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Full Length Research Paper

Herpes simplex virus type 2 seroprevalence, HIV and Antiretroviral therapy knowledge and beliefs in the general population in Kisumu, Kenya

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With the increasing use of antiretroviral therapy (ART) in developing countries, little is known on the potential impact of large-scale ART use on sexual behavior. We used Herpes simplex virus type 2 (HSV-2) infection as a marker for sexual behavior to aid in assessing the association between ART related knowledge and beliefs and sexual behavior. This cross-sectional study analyzed secondary data collected in Kisumu's general population. A total of 1,655 participants (749 men, 906 women) aged 15 to 49yrs were interviewed. Socio-demographic factors, prevalence of HSV-2 and ART related knowledge and beliefs and their association with HSV-2 infection were evaluated. Overall, the prevalence of HSV-2 was 53%, and significantly higher in females (65%) than males (38%), p<0.001. Males and females with only primary education, history of drug abuse, who have ever been married and of Luo ethnic community were more likely to have HSV-2 infection. Overall, 17% believed that ART cured HIV/AIDS. Males who believed ART cured HIV had significantly >2 times odds of having HSV-2 (aOR: 2.02, 95% CI: 1.1 to 3.43) similar observations in females (aOR: 2.14, 95% CI: 1.34 to 3.40). Misinformation on ART capability may lead to increased HIV and sexually transmitted infection incidence if people think they are a cure for HIV. Targeted informative messages on ART to those at risk may aid in reducing the incidence of HSV-2.

Key words: Antiretroviral therapy, knowledge, beliefs, herpes simplex virus, general population, Kisumu, Kenya.

INTRODUCTION

The availability of drugs for management of HIV and AIDS in many sub-Saharan African countries has increased dramatically in recent years. Antiretroviral therapy (ART) coverage rose from 7% in 2003 to 42% in 2008, with especially high coverage achieved in eastern and southern Africa (48%) WHO (2009). ART has been shown to significantly reduce patients' viral load, often to undetectable levels (Autran et al., 1997). This may lead to the perception by the general public including HIV infected patients that HIV infected patients are no longer infectious. In addition, ART improves physical health and quality of life, which may enable or encourage individuals to resume sexual activity (Wamoyi et al., 2011). Thus, with improved health and life expectancy of people living with HIV/AIDS (PLWHA) secondary to ART use, the general population could believe that HIV is no longer a serious and deadly disease.

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Studies conducted among men who have sex with men (MSM) and heterosexuals have shown an increasing trend in high risk sexual behavior in this era of ART use (Gremy and Beltzer, 2004; Katz et al., 2002; Lertpiriyasuwat et al., 2007). In addition, increased high risk sexual behavior (Dukers et al., 2001; Kalichman et al., 2001; Vanable et al., 2003; Vlahov et al., 2001) and incidence of sexually transmitted diseases (Scheer et al., 2001) has been shown to be more common in patients with HIV and are on ART treatment than those with HIV and not on treatment.

With the scale up of ART treatment services in most developing countries, it is feared that misinformed knowledge on the ability of these drugs may result in an increase in risky sexual behavior which may increase HIV incidence in the general HIV negative population.

Monitoring sexual behavior is an important tool in understanding HIV risk behavior. Sex however is a highly private activity and people sometimes feel intensely embarrassed or threatened when asked to reveal what they do, think, and feel during their sexual encounters. Consequently, surveys of sexual behavior have usually been susceptible to criticisms of participation bias and under reporting (Catania et al., 1990; Glynn et al., 2011).

Herpes virus type 2 (HSV-2) has been associated with risky sexual behavior (Cowan et al., 1994; Cunningham et al., 1993). It is almost exclusively sexually transmitted (Nahmias et al., 1990). HSV-2 antibodies have therefore been used as a surrogate marker for assessing risky sexual behavior (Nahmias et al., 1990; Obasi et al., 1999). However, presence of HSV-2 antibodies is limited in identifying recent change in sexual behavior due to their lifelong production.

Using secondary analysis of data from a survey done in Kisumu (Cohen et al., 2009) we evaluated ART related knowledge and beliefs and their possible association with past sexual behavior as measured by HSV-2 seroprevalence as a surrogate marker for sexual behavior.

Methods

This study was done in the Municipality of Kisumu, Kenya's third largest city. It is located in the western part of Kenya on the shores of Lake Victoria. It is within Nyanza province which has the highest prevalence of HIV (15%) in the country whose national average is estimated at 7.4% (National AIDS and STI Control Programme, 2007).

Kisumu municipality is mainly inhabited by the Luo ethnic community who traditionally are fishermen and small scale farmers. They have a rich traditional culture and to date many still closely follow some of their traditional practices which include: sexual cleansing- the woman after the death of her husband undergoes some rituals which include sex to "purify" her and make her acceptable in the community; widow inheritance- the woman is inherited by her brother-in-law as his new wife after the death of her husband; polygamy- having more than one wife (Ayikukwei et al., 2008). These practices have the potential of increasing the risk of sexually transmitted infections including HSV-2 and HIV (Ayikukwei et al., 2008).

Study design

We performed secondary data analysis on cross-sectional data collected among the general population of Kisumu municipality. The sampling procedures, questionnaire, and sample collection have been described elsewhere (Cohen et al., 2009). Briefly, households were selected by systematic random sampling: a random 'start point' was chosen between 1 and 4, with every fourth household sampled thereafter. Each household was visited a day or two prior to the study by a community mobilizer, who informed selected households about the study team's upcoming visit. The household was then visited by the study team which included a trained certified community nurse with HIV voluntary counseling and testing (VCT) training. If eligible participants, aged 15-49 years were not at home, the study team made at least 2 additional visits to the household. If no one was found at home on all three visits, this household was replaced with the next household number.

Of the 1,210 households in the original sampling frame, 708 (59%) were contacted and 645 (53%) had at least one household member who participated in the study. Of the 502 households that needed replacement, 219 households (43%) participated in a second round of sampling. This resulted in a total of 864 participating households. Of the 3,376 eligible persons (men and women) in these households, 1,844 (55%) were contacted and asked to enroll and 1532 (45%) were not at home during the study visit. Of the 1,844 who were contacted, 1655 (91%) people 749 men and 906 women aged 15 to 49% enrolled in the study and 189 (9%) refused to enroll. After giving written informed consent, each participant was interviewed and data on sociodemographic characteristics including history of abusing any of the following drugs: cannabis (bhang), mandrax, valium, industrial glue, khat (miraa) and kuber were collected. Data on: HIV knowledge, ART-related attitude and beliefs (AB), sexual history with spousal and non-spousal partners, history of sexually transmitted infections (STIs), HIV testing history, and HIV risk perception were also collected. Study interviews, physical examination and specimen collections were carried out at a private location in or nearby the homes of the study participants. After the interview, study team members requested that participants provide a peripheral venous blood sample. In total, 1508 participants (91%) provided a blood sample, which was later tested for HIV and HSV-2 infections. Study participants with symptoms and/or signs suggestive of a STI were treated immediately by the study nurse using the Kenyan guidelines for STI syndromic management. HIV testing results were linked to interview data using a separate ''link'' identification number to protect confidentiality. Beginning approximately one to two weeks after specimen collection, trained testing counselors offered HIV counseling and test results both within the selected clusters and at a central location in town. Those who tested HIV-positive were referred to HIV care and treatment facilities.

Ethical consideration

The study was approved by the Ethical Committee of the Kenya Medical Research Institute (KEMRI) and the Committee on Human Research (CHR), University of California, San Francisco.

Laboratory procedures

Blood samples collected were processed, labeled with unique identifiers and packed for shipment to the Research Care Training Program (RCTP) laboratory in Kisumu established by a joint collaboration between University of California San Francisco (UCSF) and the Kenya Medical Research Institute (KEMRI). HSV-2 serologic testing was done using Kalon HSV-2 IgG ELISA test kits Kalon, Ltd, Aldershot, UK which according to the manufacturer, has

a sensitivity of 96.4% and specificity of 99.1% (Kalon Biological Ltd, 2011).

Statistical analysis

Data were entered into MS Access database and cleaned for errors and inconsistent answers. Statistical analysis were done using Stata 9.0 (Stata Corporation, College Station,Tx). In this community, just like others in sub Saharan Africa, men culturally have greater autonomy and independence than women. We therefore theorized that the associations of ART related beliefs with HSV-2 seroprevalence will depend on gender (Shisana and Davids, 2004). We conducted separate analysis for males and females and later compared the two to determine any significant differences. We used Chi-square test to assess for differences in socio-demographic characteristics between males and females. To evaluate HIV knowledge and beliefs, correct answers and positive beliefs for the HIV knowledge and beliefs statements were determined. The proportions of participants giving correct answers were calculated and differences in these answers by sex evaluated using Chi-square test. HSV-2 prevalence calculations were done with the number of HSV-2 positive persons as the numerator and all participants who were tested for HSV-2 as the denominator. This was further broken down by sex and age category. As an indirect measure of relative risk for HSV-2 inflection, age adjusted odds ratios (aORs) and their 95% confidence intervals (CIs) were computed to determine which sociodemographic factors were significantly associated with HSV-2 seroprevalence. To control for potential confounding, socio-demographic factors with significant ORs (P<0.05) on bivariate analysis were included into a multivariate logistic model.

The findings are presented in tables. For all the analyses, two-sided tests were used together with the 5% level of significance with p-values of <0.05 being considered to be statistically significant.

RESULTS

Socio-demographic characteristics of survey participants

Of the 1655 participants ages 15 to 49 years who were interviewed, 749 (45%) were male and 906 (55%) were female. The largest age group was the 20 to 24year old (30%); a quarter were in the 15 to 19 years age group, 18% in the 25 to 29 year and 30 to 39 year age groups while only 9% were aged 40 to 49 years. There was no significant difference in age distribution between males and females.

Men had attained a higher level of overall education compared to women: more females (61%) compared to males (48%) had primary education as their highest, a higher proportion of males (42%) compared to females (33%) had secondary education as their highest level and 11% of males compared to 6% of females had college/university education as their highest. 60% of the participants had ever been married. A significantly higher proportion of females (72%) than males (46%) had ever married (P < 0.001). In addition, 63% of young females between the ages 15-29 years had ever married compared to 28% of males of similar age (P<0.001). There was no significant difference in marriage history between older females and older males in the 30 to 39 and 40 to 49 years age groups (Table 1).

HSV-2 seroprevalence and socio-demographic characteristics

Of the 1655 participants, 1501 (91%) agreed to have a blood sample taken and tested for HSV-2. There was no significant difference in socio-demographic characteristics between participants who accepted to have blood tested for HSV-2 and HIV from those who declined (data not shown). The overall HSV-2 prevalence among participants who accepted HSV-2 testing was 53%. Females had significantly higher HSV-2 prevalence (65%) compared to males (38%), (aOR: 3.01, 95% CI: 2.42-3.74) (Table 2).

Prevalence of HSV-2 increased with increasing age for both sexes peaking in the 40-49 age groups with 72% males and 95% females having HSV-2 infection. When compared to those with college/university education, males with only primary education were significantly more likely to have HSV-2 infection (aOR: 2.39, 95% CI: 1.25 to 4.57), among females, those with only primary education and those with secondary education as their highest were more likely to have HSV-2 infection (aOR: 3.77, 95% CI: 1.88 to 7.53) and (aOR: 2.05, 95% CI: 1.01 to 4.14) respectively. History of ever been married, belonging to the Luo ethnic community, and abusing drugs was significantly associated with having HSV-2 infection for both males and females. Females who consumed alcohol had a significantly increased likelihood of having HSV-2 infection compared to those who did not (Table 2).

When the significant socio-demographic characteristic on bivariate analysis were put into a multivariate logistic regression model, the following sociodemographic characteristics remained independently associated with an increased odds of HSV-2 infection (i.) ever married (aOR: 4.13, 95% CI: 2.28 to 7.46), (ii.) Luo ethnicity (aOR: 1.86, 95% CI: 1.06 to 3.26) and (iii.) having abused drugs (aOR: 1.70, 95% CI: 1.09 to 2.65) amongst males and (i.) ever married (aOR: 3.04, 95% CI: 1.87 to 4.95), (ii.) primary education (aOR: 2.31, 95% CI: 1.05 to 5.09), (iii.) Luo ethniciy (aOR: 1.75, 95% CI: 1.07 to 2.85) and (iv.) drinking alcohol aOR: 2.86, 95% CI: 1.37 to 6.01% amongst females (Table 3).

HIV and ART related knowledge and beliefs

Seventy percent (1164/1655) of all the participants had heard of ART. This was equally distributed among males and females. Ninety three percent correctly knew that ART leads to strengthening of the immune system and 92% correctly knew that HIV/AIDS can be controlled or stabilized with ART. Only a quarter correctly knew that ART should not be started immediately one is diagnosed

Table 1. Socio-demographic characteristics of study participants according to sex, Kisumu, Kenya.

Characteristics	Males	Females	Total	
	n (%)	n (%)	n (%)	p-value
Age category				
15-19	197(26)	213(24)	410(25)	0.197
20-24	210(28)	294(32)	504(30)	
25-29	140(19)	151(17)	291(18)	
30-39	128(17)	169(19)	297(18)	
40-49	74(10)	79(9)	153(9)	
Total	749(100)	906(100)	1655(100)	
Ever been married	341(46)	647(72)	988(60)	<0.001
Education level				
Primary	353(48)	525(61)	878(55)	<0.001
Secondary	310(42)	290(33)	600(37)	
College/university	80(11)	52(6)	132(8)	
Currently employed	373(50)	321(36)	694(42)	<0.001
Christian	706(94)	861(95)	1567(95)	0.485
Luo	590(79)	684(75)	1274(77)	0.115
Took alcohol in last 4wks	321(43)	120(13)	441(27)	<0.001
Ever used drugs	309(41)	96(11)	405(25)	<0.001
Have electricity	207(28)	265(29)	472(29)	0.439
Have a working TV	268(36)	352(39)	620(38)	0.177
Have a working Radio	647(87)	768(85)	1415(86)	0.457
Travelled outside Kisumu in last 3 months	313(45)	348(41)	661(43)	0.076
Length of time in Kisumu				
<1year	78(10)	121(13)	199(12)	0.010
1-5yrs	174(23)	249(27)	423(26)	
>5yrs	497(66)	536(59)	1033(62)	

with HIV unless clinically eligible and 41% knew that ART can cause side effects. About a quarter of the participants believed that ART can cure HIV/AIDS. More females (27%) compared to males (19%) had this false belief (P=0.002). A higher proportion of females (80%) compared to males (72%) correctly knew that once a person starts ART, he/she should take it every day for life (P<0.001). Only 7% both males and females believed that with the availability of ART, condom use was less necessary.

In addition, 8% (47/1152) reported that they were less worried about HIV infection and 5% (61/1150) were more likely to have more than one sexual partner now that ART was available. With the availability of ART, 4% (42/1139) were willing to take a chance of getting infected or infecting someone with HIV and another 4% (45/1152) were more likely to have sex without a condom. The majority, 89% (1022/1153) believed that with the availability of ART, it was important for people to know their HIV status, 83% (927/1118) were willing to get tested and 72% (815/1127) believed that HIV was a controllable disease. A higher proportion of females 442/616 (72%) compared to males 315/519 (61%) believed that with the availability of ART, HIV was less serious than it used to be (p=0.000) while a higher proportion of males 43/519 (8%) compared to females 18/631 (3%) were more likely to have more than one sexual partner (p<0.001).

Association of HIV and ART-related knowledge and beliefs with HSV-2 seroprevalence

Both males and females who agreed that HIV can be cured with ART were more likely to have HSV-2 infection compared to those who disagreed (OR: 2.02, 95% CI: 1.19 to 3.43 and OR: 2.14, 95% CI: 1.34 to 3.40), respectively (Table 4). Females who knew that ART can cause side effects compared to those who did not were less likely to have HSV-2 infection (OR: 0.56, 95% CI: 0.34 to 0.92). However females who thought that most people get life threatening side effects and that ART is

Table 2. Associations between sociodemographic characteristics and HSV-2 infection according to sex, Kisumu, Kenya.

Characteristic	Male			Female		
	HSV-2 +ve (%)	aOR*, 95% CI	P value	HSV-2 +ve (%)	aOR*, 95% CI	P value
Age category						
15-19	25(14)	1.0		67(35)	1.0	
20-24	52(29)	2.45(1.40-4.35)	0.001	169(63)	3.18(2.12-4.78)	<0.001
25-29	63(49)	5.84(3.28-10.52)	<0.001	92(68)	3.99(2.44-6.56)	<0.001
30-39	65(56)	7.80(4.31-14.24)	<0.001	134(87)	12.50(6.97-22.91)	<0.001
40-49	51(72)	15.61(7.62-32.24)	<0.001	72(95)	33.58(11.66-130.43)	<0.001
All	256(38)	1.0		534 (65)	3.01(2.42-3.74)	<0.001
Has ever been married**	142(62)	4.11(2.33-7.28)	<0.001	331(76)	3.53(2.25-5.53)	<0.001
Education level						
College/university	20(29)	1.0	<0.001	22(49)	1.0	
Primary	86(47)	2.39(1.25-4.57)	0.009	223(73)	3.77(1.88-7.53)	<0.001
Secondary	73(33)	1.54(0.81-2.93)	0.185	118(56)	2.05(1.01-4.14)	0.046
Is employed**	61(27)	1.34(0.87-2.08)	0.189	213(60)	1.13(0.75-1.70)	0.567
Is a Christian**	171(38)	0.75(0.31-1.80)	0.520	366(66)	1.96(0.77-4.98)	0.156
Belongs to Luo ethnic community**	150(39)	1.89(1.09-3.27)	0.023	303(68)	1.94(1.24-3.04)	0.004
Has had alcohol in last 4wks**	99(47)	1.48(0.97-2.25)	0.068	57(80)	2.19(1.15-4.20)	0.018
Has ever abused drugs**	97(46)	1.7(1.12-2.58)	0.013	49(79)	2.03(1.04-3.96)	0.039
Have electricity**	46(30)	0.62(0.39-0.98)	0.040	103(56)	0.51(0.34-0.76)	0.001
Have a working TV**	68(34)	0.76(0.49-1.15)	0.193	155(63)	0.76(0.52-1.10)	0.144
Have a working Radio**	163(38)	1.11(0.56-2.21)	0.762	330(65)	0.8(0.44-1.48)	0.482
Travelled outside Kisumu (3 month) **	91(43)	1.36(0.89-2.10)	0.159	168(70)	1.35(0.92-2.00)	0.129
Length of time in Kisumu						
<1year	12(25)	1.0		28(42)	1.0	
1-5yrs	39(34)	1.35(0.60-3.03)	0.473	94(62)	2.01(1.08-3.77)	0.027
>5yrs	130(41)	1.42(0.68-2.99)	0.351	257(71)	2.03(1.13-3.65)	0.017

*age adjusted odds ratio; **Reference category, those whose answer was “no”.

available to most people who need it showed an increased likelihood of having HSV-2 infection (OR: 1.75, 95% CI: 1.05 to 2.92 and OR: 2.09, 95% CI: 1.24 to 3.52), respectively. The other variables on HIV and ART related knowledge were not significantly associated with HSV-2 infection (Table 4). After controlling for age, there was no significant association between beliefs on ART and HSV-2 infection for both males and females.

DISCUSSION

Despite the increased use of ART treatment in the general public over the last eight years, this is the first study that explored the association between

Table 3. Multivariate analysis of the significant sociodemographic characteristics, Kisumu, Kenya.

Characteristics	Males		Females	
	OR(95%CI)	P value	OR(95%CI)	P value
Has ever married	4.13(2.28-7.46)	0.001	3.04(1.87-4.95)	0.001
Has primary education	1.78(0.84-3.79)	0.14	2.31(1.05-5.09)	0.04
Has secondary education	1.38(0.68-2.81)	0.37	1.55(0.71-3.38)	0.27
Belongs to Luo ethnic community	1.86(1.06-3.26)	0.03	1.75(1.07-2.85)	0.03
Took alcohol in last 4wks[#]			2.86(1.37-6.01)	0.01
Has ever abused drugs	1.70(1.09-2.65)	0.02	1.62(0.78-3.38)	0.20
Has electricity	0.87(0.51-1.49)	0.61	0.67(0.42-1.05)	0.08

[#]Only significant among females.

ART related knowledge and beliefs and used HSV-2 infection as a surrogate marker of past sexual behavior in the general population in Kenya. Previous studies have focused on ART related knowledge attitude and beliefs and their influences on sexual behavior among HIV infected patients (Bunnell et al., 2006; Eisele et al., 2009; Moatti et al., 2003).

Our study revealed a high prevalence of HSV-2 infection in the general population of Kisumu municipality. Women had the highest prevalence compared to men. HSV-2 prevalence in other studies done in Africa varies from country to country. In Senegal, a study done among pregnant women aged 15 to 44 years attending a maternity and antenatal clinic had a low HSV-2 prevalence estimated at 22% (Diawara et al., 2008). In Tanzania, a cross sectional survey of women aged 15 to 49 years attending primary health care clinics in urban Tanzania revealed a prevalence of 39% (Msuya et al., 2003). Another study done in Uganda among a rural cohort revealed a very high prevalence of HSV-2 among females (72%) compared to males (36%) Kamali et al. (1999). Direct comparisons of overall prevalence from these studies should be made with caution given substantial differences in the populations surveyed, age distributions, HSV serologic test methods used and HIV prevalence.

HSV-2 prevalence increased with age. More than two thirds of the participants in the 40 to 49 years age group had HSV-2 infection. This increase in HSV-2 prevalence by age has also been shown in other studies (MMWR, 2010; Msuya et al., 2003; Smith and Robinson, 2002). It may be explained by the fact that once one is infected with HSV-2, he/she remains infected for life. Older persons are more likely to have had more sexual experience in their lifetime compared to younger persons. They are therefore more likely to have HSV-2 infection.

Slightly over half of the participants had primary education as their highest levels of education. Majority of those with only primary education were females while males had higher levels of education. This reflects gender disparity in formal education against females in Kisumu (Moumié, 2008). It is likely that the majority of females who do not pursue higher education levels end up in marriage. This is supported by the finding that more females than males in the age group 15 to 29 years reported to have ever married. Marriage may expose them to the risks of sexually transmitted infections including HSV-2 and HIV. In a recent study on modes of transmission of HIV, in Kenya, marriage was found to be a risk factor for HIV infection (Lawrence et al., 2009).

Females had a higher prevalence of HSV-2 infection compared to males. This disproportionately higher prevalence of HSV-2 among females has also been seen in other studies (Looker et al., 2008; MMWR, 2010; Weiss et al., 2001). It has been postulated that the increased prevalence of HSV-2 in women is the result of more efficient male to female transmission of the virus, anatomical differences in susceptibility to infection or the tendency of women to choose sex partners who are older than themselves and likely to have more sexual experience (Lazcano-Ponce et al., 2001; Mertz et al., 1992).

Alcohol consumption by women, and history of drug abuse by both men and women were found to increase the risk of HSV-2 infection. This association has also been seen in other studies that have investigated the risks of HSV-2 infection (Beydoun et al., 2010; Tobian et al., 2009). It is possible that persons who consume alcohol and abuse drugs are also more likely to engage in risky sexual behavior increasing their risk of acquiring HSV-2 infection (Dintwa, 2010; Simons et al., 2010).

Kisumu municipality is within Nyanza province which has the highest prevalence of HIV in Kenya (NASCOP, 2008). Over 70% of the participants with equal distribution among males and females had heard of ART. Most of the participants had correct knowledge on specific HIV and ART knowledge areas. The majority correctly agreed that condoms can be used to reduce the chances of getting HIV and that ART can be used to control or stabilize HIV/AIDS. However, about a fifth wrongly thought that ART can cure HIV/AIDS. Those who had this misinformation were more likely to have HSV-2 infection. It is possible that those with risky sexual behavior and had HSV-2 infection thought they could be cured so

Table 4. Association of HIV and ART related knowledge and HSV-2 infection according to sex, Kisumu, Kenya.

HIV knowledge statements	Males		Females	
	HSV+/total tested (%)	OR(95%CI)~	HSV+/total tested (%)	OR(95%CI)~
Agreed that people can reduce their chances of getting HIV by using a condom every time they have sex.	165/433 (38)	1.39(0.61-3.18)	333/507 (65)	0.99(0.53-1.85)
Agreed that if someone is tested for HIV, a positive blood test means that the person is infected with HIV for life	158/418 (38)	0.76(0.37-1.59)	330/496 (67)	1.42(0.73-2.73)
Agreed that most people with HIV show signs of being sick right away (for example losing weight or getting skin rashes)	66/148 (45)	1.38(0.88-2.17)	119/167 (71)	1.35(0.88-2.06)
Agreed that HIV can be transmitted from a mother to a child	66/337 (20)	0.55(0.24-1.23)	347/519 (67)	1.35(0.67-2.73)
Agreed that a mother who is infected with HIV can reduce the risk of giving the virus to the baby by taking certain medicines during pregnancy	154/400 (39)	1.36(0.59-3.15)	340/507 (67)	1.32(0.52-3.36)
Agreed that it is recommended that everyone with a positive blood test for HIV start ART right away	144/365 (39)	1.42(0.78-2.60)	279/427 (65)	1.03(0.62-1.71)
Agreed that HIV/AIDS can be controlled or stabilized with ART	169/438 (39)	0.68(0.26-1.78)	351/537 (65)	1.01(0.38-2.68)
Agreed that missing doses of ART leads to disease worsening	168/434 (39)	0.7(0.15-3.39)	343/510 (67)	3.02(0.67-13.66)
Agreed that taking ART on schedule can help someone with HIV to prolong his/her life.	179/469 (38)	0.4(0.04-3.82)	368/564 (65)	3.8(0.58-25.07)
Agreed that the main way that ART works is to strengthen the immune system	174/450 (39)	2.49(0.29-21.42)	352/532 (66)	1.43(0.33-6.22)
Agreed that ART can cause side-effects	174/450 (39)	0.89(0.52-1.51)	352/532 (66)	0.56(0.34-0.92)
Agreed that HIV/AIDS can be cured with ART	44/89 (49)	2.02(1.19-3.43)	117/150 (78)	2.14(1.34-3.40)
Agreed that ART increases a person's sexual drive	31/91 (34)	1.15(0.61-2.17)	57/85 (67)	1.01(0.55-1.85)
Agreed that once a person starts ART, he/she should take ART everyday for life	135/347 (39)	0.88(0.43-1.82)	303/459 (66)	1.78(0.57-5.60)
Agreed that many people get life threatening side effects from ART	47/143 (33)	0.73(0.42-1.26)	110/148 (74)	1.75(1.05-2.92)
Agreed that ART is available to most people who need it	137/342 (40)	1.58(0.93-2.70)	308/449 (69)	2.09(1.24-3.52)
Agreed that ART drugs are free at HIV clinics in Kenya	133/355 (37)	1.57(0.79-3.09)	318/468 (68)	1.44(0.74-2.80)

~Reference category, those who disagreed

they did not take precautions to reduce chances of infection or were likely to justify their actions by acknowledging that ART cures HIV/AIDS. In trying to understand this relationship in the context of the health belief model, an exten-sively studied model on health behavior change which posits that individuals must perceive themselves at risk of the health threat in order to take actions to reduce risky behavior or engage in healthy alternative behaviors (Rosenstock et al., 1988). It is possible that individuals who believed that ART can cure HIV/AIDS have less perceived threats of

HIV infection and hence did not adopt safe sexual behavior that predisposed them to getting HSV-2 infection.

Our study is not devoid of limitations. It relied on data collected during a general population survey which had a lower response rate than expected. It is possible that those who were not available or declined to be interviewed had different characteristics and hence introduce bias. In addition, data were collected from participants who were found at home. In this community, most men spend their day at work places away from home while most women spend their day at home attending to household chores. It is possible that some men found at home were sick to attend work or had other characteristics likely to introduce bias. Due to these reasons, this study may therefore not be representative of the entire population in Kisumu municipality. We also used HSV-2 infection as a surrogate marker for past sexual behavior. Since when one is infected with HSV-2, s/he remains positive for life. HSV-2 is therefore cannot be used to assess sexual behavior for persons who change their sexual behavior after infection.

Despite these limitations, the study was able to demonstrate a high prevalence of HSV-2 and knowledge, attitudes and beliefs on ART that may potentially impact on sexual behavior. Such information is useful in formulating health intervention strategies to mitigate HSV-2 infection and sex behavior change that may be due to ART availability.

Measures should be put in place to protect persons from HSV-2 and HIV infection through safe sexual behavior. Improving women's access to higher education may improve their economic independence leading to greater autonomy over sexual related decisions. This could be done by encouraging parents to have the girl child access higher education levels. This may not only narrow the difference in education levels between males and females but will also enable females stand a better chance to becoming economically independent as they can compete with men for competitive employment opportunities.

Campaigns against drug abuse should be intensified to decrease this vice. In addition, the public should be educated on the dangers of drug and substance abuse and their potential impact on sexual behavior.

Further studies in this subject is encouraged, this will help us understand better the field of HIV management with special emphasis on prevention as cure of HIV is not yet available.

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