



# Relationship between Socio Demographic Characteristics and HIV Indicators among Women in Kenya, Tanzania, Uganda, Rwanda, Zambia and Malawi Based on DHS Data

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## Abstract

In sub-Saharan Africa women have disproportionately higher HIV prevalence than men. This is in spite of the wide availability of HIV information, condoms and HIV testing services. UNAIDS has proposed that due to women's fear of stigma and rejection by their partners, women are not able to seek HIV testing and other HIV services. In order to inform targeted programming for women it is important to examine to what extent women in Africa have attained HIV information and positive attitudes and whether these have been transformed into preventive behavior and ultimately reduction in HIV risk. In addition, it is vital to delineate the influence of socio demographic characteristics on the behavior change pathway of women.

We analyzed cross-sectional data from demographic health surveys (DHS) conducted between 2010 and 2014 in Kenya, Tanzania, Uganda, Rwanda, Zambia and Malawi. The data showed that only 48% had comprehensive knowledge and that younger, rural, unmarried and poorer women were more likely to have low levels of HIV knowledge compared to older, urban, married and richer women respectively. The data also showed that while 75% of the respondents supported refusal of sex and 85% supported demand of condom use with a husband in case of suspected extra-marital sex women with certain characteristics- younger, less educated, poorer women- were less supportive of, and likely less motivated to undertake, sexual negotiation. The analysis also shows that 71% of the respondents had ever been tested for HIV but again women with certain characteristics- younger, rural, less educated, unmarried and poorer- had significantly lower odds of having ever been tested for HIV.

We therefore, recommend that national HIV/AIDS programs undertake to examine barriers hindering younger, rural, less educated, unmarried and poorer women from accessing comprehensive HIV information, gender empowerment interventions, female and male condom supplies as well as HIV testing services. Specific strategies tailored to women of these characteristics should be developed and rolled out targeting these women.

## Keywords

African women, HIV knowledge, HIV attitudes, Sexual behavior, Sexual negotiation, Marital status, Urban residence, Rural residence, Education status, Wealth status

## Background

Sub-Saharan Africa has the largest burden of HIV infection. Of the 36.9 million people that were living with HIV in 2014, 25.8 million (70%) were from sub-Saharan Africa. The HIV epidemic in sub-Saharan Africa varies by region. The largest burden lies in a contiguous belt of 14 countries in the East, Central and Southern regions of the continent from Uganda down to South Africa. The data in [table 1](#) shows that this belt contains a total of 18.065 million (70%) living with HIV in sub-Saharan Africa [1]. Countries in this belt have a generalized epidemic defined by UNAIDS as an epidemic that is self-sustaining through heterosexual transmission and has a prevalence of > 1% in the general population [2].

According to UNAIDS more women than men are living with HIV in sub-Saharan Africa, accounting for 59% of people living with HIV. In sub-Saharan Africa, young women aged 15-24 years are as much as eight times more likely than men to be living with HIV. Studies among women in sub-Saharan Africa show that fear of a partner's negative reaction, including abandonment, violence, rejection, loss of economic support and accusations of infidelity were the most commonly

**Table 1:** Number of PLHIV in East and Southern African Countries in 2014.

Country	Number of People Living with HIV in 2014 (Millions)
Uganda	1.5
Kenya	1.4
Tanzania	1.5
Rwanda	0.21
Burundi	0.085
Mozambique	1.5
Malawi	1.1
Zambia	1.2
Zimbabwe	1.6
Namibia	0.26
Swaziland	0.21
Botswana	0.39
Lesotho	0.31
South Africa	6.8
TOTAL	18.065

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reported barriers to HIV testing and disclosure of HIV status. Thus, it appears that the vulnerability of women and girls to HIV is at least partly facilitated by inability to seek services such as HIV testing and fear of negotiation of safer sex with the male partner [3].

The “Information-Motivation-Behavioral (IMB) skills model of AIDS-preventive behaviors” [4] predicts that HIV knowledge combined with positive attitudes toward HIV prevention can be mediating steps towards protective behavior. Thus HIV information and motivational interventions that attempt to induce favorable attitudes can be seen as intermediary steps towards behavior change which should lead to reduced HIV risk. It is also stressed that the impact of these interventions is influenced by the various socio demographic characteristics of the target audience and the services available to them [4].

Therefore, it becomes important to examine the extent to which women in Africa have achieved the intermediary steps of HIV information and positive attitudes and whether these have been transformed into preventive behavior. In addition, it is vital to delineate the influence of socio demographic characteristics on the behavior change pathway. The objective of this study is to examine how age, marital status, residence, education level and wealth status relate to HIV knowledge, attitudes, and sexual behavior among women in Kenya, Tanzania, Uganda, Rwanda, Zambia and Malawi using DHS data.

## Methods

This is a review of cross-sectional data from demographic health surveys (DHS) conducted between 2010 and 2014 in Kenya, Tanzania, Uganda, Rwanda, Zambia and Malawi. The DHS was selected because it uses similar questionnaires and population-based nationally representative samples to study the interaction between demographic variables and sexual and reproductive health indicators.

### Conceptual framework

Based on the “Information-Motivation-Behavioral (IMB) skills model of AIDS-preventive behaviors” [4] a conceptual framework (Figure 1) was formulated to guide the study based on indicators commonly collected by the DHS. At the core of the model is the behavior change path from knowledge to attitudes and to behaviors. Within each of these major concept areas is shown the indicator selected in the DHS as most representative of this concept. For knowledge the variable “comprehensive knowledge of HIV” was selected because it is a compound variable that combines knowledge about HIV prevention and refuting of myths. For attitudes the variable “attitudes towards safer sex” was selected because it addresses a key issue of power in relations-whether a woman should refuse sex or demand condom use with her husband if she knows that he has a sexually transmitted

infection (STI) or that he has sex with other women. For behaviors, HIV testing behavior and number of sexual partners were chosen as indicators. It would have been ideal to add condom use but the data on condom use available in the DHS had a number of gaps making it inappropriate for this multi-country analysis.

On the peripheries of the model are the following socio demographic factors that can influence the behavior change process: age, marital status, residence, education status and wealth status. The indicators shown in the conceptual framework are defined by the DHS as follows [5,6]:

#### Educational status:

- Secondary school comprises four years of education, after primary school, ages 14 to 17 years
- Higher than secondary includes all post-secondary education including advance “A” level, colleges, poly technics and university.

**Wealth index:** It is based on data from the household’s ownership of consumer goods; dwelling characteristics; type of drinking water source; toilet facilities; and other characteristics that are related to a household’s socioeconomic status. Each of these items was assigned a weight and the scores were summed for each household. The index for an individual was based on the wealth index of their household and the scores were then divided into quintiles.

**Marital status:** According to the DHS marriage is a self-defined state. Respondents are coded as married in response to a question of whether they are currently or ever married or are living with a partner [7]. The DHS questionnaire offers the following options for recording marital status of respondents:

- Never Married
- Married
- Living together
- Divorced/separated
- Widowed

**Residence:** Type of place of residence where the respondent was interviewed as either urban or rural. Note that this is not the respondent’s own categorization, but was created based on whether the cluster or sample point number is defined as urban or rural by the central statistics office of that country.

**Comprehensive knowledge about HIV and AIDS:** Comprehensive knowledge is defined as knowing that consistent use of condoms during sexual intercourse and having just one uninfected

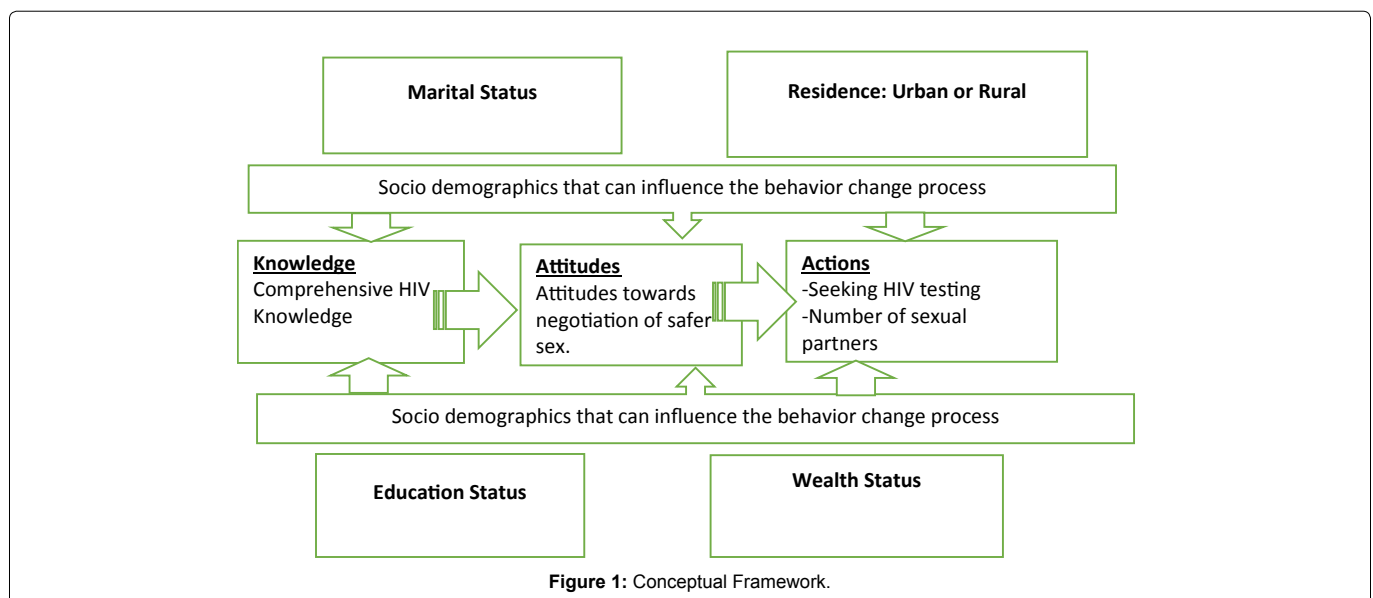


Figure 1: Conceptual Framework.

faithful partner can reduce the chances of getting the AIDS virus, knowing that a healthy-looking person can have HIV, and rejecting the two most common local misconceptions about HIV transmission (that the AIDS virus can be transmitted by mosquito bites and that a person can become infected by sharing food with someone who has the AIDS virus).

**Attitudes towards negotiation of safer sex:** Respondents were asked if they thought that a wife is justified in refusing to have sexual intercourse with her husband if she knows that he has sex with other women or in asking that he uses condoms if she knows that he has a sexually transmitted infection.

**History of prior HIV testing:** Respondents were asked whether they had ever been tested for HIV. If they said they had been tested for

HIV, respondents were asked whether they had received the results of their last test.

**Number of sexual partners:** Respondents who had ever had intercourse were asked the number of sexual partners they had during the 12 months before the survey.

**Site selection:** The country selection process involved reviewing DHS reports on the DHS website for the 14 countries with a generalized HIV epidemic in the East, Central and Southern African belt. The following criteria were used for selecting the countries:

- Has a DHS survey report not older than 2010 written in English
- The DHS has complete data on the selected variables
- The countries are adjacent to each other with the potential for a continuous cross-border connection of the peoples.
- Applying the above criteria, the study team selected the following six contiguous eastern African countries: Kenya, Tanzania, Uganda, Rwanda, Zambia and Malawi for the analysis. See map in [figure 2](#).

### Sources of Data

The data used in this study was obtained from the publicly available datasets of the DHS surveys of Kenya (DHS 2014) [8], Tanzania (DHS 2010) [9], Uganda (DHS 2011) [10], Rwanda (DHS2010) [11], Zambia (DHS2014) [6], and Malawi (DHS2010) [12]. The datasets were obtained from the DHS Program by making a data request through the program website, this process included providing the proposed study title, the names and dates of the datasets needed and the countries involved.

### Analysis

At national level, weighting was done using the standard DHS weighting variable for women datasets, v005. Chi-square test was used to determine if there existed a significant relationship between basic demographic factors (age, residence, education status, marital status and wealth quintile) and relevant HIV indicators. Data from the six countries were combined (creating a pooled dataset for women of reproductive age across the six countries) to come up with regional measures for the relevant HIV indicators. Since DHS weights are normalized at national level, they had to be de-

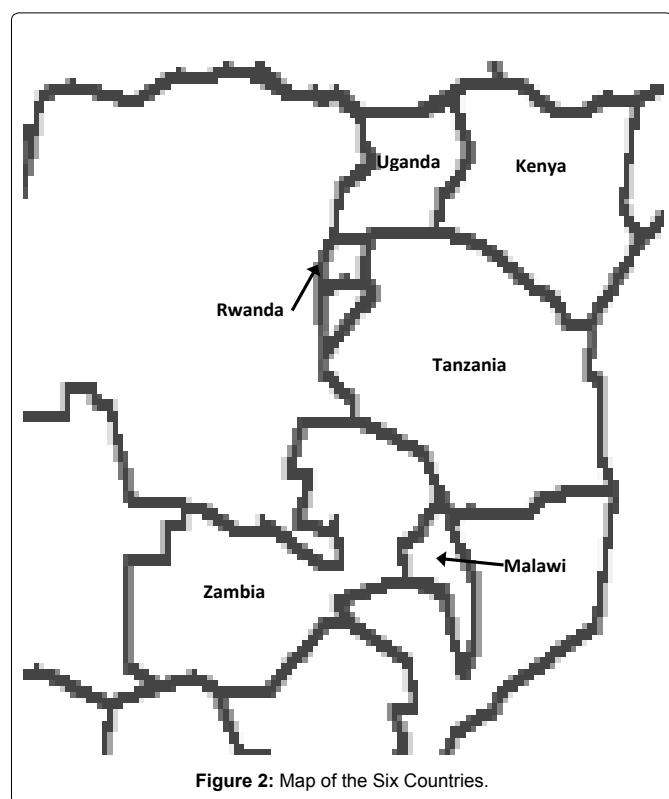


Figure 2: Map of the Six Countries.

Table 2: Demographic characteristics of female respondents to DHS surveys.

		Kenya		Malawi		Rwanda		Tanzania		Uganda		Zambia	
		N	%	N	%	N	%	N	%	N	%	N	%
Age group	15-19	5,820	18.7	5005	21.7	2945	21.5	2172	21.4	2048	23.6	3625	22.1
	20-24	5,735	18.5	4555	19.8	2683	19.6	1909	18.8	1629	18.8	3006	18.3
	25-29	6,099	19.6	4400	19.1	2494	18.2	1668	16.5	1569	18.1	2813	17.1
	30-34	4,510	14.5	3250	14.1	1822	13.3	1422	14.0	1086	12.5	2476	15.1
	35-39	3,773	12.1	2522	11.0	1447	10.6	1290	12.7	1026	11.8	2009	12.2
	40-44	2,885	9.3	1730	7.5	1168	8.5	938	9.3	729	8.4	1464	8.9
	45-49	2,257	7.3	1558	6.8	1112	8.1	740	7.3	587	6.8	1018	6.2
Current marital status	Never married	8,997	28.9	4538	19.7	5285	38.7	2540	25.1	2118	24.4	4572	27.9
	Currently married/living with partner	16,961	54.6	13520	58.7	4799	35.1	5909	58.3	3087	35.6	9759	59.5
	No longer married/living with partner	5,121	16.5	4962	21.6	3587	26.2	1690	16.7	3464	40.0	2080	12.7
Residence	Urban	12,690	40.8	4302	18.7	2057	15.0	2892	28.5	1717	19.8	7585	46.2
	Rural	18,389	59.2	18718	81.3	11614	85.0	7247	71.5	6957	80.2	8826	53.8
Education status	No education	2,176	7.0	3505	15.2	2119	15.5	1940	19.1	1120	12.9	1375	8.4
	Primary	15,626	50.3	14916	64.8	9337	68.3	6553	64.6	5152	59.4	7677	46.8
	Secondary	9,802	31.5	4177	18.1	2008	14.7	1601	15.8	1948	22.5	6519	39.7
	Higher	3,475	11.2	422	1.8	207	1.5	45	0.4	454	5.2	830	5.1
Wealth quintile	Poorest	4,838	15.6	4268	18.5	2622	19.2	1680	16.6	1519	17.5	2859	17.4
	Poorer	5,457	17.6	4332	18.8	2661	19.5	1947	19.2	1579	18.2	2861	17.4
	Middle	6,032	19.4	4517	19.6	2735	20.0	1997	19.7	1608	18.5	3078	18.8
	Richer	6,550	21.1	4515	19.6	2677	19.6	2112	20.8	1726	19.9	3510	21.4
	Richest	8,202	26.4	5388	23.4	2976	21.8	2403	23.7	2242	25.8	4103	25.0

normalized to be used for regional measures. New weights were created by multiplying the DHS standard weight for women with sampling weight (the inverse of the probability of a woman being picked to be in the national sample) for each country, giving higher weights to more populous countries.

The analysis then followed simple logistic regression between the HIV indicators (outcome variables) and basic demographic characteristics (explanatory variables). Odds ratios and p-values have been used to indicate if the explanatory variable is a significant predictor of the outcome and the extent of that influence. To facilitate multivariate analysis, all explanatory variables with significant relationship with the outcome variable were used (after ascertaining the absence of collinearity among the explanatory variables). The forward selection model approach was used with variables fitted into the model according to the strength of their association with the outcome variable (using Kendall's Tau test). Stata version 13 was used. A p-value of  $< 0.05$  was used to indicated statistical significance.

## Results

Table 2 shows the demographic characteristics of women respondents to the DHS surveys of Kenya, Malawi, Rwanda, Tanzania, Uganda and Zambia. The data shows that the proportion aged 15 to 19 years ranged from 18.7% in Kenya to 23.6% in Uganda while the proportion aged 45 to 49 years ranged from 6.2% in Zambia to 8.1% in Rwanda. The never married ranged from 19.7% in Malawi to 38.7% in Rwanda while the currently married ranged from 35.1% in Rwanda to 59.5% in Zambia. Urban residence was highest in Zambia (46.2%) and lowest in Rwanda (15%). The proportion with no education ranged from 7% in Kenya to 19.1% in Tanzania while higher than secondary education ranged from 0.4% in Tanzania to 11.2% in Kenya. Thus, there were wide variations among the countries regarding marital status, urban/rural residence and education status.

## Knowledge

In table 3 the data examines the relationship between HIV

knowledge and the following socio demographic variables of women: age, marital status, residence, education status and wealth. It is shown that 47.8% of the respondents had comprehensive HIV knowledge. The age of the respondent was not a significant predictor of HIV knowledge OR = 1 (0.99 - 1.01)  $p = 0.809$ . However, the odds of having comprehensive knowledge by women aged 20 to 39 years were at least 1.18 times higher than those of women aged 15-19 years ( $P = 0.000$ ) while women aged 40 to 49 years had no knowledge difference with the age group 15 to 19 years. Place of residence was a significant predictor of HIV knowledge AOR = 0.86 (0.81 - 0.92)  $p = 0.000$  and rural women were 15% less likely than urban women to have comprehensive HIV knowledge AOR 0.85 (0.79-0.9)  $p = 0.000$ .

Education level was a significant predictor of HIV knowledge AOR = 1.76 (1.7 - 1.83)  $p = 0.000$ . The odds of having comprehensive HIV knowledge by women with primary education were 1.85 times higher than those of women with no education. The odds of having comprehensive HIV knowledge by women with a secondary education were 3.24 times higher than those of women with no education; and the odds of women with higher than secondary education were 5.92 times higher than women with no education.

Marital status was a significant predictor of HIV knowledge AOR = 1.11 (1.07 - 1.15)  $p = 0.000$ . The odds of having comprehensive HIV knowledge by women who were married or living with partner were 1.26 times higher than women who were never married. Also the odds of having comprehensive HIV knowledge by women who were divorced or widowed were 1.22 times higher than women who were never married.

The data also shows that wealth status was a significant predictor of HIV knowledge AOR = 1.12 (1.1 - 1.14)  $p = 0.000$ . The odds of having comprehensive HIV knowledge by women in the second quintile were 1.22 times higher than women in the first quintile; the odds of women in the third quintile were 1.37 times higher than the first quintile; the odds of women in the fourth quintile were 1.43 times higher than women in the first quintile; and the odds of women in the fifth quintile were 1.62 times higher than women in the first quintile.

**Table 3:** Percent of women aged 15-49 years with comprehensive HIV knowledge by socio-demographic characteristics for the six countries together.

		N	Percent	Odds ratio	p-value	Adjusted Odds ratio	p-value
Age group		102,994	47.8	1 (0.99 - 1.01)	0.809		
	15-19	21,814	43.5				
	20-24	19,363	50.5	1.32 (1.24 - 1.41)	0.000		
	25-29	18,632	50.7	1.33 (1.25 - 1.42)	0.000		
	30-34	14,336	50.5	1.32 (1.24 - 1.41)	0.000		
	35-39	12,400	47.7	1.18 (1.1 - 1.27)	0.000		
	40-44	9,136	45.3	1.07 (1 - 1.16)	0.061		
Residence	45-49	7,313	43.9	1.02 (0.94 - 1.1)	0.682		
		102,994	47.8	0.54 (0.51 - 0.58)	0.000	0.86 (0.81 - 0.92)	0.000
	Urban	31,042	58.3				
Education status	Rural	71,952	43.2	0.54 (0.51 - 0.58)	0.000	0.85 (0.79 - 0.9)	0.000
		102,984	47.8	1.96 (1.89 - 2.03)	0.000	1.76 (1.7 - 1.83)	0.000
	No education	13,295	28.5				
	Primary	59,927	44.4	2 (1.84 - 2.17)	0.000	1.85 (1.71 - 2.01)	0.000
	Secondary	24,572	60.5	3.83 (3.5 - 4.19)	0.000	3.24 (2.95 - 3.56)	0.000
Current marital status	Higher	5,190	75.9	7.9 (6.87 - 9.08)	0.000	5.92 (5.13 - 6.84)	0.000
		102,994	47.8	0.94 (0.91 - 0.97)	0.000	1.11 (1.07 - 1.15)	0.000
	Never married	27,571	49.4				
	Currently married/living with partner	52,887	47.5	0.93 (0.88 - 0.97)	0.002	1.26 (1.2 - 1.33)	0.000
Wealth quintile	No longer married/living with partner (widowed or divorced)	22,536	46.4	0.89 (0.83 - 0.95)	0.000	1.22 (1.14 - 1.3)	0.000
		102,994	47.8	1.29 (1.27 - 1.32)	0.000	1.12 (1.1 - 1.14)	0.000
	Poorest (1 <sup>st</sup> Quintile)	17,406	34.1				
	Poorer (2 <sup>nd</sup> Quintile)	18,920	41.5	1.37 (1.27 - 1.47)	0.000	1.22 (1.14 - 1.32)	0.000
	Middle (3 <sup>rd</sup> Quintile)	19,888	46.2	1.66 (1.54 - 1.8)	0.000	1.37 (1.27 - 1.48)	0.000
	Richer (4 <sup>th</sup> Quintile)	21,196	50.7	1.98 (1.83 - 2.15)	0.000	1.43 (1.32 - 1.55)	0.000
	25,584	60.5	2.96 (2.72 - 3.22)	0.000	1.62 (1.48 - 1.78)	0.000	

## Attitudes

### Attitudes towards a woman refusing sex with husband if she knows he has STI or has sex with other women

In table 4 it is shown that 76.7% of the respondents support the idea that a woman can refuse sex with her husband if she knows that he has an STI or has sex with other women. It is also shown that age was a significant predictor of respondents supporting women refusing sex with husband AOR = 1.06 (1.05 - 1.08) (p = 0.000). Using the age group 15-19 years as the reference, the odds of respondent supporting women refusal of sex with husband were higher in all older age groups with the age group 40-44 years being highest (1.52 times), p = 0.000.

Urban or rural residence was not a significant predictor of support for refusal of sex with husband AOR = 0.93 (0.85- 1.03) p = 0.155. Education level was a significant predictor of respondents supporting refusal of sex with husband AOR = 1.24 (1.18 - 1.3) (p = 0.000). The odds of respondents with a primary education supporting refusal of sex were 1.38 times higher than respondents with no education. The odds of respondents with a secondary education were 1.56 times higher than respondents with no education. And the odds of respondents with higher than secondary education were 2.02 times greater than respondents with no education.

Marital status was not a significant predictor of support for refusal of sex with husband OR = 1.03 (0.99 - 1.07) (p = 0.183). Wealth status was a significant predictor of support for refusal of sex with husband AOR = 1.06 (1.03 - 1.09) (p = 0.000). The odds of respondents in the third quintile supporting refusal of sex were 1.15 times higher than respondents in the first quintile. The odds for the fourth quintile were 1.22 times higher than the first quintile and the odds for the fifth quintile were 1.28 times higher than the first quintile.

### Attitudes towards a woman demanding condom use with husband if she knows he has STI or has sex with other women

Table 5 shows that 84.5% of respondents support the idea that a

woman can demand condom use with her husband if she knows that he has an STI or has sex with other women. Age was a significant predictor of support for condom demand with a husband AOR = 1.03 (1.01 - 1.05) (p = 0.001). The odds of respondents of older age groups supporting condom demand were higher than the age group 15 to 19 years, particularly the odds of respondents in the 30-34 years age group were 1.55 times higher than respondents in the 15 to 19 year age group.

Rural or urban residence was not a significant predictor of support for condom demand AOR = 1.01 (0.89 - 1.14) p = 0.884. Education level was a significant predictor of support for condom demand AOR = 1.78 (1.67 - 1.9) p = 0.000. The odds of respondents with any education supporting condom demand were higher than respondents with no education. Most notably, the odds of respondents with a higher than secondary education were 5.07 times greater than the odds of respondents with no education.

Marital status was a significant predictor of support for condom demand AOR = 1.32 (1.24 - 1.42) p = 0.000. The odds of respondents currently married or living with partner and those divorced or widowed supporting condom demand were 1.24 and 1.41 times respectively higher than respondents never married.

Wealth status was a significant predictor of respondents supporting condom demand AOR = 1.13 (1.09 - 1.17) p = 0.000. The odds of respondents in higher wealth quintiles supporting condom demand were greater than those in the first quintile. Particularly the odds for respondents in the fifth quintile were 1.58 times greater than respondents in the first quintile.

## Behavior

### History of prior HIV testing

In table 6 it is shown that 71.3% of the respondents had ever been tested for HIV and received test results. Age of respondent was a significant predictor of prior HIV testing AOR = 1.05 (1.03 - 1.07) p = 0.000. The odds of respondents in older age groups having ever been

**Table 4:** Percent of women (15-49 years) who support women in refusing sex with husband if husband had sex with other women or has STI by socio-demographic characteristics.

	N	Percent	Odds ratio (OR)	p-value	Adjusted Odds ratio (AOR)	p-value	
Age group	86,651	76.7	1.04 (1.03 - 1.06)	0.000	1.06 (1.05 - 1.08)	0.000	
	15-19	18,708	73.0				
	20-24	16,342	76.9	1.24 (1.14 - 1.34)	0.000	1.25 (1.16 - 1.36)	0.000
	25-29	15,493	78.6	1.36 (1.25 - 1.48)	0.000	1.41 (1.3 - 1.54)	0.000
	30-34	12,010	77.5	1.28 (1.18 - 1.39)	0.000	1.35 (1.24 - 1.46)	0.000
	35-39	10,424	77.7	1.29 (1.18 - 1.42)	0.000	1.42 (1.29 - 1.56)	0.000
	40-44	7,556	78.8	1.38 (1.24 - 1.52)	0.000	1.52 (1.38 - 1.68)	0.000
Residence	86,651	76.7	0.77 (0.71 - 0.83)	0.000	0.93 (0.85 - 1.03)	0.155	
	Urban	25,493	80.0				
	Rural	61,158	75.4	0.77 (0.71 - 0.83)	0.000	0.93 (0.84 - 1.03)	0.144
Education status	86,641	76.7	1.27 (1.22 - 1.33)	0.000	1.24 (1.18 - 1.3)	0.000	
	No education	12,086	70.5				
	Primary	51,613	76.7	1.38 (1.27 - 1.5)	0.000	1.38 (1.27 - 1.51)	0.000
	Secondary	19,572	79.1	1.59 (1.44 - 1.75)	0.000	1.56 (1.4 - 1.74)	0.000
Current marital status	86,651	76.7	1.03 (0.99 - 1.07)	0.183			
	Never married	22,876	75.7				
	Currently married/living with partner	43,993	77.3	1.09 (1.03 - 1.17)	0.007		
	No longer married/living with partner (widowed or divorced)	19,782	76.5	1.05 (0.97 - 1.13)	0.229		
Wealth quintile	86,651	76.7	1.12 (1.09 - 1.14)	0.000	1.06 (1.03 - 1.09)	0.000	
	Poorest (1 <sup>st</sup> Quintile)	14,818	72.2				
	Poorer (2 <sup>nd</sup> Quintile)	16,056	75.1	1.16 (1.07 - 1.27)	0.000	1.12 (1.03 - 1.22)	0.008
	Middle (3 <sup>rd</sup> Quintile)	16,741	76.2	1.23 (1.13 - 1.35)	0.000	1.15 (1.05 - 1.26)	0.002
	Richer (4 <sup>th</sup> Quintile)	17,781	78.0	1.37 (1.24 - 1.51)	0.000	1.22 (1.11 - 1.35)	0.000
Richest (5 <sup>th</sup> Quintile)	21,255	80.4	1.59 (1.44 - 1.75)	0.000	1.28 (1.14 - 1.43)	0.000	

**Table 5:** Percent of women (15-49) who support women in demanding that husband uses condoms if husband has STIs or had sex with other women by socio-demographic characteristics.

		N	Percent	Odds ratio (OR)	p-value	Adjusted Odds ratio (AOR)	p-value
Age group		86,643	84.5	1.03 (1.01 - 1.04)	0.003	1.03 (1.01 - 1.05)	0.001
	15-19	18,706	80.1				
	20-24	16,341	86.4	1.58 (1.43 - 1.75)	0.000	1.5 (1.35 - 1.67)	0.000
	25-29	15,492	87.4	1.73 (1.55 - 1.93)	0.000	1.66 (1.47 - 1.88)	0.000
	30-34	12,009	86.3	1.57 (1.41 - 1.75)	0.000	1.55 (1.36 - 1.77)	0.000
	35-39	10,423	84.6	1.36 (1.23 - 1.52)	0.000	1.47 (1.29 - 1.67)	0.000
	40-44	7,555	84.2	1.33 (1.16 - 1.52)	0.000	1.43 (1.23 - 1.66)	0.000
Residence		86,643	84.5	0.64 (0.57 - 0.72)	0.000	1.01 (0.89 - 1.14)	0.884
	Urban	24,442	88.4				
	Rural	62,201	83.0	0.64 (0.57 - 0.72)	0.000	0.95 (0.83 - 1.09)	0.492
Education status		86,633	84.5	1.8 (1.69 - 1.92)	0.000	1.78 (1.67 - 1.9)	0.000
	No education	12,085	72.2				
	Primary	51,608	85.0	2.18 (1.99 - 2.39)	0.000	2.19 (1.99 - 2.41)	0.000
	Secondary	19,570	89.1	3.16 (2.8 - 3.57)	0.000	3.23 (2.84 - 3.68)	0.000
	Higher	3,370	94.2	6.23 (4.74 - 8.19)	0.000	5.07 (3.87 - 6.64)	0.000
Current marital status		86,643	84.5	1.16 (1.1 - 1.22)	0.000	1.32 (1.24 - 1.42)	0.000
	Never married	22,882	82.4				
	Currently married/living with partner	43,980	84.8	1.19 (1.1 - 1.28)	0.000	1.24 (1.12 - 1.38)	0.000
	No longer married/living with partner (widowed or divorced)	19,781	86.3	1.34 (1.21 - 1.49)	0.000	1.41 (1.24 - 1.62)	0.000
Wealth quintile		86,643	84.5	1.24 (1.2 - 1.28)	0.000	1.13 (1.09 - 1.17)	0.000
	Poorest (1 <sup>st</sup> Quintile)	14,807	76.9				
	Poorer (2 <sup>nd</sup> Quintile)	16,055	82.7	1.44 (1.29 - 1.61)	0.000	1.32 (1.19 - 1.47)	0.000
	Middle (3 <sup>rd</sup> Quintile)	16,739	84.7	1.66 (1.48 - 1.87)	0.000	1.42 (1.27 - 1.6)	0.000
	Richer (4 <sup>th</sup> Quintile)	17,779	86.9	2 (1.77 - 2.26)	0.000	1.57 (1.39 - 1.77)	0.000
	Richest (5 <sup>th</sup> Quintile)	21,254	89.0	2.43 (2.11 - 2.79)	0.000	1.58 (1.35 - 1.86)	0.000

**Table 6:** Percent of women (15-49 years) with history of ever testing for HIV by socio-demographic characteristics.

		N	Percent	Odds ratio (OR)	p-value	Adjusted Odds ratio (AOR)	p-value
Age group		102,838	71.3	1.19 (1.17 - 1.21)	0.000	1.05 (1.03 - 1.07)	0.000
	15-19	21,802	42.6	0 (0 - 0)	0.000	0 (0 - 0)	0.000
	20-24	19,344	80.0	5.37 (4.98 - 5.8)	0.000	3.11 (2.86 - 3.37)	0.000
	25-29	18,593	85.2	7.77 (7.09 - 8.51)	0.000	3.63 (3.29 - 4.01)	0.000
	30-34	14,305	82.8	6.49 (5.9 - 7.14)	0.000	2.95 (2.63 - 3.31)	0.000
	35-39	12,371	77.6	4.67 (4.24 - 5.14)	0.000	2.23 (1.97 - 2.53)	0.000
	40-44	9,122	72.5	3.54 (3.23 - 3.88)	0.000	1.69 (1.49 - 1.91)	0.000
Residence		7,301	63.2	2.31 (2.11 - 2.52)	0.000	1.15 (1.02 - 1.29)	0.022
	Urban	102,838	71.3	0.57 (0.52 - 0.62)	0.000	0.67 (0.61 - 0.73)	0.000
	Rural	30,995	79.0	0 (0 - 0)	0.000	0 (0 - 0)	0.000
Education status		71,843	68.0	0.57 (0.52 - 0.62)	0.000	0.68 (0.62 - 0.75)	0.000
	No education	102,828	71.3	1.53 (1.46 - 1.6)	0.000	1.92 (1.83 - 2.02)	0.000
	Primary	13,265	61.4	0 (0 - 0)	0.000	0 (0 - 0)	0.000
	Secondary	59,846	69.9	1.46 (1.35 - 1.59)	0.000	1.95 (1.78 - 2.14)	0.000
	Higher	24,535	75.6	1.96 (1.76 - 2.17)	0.000	4.19 (3.7 - 4.74)	0.000
Current marital status		5,183	91.3	6.63 (5.53 - 7.95)	0.000	8.59 (7.06 - 10.46)	0.000
	Never married	102,838	71.3	2.29 (2.19 - 2.4)	0.000	2.72 (2.59 - 2.87)	0.000
	Currently married/living with partner	27,550	49.1	0 (0 - 0)	0.000	0 (0 - 0)	0.000
	No longer married/living with partner (widowed or divorced)	52,787	79.3	3.97 (3.68 - 4.27)	0.000	3.86 (3.53 - 4.22)	0.000
Wealth quintile		22,501	79.6	4.03 (3.75 - 4.34)	0.000	4.13 (3.78 - 4.52)	0.000
	Poorest (1 <sup>st</sup> Quintile)	102,838	71.3	1.15 (1.12 - 1.17)	0.000	1 (0.98 - 1.03)	0.752
	Poorer (2 <sup>nd</sup> Quintile)	17,359	65.6	0 (0 - 0)	0.000	0 (0 - 0)	0.000
	Middle (3 <sup>rd</sup> Quintile)	18,881	68.2	1.12 (1.04 - 1.22)	0.004	1.07 (0.97 - 1.17)	0.168
	Richer (4 <sup>th</sup> Quintile)	19,868	70.2	1.23 (1.14 - 1.34)	0.000	1.13 (1.03 - 1.25)	0.014
	Richest (5 <sup>th</sup> Quintile)	21,164	72.8	1.4 (1.29 - 1.53)	0.000	1.1 (1 - 1.22)	0.053
		25,566	77.0	1.76 (1.59 - 1.94)	0.000	1.01 (0.89 - 1.14)	0.905

tested were higher than the odds for the 15 to 19-year age group. In particular, the odds for the 25 to 29 year olds were 3.63 times higher than the odds for the 15 to 19 year olds.

Residence was a significant predictor of prior HIV testing AOR

= 0.67 (0.61 - 0.73) p = 0.000. The odds of rural residents having ever been tested were 32% less than the odds for urban residents. Education level was a significant predictor of prior HIV testing AOR = 1.92 (1.83 - 2.02) p = 0.000. The odds of respondents with any education having ever been tested were higher than the odds of

respondents with no education. Notably, the odds of respondents with a higher than secondary level were 8.59 times higher than the odds of respondents with no education.

Marital status was a significant predictor of prior HIV testing AOR = 2.72 (2.59 - 2.87) p = 0.000. The odds of respondents who were married or living with partner and those widowed or separated having ever been tested were 3.86 and 4.13 times respectively higher than the odds of respondents never married. Wealth status was not a significant predictor of having ever been tested AOR = 1 (0.98 - 1.03) p = 0.752.

### Sexual partners in past 12 months

Only 2% of the respondents reported two or more sexual partners in past 12 months as shown in table 7. Age of respondent was a significant predictor of reporting two or more sexual partners AOR = 0.87 (0.83 - 0.92) p = 0.000. The odds of respondents of the age groups 20-24 years and 25 to 29 years reporting two or more partners were 1.88 times and 1.5 times, respectively, higher than the odds for the age group 15 to 19 years. Residence of respondents was a significant predictor of reporting two or more sexual partners AOR = 0.71 (0.56 - 0.91) p = 0.006. The odds of rural residents reporting two or more partners were 32% less than the odds of urban residents.

Education level of respondents was not a significant predictor of reporting two or more sexual partners AOR = 0.87 (0.76 - 1.01) p = 0.069.

Marital status was a significant predictor of reporting two or more sexual partners AOR: 1.96 (1.63 - 2.36) p = 0.000. The odds of respondents currently married or living with a partner reporting two or more sexual partners were 29% less than the odds of respondents who were never married. On the other hand, the odds of respondents who were divorced or widowed reporting two or more sexual partners were 2.11 times higher than the odds of respondents who were never married.

Wealth status was not a significant predictor of reporting two or more sexual partners in the past 12 months AOR = 0.99 (0.91 - 1.07) p = 0.779. However, it should be noted that the proportion reporting

more than two sexual partners in the past 12 months was quite low in all the countries. Hence the association or lack of association shown by this data may not reflect the true picture in the sample. Further research is needed to explore this issue.

### Discussion and Conclusions

The purpose of this study was to examine the association between elements of the HIV behavior change pathway-knowledge, attitudes, sexual behaviors-and socio demographic characteristics of women in six African countries. The data has shown that HIV knowledge increased with age but peaked at age 40 and then dropped; was higher among urban compared to rural women; and among educated women compared to women with no education; among married and ever married women compared to never married and among richer women.

Support for a woman to refuse sex with her husband if she knows that he has an STI or has sex with other women increased with age of respondents but dropped off in the age group 45-49 years and it also increased with level of education and wealth quintile. However, there was no difference between rural and urban respondents and by marital status.

Support for the idea that a woman can demand condom use with her husband if she knows that he has an STI or has sex with other women increased with age of respondent, was higher among the currently married and ever married than among the never married and increased with the level of education and with the wealth quintile. However, there was no difference between urban and rural residents.

Having ever been tested for HIV peaked at the 25-29 years' age group, it was higher among the urban compared to rural respondents, it increased with level of education, was higher among the currently married and ever married compared to the never married. It also had a slightly significant positive association with higher wealth quintiles. There was a low proportion of respondents who reported more than one partner in the past 12 months. It was higher in the 20-29 years' age group than in the other age groups. It was lower among rural than urban residents; and lower among currently married than

**Table 7:** Percent women with two or more sexual partners in past 12 months by socio-demographic characteristics.

	N	Percent	Odds ratio (OR)	p-value	Adjusted Odds ratio (AOR)	p-value	
Age group		86,575	2.0	0.98 (0.95 - 1.02)	0.384	0.87 (0.83 - 0.92)	0.000
	15-19	18,700	1.4				
	20-24	16,328	2.8	2.04 (1.55 - 2.68)	0.000	1.88 (1.35 - 2.61)	0.000
	25-29	15,480	2.3	1.67 (1.25 - 2.24)	0.001	1.5 (1.03 - 2.18)	0.035
	30-34	12,008	2.0	1.41 (1 - 1.99)	0.051	1.22 (0.8 - 1.86)	0.356
	35-39	10,415	2.1	1.53 (1.11 - 2.12)	0.010	1.31 (0.87 - 1.97)	0.194
	40-44	7,540	1.7	1.25 (0.87 - 1.78)	0.221	1.03 (0.64 - 1.66)	0.892
Residence	45-49	6,104	1.4	0.99 (0.66 - 1.48)	0.969	0.78 (0.47 - 1.28)	0.321
		86,575	2.0	0.8 (0.64 - 1)	0.052	0.71 (0.56 - 0.91)	0.006
	Urban	24,405	2.4				
	62,170	1.9	0.8 (0.64 - 1)	0.052	0.68 (0.54 - 0.87)	0.002	
Education status		86,565	2.0	0.88 (0.76 - 1.01)	0.073	0.87 (0.76 - 1.01)	0.069
	No education	12,076	2.0				
	Primary	51,567	2.2	1.09 (0.78 - 1.51)	0.614	1.01 (0.73 - 1.41)	0.942
	Secondary	19,563	1.6	0.78 (0.53 - 1.16)	0.223	0.69 (0.47 - 1.01)	0.057
	Higher	3,359	1.6	0.8 (0.47 - 1.35)	0.403	0.68 (0.4 - 1.17)	0.164
Current marital status		86,575	2.0	1.76 (1.47 - 2.1)	0.000	1.96 (1.63 - 2.36)	0.000
	Never married	22,864	1.6				
	Currently married/living with partner	43,963	1.4	0.85 (0.69 - 1.05)	0.133	0.71 (0.52 - 0.97)	0.032
	19,748	3.9	2.48 (1.91 - 3.22)	0.000	2.11 (1.52 - 2.93)	0.000	
Wealth quintile	No longer married/living with partner (widowed or divorced)	19,748	3.9	2.48 (1.91 - 3.22)	0.000	2.11 (1.52 - 2.93)	0.000
		86,575	2.0	0.99 (0.92 - 1.07)	0.895	0.99 (0.91 - 1.07)	0.779
	Poorest (1 <sup>st</sup> Quintile)	14,796	2.1				
	Poorer (2 <sup>nd</sup> Quintile)	16,051	1.9	0.94 (0.66 - 1.33)	0.717	1 (0.71 - 1.39)	0.981
	Middle (3 <sup>rd</sup> Quintile)	16,735	1.9	0.94 (0.71 - 1.23)	0.641	1 (0.76 - 1.33)	0.995
	Richer (4 <sup>th</sup> Quintile)	17,765	2.4	1.14 (0.8 - 1.63)	0.457	1.15 (0.83 - 1.61)	0.396
	21,228	1.8	0.89 (0.62 - 1.27)	0.514	0.81 (0.57 - 1.16)	0.259	

never married but higher among ever married but no longer married. However, there was no association with level of education and wealth quintile.

Thus, the data has consistently shown that education and wealth are significant predictors of the following outcomes: high HIV knowledge, positive attitudes towards safer sexual negotiation and having ever tested for HIV. This clearly calls for the need to empower young girls with school education. Keeping girls at school is known to reduce their risk of HIV [13,14]. There is also a need to economically empower young girls and women both as a means to improve their general well-being as well as reduce their vulnerability to HIV. The lower socio-economic status of women in society often puts them at increased risk of HIV since they become vulnerable to transactional sex which is often unprotected [15,16].

Being a rural resident was associated with low levels of HIV knowledge and having ever been tested which is probably due to lack of access to information and services in rural areas. Given that the majority of people in African countries live in rural areas, it becomes imperative to strengthen outreach and community based approaches that can reach rural people.

Being never married was associated with lower HIV knowledge, and less support for the idea that a married woman can demand condom use with a husband she suspects of having extra marital sex. Never married respondents were also less likely to have been ever tested. These data suggest the need to target single women with HIV information, gender empowerment interventions as well as HIV testing and counseling. Indeed, other studies have indicated that being young and unmarried is associated with a high risk of HIV [15]. It should however, also be noted that being married does not necessarily put the African woman in a safe position as far as HIV is concerned. Due to male dominance in marriage, sexual negotiation or suggestion of a condom can be considered a sign of infidelity and may result in violence and the risk of infection is particularly high if the partner is HIV infected and refuses to use condoms [17,18].

Having multiple sexual partners is a risk factor for HIV transmission [19,20]. The data showed that only 2% reported having more than one sexual partner in the past 12 months. Being currently married or residing in a rural area were associated with less likelihood of reporting multiple sexual partners while being divorced or widowed was associated with a higher likelihood of reporting multiple sexual partners. This is a sensitive topic likely to be subject to under reporting especially for married women, older women and rural women. This finding points to the need to use other means such as biomarkers to validate reported sexual behavior in surveys [21].

In conclusion, while behavior change can lead to reduced risk of acquisition of HIV [15] the African woman remains vulnerable to HIV due to certain demographic characteristics that are negatively associated with elements of the behavior change pathway. While knowledge is not enough to cause behavior change it is a key initial step in the behavior change pathway. Our study has shown that only 48% had comprehensive knowledge and that younger, rural, unmarried and poorer women were most disadvantaged in HIV knowledge. After knowledge, the next stage in the behavior change pathway is attitudes towards sexual negotiation. The data showed that while 75% of the respondents supported refusal of sex and 85% supported demand of condom use with a husband in case of suspected extra-marital sex women with certain characteristics-younger, less educated, poorer-were less supportive of, and likely less motivated to, undertake sexual negotiation. Action is the next step in behavior change and knowing one's HIV status is a key to developing a risk reduction strategy. The data showed that 71% of the respondents had ever been tested for HIV but again women with certain characteristics-younger, rural, less educated, unmarried, poorer-had significantly lower odds of having ever been tested for HIV.

We therefore, recommend that national HIV/AIDS programs undertake to examine barriers hindering younger, rural, less educated, unmarried and poorer women from accessing comprehensive HIV

information, gender empowerment interventions, female and male condom supplies as well as HIV testing services. Specific strategies tailored to women of these characteristics should be developed and rolled out to target these women. These are the sub-populations of women who should be considered for new risk-oriented interventions such as PREP (Pre Exposure Prophylaxis) [22].

## Limitations

A key limitation of this analysis is the fact that the data was collected using interviewer administered questionnaires and therefore the data is subject to respondent bias and may be inaccurate especially regarding sexual behavior. This is a general problem of self-report studies especially with regard to sexual behavior where the study participants may fear to be judged by the interviewer based on the participants' response to questions.

## Ethical Considerations

This data was collected by DHS staff who were trained in ethics and confidentiality and the study participants were administered informed consent forms. Our study team obtained the data for this analysis from de-identified datasets prepared by DHS for interested researchers to carry out further analysis. We followed DHS regulations in requesting for the datasets by submitting our study title and indicators of analysis.

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## Conflict of Interest

The authors declare no conflict of interest.

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