five years

Bivariate regression							*Multivariate regression*					
	Rwanda			Malawi			*Rwanda* n=*5663*			Malawi n=2864		
	*Coef.	Odds	P	Coef.	odds	P	Coef.	odds	P	Coef.	odds	P
Age												
21-29	1.52	4.56	0.000	**1.18**	**3.26**	**0.000**	1.32	3.74	0.000	**1.06**	**2.91**	**0.000**
30-39	2.27	9.65	0.000	**1.41**	**4.09**	**0.000**	1.93	6.89	0.000	**1.13**	**3.09**	**0.000**
40-49	2.00	7.39	0.000	**1.26**	**3.38**	**0.000**	1.44	4.23	0.000	**0.49**	**1.63**	**0.038**
<20												
Marital status												
Formerly married	1.11	3.05	0.000	**1.10**	**3.01**	**0.000**	0.86	2.35	0.000	**0.99**	**2.69**	**0.000**
never married	-1.09	0.33	0.000	**-1.22**	**0.29**	**0.000**	-0.77	0.46	0.003	**-1.21**	**0.29**	**0.000**
Married												
Residence												
Rural	-1.24	0.29	0.000	**-0.54**	**0.58**	**0.000**	-1.28	0.28	0.000	**-0.65**	**0.52**	**0.000**
urban												
Birth past 5 yrs.												
Birth	0.17	1.19	0.200	**-0.33**	**0.72**	**0.002**	-0.48	0.62	0.007	**-0.84**	**0.43**	**0.000**
No birth												
Occupation status							*ns	ns	ns	ns	ns	ns
Not working	-0.38	0.68	0.016	**-0.20**	**0.82**	**0.065**						
Working												
Educational level										ns	ns	ns
primary	-0.01	***0.99***	***1.000***	**-0.10**	**0.90**	**0.412**	0.27	1.31	0.136			
Secondary and over	0.69	***2.01***	0.001	**0.04**	**1.05**	**0.791**	0.31	1.36	0.204			
No education												

Source: computed from 2004 MDHS and 2005 RDHS

*ns: not significant in bivariate regression / *coef.: coefficient

Table 4. 6: Likelihood of being infected for women who used ANC compared to those who do not

Bivariate logistic regression							*Multivariate regression*					
	Rwanda			**Malawi**			***Rwanda n= 2695***			**Malawi n=1848**		
	*Coef.	odds	P	**Coef.**	**odds**	**P**	Coef.	odds	P	**Coef.**	**odds**	**P**
Age(years)							*ns	ns	ns	**ns**	**ns**	**ns**
21-29	0.57	1.77	0.437	**0.59**	**1.81**	**0.014**						
30-39	1.15	3.15	0.114	**0.75**	**2.12**	**0.003**						
40-49	0.64	1.44	0.396	**0.37**	**1.45**	**0.270**						
<20												
Marital status							ns	ns	ns			
Formerly married	0.96	2.62	0.013	**1.04**	**2.83**	**0.000**				**1.08**	**2.93**	**0.000**
never married	0.30	1.35	0.420	**0.02**	**1.02**	**0.958**				**-0.17**	**0.84**	**0.705**
Married												
Residence												
Rural	-1.48	0.23	0.000	**-0.86**	**0.42**	**0.000**	-1.46	0.23	0.000	**-0.91**	**0.40**	**0.000**
urban												
Usage of ANC												
Use	-0.77	0.46	0.012	**-0.48**	**0.62**	**0.114**	-0.64	0.53	0.041	**-0.69**	**0.58**	**0.085**
No use												
Occupational status							ns	ns	ns	ns	ns	ns
Not working	0.02	1.02	0.928	**0.03**	**1.03**	**0.832**						
Working												
Educational level							ns	ns	ns	ns	ns	ns
primary	0.09	1.09	0.672	**0.04**	**1.04**	**0.798**						
Secondary and over	0.46	1.58	0.163	**0.31**	**1.36**	**0.187**						
No education												

Source: computed from 2004MDHS and 2005RDHS/ *coef.: coefficient/ *ns: not significant in bivariate regression

DISCUSSION OF RESULTS

General results of this research report, on the one hand, show that for both countries women who give birth are less likely to be infected compared to those who do not give birth. They also show that women who use ANC are less likely to be infected compared to those who do not use ANC. In fact, this infers that women in general population have a higher prevalence of HIV than those seen in ANC.

Correspondence between respondents' birth history and their HIV status

In this study, one of the assumptions was that women who give birth are more exposed to HIV infection than those who do not give birth. According to Zaba (2000b) this was one of the reasons why those who give birth and visit ANC, are used to monitor HIV trends in the general population.

Under this assumption, results were as follow. Considering Table 4.2 and 4.3, there is a need to demonstrate whether there is a differential relationship between the fact of having live birth in last five years and HIV infection. In fact, in a case where the relationship is positive women who give birth will be more likely to be HIV infected (Zaba 2000). Where the relationship is going to be discordant the fact that women who are infected are less likely to become pregnant (Ross 2004) is considered.

Taking into account the age group of respondents which is considered as the strong explanatory variable in this study, we found that in Rwanda the age group which is most infected is the same as the one which was most reproductive (had live birth in last five years). However, this was contrary in Malawi where the most infected age group was not the same as one which was most reproductive. Some of the explanations of the difference in reproduction history of both countries may be based on culture. In fact, in Rwanda women are getting married a bit later than in Malawi and some of the culture practices in Malawi encourage somehow the early involvement in sexual intercourse (Kondowe

1999).Besides, the differential quality of data used and the differential health policy of the two countries.

Considering women's marital status for both countries, the 'formerly married' category was the one having the high percentage of infected women. However considering their 'birth history' the 'married' category is the one with high percentage. In fact, formerly married (that is divorced or widowed) are considered to become infertile because of HIV infection. This differential relationship between sampled women's birth history and their HIV status is also present in residence and education level of women. In fact, reflecting on residence type of women, the 'urban' type of residence is the one which has greatest number of infected women although the 'rural' type of residence records high percentage of women who had live birth in last five years. With women's education level, those in 'secondary and over' category are the most infected but they are not the ones who give birth in high percentage. It is those in the 'no education' category who give birth in high percentage compared to other categories.

Besides, the result from Figure 4.3 appears interesting. In fact, the result shows that in Rwanda, those who had live birth are more likely to be infected than those who had no live birth. In contrast, in Malawi those who had no live birth are the ones who are most infected. In fact, these results (from Malawi, see Figure4.3) are consistent with previous studies done in Ivory Cost and Uganda which have indicated that HIV infected women have fewer pregnancies than HIV negative women (Gray 1998). Actually, because HIV infection lowers fertility, ANC data may tend to underestimate the HIV prevalence rate among the general women. In addition, some of the reasons of decline in fertility rates in Sub-Saharan Africa are: firstly, foetal deaths through spontaneous abortion and still births due to HIV infection reduce the live births which are used in the calculation of fertility.

Results implication in discussion on HIV prevalence estimates

At the beginning of this study, the representativeness of ANC-based HIV prevalence was investigated. The assumption was that women who use ANC are less likely to be

infected, which will imply the under estimation of HIV prevalence in general female population. In fact, the results have shown that in both Rwanda and Malawi women who use ANC are less likely to be infected than those who do not use ANC.

Theoretically, those results are not consistent with some of the HIV prevalence published in UNAIDS or in ANC. Table 1.1 shows that ANC and UNAIDS HIV prevalence estimates tend to overestimate HIV prevalence, compared with HIV prevalence produced in DHS. This may be explained by different methods of adjustments used whereas in this study, a straight comparison was done between HIV status among those who use ANC and those who do not.

However, as Figure 4.7 shows, those who use ANC are less likely to be infected compared to those who do not. In fact, based on that fact, in Rwanda HIV infection in women who use ANC is 4.02 % whereas HIV infection in general female population is 3.6% (2005 RDHS). In Malawi, HIV prevalence in ANC users is 12.9% while general female population prevalence is 13% (2004 MDHS). In brief, considering HIV prevalence in ANC users, in Rwanda HIV prevalence will tend to be overestimated in general female population and underestimate this prevalence in Malawi even if the difference between HIV prevalence in women seen in ANC and in general female population is not higher. The explanation of this may be the fact that in Rwanda we have seen that women who had live birth are more likely to be infected than their counterparts who do not (even if it was not statistically significant and has then changed when confronted with other control variables [see Table 4.6]).

Other possible explanations may be found in literature about the contraception use. Considering the level of contraception used in both Rwanda and Malawi, women in Malawi use contraception more than women in Rwanda (15.97% versus 7.6%). In fact, according to Rodriguez and Hayes (2002), patterns of contraception use will determine the effect of an increase in the proportion of individuals using contraception in HIV transmission and this effect could lead to artificial declines or increases in ANC prevalence estimates. As we have seen that in Malawi those who do not have live birth

are the most infected, individuals who think they are at high risk of HIV infection will adopt condom use to protect themselves or their partners as well as to avoid pregnancies (Rodriguez and Hayes 2002). This would result in higher prevalence of infection in non-ANC users as found in results (Figure 4.7).

CONCLUSION

In this research report, I interrogate the accuracy of estimation of HIV prevalence using data from ANC users and its representativeness of the prevalence to the general female population. Measuring the differences and their significance between women (15-49) who visit ANC compared to those who do not use ANC was the main objective of the study. The assumptions were, on the one hand, that the probability of being HIV+ for women who just give birth is higher compared to their counterparts who do not give birth. On the other hand, I assumed that the probability of being HIV positive for women who visit ANC is lower compared to their counterparts who did not (conditional on being pregnant). Most of the factors investigated are related to the demographic and socio-cultural characteristics of women. Those were respondents' age, type of residence, occupational status, education level, marital status, ANC usage, and HIV status and birth history. However, the study was most interested in 'use of ANC', 'birth history' and 'HIV status' of respondents.

Considering the main objective and the study's hypotheses, the major findings for both countries is that, firstly, women who give birth are less likely to be infected comparing to those who do not give birth. Secondly, women who use ANC have been found at lower risk of infection than those who do not use ANC. These research findings basically join a number of other researchers who question the accuracy of and validity of the representativness of ANC- based HIV estimates. In fact, as we have seen, especially in Sub-Saharan Africa one of the possible explanations is that HIV infection reduces live birth (UN 2002).

Based on these findings, data from ANC users are not always reliable information for monitoring HIV prevalence in general female population. More to the point, even if, in general, results have been similar for Rwanda and Malawi, they have not been of the same significance. In fact, in Malawi women who had live birth in last five years were more than the majority (62.44%) whereas this was different in Rwanda (with only

47.61%). Besides, women in Malawi are, in general, most infected than women in Rwanda (3.92% versus 14.70%).

Briefly, for this study, those two factors (% of those who had live birth and their HIV prevalence) have been at the basis of difference in results' significance between two countries. Accordingly, on one hand, the difference in probability of being infected for women who had live birth in last five years compared to those who did not had live birth (prior to the surveys), were significant in Malawi (P=0.000) but this was only significant at 10% (level of significance) in Rwanda. On the other hand, the difference in probability of being infected in women who use ANC compared to those who do not use ANC were significant in Rwanda (5%) than in Malawi (10%).

Generally, there is no discrepancy between literature and the findings of the study. Literature reports that in some countries, on the one hand, women who give birth are less likely to have live birth. On the other hand, it reports that those who use ANC are less likely to be infected compared to those who do not use ANC. Even though there appears to be no discrepancies between literature and the findings, it was important for the study to be conducted. The importance of the study lays in the fact that using data from DHS the accuracy of data from sentinel surveillance (particularly ANC-based HIV prevalence estimates) will be experienced. In fact, question about the use of ANC and the same respondents were tested.

Besides, these results suggest that not only the degree of ANC data representativeness is changing depending on various stages of HIV epidemic as Fylkesnes said (1998), but also is affected by the amount of women who had live birth and their respective HIV status. In fact, in a country with more women with live birth and being at the same time more infected, women who had live birth will be less likely to be infected (at high level of significance) because HIV infection will lower live birth (UN2002). Besides, women who use ANC will be less likely to be infected (at lower level of significance) because the chance of being HIV positive will be higher compared to a country with respective HIV infection.

Using the findings of this study it is recommended that another comparative study be conducted, which would have as the main objective to verify whether it is always the case that in a country with more women with live birth and being at the same time more infected, women who had live birth will be less likely to be infected. This recommendation is important because it will give other substitutes for performing HIV prevalence estimates depending on each country's particularity.

The matter, here, is still based on the world 'estimate' define as approximate judgment regarding the size. UNAIDS and other organization concerned with HIV estimates should define this approximate size. This contrast issue shows how much HIV prevalence estimates are still a debatable subject. In fact, whereas results suggest, in general, that women who use ANC are less likely to be infected, other results show that in one country HIV prevalence tend to overestimate and underestimate in the other.

All this shows the danger of exclusively basing HIV prevalence estimation on ANC users (ANC-based prevalence estimates). In fact, it is important to support ANC-based HIV prevalence estimates with community-based HIV prevalence. That is, especially, the link of HIV test with behavioural which is one of the strengths of the surveys herein used (2004 MDHS and 2005 RDHS) even such data, generally, suffered from a number of limitations. This is based on the fact that, even if the survey's sample is assumed to be representative, the survey did not test all respondents with the possibilities of refusal and missing. However, this has not significantly affected the final results of the present study because women are considered to be most representative compared to men (considering response rates in DHS; that is 98% in Rwanda and 94% in Malawi).

REFERENCES

Allen, S., A. et al. (1993). Pregnancy and contraception use among urban Rwandan women after testing and counseling. *American Journal of Public Health* 83:705-710.

Bennell P. (2007), *Is UNAIDS right? Levels and trends in HIV prevalence in Sub-Saharan Africa,* Paper presented for BN1 6ED, Brighton: Knowledge and Skills for Development.

Bernardi L. and Hutter I (2007), The anthropological demography of Europe: Reflexion in *Demographic research*, Vol.17 art.18, 541-566p.
http://www.demographic-research.org/Volumes/Vol17/18/.

Bignami-Van A.S et al. (2005), *Evidence from National Population-Based Surveys on Bias in Antenatal Clinic-Based Estimates of HIV Prevalence*, Harvard University Cambridge, Massachusetts.

Boerma, J.T et al. 2003. "Estimate of HIV-1 prevalence from national population-based survey as a new gold standard." *The lancet* ,Vol 362, Issue 9399, p 1929-1931.

Bury, J. et al. 1992. *Working with women and Aids. Medical, social and counseling issues*. United Kingdom.

Changalucha, J. et al. (2002). Comparison of HIV prevalence in community-based and antenatal clinic survey in rural Mwanza, Tanzania. *AIDS*, 16:661-665.

Enkin, M. and Chalmers, I. (1982). *Effectiveness and satisfaction in Antenatal care*. London; Spastics International Medical Publication.

Fylkesnes, K. et al. (1998). Studying dynamics of the HIV epidemic: population-based data compared with sentinel surveillance in Zambia. *AIDS* 12:1227-1234.

Glynn, J. R. et al. (2001). Factors that influencing the difference between antenatal clinic and general population in sub-Saharan Africa. *AIDS* **15**,1717-1725

Goldberg DJ et al. (1992). Prevalence of HIV among childbearing women and women having termination of pregnancy: multidisciplinary steering group study. *BMJ* 1992, 304:1082–1085.

Gray RH et al. (1998). Population-based study of fertility inwomen with HIV-1 infection in Uganda. Lancet 1998, 351:98–103.

Hunter SC et al. (2003). The association between HIV and fertility in a cohort study in rural Tanzania. J Biosoc Sci 2003, 35:189–199.

Kayirangwa, E. et al. (2006). Current trends in Rwanda's HIV/AIDS epidemic. *Sex Transm Infect 2006;82(Suppl I*):i27–i31.

Kondowe B.Z and Mulera D.(1999), A cultural approach to HIV/AIDS prevention and care; Malawi's experience. UNESCO/UNAIDS research project

Lindan, C et al. (1991). Knowledge, Attitudes, and Perceived Risk of AIDS among Urban Rwandan Women: Relationship to HIV Infection and Behavior Change AIDS, vol. 5, no. 8, pp. 993-1002.

Malawi Demographic and Health Survey 2004. http://www.measuredhs.com.

McCoy HV, McCoy CB, Zhao W. Int Conf AIDS. (2002) Jul 7-12; 14: abstract no. D11132. HIV in urban vs. rural areas: Social and behavioral determinants of sexual risks among drug using intervention participants.

Mekonnen Y. and Mekonnen A. (2002), Utilization of Maternal Health Care Services in Ethiopia, (Ethiopian Health and Nutrition Research Institute Addis Ababa, Ethiopia) ORC Macro Calverton, Maryland, USA

Michelo et al. (2006) .Marked HIV prevalence declines in higher educated young people: evidence from population-based surveys (1995-2003) in Zambia. Apr 24;20(7):1031-8.

Mishra V. et al. (2006), HIV testing in national population-based surveys: experience from Demographic and Health Surveys, Bulletin of the WHO; 84(7):537-545.

National AIDS Control Programme-The POLICY Project (2001), *Estimating National HIV Prevalence in Malawi from Sentinel Surveillance Data,* Lilongwe, Malawi.

Niang, C.I.,Tapsoba, P.,Weiss, E., Diagne, M., Niang,Y., Moreau, A.M., Gomis, D., Wade,A.S., Seck, K. & Castle C. (2003). It's raining stones: Stigma, HIV vulnerability among men who have sex with men in Dakar, Senegal. *Culture, Health and Sexuality*, 5, 499-512.

Nicoll, A. et al.1998. The relationship of HIV prevalence in pregnant women to that in women of reproductive age: a validated method for adjustment. *AIDS* 12:1861-1867.

Ntozi J.P.M. 2002.Impact of HIV/AIDS on fertility in Sub-Saharan Africa. Economic Comission for Africa. 4th meeting of the follow-up committee on the implementation of the DND and the ICPD-PA. Yaounde, Camerroon.

Parker R. (2001), Sexuality, culture and power in HIV/AIDS research. Annual review of anthropology. vol. 30:136-179

Rodriguez and Hayes (2002). Reducing HIV prevalence among oung people: A review of the UNGASS prevalence goal and how it should be monitored. London School of Hygiene and Tropical Medicine London, UK

Ross A et al. (2004), HIV-1 disease progression and fertility: the incidence of recognized pregnancy and pregnancy outcome in Uganda, *AIDS* , 18:799–804.

Rwanda: Standard DHS, *2005 DHS Final reports*. ORC Macro Calverton, Maryland, USA July 2006

Ryder RW *et al.* (1991). Fertility rates in 238 HIV-1-seropositive women in Zaïre followed for 3 years postpartum. *AIDS* 1991, 5:1521–1527.

Serwadda, D. et al. (1997). HIV, STDs and fertility: a population-based study in Rakai district, Uganda.

Sewankambo, N.K. et al.(1994). Demographic impact of HIV infection in rural Rakai District, Uganda: results of a population-based cohort study. *AIDS* 8:1707-1713.

Shisana, O. & Simbayi, L. (2002). *Nelson Mandela/HSRC study of HIV/AIDS: South African national HIV prevalence, behavioural risks and mass media household survey*. Cape Town: Human Sciences Research Council

Thackway V.S et al. (1997) Fertility and reproductive choice in women with HIV-1 infection, *AIDS,* 11:663–667

Timberg C. (2007), U.N. to Cut Estimate Of AIDS Epidemic Population With Virus Overstated by Millions, Washington Post Foreign Service

TRAC (Treatment and research aids center) 2002. *Protocol HIV sentinel surveillance among women receiving antenatal care in Rwanda 2002*. Ministry of health, Rwanda.

The United Nations Joint Programme of HIV/AIDS (UNAIDS) 2000.Report on the global HIV/AIDS epidemic, June 2000. Geneva.

UNAIDS/WHO 2003. *Guidelines for conducting HIV sentinel sero surveys among pregnant women and other groups.* Geneva, WHO/UNAIDS. (http://www.who.int/hiv/pub/surveillance/ anc_guidelines/en, accessed May 2005).

UNAIDS/WHO (2004). *Guidelines for effective use of data from HIV surveillance systems*. Geneva, UNAIDS/WHO (http://www.who.int/hiv/strategic/surveillance/hivpubepidemiology/en, accessed 19 May 2007).

UNAIDS (2005). Methods and assumptions for estimates [web site]. Geneva, UNAIDS

(http://www.unaids.org/Unaids/EN/Resources/Epidemiology/How+do+UNAIDS_

UNAIDS/WHO(2006). *Report on the global AIDS epidemic***.** Worldwide HIV and AIDS statistics 2006 (www.avert.org/worlstatinfo.html)

UNAIDS/WHO (2007)**.** Revised HIV estimates, 2007 AIDS Epidemic Update, UNAIDS, Geneva.

Walker, N. et al. 2001a. Methods and procedures for estimating HIV/AIDS and its impact. The UNAIDS/WHO estimates for the end of 2001. *AIDS* 2003, 17:2215–2225.

Walker N. et al. 2001b. Epidemiological analysis of the quality of HIV serosurveillance in the world: how well do we track the epidemic? *AIDS* 15:1545-1554

World Bank (2002). Education and HIV/AIDS: A Window of Hope, World Bank ISBN: 0-8213-5117-6

World Bank (2007).World Development Report: Investing in Health.Washington DC: World Bank.

Zaba, B. et al. (2000a). Adjusting ante-natal clinic data for improved estimates of HIV prevalence among women in sub-Saharan Africa. *AIDS* 14:2741-2750.

Zaba, B. et al. 2000b. Monitoring the AIDS epidemic using HIV prevalence data among young women attending antenatal clinics: prospects and problems. *AIDS* 14:1633-1645.

UN-Economic and social council (2002), *Impact of HIV/Aids on fertility in sub-Saharan Africa*, economic commission for Africa, Yaounde, Cameroon.

ANNEXE

ZABA' ADJUSTMENT APPLICATION

The results of regression are showing that women who use ANC are less likely to be infected than those who do not use ANC, this infers the fact that women in general population have a higher prevalence of HIV than those seen in ANC. That was one of the base on which Zaba (2000) proposed the adjustment method on the condition that this difference is significantly higher. Even if this difference is statistically significant, with Zaba's recognition that this adjustment method is aimed to improve estimation of HIV prevalence among women in Sub-Saharan Africa, it was important for this study to apply it and notice its applicability in Malawi and in Rwanda.

However, While Table 4.6 shows that there was not need of adjustment for data from Rwanda as there was no significant difference (0.1%) in HIV prevalence in women who used ANC and all women, the Malawian results have been adjusted due to a significant difference of 1.65% found in two HIV prevalence.

In her adjustment method, Zaba used two types of data; firstly, birth interval length data from ANC to allow for subfertility among HIV positive women. Secondly, she used data from demographic surveys to allow for different levels of HIV prevalence among women who are not seen in ante-natal clinics, in order to ascertain what proportions of the population are not at risk of childbearing, because they have effectively become sterile, or are using contraception or are not sexually active. It's essential to recognize that, in this study, only data from demographic and health survey was used. In fact, ANC data used in this study are not direct from ANC. We used the ones in the DHS corresponding to the question whether the respondent used ANC or not. This question was only asked in the case a respondent had live birth in last five years prior to the survey. More to the point, fertility categories, in this study, has been made by combining variables (from DHS) like contraception use, respondents sexuality, had live birth or not', ANC usage and HIV status of respondents. Beside, considering Zaba's contraception standards of 15%,

contraception rates is high in Malawi (15.97%) and lower in Rwanda (7.6%) below 15%. This point toward which relative HIV prevalence for contraception standard to be used.

Considering the table 4.7, pregnancy-based HIV prevalence rates shown in column (a) were obtained using published HIV status in MDHS among women who had no live birth in last five years prior to the survey and respectively in those who had live birth (no difference on the use or no use of ANC) at the end of column HIV prevalence in all women is presented. The HIV prevalence rate for mothers shown in column (b) is almost the same as that shown in column (a), the difference is residing on the fact that HIV prevalence in all mothers has been replaced by the one of those mothers who used ANC. Relative HIV prevalence for contraception standard, shown in column (c) are the relative prevalence for high contraception standard (15% and high) from Zaba's adjustment methodology. They are used to estimate the expected prevalence according to risk category [column (d)]. The population distribution for women in Malawi by fertility category [column (e)] is obtained from 2004 MDHS data. Expected numbers infected [column (f)] are obtained by applying the expected prevalence to the distribution of women from the 2004 MDHS. These are then summed to obtain estimated prevalence rates in the population [column (g)].

The best estimate of prevalence obtained is 14.72%. This is almost the same as the new UNAIDS (2007) estimates whereby in 2004 HIV prevalence was estimated to 14.2%. In addition, this was not very different from the 12.7% DHS estimated results on HIV prevalence. Interestingly, when looking at the results in table 4.7, HIV prevalence in Malawi is higher in women who did not give birth in last five years prior to the survey (17.42%) compared to women who used ANC for their pregnancies ('mothers') (12.95%). As Zaba recognizes, her adjustment method is sensitive to the population structure, the HIV prevalence in childless women affect the results. In fact, when comparing the adjusted results to unadjusted ones, in Malawi the adjusted HIV prevalence (14.72%) has become greater than the unadjusted (14.70%). However, for

Rwandan case, those who use ANC (‘mothers’) are the one who are most infected (4.02 versus 3.61%) this may be the cause of lower percentage of 3.92 found in all women.

Table A Zaba's adjustment method application using data from 2004 MDHS and 2005 RDHS

Fertility Category	HIV prevalence in women				Relative HIV prevalence for contraception standard (c)	**Expected HIV prev.(d)=(c) (b)**	**Percentage distribution in women in Malawi**	**Expected HIV infected (F)=(d)(e)/100**	**Expected HIV prev rate (g) sum of (f)**
Childless women	Observed (a)		ANC prev.(mothers)(b)		**high**		Malawi	Malawi	Malawi
	Malawi	**Rwanda**	Malawi	**Rwanda**	Malawi	Malawi	**37.56**		13.69
Never had sex					0.09	1.57	10.52	0.16	
Had sex not sexually active					0.92	16.03	10.93	1.75	
Sexually active using contraception					0.96	16.72	1.69	0.28	
Sexually active infecund					2.28	39.72	1.92	0.76	
Sexually active fecund	*17.42*	***3.61***	*17.42*	***3.61***	1.00	17.42	12.50	2.18	
Mothers							**62.44**		15.35
Not currently sexually active					1.49	19.30	23.69	4.57	
Sexually active using contraception					0.95	12.30	14.28	1.76	
Sexually active infecund					1.43	18.52	1.53	0.28	
Sexually active fecund	*13.20*	***4.27***	*12.95*	**4.02**	1.00	12.95	22.94	2.97	
All women	*14.70*	***3.92***					100.00		14.72