

UNIVERSITY OF NAIROBI

COLLEGE OF BIOLOGICAL AND PHYSICAL SCIENCES

SCHOOL OF MATHEMATICS

**" EVALUATION OF VCT UTILIZATION BY WOMEN IN KENYA
USING THE LOGISTIC REGRESSION MODEL."**

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**A research project submitted in partial fulfilment of the award of a master
degree in Biometry.**

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Declaration

I hereby declare that this is my original work and has not been submitted for the award of degree or any other award in any university.

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Dedication

For my husband, Osborn Obayo for the continued support and encouragement which gave me hope for a brighter tomorrow. You have always been a pillar of strength. In memory of my late parents Mr. and Mrs. Richard Akello, the foundation you gave me made me what I am today.

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Abstract

HIV/AIDS pandemic is a global crisis with consequences that will be felt for decades to come. It has already claimed more than 25 million lives and another 40 million people are currently estimated to be living with HIV/AIDS worldwide. Women account for half of the people living with HIV/AIDS worldwide and nearly 60% of HIV infections in Sub-Saharan Africa. VCT has been described as a high-leverage intervention for HIV/AIDS prevention in sub-Saharan Africa because of its demonstrated effectiveness. This is, however, restricted to few areas making it inaccessible to various individuals who may want to be tested. This study sought to establish the trend in uptake of VCT and establish factors associated with the utilization of VCT. Data was extracted from KDHS data collected for the years 2003 and 2008. Using SPSS version 15.0 and 17.0, several variables were cross tabulated against the constant variable ever been tested for HIV and Chi square used to detect differences in categorical variables between or among groups. To test if there was a significant difference in the two years, the t value of the proportions was calculated and compared with the t tab. Logistic regression analysis with stepwise elimination was used to determine factors that had statistical significant association with the outcome ever been tested. Factors included in the analysis were age, marital status, wealth index, region, residence, highest education level, religion, currently/formerly/never married, number of unions, husband lives in house, ever been married and number of other wives. The outcome of this study revealed a significant association between VCT utilization and various factors. These included age, marital status, wealth index, residence, region, religion, highest education level and husband lives in house. VCT uptake was greater in 2008 compared to 2003.

ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
ARV	Antiretroviral
HIV	Human Immunodeficiency Virus
IPPF	International Planned Parenthood Federation
KDHS	Kenya Demographic and Health Survey
PRB	Population Reference Bureau
UHSBS	Uganda HIV/AIDS Sero-Behavioral Survey
UNAIDS	United Nations Program on HIV/AIDS
UNFPA	United Nations Population Funds
UNPD	United Nations Population Division
VCT	Voluntary counselling and Testing

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1 INTRODUCTION AND LITERATURE REVIEW

1.1 Background

HIV/AIDS pandemic is a global crisis with consequences that will be felt for decades to come (Gillespie and Kadiyala, 2005). It has already claimed more than 25 million lives and another 40 million people are currently estimated to be living with HIV/AIDS worldwide (UNAIDS, 2005). Sub-Saharan Africa has been hardest hit and is home to 64% (25.8 million) of people living with HIV/AIDS accounting for 11–12% of the world's population (PRB, 2005). Kenya has approximately 1.4 million adults and children living with HIV, representing a national prevalence rate of about 10% (KDHS, 2003). Women account for half of the people living with HIV/AIDS worldwide and nearly 60% of HIV infections in Sub-Saharan Africa (UNAIDS, 2008).

The epidemic is considered a threat to the economic well-being, social, and political stability of many nations (UNPD, 2005). The economic impact of HIV/AIDS on households is so significant since most individuals living with HIV/AIDS in highly affected countries are parents and workers providing for their households (Zaaba *et al.*, 2004).

Although there are some indications that HIV incidence may finally be stabilizing in some Sub-Saharan African countries (UNAIDS, 2000), HIV prevalence is still high and the epidemic continues to have a devastating effect. The percentage of people living with HIV/aids has steadily increased as new infections occur each year. The region accounted for 75% of AIDS deaths in 2007 (UNAIDS, 2008).

The predominant mode of HIV transmission is through heterosexual contact, followed in magnitude by prenatal transmission, in which the mother passes the virus to the child during pregnancy, delivery or breastfeeding (UHSBS, 2004; UNAIDS, 2005). Many HIV testing programs in Africa, including Kenya aim to reduce risk taking behaviour by providing individuals with their HIV status through VCT services (Paula *et al.*, 2008).

1.2 Statement of the problem

There are an estimated 40.3 million people living with HIV/AIDS worldwide most of whom are unaware that they are infected. VCT has been described as a high-leverage intervention for HIV/AIDS prevention in sub-Saharan Africa because of its demonstrated effectiveness. This is, however, restricted to few areas making it inaccessible to various individuals who may want to be tested. Apart from this several factors have been reported as deterrents in the utilization of VCT making it less effective in reducing incidence of HIV. Since treatment is becoming more widely available, more health planners see VCT as a way of identifying those who need care. As the emphasis changes from prevention to care, less attention is being placed on the high-quality counselling that can motivate people to adopt safe behaviours and the usefulness of VCT as a preventive measure is being weakened

1.3 Null hypothesis

- There is no trend in the uptake of VCT in Kenya
- There are no factors associated with the utilization of VCT among women in Kenya

1.4 Objectives

1.4.1 General objective

To establish factors influencing the utilization of VCT among women in Kenya using logistic regression

1.4.2 Specific objectives

- To determine the trend in uptake of VCT
- To establish factors associated with the utilization of VCT

1.5 Literature Review

1.5.1 Utilization of VCT

VCT is the process by which an individual undergoes confidential counselling to enable the individual to make an informed choice about learning his or her HIV status and take appropriate action (UNFPA and IPPF, 2004). It is also described as the process whereby individuals or couples undergo pre-test counselling, risk assessment, a same-day rapid HIV test, post-test HIV prevention counselling (often not received in traditional testing), and referral for medical and support services by trained counsellors (Irungu *et al.*, 2007). Recent studies have shown that VCT is a cost-effective intervention for reducing HIV-related risk behaviour, particularly when it serves at-risk couples (The Voluntary HIV-1 Counselling and Testing Efficacy Study Group, 2000; Sweat *et al.*, 2000). It plays a pivotal role in the public health response to the HIV epidemic and is a vital point of entry to HIV/AIDS services including primary prevention, prevention of mother to-child transmission, antiretroviral therapy, management of HIV-related illnesses, tuberculosis control and psychosocial support (Grinstead *et al.*, 2001; Maman *et al.*, 2001; Painter, 2001).

VCT has been described as a cornerstone of early access to prevention of HIV infection as well as to care and support services (Mabunda, 2004). In previous studies, VCT has been shown to lower the incidence of sexually transmitted infections (STIs) and offer longer periods of HIV/STI risk reduction (Allen *et al.*, 1992). It also plays a pivotal role in reducing stigma and discrimination of people living with HIV/AIDS and is key in the prevention of mother to child transmission (UNAIDS, 2008b; UNFPA and IPPF, 2004).

In resource poor settings, including many Sub Saharan countries with generalized epidemics, VCT is becoming increasingly available, but study results conflict with regards to the potential impact of VCT to promote reductions in risky behaviours (Sherr *et al.*, 2007).

VCT has been shown to be efficacious and cost-effective for developing countries such as Kenya and Tanzania (Irungu *et al.*, 2007). The Kenyan government, in partnership with donor

organizations, has undertaken an ambitious programme to expand VCT services throughout the country using stand-alone sites and those integrated into other health facilities (CDC-GAP, 2007). Kenya has had a phenomenal expansion of VCT sites from only three in 2000 to 865 sites in 2007 (Namazi, 2009). Despite the rapid scale up, the use of VCT services remains low with about 15% of women and 14% of men having used the services (KDHS, 2003). More than 80% of people living with HIV/AIDS in low and middle income countries do not know that they are infected (UNAIDS, 2008b).

As initially planned, VCT services were focused on prevention of new HIV infections. Now that treatment is becoming more widely available, more health planners see VCT as a way of identifying those who need care. As the emphasis changes from prevention to care, less attention is being placed on the high-quality counselling that can motivate people to adopt safe behaviours and the usefulness of VCT as a preventive measure is being weakened (McCauley, 2004).

1.5.2 Factors affecting the utilization of VCT

Several factors have been implicated on the utilization of VCT though these differ from one author to the other. These include age, sex, marital status, education attainment, wealth status, HIV serostatus and area of residence among others.

According to Namazzi (2009), education attainment, wealth status and age had a positive association with VCT services. The use of VCT increased with age up to 34years probably due the fact that women between the ages of 20-34 are the most reproductively active and inevitably use VCT health care services in a bid to prevent mother to child transmission. These findings were similar to findings by Damien (2006) who also established that education achievement predicted behaviour like HIV testing through VCT services and high probability of testing by the rich due to easy access to health services. Matovu et al. (2005), however,

indicated that VCT acceptance was significantly lower among the educated compared to those with no formal education.

A positive association has also been reported between VCT services and HIV sero-positivity (Namazzi, 2009). This is similar to findings by Maman *et al.* (2001) where women described HIV testing as a means to confirm their HIV positive status. Persons who considered themselves to be at risk of HIV infection had relatively high acceptance of VCT while those who were actually positive were reluctant to take up the test (Matovu *et al.*, 2005).

The married and formerly married have higher risk of infection and this probably motivates them to use VCT services more than the never married (Namazzi, 2009). The married have also been reported to readily accept VCT compared to the singles (Matovu *et al.*, 2005).

1.5.3 Statistical modelling for factors implicated in the utilization of VCT

Several studies have been carried out to establish factors associated with VCT utilization. Irungu *et al.* (2008) used a multivariate logistic regression analysis with stepwise elimination to determine factors that had a statistically significant association with three outcomes: readiness to obtain VCT, past HIV testing and a preference for couples VCT. Factors included in the analysis were gender, education, area of residence, religion, awareness of a nearby HIV or VCT clinic, belief that everyone should know their HIV status, knowledge of someone with HIV/AIDS, and reported willingness to change sexual behavior if HIV testing was positive. Majority of their respondents reported readiness for testing and preferred couples testing while few had been tested previously.

Sherr *et al.* (2007) sought to examine the determinants of uptake of voluntary counselling and testing (VCT) services, to assess changes in sexual risk behaviour following VCT, and to compare HIV incidence amongst testers and non-testers. Separate logistic regression models were fitted for the male and female populations. First univariate models were fitted. All variables significant in the univariate models ($P < 0.05$, likelihood ratio test comparing with the

null model with no explanatory variables) were included in an initial multivariable model. Variables were dropped from the multivariable models one at a time if inclusion did not significantly improve the fit of the model ($P < 0.1$, likelihood ratio test). They established that psychological factors were the most common deterrent to VCT utilization followed by stigma and discrimination and the belief that knowledge of infection would accelerate disease progression.

To establish the determinants of VCT and effects on HIV, Matovu *et al.* (2005) used a log-binomial generalized linear model (GLM) to estimate crude and adjusted risk ratios (RR) of VCT acceptance, and 95% confidence intervals (95% CI). In the univariate analyses, they estimated crude risk ratios of VCT acceptance by all covariates. In the multivariate analysis they estimated adjusted risk ratios of VCT acceptance controlling for suspected confounders and checking for interactions. All variables with a P-value < 0.15 , or with RRs greater than 2 or less than 0.5, or potential confounders identified in the univariate analyses, were included in the multivariate models.

Namazzi (2009) on the other hand used probit model for the dependent variable that indicated an individual having used VCT when seeking the determinants of using VCT for HIV/AIDS. The analysis focused on women who are believed to be at a higher risk of infection given that women HIV incidence in Africa is twice that of men.

1.5.4 Logistic regression

In statistics, logistic regression (sometimes called the logistic model or logit model) is used for prediction of the probability of occurrence of an event by fitting data to a logit function logistic curve. It is a generalized linear model used for binomial regression. Like many forms of regression analysis, it makes use of several predictor variables that may be either numerical or categorical. For example, the probability that a person has a heart attack within a specified time period might be predicted from knowledge of the person's age, sex and body mass index.

Logistic regression is used extensively in the medical and social sciences as well as marketing applications such as prediction of a customer's propensity to purchase a product or cease a subscription (Nemes *et al.*, 2009).

A logistic regression model does not involve decision trees and is more akin to nonlinear regression such as fitting a polynomial to a set of data values. Logistic regression can be used only with two types of target variables: a categorical target variable that has exactly two categories (i.e., a *binary* or *dichotomous* variable) and a continuous target variable that has values in the range 0.0 to 1.0 representing probability values or proportions.

2 METHODOLOGY

2.1 *Data extraction and manipulation*

Data was extracted from KDHS data collected for the years 2003 and 2008. The data utilized in the study was restricted to women and took into account factors associated with HIV testing and prevalence.

The 2003 survey was carried out by the Kenya Central Bureau of Statistics in partnership with the Ministry of Health and the National Council for Population and Development. It was designed to provide data to monitor the population and health situation in Kenya as a follow-up of the 1989, 1993, and 1998 Kenya DHS surveys. Data was collected on fertility, family planning and maternal and child health. Other features included HIV prevalence, domestic violence, and malaria. A nationally representative sample of 8,195 women age 15–49 (94 percent of those eligible) and 3,578 men age 15–54 (86 percent of those eligible) were interviewed. This sample provides estimates for Kenya as a whole, for urban and rural areas, and for each of the eight provinces.

The 2008 KDHS data is the fifth national demographic and health survey conducted in the country. The survey is based on a nationally representative sample. It provides estimates for rural and urban areas of the country and for each of the eight provinces. The survey also included HIV testing. A total of 9,057 households were interviewed. 8,444 women (age 15–49) and 3,465 men (age 15–54) were interviewed. Three questionnaires were used during the interviews. These included a household questionnaire, individual women and individual male questionnaires.

This was coded and analyzed using SPSS version 15.0 and 17.0. Several variables were cross tabulated against the variable “*ever been tested for HIV*” and Chi square used to detect differences in categorical variables between or among groups. To test if there was a

significant difference in the two years, the t-value of the proportions was calculated and compared with the t-tab.

Logistic regression analysis with stepwise elimination was used to determine factors that had statistical significant association with the outcome ever been tested. Factors included in the analysis were age, marital status, wealth index, region, residence, highest education level, religion, currently/formerly/never married, number of unions, husband lives in house, ever been married, number of other wives, partners level of education, ever talked to husband about AIDS, ever heard of AIDS, knows someone who has or died of AIDS, had any STD in the last 12 months, heard about condoms (TV), heard about condoms (Radio) and heard about condoms (News papers). All p-value less than 0.05 were considered significant.

2.2 Paired-sampled t-test

To test whether proportion computed for the year 2003 were significantly different from those in 2008, a t-statistic given by

$$t_{comp} = \frac{d}{s.e.(d)},$$

where $d = p_1 - p_2$ and $s.e.(d) = \sqrt{\frac{p_1(1-p_1)}{n_1} + \frac{p_2(1-p_2)}{n_2}}$, was computed.

Here p_1 and p_2 are proportions of 2003 and 2008 respectively, n_1 and n_2 are the numbers per category for 2003 and 2008 respectively.

2.3 The Logistic Model Formula

The logistic model formula computes the probability of the selected response as a function of the values of the predictor variables. If a predictor variable is categorical variable with two values, then one of the values is assigned the value 1 and the other is assigned the value 0.

If a predictor variable is a categorical variable with more than two categories, then a separate dummy variable is generated to represent each of the categories except for one which is

excluded. The value of the dummy variable is 1 if the variable has that category, and the value is 0 if the variable has any other category; hence, no more than one dummy variable will be 1. If the variable has the value of the excluded category, then all of the dummy variables generated for the variable are 0.

The formula is stated in terms of probability that $P(Y=1)=p$ and the probability $P(Y=0)=1-p$.

Logistic regression equation being a generalised linear mixed model, is given as

$$\ln \left(\frac{p}{1-p} \right) = \mathbf{X}'\beta$$

where $\mathbf{X}'\beta$ is the deterministic part of the model

The Logit function is the link between the deterministic and the stochastic part of the model.

The logistic regression model can therefore be expressed as

$$\text{Logit}(p_i) = \ln \left(\frac{p_i}{1-p_i} \right) = \mathbf{X}'\beta$$

where p_i is the probability of utilization of VCT and the expression $\frac{p_i}{1-p_i}$ is referred to as

odds of utilizing VCT. This model can further be expressed as

$$\text{logit}(p_i) = \beta_0 + \beta_1 X_{1i} + \dots + \beta_k X_{ki}, \text{ where } k=20.$$

2.4 Model fit

Chi square (a measure of goodness fit) is used as a statistic for the overall fit. It gives the fit of the observed values to the expected values. The bigger the difference of observed from expected, the poorer the fit. Iterations are done; getting different solutions till the best fitting model is attained.

3 RESULTS

3.1 Summary statistics and contingency table analysis

In the year 2003, a significant association was recorded between VCT utilization and various factors (table3-1).

Table 3-1 Crosstabulation of predictor variables with usage of VCT

Variable	2003			2008		
	χ^2	df	p-value	χ^2	df	p-value
Age 5 year groups	100	12	0.0011	1023	6	0.0011
Marital status	41.93	5	0.0011	659.84	5	0.0011
Wealth index	340.68		0.0011		4	0.0011
Region	342.6	7	0.0011	444.02	7	0.0011
Residence	203.6	1	0.0011	165.11	1	0.0011
Level of education	445.7	5	0.0011	288.57	3	0.0011
Religion	458	8	0.0011	115.13	4	0.0011
currently/formerly/never married	36	2	0.0011	640.19	2	0.0011
Number of unions	3.97	1	0.04	0.41	1	0.278
Husband lives in house	0.35	1	0.296	0.9	1	0.18
Ever been married	23.07	3	0.0011	160.95	2	0.0011
No. of other wives	40.43	6	0.0011	64.08	7	0.0011
Partners level of education	281.2	6	0.0011	426.63	3	0.0011
Ever talked with husband about AIDS	158.5	1	0.0011	384.2	1	0.0011
Ever heard of AIDS	484	1	0.0011	269	1	0.0011
Knows someone who has or died of AIDS	107.2	1	0.0011	258.1	1	0.0011
Had any STD in the last 12 months	2.77	2	0.25	6.3	2	0.43

These included age, wealth index, residence, region, highest level of education, marital status, religion, currently/formerly/never married, number of unions, ever been married, number of

other wives, partners level of education, ever talked with husband about AIDS, ever heard of AIDS, knows someone who has or died of AIDS and heard about condoms (TV/Radio/newspaper). There was however, no association between testing and husband living in house and having STD within the last twelve months. A similar trend was recorded in 2008. In this case however, there was no significant association between testing and number of unions, husband living in house and having STD in the last twelve months.

According to table 3-2, fewer individuals underwent testing in the year 2003 (15%) compared to 2008 (59%). Majority of individuals tested in 2003 were in the age groups 25-29 and 30-34. This was followed by age group 20-24. Age group 15-19 recorded the least percentage of individuals tested. A similar trend was recorded in the year 2008. Majority of individuals tested in both years were not living together with their spouses. This was followed by those living together with their spouses. The least proportion of individuals tested in both years was the never married. Testing was more rampant among the richest followed by the richer in both cases. It was, however, less common among the poorest in both cases.

In 2003, Nairobi region recorded the highest percentage of individuals tested followed by Central then Rift valley. Western and North Eastern regions recorded the least proportion of individuals tested. In 2008, however, Nairobi recorded the highest proportion of individuals tested followed by Coast, Nyanza then Western. The least proportion of individuals tested was from North Eastern. In both years more urban residents were tested compared to the rural. In 2003, most individuals tested attained post primary education followed by higher education. In 2008, however, higher education preceded post primary education. In both cases the least percentage of individuals tested were not educated. In both cases more Protestants were tested followed by Catholics then Muslims.

Table 3-2 Results of cross tabulation and proportions of various variables against ever been tested for HIV

	2003		2008			2003		2008	
	%	N	%	N		%	N	%	N
Age 5 year groups					currently/formerly/never married				
15-19	7%	1778	31%	1739	Never	12%	2422	38%	2509
20-24	19%	1679	71%	1719	Currently	17%	4786	69%	4965
25-29	21%	1373	75%	1406	Formerly	18%	842	63%	852
30-34	21%	1104	73%	1168	Total	15%	8050	59%	326
35-39	15%	845	62%	916	Number of unions				
40-44	12%	770	55%	717	Once	17%	5198	68%	5400
45-49	11%	501	43%	661	More than once	13%	430	66%	409
Total	15%	8050	59%	8326	Total	17%	5628	68%	5809
Marital status					Husband lives in house				
Never married	12%	2422	38%	2509	Living with	17%	3796	69%	3865
Married	17%	4366	69%	4609	Elsewhere	16%	986	68%	1098
Living together	20%	420	69%	356	Total	18%	4782	69%	4963
Widowed	16%	329	56%	348	Ever been married				
Divorced	16%	143	56%	117	No	12%	2422	38%	2509
Not living together	21%	370	71%	387	Formerly	17%	666	62%	707
Total	15%	8050	59%	8326	Lived with	20%	176	70%	145
Wealth index					Total	13%	3264	45%	3361
Poorest	5%	1294	45%	1633	No. of other wives				
Poorer	10%	1281	57%	1269	1	18%	3889	71%	4111
Middle			58%	1450	2	10%	577	58%	626
Richer	15%	1564	59%	1605	3	7%	158	50%	117
Richest	25%	2543	71%	2369	4	9%	35	62%	27
Total	15%	8050	59%	8326	5	8%	13	0%	1
Region					6	0%	2	75%	3
Nairobi	30%	1164	73%	940	Don't know	16%	107	73%	78
Central	21%	1311	58%	967	Total	17%	4781	69%	4964
Coast	11%	928	68%	1143	Partners level of education				
Eastern	12%	985	51%	1115	None/pre-school	5%	768	37%	798
Nyanza	12%	1023	66%	1311	Primary	13%	2366	70%	2629
R/valley	14%	1259	54%	1234	Post primary	21%	1793	74%	1738
Western	10%	987	61%	1026	Higher level	35%	603	81%	648
N/Eastern	10%	413	27%	590	Total	17%	5614	68%	5813
Total	15%	8050	59%	8326	Ever talked with husband about AIDS				
Residence					No	8%	1732	50%	1747
Urban	23%	2725	69%	2587	Yes	22%	3048	76%	4066
Rural	11%	5325	54%	5739	Total	17%	4780	68%	5813
Total	15%	8050	59%	8326	Ever heard of AIDS				
Level of education					No	9%	4003	28%	1065
None/pre-school	10%	1188	41%	1174	Yes	22%	4042	64%	7256
Primary	12%	4197	59%	4366	Total	15%	8045	59%	8321
Post pri	22%	2084	62%	2075	Knows someone who has or died of AIDS				
Higher level	14%	1581	79%	711	No	8%	2116	41%	2079
Total	15%	8059	59%	8326	Yes	18%	5901	65%	6223
Religion					Total	15%	8019	59%	8302
Catholic	38%	2810	58%	1658	Had any STD in the last 12 months				
Protestant	69%	4157	63%	5108	No	15%	7915	59%	8153
Muslim	35%	930	46%	1321	Yes	13%	107	69%	133
No religion	50%	132	55%	173	Don't know	4%	24	67%	24
Other	57%	21	68%	57	Total	15%	8046	59%	8310
Total	54%	4370	59%	8317					

In 2003, most individuals tested were the formerly married compared to the currently married in 2008. In both cases testing was common among those in one union, whose husbands lived in house and whose husbands attained higher level of education. Most of the individuals

tested in both cases had talked to their partners about HIV, had heard about HIV and knew someone who had died of AIDS.

Variables in the Equation

Table 3-3 Results of logistic regression analysis

		2003				2008			
		B	S E	p-value	Exp(B)	B	S.E.	p-value	Exp(B)
Marital status	Married	Reference			1.00	Reference			1.00
	Not married	0.10	0.15	0.5066	1.10	0.01	0.13	0.935	1.01
No. of unions	Once	Reference				Reference			1.00
	More than once	0.03	0.19	0.8588	1.03	-0.01	0.14	0.942	0.99
Husband lives in house	Lives in house	Reference				Reference			1.00
	Staying elsewhere	0.12	0.11	0.2809	1.12	0.08	0.08	0.345	1.08
No. of other wives	No other wife	Reference		0.1061		Reference			1.00
	One other wife	-0.30	0.16	0.0568	0.74	-0.04	0.10	0.685	0.96
	Two or more other wives	-0.32	0.29	0.2708	0.73	-0.03	0.19	0.868	0.97
Wealth index	Poorest	Reference				Reference			1.00
	Poorer	0.42	0.20	0.0339	1.52	0.28	0.12	0.017	1.32
	Middle	0.68	0.19	0.0004	1.97	0.24	0.12	0.041	1.27
	Richer	0.80	0.19	<0.001	2.23	0.18	0.12	0.140	1.20
	Richest	0.96	0.22	<0.001	2.62	0.71	0.16	<0.001	2.03
Highest education	No formal education	Reference				Reference			1.00
	Primary	0.21	0.22	0.3495	1.23	0.49	0.12	<0.001	1.63
	Post primary	0.47	0.23	0.0403	1.60	0.61	0.14	<0.001	1.85
	Higher level	1.00	0.24	<0.001	2.71	0.85	0.17	<0.001	2.34
	Don't know	0.29	0.45	0.5155	1.34				
Religion	catholic	Reference		0.1325		Reference			1.00
	Protestant	-0.05	0.10	0.6207	0.95	0.14	0.09	0.120	1.15
	Muslim	-0.48	0.23	0.0329	0.62	-0.20	0.16	0.195	0.82
	No religion	-0.71	0.42	0.0907	0.49	-0.48	0.23	0.034	0.62
	Other	0.23	0.54	0.6643	1.26	-0.22	0.41	0.587	0.80
Region	Nairobi	Reference				Reference			1.00
	Central	0.09	0.16	0.5916	1.09	-0.48	0.20	0.020	0.62
	Coast	-0.63	0.18	<0.001	0.53	0.22	0.21	0.283	1.25
	Eastern	-0.49	0.19	<0.001	0.61	-0.64	0.20	0.001	0.53
	Nyanza	-0.51	0.17	0.0035	0.60	-0.29	0.20	0.142	0.75
	R Valley	-0.21	0.17	0.2010	0.81	-0.70	0.20	<0.001	0.50
	Western	-0.67	0.19	<0.001	0.51	-0.30	0.20	0.139	0.74
	N Eastern	-2.67	0.75	<0.001	0.07	-1.46	0.24	<0.001	0.23
Place of residence	urban	Reference				Reference			1.00
	Rural	-0.25	0.14	0.0758	0.78	-0.10	0.13	0.466	0.91
Age 5 year groups	15-19	Reference				Reference			1.00
	20-24	0.06	0.19	0.7336	1.07	0.52	0.17	0.003	1.68
	25-29	0.06	0.19	0.7604	1.06	0.36	0.17	0.032	1.44
	30-34	-0.02	0.19	0.9362	0.98	0.21	0.17	0.228	1.23
	35-39	-0.48	0.21	0.0235	0.62	-0.36	0.17	0.037	0.70
	40-44	-0.61	0.22	0.0054	0.54	-0.73	0.18	<0.001	0.48
	45-49	-0.60	0.25	0.0157	0.55	-1.28	0.18	<0.001	0.28

From table 3-3 above, considering the *p*-values, the significant variables included wealth index, age, region, highest education level and religion in 2008. Given the odds ratios, in 2003 the married were 10% less likely to utilize VCT compared to the unmarried. In 2008, however a decline was observed and the unmarried were only 1% more likely to utilize VCT compared to the married. In 2003, those who had been in more than one union were more likely to utilize VCT; however in 2008 individuals in one union were more likely to utilize VCT. In both years individuals whose spouses lived elsewhere were more likely to utilize VCT. However a decline of 4% on utilization was recorded in 2008. In both cases individuals whose spouses did not have other wives utilized VCT compared to those who had other wives. An increase in utilization was recorded in 2008. Only 3% and 4% of those whose spouses had other wives were less likely to utilize VCT in 2008 whereas in 2003 26% and 27% were less likely to utilize VCT.

In 2003, the likelihood for testing was higher among the richest and declined to the poorest. In 2008, the chances of utilizing VCT were much lower. The richest were more likely to be tested followed by the poorer. The richer were only 20% more likely to be tested compared to the poorest. In both cases individuals with formal education were more likely to utilize VCT compared to those without formal education. Individuals with higher level of education were more likely to utilize VCT followed by individuals with post Primary education.

In 2003 individuals from other religions were more likely to utilize VCT compared to the Catholics. The Catholics were however more likely to utilize VCT compared to the Protestants, Muslims and those with no religion. On the other hand Protestants were more likely to be tested in 2008 compared to the Catholics and other religions. Testing among Protestants, Muslims and those with no religion improved in 2008 compared to 2003.

In 2003 testing was 9% higher in Central region compared to Nairobi; this was however lower in the other regions compared to Nairobi. In 2008 VCT utilization was 25% more likely in Coast compared to Nairobi. Coast recorded a massive increase in VCT utilization given that testing was 47% less likely to occur compared to Nairobi in 2003. In 2008 chances of utilizing VCT declined in Rift valley, Central and Eastern regions whereas an increase was observed in Nyanza, Western and North eastern regions. In both cases testing was less likely to occur among the rural residents compared to the urban. An increase in rural utilization of VCT was recorded in 2008. Rural residents were only 9% less likely to be tested in 2008 compared to 22% in 2003.

In 2003 age groups 20-24 and 25-29 were more likely to utilize VCT compared to age group 15-19. In 2008 however individuals aged 20-34 were more likely to be tested compared to 15-19 years. Testing in age group 35-39 increased in 2008 while a decline was recorded in the age groups 40-44 and 45-49.

From table 6 in the Appendix, it can clearly be seen that there was an upward trend in all aspects of VCT utilization. That is, the percentages of uptake in 2003 are much lower compared to 2008. This shows an increase in uptake. We then conclude that there was an increase in usage of VCT in the year 2008 compared to 2003.

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

4.1 Discussion

The outcome of this study revealed a significant association between VCT utilization and various factors. These included age, marital status, wealth index, residence, region, religion, highest education level and husband lives in house. Testing was more rampant among women between ages 20-34 years. This was similar to findings by Namazzi (2009), who reported that the use of VCT increased with age up to 34 years probably due the fact that women between the ages of 20-34 are the most reproductively active and inevitably use VCT health care services in a bid to prevent mother to child transmission.

The married were more likely to be tested compared to the unmarried. This is could be due to the fact that the married and formerly married have higher risk of infection and this probably motivates them to use VCT services more than the never married (Namazzi, 2009). Findings by Matovu *et al.*, 2005 also indicated that the married readily accept VCT compared to the singles.

The more educated were less likely to be tested in this study compared to the uneducated. This was contrary to findings by Damien (2006) who established that education achievement predicted behaviour like HIV testing through VCT services. Matovu *et al.* (2005), however, indicated that VCT acceptance was significantly lower among the educated compared to those with no formal education.

The poorest were more likely to be tested compared to the rich. This could have been due to the introduction of free testing in most government facilities which they attended. This was, however, contrary to finding by Namazzi (2009) and Damien (2006) reported a higher probability of testing by the rich due to easy access to health services.

Most of individuals tested were rural residents; this could be due to the fact that the Kenyan government, in partnership with donor organizations, has undertaken an ambitious programme to expand VCT services throughout the country using stand-alone sites and those integrated into other health facilities (CDC- GAP, 2007). This has made possible for individuals from all walks of life and all parts of the country to easily access VCT. More Catholics were tested in 2003 while more Muslims were tested in 2008. Other study established that Christians more readily accept testing compared to other religions (Namazzi, 2009).

VCT utilization was much greater in 2008 compared to 2003. This could be due to the government's initiative to expand VCT services throughout the country using stand-alone sites and those integrated into other health facilities (CDC- GAP, 2007). Apart from this, the availability of ARVs may have increased the willingness to testing given that there was a remedy. In addition to this, stigmatization has considerably reduced leading to the openness to testing. The introduction of compulsory testing to prevent mother to child transmission must have also lead to the considerable increase in VCT uptake.

4.2 Conclusion

- The factors associated with utilization of VCT included age, marital status, wealth index, residence, region, religion, highest education level and husband lives in house.
- VCT uptake was greater in 2008 compared to 2003.

4.3 *Limitations of the study*

- Several factors associated with VCT utilization could not be considered since they could only be found in either 2003 or 2008 making comparison difficult.
- In some cases data was missing making analysis difficult

4.4 *Recommendation*

- Though the use of VCT has considerably improved over the years, new infections have equally increased. It is therefore necessary that as we encourage the use of VCT, we should also encourage behavioral change to reduce HIV/AIDS incidences.
- The elite of the society should also be encouraged to take up test since AIDS is not a respecter of persons.

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6 Appendix

Table 6-1 Results of the t-computed to test significance difference between the two years

	d=p ₁ - p ₂	s.e	p-value		d=p ₁ - p ₂	s.e	p-value
Age 5 year groups				currently/formerly/never married			
15-19	0.24	0.01	<0.001	Never married	0.26	0.01	<0.001
20-24	0.52	0.01	<0.001	Currently mar	0.52	0.01	<0.001
25-29	0.55	0.02	<0.001	Formerly married	0.45	0.02	<0.001
30-34	0.52	0.02	<0.001	Total	0.44	0.03	<0.001
35-39	0.47	0.02	<0.001	Number of unions			
40-44	0.43	0.02	<0.001	Once	0.51	0.01	<0.001
45-49	0.32	0.02	<0.001	More than once	0.53	0.03	<0.001
Total	0.44	0.01	<0.001	Total	0.51	0.01	<0.001
Marital status				Husband lives in house			
Never married	0.27	0.01	<0.001	Living with her	0.17	0.01	<0.001
Married	0.52	0.01	<0.001	Staying away	0.52	0.02	<0.001
Living together	0.5	0.03	<0.001	Total	0.51	0.01	<0.001
Widowed	0.41	0.03	<0.001	Ever been married			
Divorced	0.41	0.05	<0.001	No	0.26	0.01	<0.001
Not living together	0.51	0.03	<0.001	Formerly	0.45	0.02	<0.001
Total	0.44	0.01	<0.001	Lived with a man	0.5	0.05	<0.001
Wealth index				Total	0.32	0.01	<0.001
Poorest	0.4	0.01	<0.001	Number of other wives			
Poorer	0.47	0.02	<0.001	1	0.53	0.01	<0.001
Middle				2	0.48	0.02	<0.001
Richer	0.44	0.02	<0.001	3	0.43	0.05	<0.001
Richest	0.46	0.01	<0.001	4	0.53	0.11	<0.001
Total	0.44	0.01	<0.001	Don't know	0.57	0.06	<0.001
Region				Total	0.52	0.01	<0.001
Nairobi	0.43	0.02	<0.001	Partners level of education			
Central	0.37	0.02	<0.001	None/pre-school	0.32	0.02	<0.001
Coast	0.57	0.02	<0.001	Primary	0.57	0.01	<0.001
Eastern	0.39	0.02	<0.001	Post primary	0.53	0.01	<0.001
Nyanza	0.54	0.02	<0.001	Higher level	0.46	0.02	<0.001
R/valley	0.4	0.02	<0.001	Total	0.51	0.01	<0.001
Western	0.51	0.02	<0.001	Ever talked with husband about AIDS			
N/Eastern	0.17	0.02	<0.001	No	0.42	0.01	<0.001
Total	0.44	0.01	<0.001	Yes	0.54	0.01	<0.001
Residence				Total	0.51	0.01	<0.001
Urban	0.46	0.01	<0.001	Ever heard of AIDS			
Rural	0.43	0.01	<0.001	No	0.19	0.01	<0.001
Total	0.44	0.01	<0.001	Yes	0.42	0.01	<0.001
Highest education level				Total	0.44	0.01	<0.001
None/Pre-school	0.31	0.02	<0.001	Knows someone who has or died of AIDS			
Primary	0.47	0.01	<0.001	No	0.33	0.01	<0.001
Post primary	0.4	0.01	<0.001	Yes	0.47	0.01	<0.001
Higher level	0.65	0.02	<0.001	Total	0.44	0.01	<0.001
Total	0.44	0.01	<0.001	Had any STD in the last 12 months			
Religion				No	0.44	0.01	<0.001
Catholic	0.2	0.02	<0.001	Yes	0.56	0.05	<0.001
Protestant	-0.06	0.01	<0.001	Don't know	0.63	0.10	<0.001
Muslim	0.11	0.02	<0.001	Total	0.44	0.01	<0.001
No religion	0.05	0.06	<0.001				
Other	0.11	0.12	<0.001				
Total	0.05	0.01	<0.001				