Pauline Wafula '13

Advisor: Prof. Stephen Wu

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The Effect of Female Education on HIV/AIDS Prevalence in Kenya

1. Introduction

HIV/AIDS in sub-Saharan Africa

Sub-Saharan Africa is a region that suffers from the most severe epidemic of HIV/AIDS in the world. According to the UNAIDS 2011 HIV/AIDS world report, 68 percent of all people living with HIV in the world resided in this region. In addition, 70 percent of all new infections in 2010 occurred in sub-Saharan Africa (UNAIDS 2011). Women account for 59 percent of all people living with HIV/AIDS in this region, an indication that women bear a greater burden of the epidemic than men. At least one million people have died of AIDS annually in sub-Saharan Africa since 1998 (UNAIDS 2011). However, research shows that between 2001 and 2009, HIV/AIDS incidence rates have declined by more than 25 percent in twenty-two sub-Saharan countries. (UNAIDS 2011).

The first case of HIV/AIDS in Kenya was reported in 1984 (Sirengo, Kundu, Mundia 2010). The Kenyan government has since implemented several policies to fight the epidemic. In 1997, a policy blue print, 'AIDS in Kenya' was implemented, which recommended a multi-sectoral approach when dealing with HIV programs (Sirengo, Kundu, Mundia 2010). In 1999, HIV/AIDS was declared a national disaster when the prevalence rate peaked at 13 percent (Sirengo, Kundu, Mundia 2010). This led to the establishment of the National AIDS Control Council (NACC) whose purpose is to

combat HIV/AIDS by prevention of new infections, reduce of HIV related morbidity and mortality, and to mitigate the effect of the epidemic on households and communities (Buluma, Muriithi, Gitonga 2008-2009). By 2007, the HIV/AIDS prevalence rate had fallen to 6.3 percent and has been stable since then (Sirengo, Kundu, Mundia 2010). In 2010, the prevalence rate for women was 8 percent, which is almost two times higher that for men (4.3 percent) (qtd. UNGASS 2010). During the same year, the prevalence rate for young women aged 15 to 24 years was four times higher than that of young men in the same age group (4.5 percent against 1.1 percent) (qtd. UNGASS 2010).

One promising approach to decreasing the HIV infection rate is through increased education. The relationship between education and HIV/AIDS prevalence could be explained by the relationship between education and health since the impact of HIV/AIDS is primarily on a person's health. Grossman (1978) explains that education makes people efficient producers of health by giving them access to information and enabling them to better process the information. Silles (2009) found a causal relationship between education and health by showing evidence of more schooling causing better health. Other economists have argued that the relationship between education and health is due to underlying unobserved variables such as genetic or personality factors that affect both health and schooling in the same direction (qtd. Berger and Leigh 1989). However, Berger and Leigh (1989) strongly suggest that the correlation between schooling and health is due to the direct effect of schooling on the efficiency of producing health and not due to underlying variables such as personality factors. Developing countries with large disparities in education and income levels between males and females tend to have higher HIV prevalence rates (World Bank, 1997).

The Kenyan Education System

To better understand the background of my area of research, I explain the main aspects of the Kenyan education system. Education in Kenya follows the 8-4-4 system. Students attend eight years of primary school, four years of secondary school and four years of higher education (university education). Before joining primary school, children are required to undertake either one or two years of pre-primary education commonly known as nursery or pre-unit. Prior to 2003, a school fee was required to attend either public or private primary schools. However, public school fees were lower than private school fees because of government subsidies towards public schools. When the National Alliance Rainbow Coalition (NARC) party won the December 2002 election, the new government implemented free primary education for all public schools in the country starting in January of 2003. This resulted in a large influx in the number of school-aged children because poor households who could not previously educate their children due to the fee burden could now take their children to school. Between 2002 and 2003, total primary school enrollments increased by 14 percent, that is, an additional one million children enrolled in primary school during this period of time (Chen, Hamilton, Kamunge 2004).

Using data primarily from the Demographic and Health Survey, I will study the effects of female education on HIV/AIDS prevalence in Kenya. I will also briefly look at how other socioeconomic and demographic factors affect HIV/AIDS among women in Kenya. I would like to determine whether the Kenyan government's investment in female education has a role to play in controlling the HIV/AIDS epidemic. According to the

UNESCO assessment report of 2005, the implementation of free primary education resulted in more enrollments in girls than boys in most of the districts in Kenya. This is because more girls than boys were previously affected by the levying of school fees as parents opted to send boys to school instead of girls (UNESCO 2005). Girls performed domestic household chores or engaged in small-scale businesses such as selling vegetables in order to supplement household income (UNESCO 2005).

2. Literature Review

The relationship between education and HIV/AIDS is not a not a new topic of study, but has been previously analyzed at different levels in sub-Saharan countries and also in other developing countries in the world. The main objective has been to find out whether or not education can be used as a 'vaccine' to prevent new incidences of HIV and to lower HIV/AIDS prevalence rates among the most afflicted countries.

Research conducted by Damien de Walque (2006) on how the impact of HIV/AIDS information campaign varies with educational attainment in rural Uganda found that one of the ways through which education affects health outcomes is by making people more responsive to information. De Walque found that educated women were more responsive to the information campaigns than less educated or illiterate women. Therefore, increased education reduces educated women's chances of contracting the HIV virus. Between 1990 and 2000, the HIV prevalence rate for young males and females with no education or primary education decreased by 6 percentage points while that of individuals who went to secondary school decreased by 12 percent (De Walque 2006). Walque found that changes in behavior and sexual practices, for example condom use and visits to voluntary and counseling testing centers, have been more widespread

among educated individuals. Educated people not only have better access to information than less educated people but also have better response to information campaigns (De Walque 2006). In addition, De Walque found that more educated individuals were more likely to have visited an AIDS counseling center and to have obtained results from a HIV test. On the other hand, educated people were more likely to report having more partners than less educated people.

Gregson, Waddell and Chandiwana (2001) studied the dynamics of the influence of socio-economic development on HIV transmission in sub-Saharan Africa by comparing levels of HIV infection in sub-Saharan countries with more and less educated individuals at different stages of epidemics. They found evidence of recent reductions in the infection levels that were initially observed among more educated groups especially among the young. This indicates that there is faster adoption of less risky lifestyles among the more educated. An important factor studied in their research was the effect of the length of time the epidemic has lasted on HIV prevalence in a given area. Gregson, Waddell and Chandiwana found that the relationship between education and HIV prevalence is largely dependent upon the length of time the epidemic has lasted in an area. During the early stages, more educated people have a higher risk of infection than less educated individuals (Gregson, Waddell, Chandiwana 2001). However, most community surveys have found strong positive associations between the risk of HIV infection and socio-economic status such as the level of education and employment during the early stages of HIV/AIDS epidemic (qtd. Gregson, Waddell, Chandiwana 2001). This is because more educated people generally have higher rates of changes in sexual partners,

greater personal autonomy and higher mobility (qtd. Gregson, Waddell, Chandiwana 2001).

As HIV epidemics become mature and their effects on morbidity and mortality become more apparent, more educated people have a faster response of adopting safer lifestyles than less educated people (Gregson, Waddell, Chandiwana 2001). Therefore, infection in more educated adults reduces as the epidemics age, so that more educated women are generally at greater risk in the initial stages of the epidemic than in later stages (Gregson, Waddell, Chandiwana 2001). One explanation given for a positive relationship between education and HIV prevalence in the mature stages is that more educated groups have better general health care and nutrition thus slightly extending their survival periods. This may interfere with any shifts towards a negative association between higher education and HIV incidence as the epidemic ages (Gregson, Waddell, Chandiwana 2001). For instance, 1991-1994 in Fort Portal Uganda, HIV prevalence was highest in women with secondary education in age groups of both 15-24 years and 25-49 years (Kilian et al. 1999). Between 1995 and 1997, infection rates lowered for all age groups and education categories with the exception of older illiterate groups (Kilinan et al. 1999). In summary, Gregson, Waddell and Chandiwana found that in sub-Saharan countries, higher levels of education are associated with large HIV epidemics, but that the more educated are quicker to respond to the effects of HIV/AIDS morbidity and mortality.

Previous research conducted by Robert Brent (2006) in thirty-one sub-Saharan countries found that female education is positively related to country HIV/AIDS infection rates. This indicates that female education does not prevent the spread of HIV/AIDS in sub-Saharan Africa. However, Brent found evidence showing that substituting one type

of education for another would help lower HIV prevalence rates. He also defined a category of female students known as non-standard primary students. These are students who may be older, repeaters and, less able than conventional students of the official school going age. He found that substitution from secondary to non-standard primary enrollees would lower the HIV/AIDS infection rates. Brent proposed country specific studies in order to reveal the dynamics of the HIV/AIDS epidemic.

3. Data Description and Methodology

My data is taken from the results of the 2008-2009 Demographic and Health Survey conducted in Kenya. The survey respondents were divided into three main groups: households with a sample size of 9057, women aged 15 to 49 years with a sample size of 8444 and men aged 15 to 49 years with a sample size of 3465. The information obtained from administering the questionnaires was generally about the respondents' age, region of residence, educational background, marital status, health related issues, family, sexual behavior and wealth status. In addition, the respondents of the women (individual) survey undertook an HIV test, and the results of the test were made available for analysis. The confidentiality of the respondents was maintained.

For my research, I used data obtained from the individual (women) survey. My main estimation equation was:

$$\text{HIV positive} = \beta_{1\text{-}4}*\text{education} + \beta_{5\text{-}11}*\text{province} + \beta_{12}*\text{urban} + \beta_{13}*\text{age} + \beta_{14}*\text{age}^2 + \beta_{15\text{-}19}*\text{marital} + \beta_{20\text{-}23}*\text{wealth}$$

HIV positive is an indicator variable representing women who tested positive for the HIV virus after the administration of the test. For a second equation, I substituted HIV positive with AIDS test as the dependent variable. AIDS test is an indicator variable for the

women who admitted to having undertaken an AIDS test at some point in their lives before they took part in the survey. The above equation shows different groups of dummy independent variables. The education independent variables include: some primary, primary, some secondary and secondary-higher education. I combined secondary and higher education variables because the percentage of respondents who had acquired higher education was only 8 percent of the total, therefore deeming it necessary to combine these two groups in order to obtain more accurate results. The omitted education variable is no education. The province variables are Central, Coast, Eastern, Nyanza, Rift Valley, Western and North Eastern. The omitted province is Nairobi. Under the marital group are variables: married, living together (cohabitation), widowed, divorced and separated. The omitted variable is never married. Variables under wealth include poorer, middle, richer and richest with the omitted variable being poorest. The wealth index of the respondents was determined as a composite measure of the household's standard of living (DHS). This index was calculated using data on a respondent's household ownership of a number of assets such as televisions, bicycles and motor vehicles; materials used for housing construction; and types of water access and sanitation facilities (DHS). I used the age and age^2 variables to determine the turning point of the relationship between age and the dependent variable.

To better understand the relationship between the HIV positive dependent variable and the independent variables, I also conducted other regression equations to reveal the existence of interaction effects between demographic factors (region and age) and other variables. The two variables under region are urban and rural. Studying these two groups separately was important to figure out whether or not the infrastructural and social

differences that exist between urban and rural areas will affect the relationship between education and HIV prevalence among women. The resulting equations were:

1. HIV positive = $\beta_{1\text{-}4}$*education + $\beta_{5\text{-}11}$*province + β_{12}*age + β_{13}*age^2 + $\beta_{14\text{-}18}$*marital + $\beta_{19\text{-}22}$*wealth if urban=1
2. HIV positive = $\beta_{1\text{-}4}$*education + $\beta_{5\text{-}11}$*province + β_{12}*urban + β_{13}*age + β_{14}*age^2 + $\beta_{15\text{-}19}$*marital + $\beta_{20\text{-}23}$*wealth if rural=1

The other demographic group is age. I divided the respondents into two age cohorts: younger women and older women. The younger women cohort consists of women aged 15 to 30 years while the older women cohort consists of women aged 30 to 49 years. The reason for separating the respondents into two age cohorts is due to the differences in life experiences for instance a change in the education system, which may have affected the relationship between education and HIV prevalence for the two age groups. The resulting equations were:

3. HIV positive = $\beta_{1\text{-}4}$*education + $\beta_{5\text{-}11}$*province + β_{12}*urban + β_{13}*age + β_{14}*age^2 + $\beta_{15\text{-}19}$*marital + $\beta_{20\text{-}23}$*wealth if younger women=1
4. HIV positive = $\beta_{1\text{-}4}$*education + $\beta_{5\text{-}11}$*province + β_{12}*urban + β_{13}*age + β_{14}*age^2 + $\beta_{15\text{-}19}$*marital + $\beta_{20\text{-}23}$*wealth if older women =1

The following are useful summary statistics for the data I used for my research: As shown in tables 1 and 2, forty six percent of the individuals were aged between 15-25 years, 30 percent were aged between 25-35 years and 25 percent had ages between 35-49 years. The mean age was 28 years with a standard deviation of 9.5 years. As presented in table 3, the distribution of the respondents by region was as follows: 11 percent of the women were from Nairobi province, 12 percent from Central, 14 percent from Coast, 13 percent from Eastern, 16 percent from Nyanza, 15 percent from Rift valley, 12 percent

from Western and 7 percent from Northeastern province. Thirty one percent of the women resided in an urban area while 69 percent lived in a rural area as shown in table 4.

With regard to educational attainment, summary statistics in table 5 show that: 15 percent of the respondents had no education, 29 percent had incomplete primary education, 23 percent had complete primary education, 11 percent had incomplete secondary education, and 22 percent complete secondary education and higher. As shown in table 6, thirty percent of the women were never married, 56 percent were married, 4 percent were living together with their spouses, 4 percent were widowed, 1 percent of the respondents were divorced and 5 percent were not living together with their spouses. Twenty percent of the women were from the poorest households, 15 percent were from poorer households, 17 percent were from middle wealth households, 19 percent were from richer households and 28 percent of the women were from the richest households.

Fifty nine percent of the respondents had previously undertaken an AIDS test while the rest had never had an AIDS test before the survey was conducted (Table 8). Of those who dwelled in an urban residence, 69 percent had previously been tested for AIDS while the same was true for 54 percent of those who dwelled in a rural residence (Table 9). Forty six percent of the respondents had never used any form of contraceptive, 3 percent used only traditional methods while 50 percent used modern contraceptive methods (Table 10). Since the dependent variables were indicator variables, I used probit regression to obtain the results discussed in the next section.

4. Results and Analysis

Table 11 shows the results for probit and dprobit regression of HIV positive dependent variable. Compared with no education, all levels of education lower the HIV prevalence rate among women of ages 15 to 49 years. There is a negative relationship between level of schooling and HIV/AIDS morbidity. In comparison with no education, some primary education reduces prevalence by 0.6 percent, primary education reduces the rate by 1.6 percent, some secondary education reduces the rate by 2.4 percent and joint secondary-higher education lower the prevalence rate by 3.6 percent. The effect of combined secondary and higher education on HIV morbidity rate is statistically significant at the 0.05 level of significance (p-value 0.011).

With regard to HIV prevalence rate among women by province of residence, I find that women living in Central province have a HIV prevalence rate that is 1.4 percent lower than women living in Nairobi. Women in Coast, Rift Valley, Eastern and North Eastern provinces have prevalence rates that are lower than Nairobi by 2.1, 0.1, 2.1 and 5.4 percent respectively. Women living in Nyanza are 10 percent and women in Western are 3 percent more likely than women in Nairobi to bear the virus. Results for Nyanza and North Eastern provinces are statistically significant.

The high HIV prevalence rate among women in Nyanza province can be attributed to the cultural practices performed by people in this region. The Luo are the predominant language group inhabiting Nyanza province. One characteristic that distinguishes the Luo from other language groups in Kenya is that the former do not traditionally practice male

circumcision. Studies have shown that in areas where HIV transmission is predominantly heterosexual, HIV prevalence and male circumcision are inversely correlated (Bailey et al. 2007). Other traditional practices that could explain the high HIV morbidity rates among the Luo include ritual sex around funerals, polygamy and widow inheritance (Amornkul et al. 2009). Such practices are more common in the rural parts of Nyanza province than in the urban areas.

Women residing in urban areas in Kenya have a HIV prevalence rate that is 3.2 percent higher than their counterparts in the rural areas. This result is statistically significant (p-value 0.016). Referring to the different wealth groups that I described in the previous section, there is evidence of a positive relationship between HIV prevalence and wealth. Richer women have a prevalence rate that is 3.1 percent higher than that for the poorest women and the richest women have one that is 4.3 percent higher than women in the lowest wealth group. Results for both wealth groups are statistically significant. One reason could be that women living in urban areas have greater spatial mobility compared to women living in rural areas. This is mainly due to the fact that urban areas have better infrastructure than the rural areas, hence enabling easy movement from one location to another. The accessibility of places and ease of movement increases the likelihood of having multiple sexual partners in urban areas (Gillespie, Kadiyala, Greener, 2007). This is also the case with wealthier women who in addition to having better mobility are also likely to engage in sex with non-regular partners than poorer women resulting in a higher HIV morbidity rate. Another reason is that wealthier women are able to afford better health care services and nutrition thus enabling them to live longer with the virus than poorer women (Gillespie, Kadiyala, Greener, 2007).

Married women have a HIV prevalence rate that is 0.9 percent higher than never-married women. Widowed women have a HIV morbidity rate that 32 percent higher than never-married women. Divorced women, women separated from their spouses and cohabitating women have HIV morbidity rates that are higher than that of never-married women by 11, 12 and 3.2 percent respectively. Results for widowed, divorced and separated women are statistically significant. The high prevalence rate among widows may be explained by the likelihood that a significant number of these women's deceased husbands died of AIDS. A documentary filmed in Kenya by Population Action International, *The Silent Partner: HIV in Marriage*, explores some of the challenges and complex realities facing the prevention of HIV in a marriage setting (The Silent Partner: HIV in Marriage 2008). According to this documentary approximately one out of ten married couples in Kenya have at least one partner living with HIV. In Rwanda and Zambia, over half of new infections occur within marriage or in cohabitating relationships and the same is true for slightly below half of the infections in Uganda (The Silent Partner: HIV in Marriage 2008).

Another reason for the high HIV prevalence rate among married women is that condom use is lower among married couples than among single women or men. In Kenya for instance, 97 percent of people in married or cohabitating relationships reported that they did not use a condom when last engaging in sexual intercourse (The Silent Partner: HIV in Marriage, 2008). Another traditional practice that is associated with the increased risk of HIV in marriage is polygamy. According to the documentary, 7 percent of those in a monogamous relationship are HIV positive but the rate rises to 11 percent among those

in a polygamous marriage. In addition to marital status, it is vital to understand existing interaction effects between other independent variables.

Tables 12 and 13 show evidence of an interaction effect between region and education among women aged 15 to 49 years. In general, an increase in the level of education lowers the HIV prevalence rate in both urban and rural areas; however, the effect of secondary and higher education on reduction of HIV rates is much larger in urban areas than in rural areas. In urban areas, combined secondary and higher education reduces HIV prevalence rate by 7.9 percent while the same reduces morbidity rate by 2.7 percent in the rural areas. One way to explain the disparity is that secondary schools and institutions of higher education in urban areas have better facilities, therefore provide better quality education than learning institutions in rural areas. I also observed that the effect of primary education in lowering HIV morbidity rate in urban areas is approximately three times greater than that in rural areas. Student absenteeism in the rural areas affects the quality of education especially in primary schools. School-going children in such areas often miss school in order to work in the fields or to perform other household chores for the purpose of supplementing household income (Chen, Hamilton, Kamunge 2004).

Compared to women who are never married, married women in the rural areas have a HIV prevalence rate that is higher by 0.5 percent. I found strong statistical significance showing that widowed women in urban areas have a HIV prevalence rate that is 43 percent higher than that of never-married women (p-value 0.00). In rural areas, widowed women have a prevalence rate that is 28 percent higher than that of never-married women. Divorced women in rural areas have a HIV morbidity rate that is 13 percent higher than

that of never-married women (statistically significant). Divorced women in urban areas have a HIV prevalence rate that is 8 percent higher than the prevalence rate of never-married women. Compared to women who are never married, women in urban areas separated from their spouses are 16 percent more likely to suffer the disease. The same is true for women in rural areas with a 10 percent change in the likelihood (p value = 0.001).

In rural areas, there is a positive linear relationship between wealth and HIV prevalence for women. The richest are 6 percent more likely to have the virus than the poorest, and the results are statistically significant (p-value 0.012). However, the same trend between wealth and HIV prevalence does not hold in the urban areas. Although not statistically significant, I observed that the relationship between wealth and HIV prevalence in urban areas is not a linear one. For instance, the HIV prevalence rate for women from middle wealth households is twice that of women from the richest households. One reason could be that, despite their lack of adequate financial resources, poorer women in urban areas are able to enjoy some of the benefits of better infrastructure available in urban areas. Therefore, women from poor households in urban areas tend to be more mobile and have more sexual partners than their counterparts in the rural areas. Poor women in the urban areas also tend to have access to better healthcare facilities and may be able to live longer with the virus than poor women in the rural areas.

Tables 14 and 15 show that for both the younger and older women cohorts, an increase in the level of education reduces the rate of HIV morbidity. However, there is evidence of an interaction effect between age cohorts and education. Combined secondary and higher education has a stronger effect on reducing HIV morbidity rate among the older women cohort than the younger women cohort, that is, among older

women, there is a 4.5 percent reduction while a 2.3 percent reduction in prevalence rate is observed among younger women. One way to explain this observed effect is that the quality of Kenyan education is believed to have worsened after the Kenyan government changed the education system from the 7-4-2-3 system to the 8-4-4 system in 1985 (Ojiambo, 2009).

In 1964, when Kenya became a republic, the government implemented a system of education similar to the British system: the 7-4-2-3 system. This system of education entailed seven years of primary school, four years of lower secondary education, two years of higher secondary education and 3 years of university education. The ultimate goal of the 7-4-2-3 system was " to provide high level skills needed for economic, industrial, vocational and technical training that was essential for employment and development" (Ojiambo, 2009). In the 1980s, the Kenyan government changed its policy on education and designed an educational system that was more geared towards ensuring that students acquired more practical skills that would encourage self-employment. However, according to critics, the switch from 7-4-2-3 system to 8-4-4 system was considered to be more of a political one than an educational need (Ojiambo, 2009). Since the time of its implementation, the 8-4-4 system has faced numerous challenges such as lack of involvement of stakeholders, lack of infrastructure such as classrooms, lack of proper curriculum, and lack of trained personnel and funds. Some women in the older women cohort benefited from the higher quality 7-4-2-3 educational system compared with women in the younger women cohort who have gone through the current 8-4-4 system. This could explain the greater impact of education in lowering HIV prevalence rates among the older women cohort relative to the younger women cohort.

Women in the younger cohort living in Central, Coast, Eastern Rift Valley, Western and North Eastern Provinces have a lower HIV prevalence rate than their counterparts in Nairobi province. Only in Nyanza province is the HIV morbidity rate higher than that of Nairobi. For the older women cohort, we find that Coast province has a HIV morbidity rate that is lower than Nairobi province while all other provinces, excluding North Eastern province, have a HIV prevalence rate that is higher than that of Nairobi province. The effect on HIV prevalence rate of being in Nyanza relative to Nairobi is twice as large for older women than for younger women (statistically significant). This disparity could be as a result of the current outfacing of traditional practices such as wife inheritance among the Luo found in Nyanza. Another reason is that the younger generation among the Luo are currently embracing male circumcision after being educated on the benefits of this practice in reducing one's risk of infection.

There exists a difference in the relationship between marital status and HIV morbidity rate between the younger and older women cohorts. Married younger women have a prevalence rate that is 5.5 percent higher than women who have never married. Among older women, marriage reduces prevalence rates by 13 percent. Both results are strongly statistically significant (p-value 0.00). I found statistical significance for divorced younger women having a HIV morbidity rate that is 20 percent higher than that for never-married younger women (p-value 0.02). Divorced older women are 0.4 percent less likely to be HIV positive than never-married women in the same age cohort. In both age cohorts, widowed women and women separated from their spouses had larger HIV prevalence rates than never-married women. However, I observed a significantly greater effect among widowed and separated women in the younger cohort than in the older cohort.

Widowed women in the younger cohort have a HIV prevalence rate that is 7 times higher than that of their counterparts in the older women cohort. These results are statistically significant (p-values: younger women 0.00, older women 0.02). The HIV morbidity rate for younger women separated from their spouses is approximately 70 times greater than older women separated from their spouses. This may be due to the fact that younger women are more sexually active compared to older women and are therefore more likely to have more sexual partners than older women.

There exists a quadratic relationship between HIV prevalence rate and age. The prevalence rate first increases with age and then declines with the turning point being 33 years. The results are strongly statistically significant (p-value 0.00). A similar quadratic relationship between age and HIV prevalence is observed in both urban and rural areas, with 34 years as the turning point in urban areas and 32 years in the rural areas. One reason is that women are more sexually active during their younger years thus the observed initial positive relationship between age and HIV positive status, then sexual activity drops after reaching a maximum resulting in a negative relationship between age and HIV infections thereafter.

Urban areas have a higher HIV morbidity rate than rural areas for both younger and older women; however, the difference in the rates between urban and rural areas is twice as large in the older women cohort than in the younger women cohort. In the younger women cohort, HIV prevalence is positively related to wealth. We observe roughly the same trend in the older women cohort, however, the results show that compared to the poorest households, women from middle class households have a HIV morbidity rate that is lower by 0.06 percent (not statistically significant).

Next we analyze the results for the regression that I ran with AIDS test as the dependent variable. Knowing one's HIV status is an integral part in the fight against HIV/AIDS. This is because, by knowing one's status, a person who is HIV positive would be more cautious not only on how to avoid spreading the virus but also on how to undertake the necessary steps in proper nutrition and antiretroviral treatment. Table 16 shows the results for the AIDS test probit regression. There exists a quadratic relationship between age and the likelihood of undertaking an AIDS test. The possibility of undertaking an AIDS test initially increases with age and then declines with the turning point being 30 years.

I find that more educated women are more likely to have previously undertaken an AIDS test. Compared to having no education, some primary education increases the likelihood of undertaking an AIDS test by 7.2 percent, complete primary education increases the likelihood by 16 percent, some secondary education increases by 17 percent and secondary and higher education increase the likelihood by 20 percent. All the results are strongly statistically significant (p-values<=0.01).

Compared to women residing in Nairobi province women in Central, Eastern, Rift Valley, Western and North Eastern provinces are less likely to have previously undertaken an AIDS test. There is strong statistical significance for Central, Eastern, Rift Valley and North Eastern provinces (p-values 0.00). Women living in Coast province are 2.9 percent more probable to have undertaken an AIDS test than women in Nairobi province. Women in Nyanza province are 0.6 percent as likely to undertake an AIDS test. Women in urban areas are 3.2 percent more plausible to have had an AIDS test than their counterparts in rural areas. Since Nairobi is the capital city of Kenya, we would expect

more testing centers to be located in this province thus increasing the likelihood of its residents to undertake an AIDS test. Mombasa, the second largest city in Kenya, is found in Coast province. Due to the cosmopolitan nature of the province, we would expect the residents of Coast province to have access to more information about HIV/AIDS thus increasing their likelihood of undertaking an AIDS test. We also expect Nyanza province to have a large number of AIDS test takers because of the high HIV prevalence rate in this region.

Compared to women who have never married, married women are 33 percent more likely to have undertaken an AIDS test with strong statistical significance (p-value 0.00). Widowed women are 26 percent more likely to have had an AIDS test than never married women. The same is true for divorced and separated women with 24 percent and 27 percent likelihood respectively. The results for all three groups are strongly statistically significant (p-value 0.00).

Wealthier women are more probable to have had an AIDS test than women from poor households. The percentage increase in likelihood of having undertaken an AIDS test compared to the poorest increases from 4.3 percent among women from poorer households to 6.5 percent for women in middle wealth households. There is a 2.2 percentage drop from middle wealth households to richer households and the percentage likelihood increases from 4.3 percent among women from richer households to 8.7 percent among the richest. Results for all wealth indexes are statistically significant.

5. Conclusion

Through this research, I have studied the effect of female education on HIV prevalence in Kenya, and also studied how several other demographic and socioeconomic factors affect the HIV prevalence rate of Kenyan women. My research stems from past research conducted by Brent (2007) who sought to find out whether or not female education prevents the spread of HIV/AIDS in Sub-Saharan Africa. One main difference is that Brent focused on 31 sub-Saharan countries and I focused on one Sub-Saharan country: Kenya. According to the results obtained from my research, I conclude that there exists a negative relationship between the level of female education and HIV/AIDS prevalence in Kenya. This is contrary to Brent's results that indicated a positive relationship between the level of female education and HIV prevalence rates in sub-Saharan Africa. However, my results support De Walque's (2006) findings that more educated people have better access to information about HIV/AIDS and are also more responsive towards the information. It is also likely that the HIV/AIDS epidemic in Kenya is now in the later stages due to the negative relationship between education and HIV prevalence rate. This is in accordance with Gregson, Waddell and Chandiwana (2001) who in their past research found that the relationship between education and HIV prevalence is dependent upon the length of time the epidemic has been present in that given area. I also find that the effect of female education on lowering HIV prevalence rate is greater in urban areas than in rural areas and is also greater in the older women cohort than in the younger women cohort. More educated women are also more likely to undertake an AIDS test than less educated women. For other demographic and socioeconomic factors, I find that Nyanza province has the highest HIV prevalence rate for women in Kenya. Women residing in urban areas have a higher HIV morbidity rate

than their counterparts in the rural areas. I also find that HIV prevalence rate increases with wealth.

One weakness of my research is that the data used is from the 2008-2009 demographic and health survey and therefore may not accurately reflect any recent changes that may have occurred with the HIV/AIDS epidemic, female education or other demographic and socioeconomic factors in Kenya. Another weakness is that I was not able to study the individual effects of secondary education and higher education on the HIV prevalence rate for women due to the relatively small number of respondents who had obtained any form of higher education especially in the rural areas.

For further research, the effect of female education on the prevalence of HIV/AIDS in Kenya could be studied for other years in order to give a better understanding of the dynamics of the relationship between female education and the HIV/AIDS epidemic in this region. The effect of female education on other HIV-related behavioral characteristics could also be studied as well as the effects of other socioeconomic and demographic factors on HIV/AIDS.

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Table 1

agegroup	Freq.	Percent	Cum.
1	3,859	45.70	45.70
2	2,504	29.65	75.36
3	2,081	24.64	100.00
Total	8,444	100.00	

1=ages 15-25years, 2=ages 26-35 years, 3=ages 36-49 years

Table 2

Variable	Obs	Mean	Std. Dev.	Min	Max
age	8444	28.42575	9.489345	15	4

Table 3

region	Freq.	Percent	Cum.
nairobi	952	11.27	11.27
central	973	11.52	22.80
coast	1,149	13.61	36.40
eastern	1,127	13.35	49.75
nyanza	1,318	15.61	65.36
rift valley	1,278	15.14	80.50
western	1,039	12.30	92.80
northeastern	608	7.20	100.00
Total	8,444	100.00	

Table 4

type of place of residence	Freq.	Percent	Cum.
urban	2,615	30.97	30.97
rural	5,829	69.03	100.00
Total	8,444	100.00	

Table 5

educational attainment	Freq.	Percent	Cum.
no education	1,242	14.71	14.71
incomplete primary	2,431	28.79	43.50
complete primary	1,973	23.37	66.86
incomplete secondary	961	11.38	78.24
complete secondary	1,123	13.30	91.54
higher	714	8.46	100.00
Total	8,444	100.00	

Table 6

current marital status	Freq.	Percent	Cum.
never married	2,540	30.08	30.08
married	4,682	55.45	85.53
living together	359	4.25	89.78
widowed	351	4.16	93.94
divorced	118	1.40	95.33
not living together	394	4.67	100.00
Total	8,444	100.00	

Table 7

wealth index	Freq.	Percent	Cum.
poorest	1,699	20.12	20.12
poorer	1,284	15.21	35.33
middle	1,455	17.23	52.56
richer	1,617	19.15	71.71
richest	2,389	28.29	100.00
Total	8,444	100.00	

Table 8

ever been tested for aids	Freq.	Percent	Cum.
no	3,411	40.80	40.80
yes	4,915	58.79	99.59
9	34	0.41	100.00
Total	8,360	100.0	

Table 9

type of place of residence	aidstest 0	aidstest 1	Total
urban	803	1,794	2,597
	30.92	69.08	100.00
rural	2,642	3,121	5,763
	45.84	54.16	100.00
Total	3,445	4,915	8,360
	41.21	58.79	100.00

Table 10

ever use of any method	Freq.	Percent	Cum.
never used	3,903	46.22	46.22
used only folkloric	17	0.20	46.42
used only trad. meth	266	3.15	49.57
used modern method	4,258	50.43	100.00
Total	8,444	100.00	

Table 11: HIV positive

Variable	probit	dprobit
somepri	-0.051	-0.006
	-0.39	-0.4
primary	-0.153	-0.016
	-1.13	-1.21
somesec	-0.247	-0.024
	-1.55	-1.82
secondary_higher	-0.376	-0.036
	(2.54)*	(3.01)**
central	-0.128	-0.013
	-0.81	-0.88
coast	-0.211	-0.021
	-1.49	-1.69
eastern	-0.215	-0.021
	-1.32	-1.51
nyanza	0.646	0.101
	(4.82)**	(3.67)**
riftvalley	-0.005	-0.001
	-0.04	-0.04
western	0.237	0.03
	-1.68	-1.47
northeastern	-0.865	-0.054
	(2.87)**	(6.47)**
urban	0.262	0.032
	(2.40)*	(2.20)*
age	0.15	0.017
	(5.20)**	(5.28)**
age2	-0.002	0
	(5.15)**	(5.22)**
married	0.083	0.009
	-0.83	-0.84
livtogether	0.238	0.032
	-1.41	-1.21

widowed	1.326	0.324
	(8.71)**	(5.85)**
divorced	0.632	0.111
	(2.57)*	-1.83
seperated	0.693	0.123
	(4.74)**	(3.38)**
poorer	0.169	0.021
	-1.44	-1.32
middle	0.195	0.024
	-1.58	-1.44
richer	0.247	0.031
	(1.96)*	-1.76
richest	0.336	0.043
	(2.28)*	(2.04)*
_cons	-4.085	
	(9.26)**	
N	3,811	3811
* p<0.05;	**p<0.01	

Note: Below each variable's coefficient is the z-statistic.

Table 12: HIV positive (if urban)

	probit	dprobit
somepri	-0.146	-0.021
	-0.54	-0.58
primary	-0.267	-0.038
	-0.99	-1.09
somesec	-0.545	-0.064
	-1.78	(2.50)*
secondary_higher	-0.529	-0.079
	-1.95	(2.02)*
central	-0.228	-0.031
	-0.9	-1.04
coast	-0.25	-0.036
	-1.51	-1.67
eastern	-0.557	-0.06
	-1.26	(2.01)*
nyanza	0.526	0.108
	(2.94)**	(2.38)*
riftvalley	0.221	0.039
	-1.1	-0.99
western	0.109	0.018
	-0.56	-0.53

northeastern	0	0
age	0.218	0.034
	(4.09)**	(4.25)**
age2	-0.003	-0.001
	(3.94)**	(4.07)**
married	0.134	0.021
	-0.89	-0.9
livtogether	0.606	0.134
	(2.23)*	-1.73
widowed	1.429	0.431
	(4.61)**	(3.56)**
divorced	0.404	0.082
	-0.88	-0.72
seperated	0.692	0.157
	(3.06)**	(2.35)*
poorer	0.072	0.012
	-0.09	-0.09
middle	0.19	0.034
	-0.27	-0.24
richer	0.144	0.024
	-0.21	-0.2
richest	0.117	0.017
	-0.17	-0.18
_cons	-4.603	
	(4.45)**	1
N	1,050	1,050
* p<0.05;	** p<0.01	

Note: Below each variable's coefficient is the z-statistic.

Table 13:HIV positive (if rural)

Variable	probit	dprobit
somepri	-0.04	-0.004
	-0.26	-0.26
primary	-0.133	-0.012
	-0.81	-0.87
somesec	-0.179	-0.016
	-0.93	-1.05
secondary_higher	-0.338	-0.027
	-1.75	(2.19)*
central	0.548	0.075
	-1.68	-1.29
coast	0.366	0.046
	-1.13	-0.92
eastern	0.501	0.064
	-1.6	-1.29
nyanza	1.356	0.257
	(4.40)**	(3.01)**
riftvalley	0.585	0.078
	-1.9	-1.49
western	0.937	0.157
	(2.97)**	(2.07)*
northeastern	0	0
age	0.129	0.013
	(3.58)**	(3.61)**
age2	-0.002	0
	(3.62)**	(3.65)**
married	0.049	0.005
	-0.35	-0.35
livtogether	0.012	0.001
	-0.06	-0.05
widowed	1.285	0.285
	(6.79)**	(4.36)**
divorced	0.759	0.131
	(2.49)*	-1.67
seperated	0.663	0.105
	(3.38)**	(2.38)*
poorer	0.155	0.016
	-1.29	-1.2
middle	0.15	0.016
	-1.16	-1.09
richer	0.203	0.022
	-1.47	-1.34
richest	0.445	0.06
	(2.52)*	-1.95
_cons	-4.387	
	(7.75)**	

N	2,718	2,718
	* p<0.05	** p<0.01

Note: Below each variable's coefficient is the z-statistic.

Table 14: HIV positive (if younger women)

Variable	probit	dprobit
somepri	-0.026	-0.002
	-0.14	-0.14
primary	-0.173	-0.015
	-0.89	-0.96
somesec	-0.363	-0.027
	-1.59	(2.03)*
secondary_higher	-0.284	-0.023
	-1.35	-1.56
central	-0.284	-0.022
	-1.3	-1.6
coast	-0.364	-0.028
	-1.93	(2.45)*
eastern	-0.421	-0.031
	-1.84	(2.48)*
nyanza	0.525	0.066
	(3.05)**	(2.38)*
riftvalley	-0.082	-0.007
	-0.43	-0.45
western	-0.026	-0.002
	-0.14	-0.14
northeastern	-0.779	-0.042
	(2.28)*	(4.62)**
urban	0.188	0.019
	-1.31	-1.23
married	0.552	0.055
	(5.35)**	(5.22)**
livtogether	0.552	0.079
	(2.49)*	-1.82
widowed	2.304	0.678
	(7.30)**	(6.48)**
divorced	1.026	0.203
	(3.09)**	(1.98)*
seperated	1.067	0.21
	(5.66)**	(3.70)**
poorer	0.163	0.017
	-1	-0.91
middle	0.332	0.038

	(2.06)*	-1.74
richer	0.345	0.039
	(2.05)*	-1.75
richest	0.343	0.037
	-1.77	-1.57
_cons	-2.082	
	(8.26)**	
N	2,397	2,397
	* p<0.05	** p<0.01

Note: Below each variable's coefficient is the z-statistic.

Table 15: HIV positive (if older women)

Variable	probit	dprobit
somepri	-0.024	-0.004
	-0.13	-0.13
primary	-0.047	-0.007
	-0.24	-0.24
somesec	-0.01	-0.001
	-0.04	-0.04
secondary_higher	-0.335	-0.045
	-1.59	-1.79
central	0.049	0.008
	-0.21	-0.2
coast	-0.029	-0.004
	-0.13	-0.13
eastern	0.045	0.007
	-0.18	-0.18
nyanza	0.72	0.151
	(3.27)**	(2.56)*
riftvalley	0.088	0.014
	-0.39	-0.37
western	0.575	0.115
	(2.56)*	(2.05)*
northeastern	0	
urban	0.267	0.044
	-1.54	-1.41
married	-0.705	-0.13
	(3.90)**	(3.33)**
livtogether	-0.385	-0.046
	-1.46	-1.94
widowed	0.496	0.098
	(2.37)*	-1.9
divorced	-0.027	-0.004

	-0.07	-0.07
seperated	0.017	0.003
	-0.07	-0.07
poorer	0.217	0.036
	-1.24	-1.14
middle	-0.004	-0.001
	-0.02	-0.02
richer	0.219	0.036
	-1.11	-1.03
richest	0.482	0.086
	(2.08)*	-1.8
_cons	-1.308	
	(4.17)**	
N	1,340	1,340
	* p<0.05;	** p<0.01

Note: Below each variable's coefficient is the z-statistic.

Table 16: AIDS test

Variable	probit	dprobit
somepri	0.188	0.072
	(3.31)**	(3.36)**
primary	0.433	0.16
	(7.21)**	(7.64)**
somesec	0.476	0.171
	(6.76)**	(7.46)**
secondary_higher	0.558	0.202
	(8.49)**	(9.27)**
central	-0.282	-0.111
	(3.77)**	(3.74)**
coast	0.076	0.029
	-1.1	-1.11
eastern	-0.371	-0.146
	(4.99)**	(4.97)**
nyanza	-0.015	-0.006
	-0.22	-0.22
riftvalley	-0.292	-0.115
	(4.12)**	(4.09)**
western	-0.109	-0.042
	-1.48	-1.47
northeastern	-0.873	-0.335
	(9.77)**	(10.90)**
urban	0.084	0.032
	-1.55	-1.56
age	0.191	0.074

	(15.18)**	(15.14)**
age2	-0.003	-0.001
	(17.03)**	(16.99)**
married	0.872	0.33
	(19.14)**	(20.19)**
livtogether	0.888	0.28
	(10.59)**	(14.80)**
widowed	0.786	0.256
	(9.02)**	(11.88)**
divorced	0.72	0.236
	(5.49)**	(7.12)**
seperated	0.821	0.265
	(10.21)**	(13.65)**
poorer	0.112	0.043
	(2.09)*	(2.12)*
middle	0.172	0.065
	(3.22)**	(3.29)**
richer	0.113	0.043
	(2.03)*	(2.05)*
richest	0.228	0.087
	(3.26)**	(3.33)**
_cons	-3.116	
	(16.34)**	
N	8,360	8,360
	* p<0.05;	** p<0.01

Note: Below each variable's coefficient is the z-statistic.

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