Urban-rural differentials in the association between HIV infection and poverty in Kenya

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Abstract

The link between HIV infection and poverty has attracted considerable research attention in recent years, but the relationship is rather complex and findings from existing studies remain inconclusive. While some argue that poverty increases vulnerability, existing empirical evidence from sub-Saharan Africa largely support the view that wealthier men and women, especially rural residents, have higher prevalence of HIV. In this paper, we focus on urban/rural differentials in the association between HIV infection and poverty in Kenya**.** The study is based on secondary analysis of data from the Kenya Demographic and Health Surveys conducted in 2003 and 2008. We apply multilevel logistic regression models, allowing the poverty risk factor to vary across rural and urban communities (i.e. clusters) in Kenya. The results suggest that the urban poor in Kenya have significantly higher odds of HIV infection than their urban non-poor counterparts, despite poverty being associated with a significantly lower risk among rural residents. Interesting urban/rural differentials are observed in poverty risk factor by key demographic and socio-cultural characteristics, including gender disparities and ethnicity. For example, the rich-poor gap among urban residents is wider for women, with poor urban women being particularly vulnerable. The findings have important policy/programme implications.

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Introduction

The link between HIV infection and poverty has attracted considerable research attention in recent years (Fox, 2010; Madise et al, 2012; Magadi, 2013), but the relationship is rather complex and findings from existing studies remain inconclusive. As with most health outcomes, some have argued that poverty increases vulnerability (Whitehead et al, 2001; Fenton 2004; Masanjala 2007). Whilst earlier empirical evidence from sub-Saharan Africa largely supported the view that wealthier men and women have higher prevalence of HIV (Shelton et Al, 2005; Mishra et al, 2007; Fox, 2010), more recent studies highlight increased vulnerability among the urban poor, with variations in gender disparity. Results of a recent cross-national analysis of poverty and the risk of HIV infection in 20 countries of sub-Saharan Africa revealed that the urban poor in sub-Saharan Africa (SSA) had significantly higher odds of HIV infection than their urban non-poor counterparts, despite poverty being associated with a significantly lower risk among rural residents (Magadi 2013). The study further observed that the gender disparity in HIV infection (i.e. the disproportionate higher risk among women or those living in women-headed households) was amplified among the urban poor in SSA. Although a recent study in Kenya focusing on two urban slums in Nairobi confirmed increased vulnerability among the urban poor, a narrower gender disparity was observed in the slums (Madise et al, 2012).

Various prepositions have been put forward to explain the apparent higher of lower risk of HIV infection among the poor. For instance, it has been argued that being wealthier is likely to lead to reckless lifestyle and risky sexual relationships as wealthier people (particularly men) tend to attract multiple partners (Hargreaves et al. 2002; Kimuna and Djamba 2005). Shelton et al. (2005) noted that wealth and social interaction are inextricably linked, and wealth might increase the number of opportunities for concurrent heterosexual partnerships to develop. On the other hand, an explanation for the positive association between HIV and poverty that is grounded in the theory of economics of sexual behaviour postulates that the adverse future life chances of people living in poverty are likely to increase their readiness to take risks today (Holmqvist 2009). In particular, women living in urban slum settings have been observed to engage in riskier sexual behavior than their counterparts in less deprived areas (Zulu et al. 2002). For women living in poverty, increased vulnerability has been attributed to possible interaction between poverty and non-biological factors such as gender-based violence and transactional sex (Dunkle et al., 2004; Hunter 2007; Rodrigo and Rajapakse 2010).

The disproportionate high risk of HIV infection observed among the urban poor in SSA (Magadi, 2013) is consistent with patterns observed for most public health outcomes which have been linked to poverty. In particular, the public health consequences of urban poverty under

conditions of rapid urban growth have been well documented (Brockerhoff and Brenan 1998; Magadi et al. 2003; Montgomery 2009). In this paper, we focus on the association between HIV infection and poverty in Kenya, paying particular attention to differences in risk factors of HIV infection by urban/rural residence and gender disparities. The specific objectives are to:

i. examine urban/rural disparities in the relationship between urban poverty and HIV infection in Kenya;
ii. determine the extent to which observed urban/rural differentials in poverty risk factor for HIV infection may be explained by sexual behavior factors; and
iii. establish gender disparities in the HIV/AIDS-poverty nexus among rural and urban residents

Data and methods

The Data

The study is based on secondary analysis of data from the Kenya Demographic and Health Surveys (KDHS) conducted in 2003 and 2008. The surveys included nationally representative samples of women of reproductive age (women aged 15-49 and males aged 15-54). Details of the sampling design and data collection procedures for each survey are available in the respective KDHS reports (CBS, MoH and ORC Macro 2004; KNBS and ICF Macro 2010). In each survey, the urban and rural samples tested for HIV are large enough to permit analysis by urban/rural residence. Furthermore, the comparative nature of the KDHS surveys make it possible to pool data across years to understand general trends. The distribution of the sample by year of survey, gender and urban/rural residence is given in Table 1.

Table 1: Distribution of study sample by year of survey, urban/rural residence and gender

Year of survey	**Urban**		**Rural**		**All**
	Females	**Males**	**Females**	**Males**	
2003	981	847	2290	2070	6188
2008	1093	943	2718	2152	6906
	2074	1790	5008	4222	
All	3864		9230		13094

The availability of HIV test data that can be linked to individual level survey data from recent KDHS surveys, provides a unique opportunity for population-based studies of factors associated with the HIV/AIDS epidemic in different contexts. The DHS HIV testing protocol undergoes a rigorous ethical review process (ICF Macro, 2010), providing for informed, anonymous, and voluntary testing of women and men of reproductive age.

Methods of analysis

The analysis starts with a bivariate examination of the association between HIV prevalence and poverty, with particular reference to the urban poor. This is followed with multivariate analysis of the poverty risk factor, while simultaneously controlling for the effects of other important factors known to be associated with the risk of HIV infection. The analysis makes particular reference to urban poverty, through comparisons of the urban versus rural poverty as a risk factor for HIV prevalence, and an examination of urban inequalities in HIV infection.

The multivariate analysis involves application of multilevel models applied to pooled KDHS data from 2003 and 2008. The modelling places particular emphasis on community variations in factors associated with HIV prevalence in urban and rural settings, and the extent of clustering of HIV positive individuals within communities (i.e clusters). The KDHS data have a hierarchical structure with individuals nested within clusters. In the multilevel analysis applied in this paper, clusters constitute the second level (n=400 in each survey). The general form of the two-level logistic regression model used may be expressed as:

$$Logit\ \pi_{ij} = X'_{ij}\beta + Y'_{ij}\, u_j \qquad (1)$$

Where:
$\boldsymbol{\pi_{ij}}$ is the probability of HIV positivity for an individual *i*, in the j^{th} cluster;
X'_{ij} is the vector of covariates which may be defined at the individual or cluster level;
β is the associated vector of usual regression parameter estimates;
Y'_{ij} is a vector of covariates (usually a subset of X'_{ij}) which vary randomly at cluster level;

and the quantities u_j are the residuals at cluster level which are assumed to have normal distribution with mean zero and variance σ^2_u (Goldstein 2003).

We have used the estimates of community (i.e. cluster) level variances to derive intra-unit correlation coefficients to examine the extent to which the risk of HIV positivity is clustered within urban or rural communities in Kenya, after taking into account the effect of significant covariates. The intra-community (ρ_u) correlation coefficients is given by:

$$\rho_u = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_e^2} \qquad (2)$$

where: σ_u^2 - is the total variance at cluster level; and
σ_u^2 - is the total variance at individual level.

We have assumed that the level-1 residuals, e_{ij}, for multilevel logistic regression model have a standard logistic distribution with mean zero and variance $\pi^2/3$, where π is the constant 3.1416 (See Hedeker and Gibbsons 1996).

The key explanatory variable of interest is poverty (details of poverty measurement are given below), with particular reference to urban/rural settings in Kenya. In the multilevel models, the association between poverty and HIV infection is allowed to vary randomly at cluster levels to establish the extent to which the observed overall patterns in the relationship between urban poverty and HIV infection varies between high and low HIV prevalence communities. Besides poverty, a number of covariates, known to be associated with HIV prevalence, are included in the models as control variables. These include a range of background demographic, socio-economic and cultural characteristics, namely: gender, age, educational attainment, gender of household head and religion. Interactions between gender and poverty are included in the model to assess whether the association between poverty and HIV prevalence differs significantly between men and women. In addition to the background factors, a set of sexual behavior risk factors are included in a subsequent stage to establish possible pathways through which poverty is associated with HIV prevalence. These include current marital status, age at first marriage, age at first sex, premarital sex, non-use of condoms with non-spousal partner and multiple sexual partners.

Poverty measurement

Although household income is the typical indicator of choice for poverty measurement for many economists, it is extremely difficult to measure accurately for a number of reasons (see Rutstein and Johnston 2004), especially in a developing country setting such as Kenya where most of the population simply do not know their precise income. Consumer expenditure has been proposed as an alternative proxy to household income, but both measures can be very volatile, especially in less developed country settings. Friedman (1957) noted that both measures of current income and expenditures will not accurately represent underlying differentials in health since health outcomes and behaviours are perhaps more related to “permanent income” than current income. As a measure of economic status, wealth (or its equivalent, net assets) has a number of advantages over income or expenditure: it represents a more permanent status; it is more easily measured (with only a single respondent needed in most cases); and it requires far fewer questions than either consumption expenditures or income (Rutstein and Johnson 2004).

This paper used the derived household wealth/asset index from the DHS data sets based on the work of Rutstein and Johnston (2004). This measure is based on Principal Components Analysis (PCA), a powerful tool in identifying the underlying patterns in the data and reducing the number of dimensions without much loss of information (Filmer and Pritchett 2001). In this paper, the resulting PCA scores have been used to classify the rural and urban populations in Kenya into three equal classes: poor, average and rich tertiles, corresponding to the lower, middle and upper 33%, respectively.

This poverty measure is a relative, rather than an absolute one. The index is relative within urban and rural environments to account for any potential differences in the meaning of assets used to derive the index. As noted by Rutstein and Johnston (2004, p.6) ‘a poverty

line based on a national percentile distribution of households by economic status, such as wealth quintiles, is useful in assessing the reach of public health programs for both the poorer and richer sections of society'.

Data limitations.

Three key data limitations should be borne in mind when interpreting the findings of this study. The first relates to our inability to infer precise causal relationships. We recognize that poverty and HIV infection are intrinsically linked and while our focus in this paper is on the role of poverty or wealth in bringing about risky social interaction that raises the chance of contracting HIV, we recognize that HIV infection may also increase the risk of poverty among affected individuals, households and communities. Given the cross-sectional nature of data analysed, we are unable to establish the time sequencing of events of interest: that is, whether the current poverty status preceded HIV infection or a consequence of it. Therefore, the relationships between HIV prevalence and poverty observed are mere associations rather than causal relationships.

The second limitation relates to possible survivorship bias. Wealthier individuals who are HIV positive are likely to survive longer as they are more likely to access appropriate treatment and nutrition, delaying the onset of AIDS and eventual death. This will weaken any positive relationship between urban poverty and HIV prevalence. However, the fact that people with HIV tend to lose wealth (i.e. because of loss of employment and increased medical expenses) will inflate the positive relationship between poverty and HIV, thus having a counter effect (Shelton et al. 2005).

Further bias may result from differential coverage in HIV testing by socio-economic status. Although the overall response rates for HIV testing in the 2003 and 2008 KDHS are reasonably high, the rates for those of higher socio-economic status (e.g. wealth quintile) tended to be lower (CBS, MoH and ORC Macro, 2004). This may create bias in the results if wealthier individuals who knew they were HIV positive were more likely to refuse HIV testing. However, it is unlikely that lower response rates would lead to bias if non-response was random and not selective by HIV prevalence. A comprehensive multivariate analysis of the determinants of non-response confirmed that eligible respondents who were not tested for HIV did not differ in significant ways from those tested (ORC Macro, 2004).

Results

Initial preliminary analyses suggested a positive gradient between wealth and the risk of HIV infection for both males and females, resident in urban and rural areas, consistent with patterns observed in some of the earlier studies. However, overall patterns by urban/rural residence were confounded by the fact that urban residence were more likely to be

classified in higher wealth quintiles (based on overall DHS wealth index) and also had relatively higher HIV prevalence. Drawing on earlier evidence suggesting differential effect of poverty on HIV by urban/rural residence across countries in sub-Saharan Africa (Magadi, 2013), a more refined wealth classification was derived by urban/rural residence, recognizing the differences in indicators of wealth in urban and rural areas. The patterns based on the revised classification were consistent with patterns observed earlier for SSA, suggesting a positive wealth gradient in HIV risk in rural areas, but a reverse pattern in urban areas where HIV risk was highest among the poor for both males and females. The bivariate and multivariate analyses presented below are based on the refined wealth classification, based on tertiles rather than quintiles to ensure sufficient cases for each category.

Bivariate analysis by urban rural residence

Bivariate analyses examined the association between poverty and the risk of HIV infection by various demographic and socio-cultural characteristics of the population, separately for urban and rural residents. Results for background demographic and socio-economic characteristics are presented in Table 2.

Table 2: Urban/rural disparities in the socio-economic inequalities of HIV infection by background demographic and socio-economic characteristics

Characteristic	Urban			Sig.	Rural			Sig.
	Poor	Middle	Rich		Poor	Middle	Rich	
Survey year								
2003	11.1	9.2	9.1	ns	5.4	4.7	7.2	**
2008	10.5	7.1	4.7	**	4.9	6.7	6.7	*
Gender								
Female	14.5	10.5	9.1	*	6.3	7.6	8.2	ns
Male	7.1	5.5	5.7	ns	3.6	3.5	5.6	**
Age group								
15-24	5.8	3.4	3.5	ns	2.5	2.9	3.4	ns
25-34	13.2	9.9	10.5	ns	6.7	8.4	10.7	*
35-44	20.1	13.7	6.8	***	8.1	8.2	9.9	ns
45+	4.8	6.9	6.5	ns	5.0	5.6	6.5	ns
Education								
None	10.8	6.5	6.3	ns	2.6	6.4	7.4	*
Primary	14.5	7.8	13.3	**	5.7	5.7	8.4	**
Secondary+	5.4	7.9	5.3	ns	5.6	5.1	5.2	ns
Region								
Nairobi	13.7	7.4	8.3	*	-	-	-	-
Central	7.6	7.9	4.7	ns	3.5	5.0	4.1	ns
Coast	4.2	8.9	3.4	ns	2.6	5.9	4.8	ns
Eastern	4.2	8.8	1.7	ns	3.2	2.4	3.5	ns
Nyanza	19.5	25.4	0.0	***	15.0	12.2	16.9	ns
Rift Valley	14.4	1.8	7.1	***	1.8	2.5	8.1	***
Western	11.3	11.4	0.0	ns	3.5	6.2	5.1	ns
Ethnic group								
Kamba	12.2	8.9	6.3	ns	4.7	2.1	4.0	ns
Kikuyu	8.1	2.5	5.1	**	3.3	4.6	4.7	ns
Luhya	20.0	6.7	4.5	***	4.4	6.2	5.7	ns
Luo	21.0	19.9	16.2	ns	20.9	20.6	24.4	ns
Other	4.9	8.6	4.3	ns	1.9	2.9	4.2	**
Religion								
Catholic	11.8	12.1	10.5	ns	5.2	4.7	4.5	ns
Protestant	12.4	6.7	6.1	***	6.0	6.1	7.1	ns
Muslim	3.6	7.1	1.4	ns	1.0	3.7	6.8	*
Other	19.2	4.8	3.8	ns	2.4	4.1	17.4	***
All	10.8	7.9	6.9	**	5.1	5.6	6.9	**

* - Chi Square p<0.05; ** - p<0.01; *** - p<0.001

Overall, the results suggest that while there is no evidence of a significant association between wealth and HIV prevalence in the combined sample (poor – 6.5%; middle – 6.1%; rich – 6.9%). However, the association was significant in both urban and rural areas, albeit in the opposite direction. Among urban residents, HIV prevalence was highest among the poor (10.8%) and lowest among the rich (6.9%), while the pattern was reversed in rural areas (poor – 5.1%; middle – 5.6%; rich – 6.9%). Indeed, the disproportionate higher prevalence of HIV in urban than rural Kenya is largely due to differences in prevalence among the urban and rural poor.

The trends suggest that the urban poor disadvantage has increased in recent years: while in 2003 the gap between poor and rich was not significant (two percentage points), in 2008, the poor in urban areas had about double the risk of HIV infection as their rich counterparts (11% vs 5%), suggesting that the recent decline in HIV risk in urban areas is largely among the rich.

The results reveal interesting gender disparities: the rich-poor gap in urban area is more apparent among women (with poor women being particularly vulnerable); while in rural area, the evidence for positive gradient between wealth and risk of HIV infection is stronger for men.

The results presented in Table 2 further reveal interesting patterns observed by ethnicity: the urban poor disadvantage is particularly pronounced among the Luhya where the risk of infection among the poor in about four times higher than the rich (20% vs 4.5%). This is in sharp contrast with rural residents for whom the risk tends to be higher among the rich, albeit not significant. While for all other ethnic groups HIV risk is higher in urban than rural areas, for Luos, the risk in rural areas is just as high as in urban areas – in fact the risk is highest among the rural rich while for other ethnic groups (especially the Luyha) the highest risk is observed among the urban poor. In fact, while the risk of HIV among the urban poor is about the same for Luos and Luhyas, the risk is more than 4 times higher for Luos than Luhyas among the rural poor.

Other notable urban/rural differences in the HIV-poverty nexus are observed by other characteristics such as age, education, region and religion. For instance, the urban poverty disadvantage in the risk of HIV infection is exemplified among middle age adults (aged 35-44 years) while the positive gradient between HIV infection and wealth in rural areas is most pronounced among young adults aged 25-34 years. With respect to regional variations, it is interesting to note that while the rich in Nyanza province had the highest HIV prevalence in rural areas, they had among the lowest prevalence in urban areas, with prevalence being particularly high among the poor or those of middle SES in the province.

Multilevel Logistic regression analysis

Multivariate analysis based on multilevel Logistic regression examined the poverty risk factor in HIV infection among urban and rural residents, while simultaneously controlling for the effects of a range of demographic and socio-cultural characteristics and sexual behaviour factors. The analysis placed special focus on the role of sexual behaviours factors, including current marital status, age at first sex, premarital sex, multiples sex partners or non-condom use with non-spousal partners. These were introduced in the model in successive stages to establish the extent to which they explained observed patterns in the link between poverty status and risk of HIV infection among urban and rural residents. The first model (Model 0) examined the association between wealth status and HIV infection without controlling for any covariates, besides year of survey, gender, age and random community variations. The second model (Model 1) controlled for background demographic, cultural and socio-economic characteristics, while the final model (Model 2) included sexual behaviour factors.

The results presented in Table 3 provide strong evidence of significant urban-rural divide in the relationship between poverty and HIV positivity in Kenya: the urban poor have significantly higher odds of HIV infection than their urban non-poor counterparts, despite poverty being associated with a significantly lower risk among rural residents. These patterns persist even after important socio-cultural, demographic and sexual behaviour factors are controlled for. Thus, the observed urban-urban differentials in poverty risk factor are hardly explained by basic background characteristics, nor sexual behaviour factors included in the analysis.

Furthermore, the gender disparity in HIV infection (i.e. the disproportionate high risk among women compared to men in Kenya, as other countries in sub-Saharan Africa) is somewhat more pronounced in urban than rural areas. These differences remain virtually unchanged when background demographic, socio-economic and cultural factors are controlled for, and are not explained by sexual behaviour factors included in the analysis.

The results further reveal interesting urban-rural differentials in risk factors of HIV infection with respect to region (i.e. province) of residence, educational attainment, religion, ethnicity, abstinence/timing of first sex, and premarital sex. In particular, the Luo ethnic group had particularly high odds of HIV infection (specially rural residents) that was neither explained by background characteristics nor sexual behaviour factors. With respect to educational attainment, secondary (or higher) education seemed protective among urban but not rural residents.

Further analysis explored interaction effects between poverty status and key factors in urban and rural areas. In particular, we were interested in establishing if there was a significant interaction between gender and wealth status in urban and rural areas. However, there was no evidence that any of the interactions were significant.

Table 3 Odds ratios for HIV infection by urban rural residence

	Urban			Rural		
Fixed effects	**Model 0**	**Model 1**	**Model 2**	**Model 0**	**Model 1**	**Model 2**
Female (Ref: male)	2.02*	2.19*	2.06*	1.88*	1.98*	1.71*
Wealth status (Ref: poor)						
Middle	0.86	0.95	0.96	1.28	1.29*	1.35*
Rich	0.49*	0.62*	0.68*	1.31*	1.33*	1.41*
2008 survey (Ref: 2003)	0.86	0.88	0.90	1.15	1.01	1.03
Age (Ref:15-24)						
25-34	2.95*	3.60*	2.55*	2.92*	3.22*	1.76*
35-44	3.28*	4.28*	2.34*	3.32*	3.78*	1.68*
45+	1.67	2.04*	1.07	2.36*	2.59*	0.98
Region (Ref: Central)						
Nairobi		0.89	0.89		-	-
Coast		0.59	0.59		1.28	1.33
Eastern		0.24*	0.28*		0.87	0.88
Nyanza		1.12	1.13		1.40	1.34
Rift Valley		1.01	0.99		1.06	1.02
Western		0.85	0.84		0.84	0.95
Religion (Ref: Catholic)						
Protestant/other Christian		0.78	0.78		1.03	1.06
Muslim		0.51*	0.51*		0.69	0.74
Traditional /no religion		1.11	1.10		1.80*	1.65
Ethnicity (Ref: Kamba)						
Kikuyu		0.50*	0.54		0.77	0.70
Luhya		0.85	0.86		1.43	1.17
Luo		2.57*	2.51*		4.90*	4.24*
other		0.69	0.75		0.63	0.65
Education level (Ref: none)						
Primary		1.08	1.33		1.51	1.60
Secondary +		0.55*	0.79		1.39	1.49
Marital status (ref: div/sep.)						
Never married			0.42*			0.37*
Married – mono			0.50*			0.33*
Married – poly			0.49*			0.53*
Widowed			3.40*			2.66*
Age at first sex (Ref: 20+)						
never			0.59			0.19*
<16			1.46			0.70*
16-17			1.13			0.71
18-19			1.19			0.82
Premarital sex			1.20			1.62*
Multiple sex partners in last 12 months			1.08			1.42
Non-condom use with non-spousal partner			0.90			0.90
Random variance						
Cluster - intercept	0.37*	0.03	0.00	1.13*	0.17*	0.14*

With respect to community variations, there was evidence of significant variations in HIV infection across communities in urban and rural areas, largely explained by regional or ethnic background. The community variations were more pronounced among rural (than urban) residents, and remained significant in the rural areas even after important background (or sexual behaviour) factors were controlled for. However, there was no evidence that the association between wealth status and HIV infection varied significantly across urban or rural communities.

To further explore gender disparities, we examined the risk factors of HIV infection among females and males separately, including the wealth-residence interaction (Table 4). As in Table 3, the background and sexual behaviour factors are introduced in successive stages to establish potential pathways in the wealth-HIV associations.

The results confirm a significant interaction between urban/rural residence and wealth status in the risk of HIV infection among both men and women. Although rural (versus urban) residence and being wealthy (versus poor) are generally associated with reduced risk of HIV infection, being wealthy is associated with greater risk among rural than urban residents. Conversely, being poor is associated with greater risk among urban than rural residents. These patterns are consistent with results presented in Table 3 which suggest that while wealth is associated with reduced odds of HIV infection in urban areas, the association is reversed in rural areas.

There is little evidence of gender differences in the wealth-HIV nexus. However, interesting gender differences in the risk of HIV infection are observed by religion and sexual debut. For instance, Muslim women have significantly lower (less than half) odds of HIV infection than catholic women, whilst the odds for Muslim men tend to be higher (albeit not significant) than for Catholic men. It is interesting to note that while earlier sexual debut is associated with increased odds of HIV infection among women, the pattern is reversed for men.

For both men and women, there is a significant variation in HIV prevalence across communities that is explained by regional and ethnic differences. However, there is no evidence that the observed interaction between residence and wealth status varies significantly across communities.

Table 4 Odds ratios for HIV infection by gender

	Women			Men		
Fixed effects	**Model 0**	**Model 1**	**Model 2**	**Model 0**	**Model 1**	**Model 2**
2008 survey (Ref: 2003)	1.02	0.97	0.99	1.05	1.01	1.00
Rural (Ref: urban)	0.37*	0.37*	0.36*	0.42*	0.42*	0.42*
Wealth status (Ref: poor)						
Middle	0.88	0.88	0.91	0.76	0.73	0.69
Rich	0.47*	0.51*	0.58*	0.47*	0.49*	0.46*
Wealth-residence interaction						
Rural -Middle	1.57	1.60*	1.61*	1.49	1.74	1.89
Rural -Rich	2.83*	2.83*	2.63*	3.13*	3.64*	3.72*
Age (Ref:15-24)						
25-34	2.40*	2.79*	1.83*	4.90*	5.92*	3.63*
35-44	2.29*	2.71*	1.31	6.80*	9.18*	4.82*
45+	1.39	1.57*	0.62*	4.03*	5.05*	2.53*
Region (Ref: Central)						
Nairobi		0.88	0.87		2.10	2.12
Coast		0.79	0.80		1.26	1.22
Eastern		0.47*	0.53*		1.04	1.04
Nyanza		1.10	0.97		2.72*	2.66*
Rift Valley		0.82	0.80		1.65	1.62
Western		0.69	0.74		1.97	1.83
Religion (Ref: Catholic)						
Protestant/other Christian		0.89	0.90		0.98	0.97
Muslim		0.44*	0.43*		1.29	1.24
Traditional /no religion		1.26	1.33		1.96*	1.80
Ethnicity (Ref: Kamba)						
Kikuyu		0.46*	0.49*		0.99	0.99
Luhya		0.94	0.93		1.04	1.04
Luo		2.58*	2.48*		5.05*	4.77*
other		0.48*	0.55*		0.86	0.86
Education level (Ref: none)						
Primary		1.06	1.28		2.42*	2.73*
Secondary +		0.74	1.11		1.65	1.91
Marital status (ref: div/sep.)						
Never married			0.38*			0.58
Married – mono			0.30*			0.62
Married – poly			0.42*			0.80
Widowed			2.70*			4.29*
Age at first sex (Ref: 20+)						
never			0.28*			0.45
<16			1.59*			0.58*
16-17			1.23			0.63*
18-19			1.37			0.63*
Premarital sex			1.30*			1.36
Multiple sex partners			0.74			1.54*
Non-condom use			0.91			0.87
Random variance						
Cluster - intercept	0.57*	0.06	0.01	0.94*	0.00	0.00

Discussion and Conclusions (work in progress)

This paper set out to: examine urban/rural disparities in the relationship between urban poverty and HIV infection in Kenya; determine the extent to which observed urban/rural differentials in poverty risk factor for HIV infection may be explained by sexual behavior factors; and establish gender disparities in the HIV/AIDS-poverty nexus among rural and urban residents. Overall, findings in Kenya confirm patterns observed across countries in SSA (Magadi, 2013) of an apparent urban/rural divide in the HIV-poverty nexus: urban poverty is associated with higher odds of HIV infection, despite poverty being associated with reduced odds in the rural areas. As noted in Magadi (2013), the observed higher risk of HIV among the urban poor is consistent with Holmqvist's interpretation grounded in a theory of economics of sexual behavior, arguing that the adverse future chances of people living in poverty is likely to increase their readiness to take risks today (Holmqvist, 2009). It is possible that the apparent disadvantage among the poor is only evident among urban and not rural residents partly due to weaker social cohesion in urban settings. The observed higher intra-community correlations in rural areas suggests that Holmqvist explanation of the role of social cohesion in establishing norms, communicating with trust and mobilizing collective resources in the pursuit of joint goals or to control risk is more apparent among rural communities in Kenya. Thus, greater homogeneity among rural clusters supports the explanation of greater social cohesion in rural communities resulting in reduced vulnerability among the poor in rural settings.

The observed gender disparities, suggesting that poor women in urban areas are particularly vulnerable, while the evidence of a positive gradient between wealth and HIV infection in rural areas is more apparent for men, is consistent with existing literature from other parts of sub-Saharan Africa. For instance, being wealthier has been linked to reckless lifestyle and risky sexual relationships among men in Zambia (Kimuna and Djamba 2005), while urban poor women have been observed to engage in riskier sexual behavior than their counterparts in less deprived areas (Zulu et al. 2002). It has been noted that for women living in poverty, increased vulnerability may be attributable to possible interaction between poverty and non-biological factors such as gender-based violence and transactional sex (Dunkle et al., 2004; Hunter 2007; Rodrigo and Rajapakse 2010), factors that are likely to be more prevalent in urban poor settings. Further gender disparities are observed with respect to sexual behaviour factors, reinforcing the need for gender specific interventions in addressing the HIV/AIDS epidemic in Kenya. In particular, the fact that earlier sexual debut is associated with increased odds of HIV infection among women, but the pattern is reversed among men, has important policy/programme implications, especially in relation to efforts to curb the spread of HIV infection among the youth in Kenya.

It is interesting to note that the urban poor disadvantage persists even after sexual behavior factors (i.e. current marital status, age at first marriage, age at first sex, premarital sex, non-

use of condoms/type of partner, and multiple sex partners) are controlled for, suggesting that the observed differences cannot be fully explained by these sexual behavior factors. This calls for further research to better understand potential pathways of the HIV-poverty link. It is possible that factors characterizing the urban poor in most of SSA such as unemployment, discrimination, violence, and crime that have been previously shown to relate closely to HIV/AIDS risks (Maas et al, 2007) may play an important role in urban settings in Kenya, as in the rest of SSA.

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