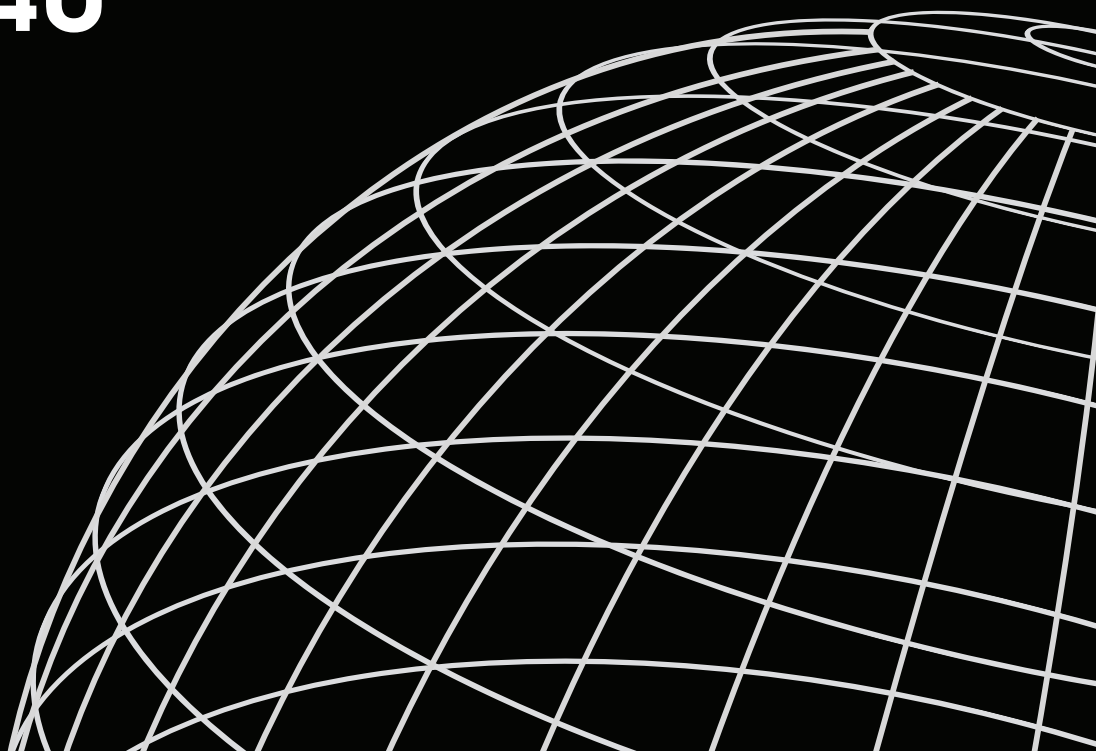




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HIV PREVALENCE PATTERNS BY AGE AND SEX: EXPLORING DIFFERENCES AMONG 19 COUNTRIES

DHS ANALYTICAL STUDIES 40



SEPTEMBER 2013

This publication was produced for review by the United States Agency for International Development. It was prepared by Chaitra Gopalappa, John Stover, and Carel Pretorius of the Futures Institute, Glastonbury, Connecticut, USA.

MEASURE DHS assists countries worldwide in the collection and use of data to monitor and evaluate population, health, and nutrition programs. Additional information about the MEASURE DHS project can be obtained by contacting MEASURE DHS, ICF International, 11785 Beltsville Drive, Suite 300, Calverton, MD 20705 (telephone: 301-572-0200; fax: 301-572-0999; e-mail: reports@measuredhs.com; internet: www.measuredhs.com).

The main objectives of the MEASURE DHS project are:

- to provide decision-makers in survey countries with information useful for informed policy choices
- to expand the international population and health database
- to advance survey methodology and
- to develop in participating countries the skills and resources necessary to conduct high-quality demographic and health surveys

DHS Analytical Studies No. 40

**HIV Prevalence Patterns by Age and Sex:
Exploring Differences among 19 Countries**

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Preface

One of the most significant contributions of the MEASURE DHS program is the creation of an internationally comparable body of data on the demographic and health characteristics of populations in developing countries.

The *DHS Comparative Reports* series examines these data across countries in a comparative framework. The *DHS Analytical Studies* series focuses on analysis of specific topics. The principal objectives of both series are to provide information for policy formulation at the international level and to examine individual country results in an international context.

While *Comparative Reports* are primarily descriptive, *Analytical Studies* provide in-depth, focused studies on a variety of substantive topics. The studies are based on a varying number of data sets, depending on the topic being examined. These studies employ a range of methodologies, including multivariate statistical techniques.

MEASURE DHS staff, in conjunction with the U.S. Agency for International Development (USAID), selects the topics covered in *Analytical Studies*.

It is anticipated that the *DHS Analytical Studies* will enhance the understanding of analysts and policymakers regarding significant issues in the fields of international population and health.

Sunita Kishor
Project Director

Executive Summary

To make national-level estimates and projections of HIV prevalence over time, UNAIDS uses HIV surveillance data from antenatal clinics. These prevalence estimates are further modified by calibrating to the proportion of people testing HIV-positive in national surveys, such as the Demographic and Health Surveys (DHS). Results are combined across countries by taking the average value as an estimate of the general pattern, and this average pattern is applied to all countries with generalized HIV epidemics.

A key question affecting the accuracy of these estimates and projections is whether HIV prevalence by age is similar across all countries with generalized HIV epidemics, or significantly different. And if different, are there any age-based behavioral variables that explain those differences? This study seeks to determine if HIV prevalence patterns, represented as HIV prevalence in an age group relative to HIV prevalence in age 25-29, are significantly different across countries and to identify variables correlated with prevalence patterns. The study uses DHS data on HIV prevalence for five-year age groups among women and men age 15-49, from 28 surveys covering 19 countries.

Our analysis finds that an average pattern of HIV prevalence by age generally matches the country-specific patterns. In some cases, however, mostly in older age groups and in a few cases in the younger age groups, HIV prevalence pattern differs from the average pattern, indicating significant variation in HIV prevalence pattern in these cases. Our analysis identifies years since the introduction of antiretroviral therapy (ART) and maturity of the HIV epidemic as significantly correlated with HIV prevalence pattern for women and men in older age groups, and the proportion sexually active or proportion with condom use as factors among young women that are significantly correlated with HIV prevalence pattern. The significance of ART as a factor in particular points to the need for continuing to identify changes in HIV prevalence patterns over time, especially as access to ART may not be similar across all age groups.

Introduction

For generalized HIV epidemics, UNAIDS uses HIV surveillance data from antenatal clinics and, using the mathematical Estimation and Projection Package (EPP) in the Spectrum software, makes national-level estimates of HIV prevalence over time.[1] These prevalence estimates are further modified by calibrating to the proportion testing HIV-positive in national surveys, such as the Demographic and Health Surveys (DHS).[2] The HIV prevalence estimates from EPP are used in Spectrum to make historical estimates and future projections of indicators of interest, such as new infections by age and sex, HIV-positive population by age and sex, number of people needing ART, and number of mothers needing PMTCT services.[3]

While estimates from the DHS surveys are a more accurate representation of national prevalence than surveillance data, the DHS surveys are conducted only every five years. Also, HIV prevalence can be obtained only from recent DHS surveys, as HIV testing was not included in earlier surveys. Thus most countries have only one or two DHS surveys available for making HIV prevalence estimates.

Using surveys for measuring HIV incidence is more challenging than for measuring prevalence, and techniques for direct measurement are in the development stage.[4] Therefore, HIV incidence by age is estimated using mathematical modeling techniques. To break down new HIV infections by age and sex, Spectrum uses patterns of incidence ratios, i.e., ratios of incidence in each age group relative to incidence in age 25-29, and ratios of incidence among women relative to incidence among men. To obtain these ratios, HIV incidence is estimated using a technique developed by Hallett et al. [5, 6] The technique uses HIV prevalence in every five-year age group between age 15 and age 49 at two different time periods (i.e., two DHS surveys) and, assuming that the surveys represent the same population, estimates new infections as any change in prevalence over this time period, after accounting for mortality.[6] For countries with a single survey, the technique can still be applied by assuming that the HIV prevalence pattern remains constant over time. Results are combined across countries by taking the average value as an estimate of the general pattern, and this average pattern is applied to all countries with generalized epidemics.

This method provides a good approximation, as verified by comparing the incidence pattern it generates with the pattern generated by the ALPHA (Analyzing Longitudinal Population-based HIV/AIDS data on Africa) network study.[7] Although the same pattern of incidence by age is used in all countries with generalized epidemics, the pattern of prevalence by age produced by Spectrum does vary by country as a function of the maturity of the epidemic, past trends in incidence, and coverage of ART.

No formal analysis has been conducted to examine differences in patterns of HIV prevalence by age across all countries with at least one DHS survey. While differences in patterns of prevalence by age may not directly translate into differences in patterns of incidence by age, identifying any difference in prevalence patterns and the factors associated with the differences could identify potential areas for further investigation.

Methods

HIV Prevalence by Age

In this report we present HIV prevalence by age and sex, based on DHS survey data and estimate and compare patterns of HIV prevalence across countries. We obtain HIV prevalence for five-year age groups among women and men age 15-49 from 28 DHS surveys covering 19 countries. While all surveyed countries have HIV data for women age 15-49, some countries also have data for men up to age 50-54 or 55-59. For comparison purpose, we limit the analysis to age 15-49 for both men and women. We use STATA software to obtain prevalence (P) and its confidence intervals from DHS data. The 95% confidence intervals around the prevalence estimates are obtained using the logit transformation method.

HIV Prevalence Pattern by Age

We represent prevalence pattern as relative risk of prevalence. We express the relative risk (RR) of HIV prevalence in an age-group (a) as the prevalence (P) relative to that in age group 25-29, i.e.,

$$RR_a = \frac{P_a}{P_{25-29}},$$

and estimate the 95% confidence interval of relative risk as

$$[RR_a e^{-1.96SE}, RR_a e^{+1.96SE}]; SE = \sqrt{\frac{1 - P_a}{P_a} + \frac{1 - P_{25-29}}{P_{25-29}}}$$

Relative risks provide a common base for comparing across countries the variation or pattern in HIV prevalence in different age groups. We obtain an average pattern by averaging relative risks across the countries and we compare this average with relative risks in each country.

Identifying Behavioral Variables Correlated with Prevalence Patterns

We perform simple linear regression and principal component analysis to identify behavioral variables significantly correlated with prevalence patterns across countries. We extract all behavioral data from the DHS datasets and for behavioral variables of interest examine data in every five-year age group between 15 and 49, in comparison with a reference group, age 25-29. These variables include the percentage of respondents reporting having non-marital partners, having multiple partners, using a condom in last sex with non-marital partners among those reporting non-marital partners, using a condom in last sex with any partner among those with non-marital partners, using a condom in last sex among those with multiple partners, using a condom in last sex among those sexually active and, for men, having commercial sex, and being circumcised.

For each of these variables we test for significant differences across age in each country and, if p-value is greater than 0.05, indicating no significant difference by age, we set the relative values to 1 in all age groups of the corresponding country. The data show that male circumcision in most countries does not significantly differ with age, and hence we exclude this variable from the analysis.

For age 15-19 and 20-24 we consider additional variables, such as percentage having sex before age 15, or before age 18, the percentage unmarried and sexually active, and women reporting partners 10 or more years older than themselves (age-mixing), which we use in absolute values instead of relative values. In addition, because the surveys were conducted at different times, we also include as independent variables

the number of years since the introduction of treatment with antiretroviral therapy (ART) at the time of survey. These two variables are used for each of the age groups.

In the simple linear regressions (conducted using STATA software) we set relative risk of HIV prevalence as the dependent variable and test for the marginal effect of each behavioral variable on the HIV prevalence pattern. As some of the behavioral variables could be correlated, before performing multiple regressions to obtain unique effects of the behavioral variables on the HIV prevalence pattern, we perform principal component analysis (PCA) that transforms correlated variables into a set of uncorrelated *components* (new independent variables), and varimax rotation to maximize the correlation with the original variables. We retain components that account for the most variability and conduct a multiple linear regression with relative risk of HIV prevalence as the dependent variable and the components as the independent variables. PCA is conducted on standardized data (subtracting mean and dividing by standard deviation) because some of the variables have different units of measurement. We exclude the reference age group 25-29 from analysis and perform regressions on each age group separately.

Ratio of Female to Male HIV Prevalence in Each Age Group

In this report we present the relative risk of HIV prevalence in women compared with men by age group. Prevalence of HIV is generally lower among men than among women. [8] The doctoral dissertation by Hertog, [9] using DHS data, provides a comprehensive analysis on the differences in HIV prevalence among women compared with men, and on the factors that could affect these differences across countries. In Hertog's analysis, the factors creating the difference in HIV prevalence between women and men vary across countries. Peak incidence of HIV occurs at a younger age for women than for men. The cumulative risk of HIV incidence at age 15-49 is higher for women than for men, but the magnitude of the difference in cumulative risk is lower than for HIV prevalence. No specific risk factor accounts for the differences across countries. None of the explanatory variables (prevalence of male circumcision, sex ratio of premarital sex, or gender disparities in education and employment) explains the differences across countries.

Results

HIV Prevalence by Age

Figure 1 and Table 1 show HIV prevalence and confidence interval estimates for each country by age and sex. Countries with low HIV prevalence mostly have wider confidence intervals compared with high-prevalence countries, due to higher relative error. In several countries the confidence intervals are narrower in younger age groups and wider in older age groups, due to a smaller number of respondents in older age groups compared with younger age groups. In most countries HIV prevalence is lowest in the two youngest age groups (15-19 and 20-24), except for Sierra Leone and Burkina Faso, for women, and DRC and Ethiopia for men, where HIV prevalence is lowest in the oldest age group, but not significantly lower than in the younger age groups (overlapping confidence intervals).

Pearson's chi-square test comparing HIV prevalence between younger age groups 15-19, 20-24, and 25-29 in each country yields p-values of <0.05 in most countries, indicating significantly lower HIV prevalence in age 15-19 compared with age 20-24 or age 25-29, or significantly lower prevalence in age 20-24 compared with age 25-29 (Table 2). Pearson's chi-square test comparing HIV prevalence between age 25-29 and older five-year age groups indicates that for some countries there is not enough statistical evidence to conclude significant differences in prevalence across age groups (i.e., p-values >0.05). Among countries with significant differences in HIV prevalence by age (p-value <0.05), prevalence peaks mostly in age 25-29, 30-34, and 35-39 for women, and age 30-34, 35-39, and 40-44 for men (Table 2).

Figure 1w. Estimated HIV Prevalence and 95% confidence bounds for women (x-axis - age group; y-axis prevalence)

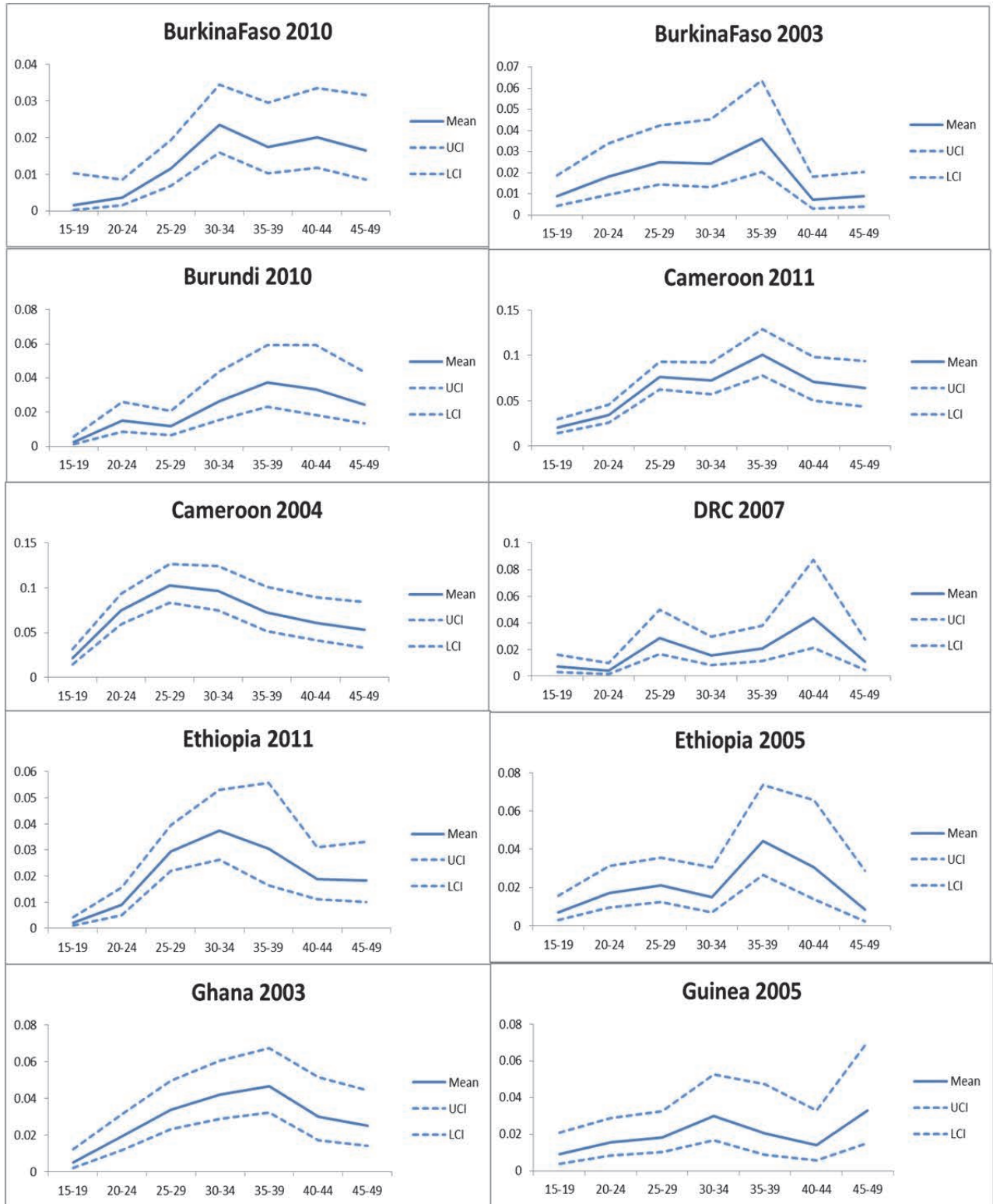


Figure 1w. (cont.) Estimated HIV Prevalence and 95% confidence bounds for women (x-axis - age group; y-axis prevalence)

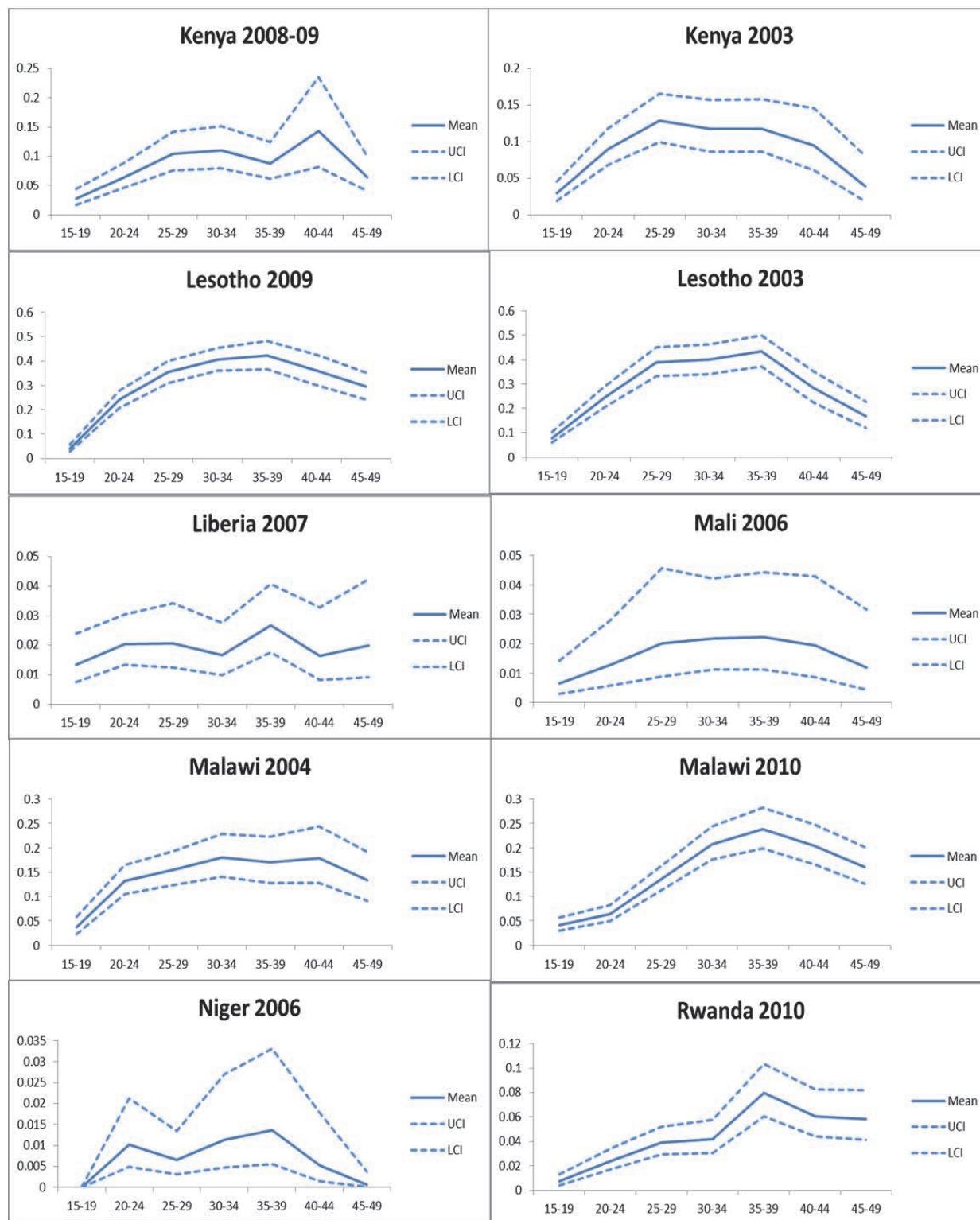


Figure 1w. (cont.) Estimated HIV Prevalence and 95% confidence bounds for women (x-axis - age group; y-axis prevalence)

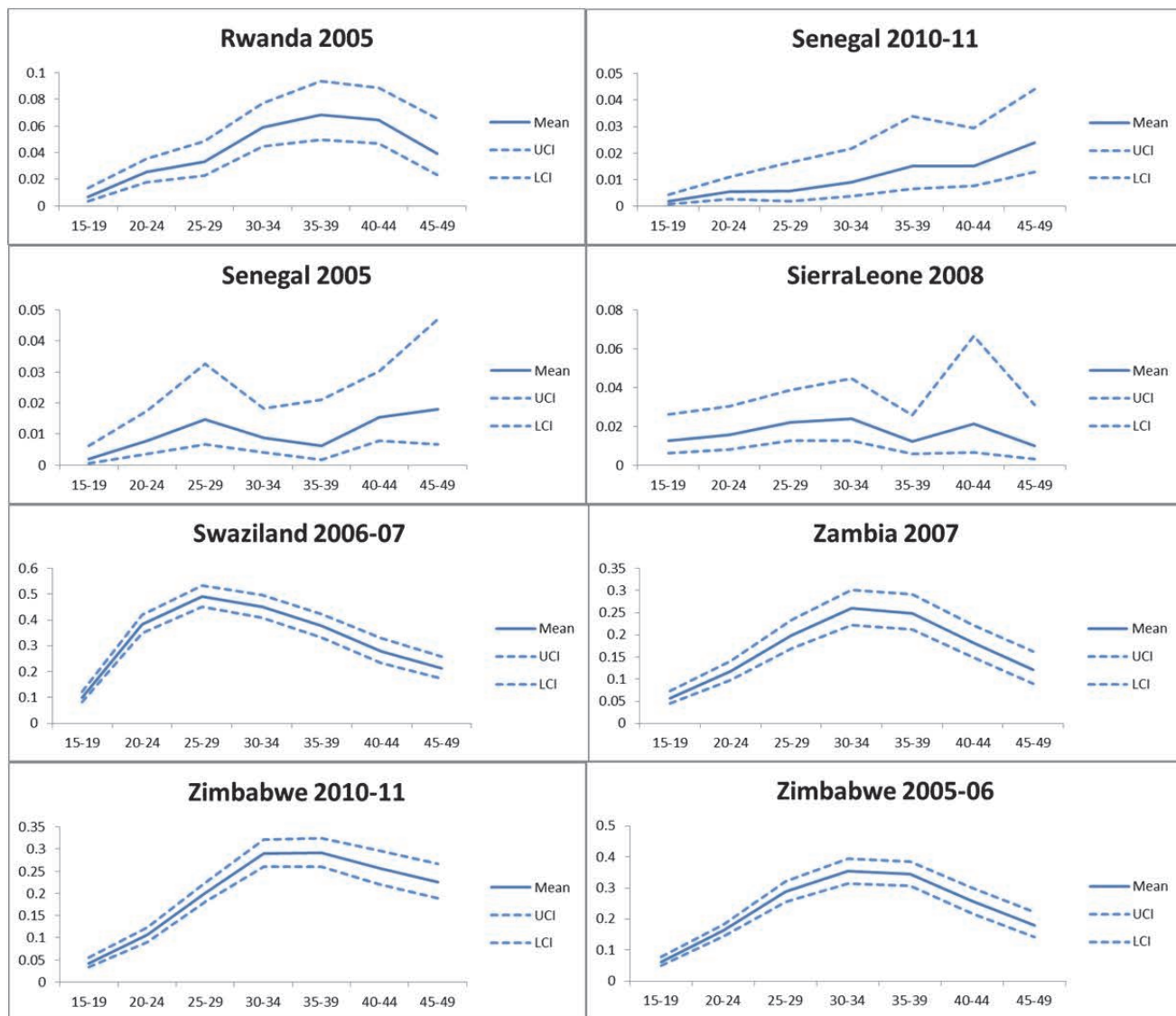


Figure 1m. Estimated HIV Prevalence and 95% confidence bounds for men (x-axis - age-group; y-axis – prevalence)

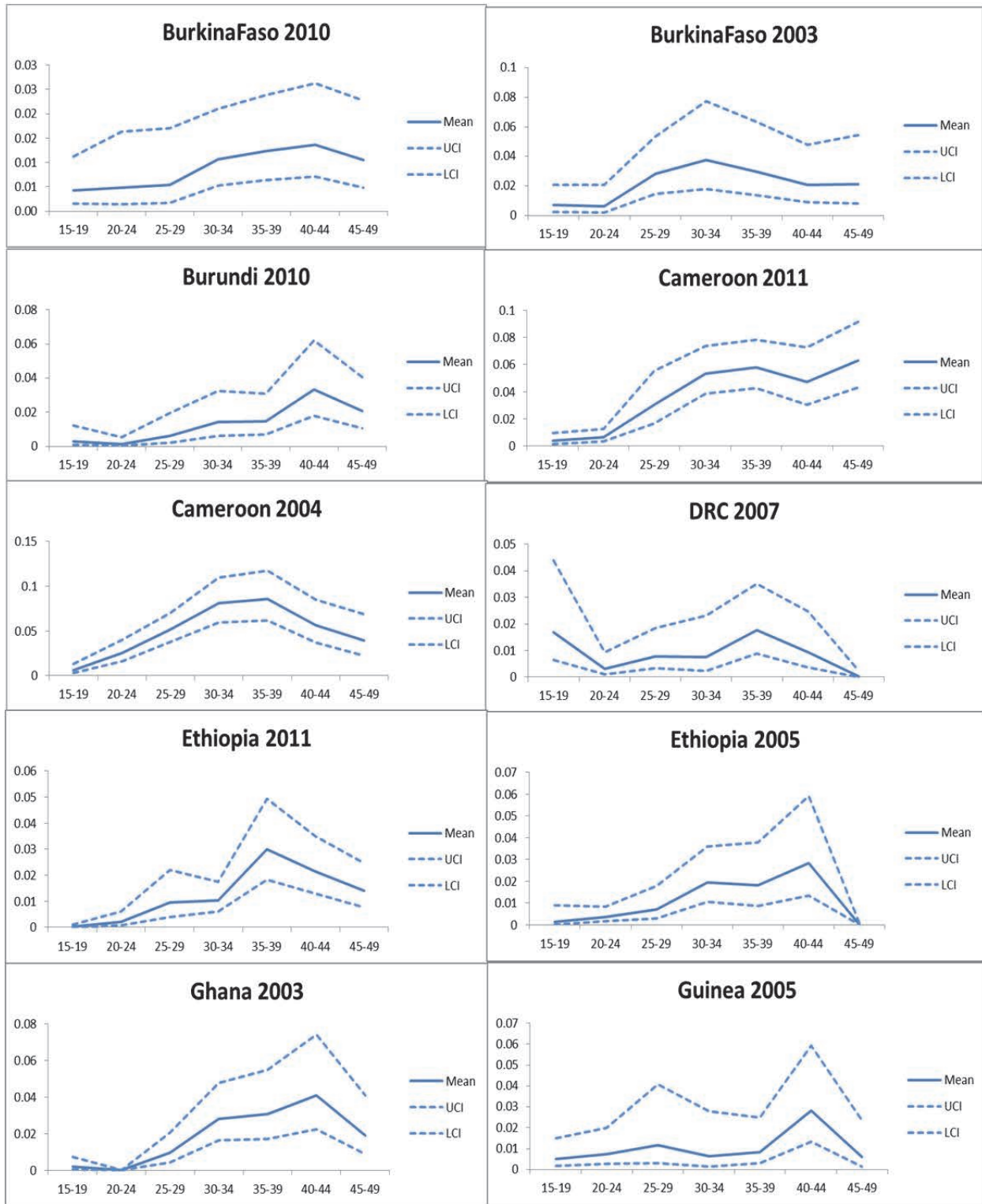


Figure 1m. (cont.) Estimated HIV Prevalence and 95% confidence bounds for men (x-axis - age-group; y-axis – prevalence)

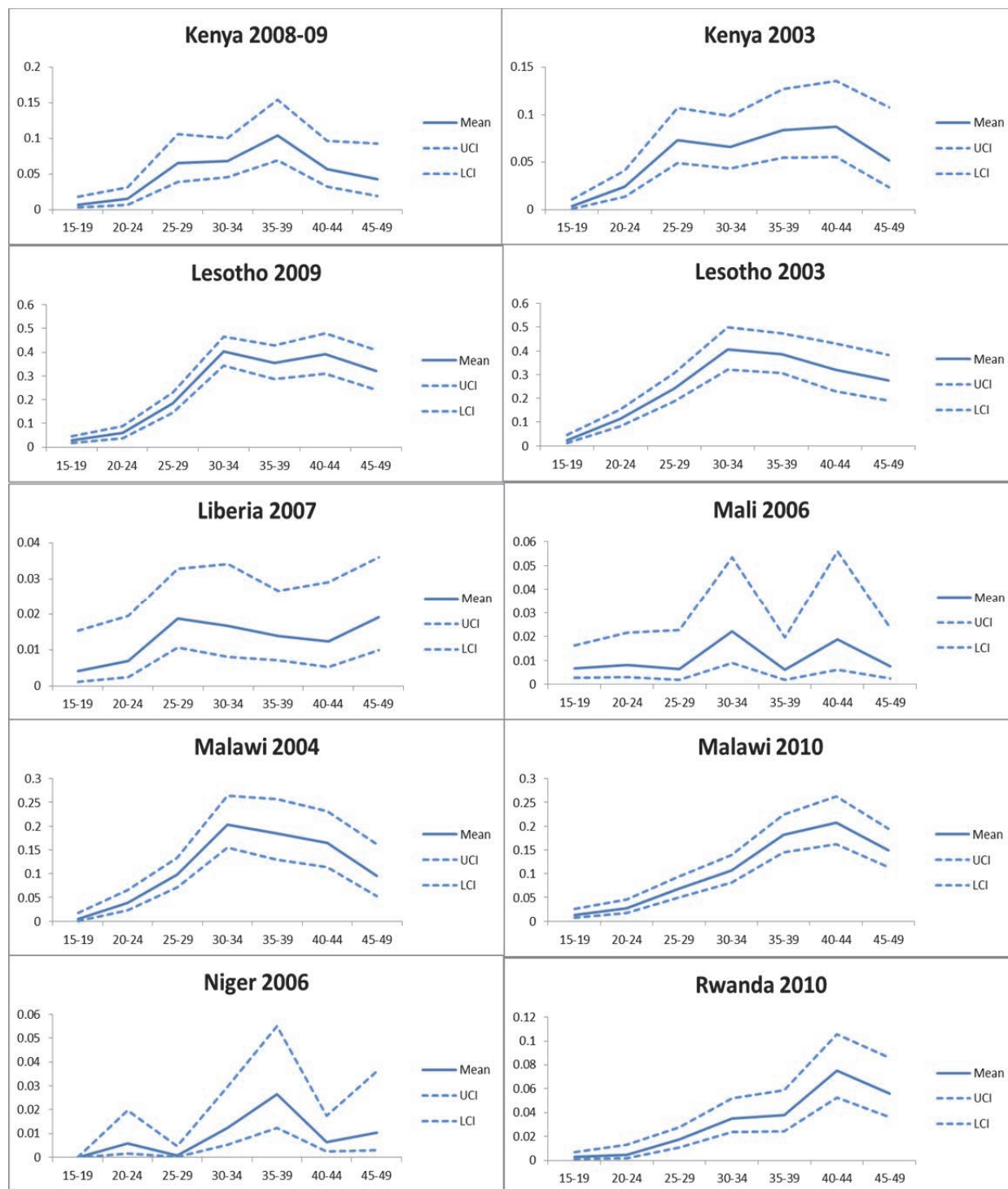


Figure 1m. (cont.) Estimated HIV Prevalence and 95% confidence bounds for men (x-axis - age-group; y-axis – prevalence)

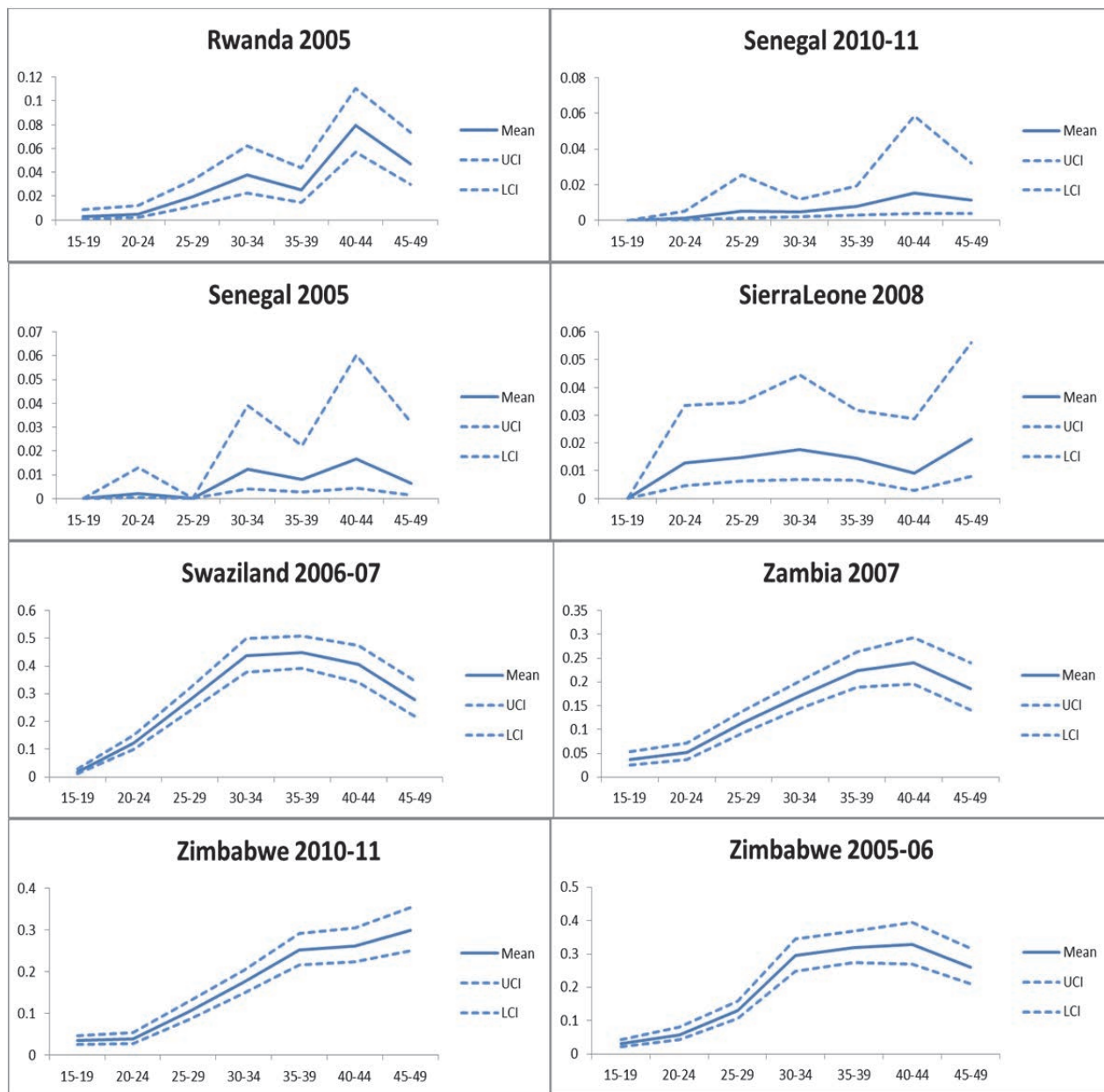


Table 1w. Estimated HIV prevalence and confidence bounds for women

Country	Survey Year	Age group							
		15-19	20-24	25-29	30-34	35-39	40-44	45-49	
Burkina Faso	2010	0.2 [0-1]	0.4 [0.2-0.9]	1.2 [0.7-1.9]	2.4 [1.6-3.4]	1.7 [1-3]	2.0 [1.2-3.4]	1.7 [0.9-3.2]	
Burkina Faso	2003	0.9 [0.4-1.9]	1.8 [1-3.4]	2.5 [1.5-4.2]	2.4 [1.3-4.5]	3.6 [2-6.4]	0.7 [0.3-1.8]	0.9 [0.4-2]	
Burundi	2010	0.3 [0.1-0.6]	1.5 [0.9-2.6]	1.2 [0.7-2.1]	2.6 [1.6-4.4]	3.7 [2.3-5.9]	3.3 [1.8-5.9]	2.4 [1.4-4.3]	
Cameroon	2011	2.0 [1.4-2.9]	3.4 [2.6-4.5]	7.6 [6.2-9.3]	7.3 [5.7-9.3]	10.0 [7.8-12.9]	7.1 [5-9.9]	6.4 [4.3-9.3]	
Cameroon	2004	2.1 [1.4-3.2]	7.5 [6-9.4]	10.3 [8.3-12.7]	9.7 [7.5-12.4]	7.3 [5.2-10.1]	6.1 [4.1-8.9]	5.3 [3.3-8.4]	
DRC	2007	0.7 [0.3-1.6]	0.4 [0.2-1]	2.9 [1.6-5]	1.6 [0.8-2.9]	2.1 [1.1-3.8]	4.4 [2.1-8.8]	1.1 [0.4-2.8]	
Ethiopia	2011	0.2 [0.1-0.4]	0.9 [0.5-1.6]	3.0 [2.2-4]	3.7 [2.6-5.3]	3.0 [1.6-5.6]	1.9 [1.1-3.1]	1.8 [1-3.3]	
Ethiopia	2005	0.7 [0.3-1.6]	1.7 [1-3.1]	2.1 [1.3-3.6]	1.5 [0.7-3.1]	4.4 [2.6-7.4]	3.1 [1.4-6.6]	0.9 [0.2-2.9]	
Ghana	2003	0.5 [0.2-1.2]	2.0 [1.2-3.2]	3.4 [2.3-5]	4.2 [2.9-6.1]	4.7 [3.2-6.7]	3.0 [1.7-5.2]	2.5 [1.4-4.4]	
Guinea	2005	0.9 [0.4-2.1]	1.6 [0.9-2.9]	1.8 [1-3.3]	3.0 [1.7-5.3]	2.1 [0.9-4.7]	1.4 [0.6-3.3]	3.3 [1.5-7.1]	
Kenya	2009	2.7 [1.7-4.4]	6.4 [4.6-8.9]	10.4 [7.6-14.2]	11.0 [7.9-15.2]	8.8 [6.2-12.4]	14.3 [8.2-23.6]	6.4 [4.1-9.9]	
Kenya	2003	3.0 [1.9-4.6]	9.0 [6.8-11.9]	12.9 [9.9-16.6]	11.7 [8.6-15.7]	11.8 [8.6-15.8]	9.5 [6.1-14.5]	3.9 [1.8-8.1]	
Lesotho	2009	4.1 [2.9-5.8]	24.1 [20.9-27.7]	35.4 [31-40.1]	40.7 [36-45.6]	42.3 [36.6-48.2]	36.1 [30.2-42.5]	29.5 [24.3-35.3]	
Lesotho	2003	7.9 [5.9-10.3]	24.5 [20.5-29]	39.0 [33.2-45.1]	40.1 [34-46.4]	43.5 [37.3-49.9]	28.5 [22.6-35.3]	16.8 [12.1-22.9]	
Liberia	2007	1.3 [0.7-2.4]	2.0 [1.3-3]	2.1 [1.3-3.4]	1.7 [1-2.8]	2.7 [1.8-4.1]	1.7 [0.8-3.3]	2.0 [0.9-4.2]	
Malawi	2010	4.2 [3-5.7]	6.4 [4.9-8.2]	13.5 [11.2-16.2]	20.8 [17.6-24.4]	23.8 [19.9-28.2]	20.4 [16.6-24.9]	16.1 [12.7-20.2]	
Malawi	2004	3.7 [2.3-5.8]	13.2 [10.5-16.5]	15.5 [12.4-19.3]	18.1 [14.1-22.8]	17.0 [12.8-22.3]	17.9 [12.8-24.4]	13.3 [9.1-19.2]	
Mali	2006	0.6 [0.3-1.4]	1.3 [0.6-2.8]	2.0 [0.9-4.6]	2.2 [1.1-4.2]	2.2 [1.1-4.4]	2.0 [0.9-4.3]	1.2 [0.5-3.2]	
Niger	2006	-	1.0 [0.5-2.1]	0.7 [0.3-1.4]	1.1 [0.5-2.7]	1.4 [0.6-3.3]	0.5 [0.2-1.8]	0.1 [0-0.4]	
Rwanda	2010	0.8 [0.4-1.3]	2.4 [1.7-3.4]	3.9 [3-5.2]	4.2 [3.1-5.8]	8.0 [6.1-10.3]	6.1 [4.4-8.3]	5.8 [4.1-8.2]	
Rwanda	2005	0.7 [0.4-1.4]	2.5 [1.8-3.5]	3.3 [2.3-4.9]	5.9 [4.5-7.8]	6.9 [5-9.4]	6.5 [4.7-8.9]	4.0 [2.3-6.6]	
Senegal	2011	0.2 [0.1-0.4]	0.5 [0.3-1.1]	0.6 [0.2-1.6]	0.9 [0.4-2.2]	1.5 [0.7-3.4]	1.5 [0.8-3]	2.4 [1.3-4.4]	
Senegal	2005	0.2 [0.1-0.6]	0.8 [0.4-1.8]	1.5 [0.7-3.3]	0.9 [0.4-1.8]	0.6 [0.2-2.1]	1.5 [0.8-3]	1.8 [0.7-4.7]	
Sierra Leone	2008	1.3 [0.6-2.6]	1.6 [0.8-3]	2.2 [1.3-3.9]	2.4 [1.3-4.5]	1.2 [0.6-2.6]	2.1 [0.7-6.7]	1.0 [0.3-3.1]	
Swaziland	2007	10.1 [8.3-12.2]	38.4 [35-41.9]	49.2 [45.1-53.3]	45.2 [41-49.6]	37.7 [33.3-42.4]	27.9 [23.3-33]	21.4 [17.4-26]	
Zambia	2007	5.7 [4.4-7.4]	11.8 [9.8-14.1]	19.9 [16.9-23.4]	26.0 [22.3-30.1]	24.9 [21.2-29.1]	18.3 [14.9-22.3]	12.2 [9-16.3]	
Zimbabwe	2011	4.2 [3.3-5.4]	10.6 [9-12.3]	20.1 [18-22.4]	29.0 [26-32.2]	29.1 [25.9-32.5]	25.7 [22-29.6]	22.6 [18.9-26.7]	
Zimbabwe	2005-06	6.2 [4.9-7.8]	16.3 [14.6-18.3]	28.8 [25.6-32.3]	35.5 [31.6-39.6]	34.5 [30.7-38.6]	25.7 [21.8-30.1]	18.0 [14.3-22.4]	

Table 1m. Estimated HIV prevalence and confidence bounds for men

Country	Survey Year	Age Group							
		15-19	20-24	25-29	30-34	35-39	40-44	45-49	
Burkina Faso	2010	0.4 [0.2-1.1]	0.5 [0.2-1.6]	0.5 [0.2-1.7]	1.1 [0.5-2.1]	1.2 [0.6-2.4]	1.4 [0.7-2.6]	1.1 [0.5-2.3]	
Burkina Faso	2003	0.7 [0.2-2]	0.6 [0.2-2.1]	2.8 [1.5-5.3]	3.8 [1.8-7.7]	3.0 [1.4-6.3]	2.1 [0.9-4.8]	2.1 [0.8-5.4]	
Burundi	2010	0.3 [0.1-1.2]	0.1 [0-0.5]	0.6 [0.2-2]	1.4 [0.6-3.3]	1.5 [0.7-3.1]	3.3 [1.8-6.2]	2.1 [1-4]	
Cameroon	2011	0.4 [0.1-1]	0.6 [0.3-1.3]	3.0 [1.6-5.5]	5.3 [3.8-7.4]	5.8 [4.3-7.8]	4.7 [3-7.3]	6.3 [4.3-9.2]	
Cameroon	2004	0.6 [0.3-1.3]	2.5 [1.6-4]	5.1 [3.7-7]	8.1 [5.9-11]	8.6 [6.2-11.8]	5.6 [3.7-8.5]	3.9 [2.2-6.9]	
DRC	2007	1.7 [0.6-4.4]	0.3 [0.1-0.9]	0.8 [0.3-1.8]	0.8 [0.2-2.3]	1.8 [0.9-3.5]	0.9 [0.4-2.5]	0.0 [0-0.2]	
Ethiopia	2011	0.0 [0-0.1]	0.2 [0.1-0.6]	0.9 [0.4-2.2]	1.0 [0.6-1.8]	3.0 [1.8-4.9]	2.1 [1.3-3.5]	1.4 [0.8-2.5]	
Ethiopia	2005	0.1 [0-0.9]	0.4 [0.2-0.8]	0.7 [0.3-1.8]	1.9 [1.1-3.6]	1.8 [0.9-3.8]	2.8 [1.3-5.9]	0.0 [0-0.1]	
Ghana	2003	0.2 [0-0.7]	-	1.0 [0.4-2.1]	2.8 [1.6-4.8]	3.1 [1.7-5.5]	4.1 [2.2-7.4]	1.9 [0.9-4.1]	
Guinea	2005	0.5 [0.2-1.5]	0.7 [0.3-2]	1.2 [0.3-4.1]	0.7 [0.2-2.8]	0.9 [0.3-2.5]	2.8 [1.3-5.9]	0.6 [0.1-2.4]	
Kenya	2009	0.7 [0.3-1.8]	1.5 [0.7-3.1]	6.5 [3.9-10.6]	6.8 [4.6-10]	10.4 [6.9-15.4]	5.7 [3.3-9.7]	4.3 [1.9-9.3]	
Kenya	2003	0.4 [0.1-1.1]	2.4 [1.4-4.1]	7.3 [4.9-10.7]	6.6 [4.4-9.9]	8.4 [5.5-12.7]	8.8 [5.6-13.6]	5.2 [2.4-10.8]	
Lesotho	2009	2.9 [1.8-4.7]	5.9 [3.9-8.9]	18.4 [14.6-22.9]	40.2 [34.2-46.5]	35.4 [28.6-42.9]	39.3 [31.1-48]	32.1 [24.3-41]	
Lesotho	2003	2.3 [1.2-4.6]	11.4 [8.3-15.3]	24.3 [18.8-30.8]	40.7 [32.2-49.9]	38.7 [30.7-47.4]	32.1 [22.9-43]	27.6 [19-38.3]	
Liberia	2007	0.4 [0.1-1.5]	0.7 [0.3-2]	1.9 [1.1-3.3]	1.7 [0.8-3.4]	1.4 [0.7-2.7]	1.2 [0.5-2.9]	1.9 [1-3.6]	
Malawi	2010	1.3 [0.7-2.5]	2.8 [1.7-4.5]	6.9 [5-9.5]	10.7 [8.2-13.9]	18.2 [14.5-22.5]	20.8 [16.2-26.2]	15.0 [11.4-19.5]	
Malawi	2004	0.4 [0.1-1.7]	3.9 [2.2-6.6]	9.8 [7.1-13.4]	20.4 [15.5-26.4]	18.4 [12.9-25.7]	16.5 [11.4-23.2]	9.5 [5.4-16.3]	
Mali	2006	0.7 [0.3-1.6]	0.8 [0.3-2.2]	0.6 [0.2-2.3]	2.2 [0.9-5.4]	0.6 [0.2-2]	1.9 [0.6-5.6]	0.8 [0.2-2.4]	
Niger	2006	-	0.6 [0.2-2]	0.1 [0-0.5]	1.2 [0.5-3]	2.6 [1.2-5.5]	0.6 [0.2-1.8]	1.1 [0.3-3.6]	
Rwanda	2010	0.3 [0.1-0.7]	0.5 [0.2-1.3]	1.8 [1.1-2.8]	3.5 [2.4-5.2]	3.8 [2.5-5.9]	7.5 [5.3-10.6]	5.6 [3.6-8.6]	
Rwanda	2005	0.3 [0.1-0.9]	0.5 [0.2-1.2]	2.0 [1.2-3.3]	3.8 [2.3-6.2]	2.5 [1.4-4.4]	8.0 [5.7-11.1]	4.7 [3-7.4]	
Senegal	2011	-	0.1 [0-0.5]	0.5 [0.1-2.5]	0.5 [0.2-1.2]	0.8 [0.3-1.9]	1.6 [0.4-5.9]	1.2 [0.4-3.2]	
Senegal	2005	-	0.2 [0-1.3]	-	1.2 [0.4-3.9]	0.8 [0.3-2.2]	1.7 [0.4-6]	0.6 [0.1-3.2]	
Sierra Leone	2008	-	1.3 [0.5-3.4]	1.5 [0.6-3.5]	1.8 [0.7-4.5]	1.4 [0.7-3.2]	0.9 [0.3-2.9]	2.1 [0.8-5.6]	
Swaziland	2007	1.9 [1.2-3]	12.3 [10-15.2]	27.8 [23.9-32.1]	43.8 [37.7-50]	44.9 [39.3-50.7]	40.7 [34.2-47.5]	27.9 [22-34.6]	
Zambia	2007	3.6 [2.5-5.3]	5.2 [3.7-7.2]	11.4 [9.4-13.9]	17.1 [14.4-20.3]	22.4 [18.9-26.3]	24.1 [19.5-29.3]	18.6 [14.2-24]	
Zimbabwe	2011	3.4 [2.5-4.6]	3.9 [2.8-5.4]	10.3 [8.4-12.7]	17.4 [14.8-20.3]	25.1 [21.5-29.2]	26.2 [22.3-30.5]	29.9 [25-35.4]	
Zimbabwe	2005-06	3.1 [2.1-4.4]	5.8 [4.2-8.1]	13 [10.6-15.9]	29.5 [24.9-34.5]	32.1 [27.5-37]	33.0 [27-39.5]	26.1 [21.1-31.7]	

Table 2. Significance of difference in HIV prevalence in younger and older age groups

Country	Survey year	p-value: comparing age groups 15-19, 20-24, and 25-29 [‡]		p-value: comparing age groups 25-29 and older [‡]		Age group of peak prevalence	
		Women	Men	Women	Men	Women	Men
BurkinaFaso	2010	0.0117*	0.8566	0.2735	0.5997	30-34	40-44
BurkinaFaso	2003	-	0.0104*	0.0224*	0.7882	35-39	30-34
Burundi	2010	0.002*	0.2787	0.0384*	0.0394*	35-39	40-44
Cameroon	2011	0*	0*	0.1769	0.1412	35-39	45-49
Cameroon	2004	0*	0*	0.018*	0.0287*	25-29	35-39
DRC	2007	0*	0.0465*	0.0764	0.092	40-44	35-39
Ethiopia	2011	0*	0*	0.255	0.0136*	30-34	35-39
Ethiopia	2005	0.0453*	0.1534	0.0367*	0.0138*	35-39	40-44
Ghana	2003	0.0001*	0.0065*	0.3449	0.0347*	35-39	40-44
Guinea	2005	0.3116	0.5727	0.4744	0.1029	45-49	40-44
Kenya	2009	0*	0*	0.2188	0.1854	40-44	35-39
Kenya	2003	0*	0*	0.0282*	0.6896	25-29	40-44
Lesotho	2009	0*	0*	0.0192*	0*	35-39	30-34
Lesotho	2003	0*	0*	0*	0.0115*	35-39	30-34
Liberia	2007	0.4464	0.0346*	0.7215	0.8911	35-39	45-49
Malawi	2010	0*	0*	0*	0*	35-39	40-44
Malawi	2004	0*	0*	0.6722	0.0018*	30-34	30-34
Mali	2006	0.1606	0.9295	0.9073	0.2227	35-39	30-34
Niger	2006	0.0202*	0.043*	0.1598	0.0091*	35-39	35-39
Rwanda	2010	0*	0.0004*	0.0018*	0*	35-39	40-44
Rwanda	2005	0*	0.0002*	0.0186*	0*	35-39	40-44
Senegal	2011	0.2353	0.0992	0.1389	0.5161	45-49	40-44
Senegal	2005	0.0136*	-	0.541	0.25	45-49	40-44
SierraLeone	2008	0.4333	0.0597	0.5789	0.8541	30-34	45-49
Swaziland	2007	0*	0*	0*	0*	25-29	35-39
Zambia	2007	0*	0*	0*	0*	30-34	40-44
Zimbabwe	2011	0*	0*	0*	0*	35-39	45-49
Zimbabwe	2005-06	0*	0*	0*	0*	30-34	40-44

*Significant at level 0.05

‡ Pearson's chi-square test to compare prevalence across age groups

- Not available

HIV Prevalence Patterns by Age

Figure 2 presents the relative risks of HIV prevalence by age, relative to prevalence in age 25-29. These patterns are similar to those in Figure 1, but the relative values provide a common scale for comparing the pattern in age groups across countries. Comparisons of confidence intervals among pairs of countries show that, for women, there are some country pairs in each age group where the confidence intervals do not overlap, indicating significant differences in prevalence patterns between these country pairs (data not shown). For men, the number of such non-overlapping country pairs is much smaller than for women, probably because of wider confidence intervals due to smaller samples of survey respondents among men than among women.

Figure 2 compares the confidence intervals for HIV prevalence by age with the average pattern (red line) derived from all data sets. For most countries the average pattern falls within the confidence bounds of the country-specific prevalence pattern (Figure 2), indicating, with the current data, we cannot conclude significance differences in prevalence patterns across countries. Note that, for men, relative risks of HIV prevalence in Niger range from 16 to 40 in the older age groups compared with a range of 1 to 4 in most other countries; hence the data for Niger were eliminated from the average calculation.

Figure 2w. Relative risks of prevalence by age group relative to prevalence in age group 25-29 for women (x-axis - age-group; y-axis – prevalence)

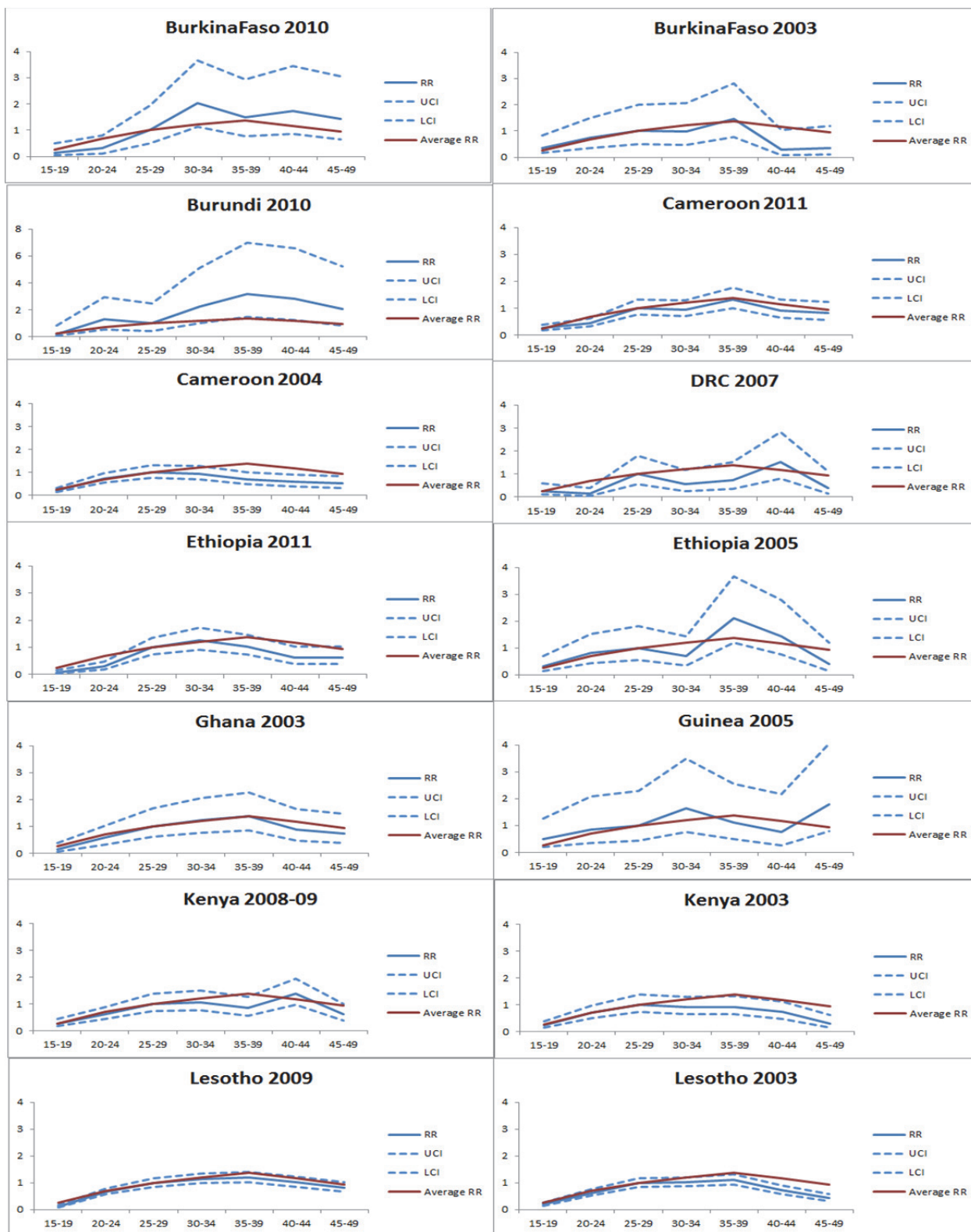


Figure 2w. (cont.) Relative risks of prevalence by age group relative to prevalence in age group 25-29 for women (x-axis - age-group; y-axis – prevalence)

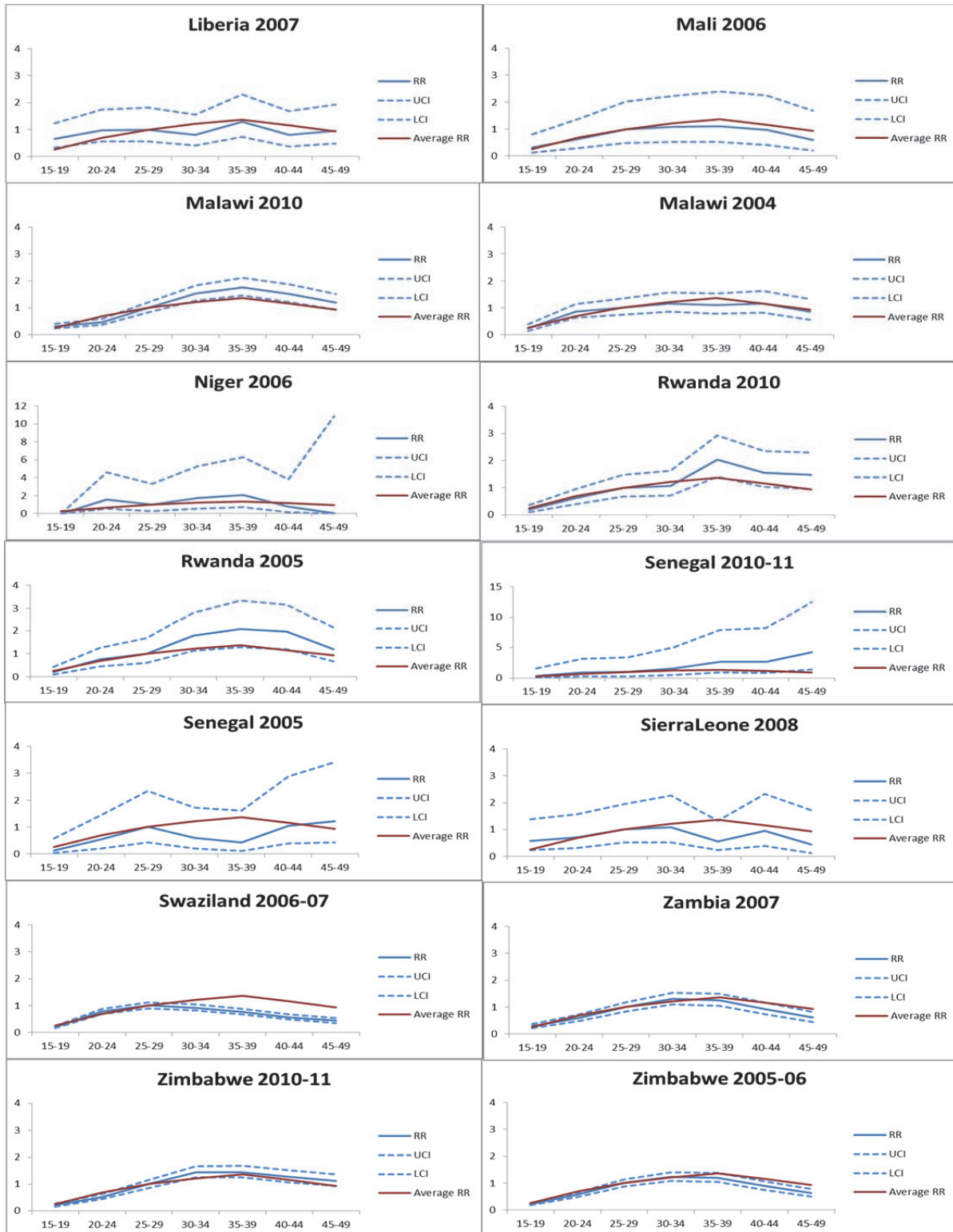


Figure 2m. Relative risks of prevalence by age group relative to prevalence in age group 25-29 for men (x-axis - age-group; y-axis – prevalence)

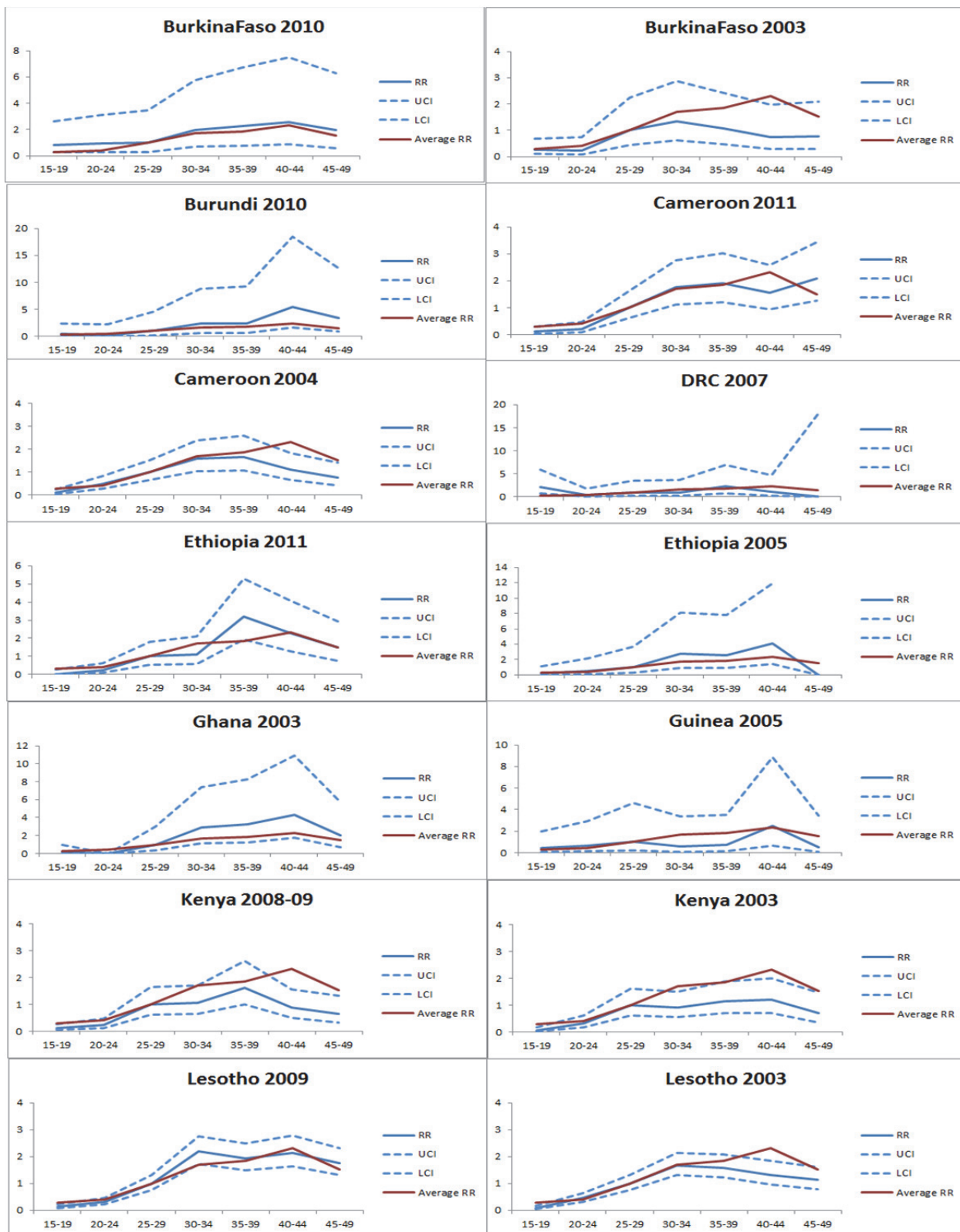
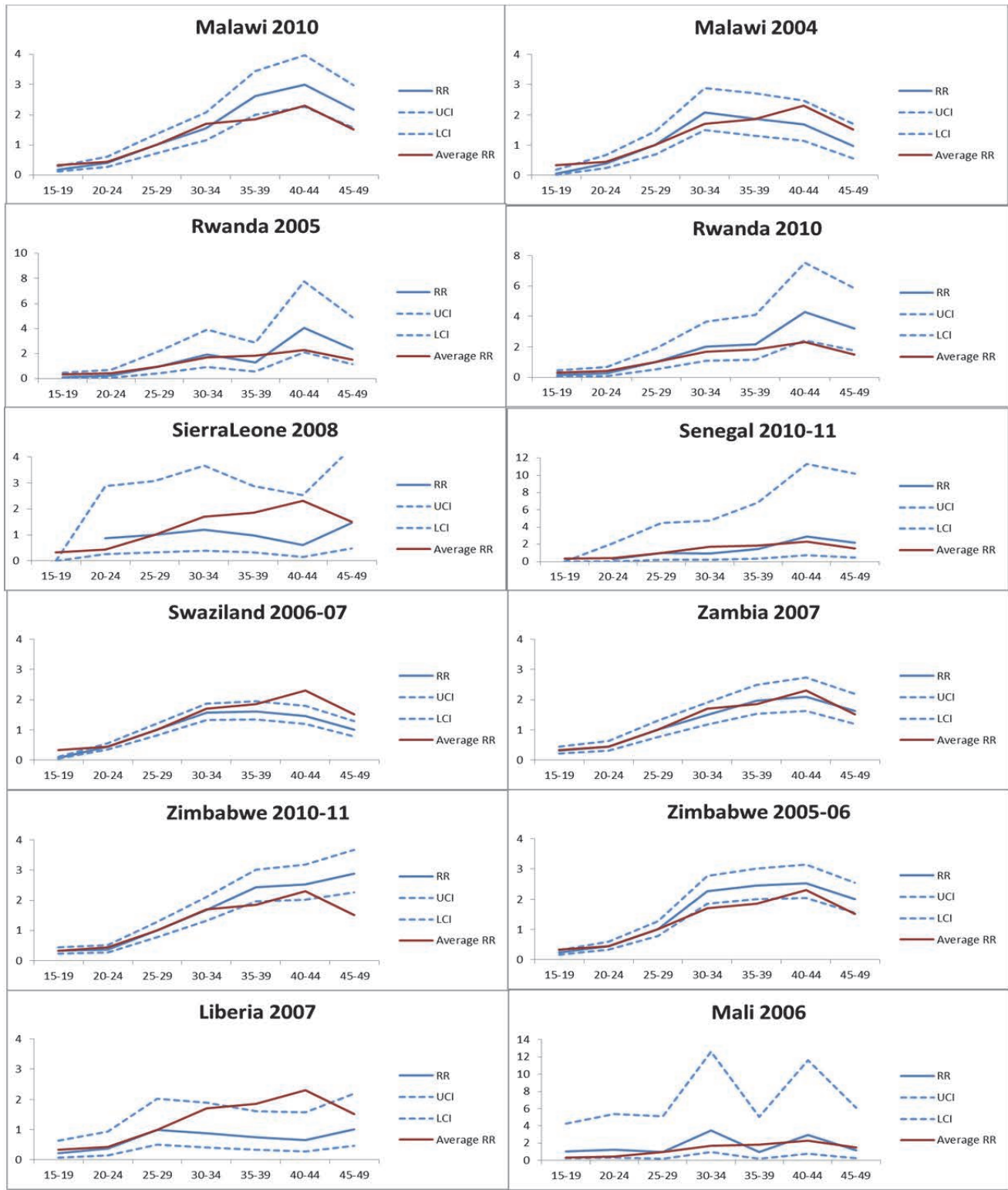


Figure 2m. (cont.) Relative risks of prevalence by age group relative to prevalence in age group 25-29 for men (x-axis - age-group; y-axis – prevalence)



Correlation between Behavioral Factors and HIV Prevalence Patterns

Tables 3.1.w to 3.8.m present data for the independent variables. For women age 15-19, simple linear regression identifies 'percent unmarried sexually active' to be positively correlated with relative risk of HIV prevalence (Table 4a). As expected, this variable is highly correlated with 'percent with non-marital partners' in this age group (data not shown), however, the 'relative value of percent with non-marital partners' (relative to age 25-29) is not statistically significant. The reason is the difference in marital status in age 15-19 compared with age 25-29. In the population age 15-19, most are unmarried and thus those 'unmarried and sexually active' and those with 'non-marital partners' are probably equal in this age group. In contrast, in the population age 25-29, those with 'non-marital partners' could include married as well as unmarried men and women.

For women age 20-24, 30-34, and 35-39, none of the observed variables is statistically significant with relative risk of HIV prevalence. For women age 40-44 and 45-49, 'year of survey' and 'year of ART introduction' are positively correlated with HIV prevalence.

For men age 30-34, the 'relative value of condom use at last sex among those with multiple partners' (compared with the reference group, age 25-29) is positively correlated with relative risk of HIV prevalence, which is counterintuitive (Table 4b). Further analysis reveals that this finding is probably due to a positive correlation between absolute values of 'condom use at last sex among those with multiple partners' and 'percent with multiple partners' in age 30-34 but not in the reference group age 25-29 (data not shown).

For men age 45-49, 'year of survey' and 'year of ART introduction' are positively correlated with HIV prevalence. All of the other age categories have no variables significantly associated with relative risk of HIV prevalence.

In all age groups of women and men, from the components generated by PCA, 80 percent to 85 percent of the variance in data is accounted for in three to five components with an Eigen value greater than or very close to 1. These components are retained for further analysis while the remaining components are eliminated from subsequent analysis, as they contribute little information. Each of these new components generated by PCA is a linear regression of the standardized original variables, and therefore, is representative of the variables with relatively high loadings, i.e., high coefficients usually <-0.5 or >0.5 . Performing multiple linear regressions with the retained components as the independent variables and relative risk of HIV prevalence as the dependent variable identifies components with a significant unique association with HIV prevalence.

In PCA analysis for women age 15-19, 'percent unmarried sexually active' and 'percent sex before 15' both load highly on the retained component c3. This component has a significant positive correlation with relative risk of HIV prevalence (Table 5a). For women age 20-24, condom use among those with non-marital partners has a high loading on component c3, which is significantly correlated with relative risk of HIV prevalence. For women age 40-44, 'year of survey' and 'year of ART introduction' are positively correlated with component c1 of PCA, which is significantly correlated with relative risk of HIV prevalence. For women in the remaining age groups, 30-34, 35-39, and 45-49, none of the retained components has a significant correlation with relative risk of HIV prevalence.

In all age groups of women, most of the original variables have high loadings on one of the retained components, except for 'age-mixing' in age 15-19 and 'relative value of percent with multiple partners' in some of the older age groups, which do not have high loadings, indicating that they add little variance to the data. In addition, PCA components indicate that 'year of survey' and 'year of ART introduction' are

correlated with each other, and relative values of ‘percent with non-marital partners’ and ‘condom use at last sex’ are correlated with each other in all age groups (Table 5a).

For men, multiple regressions on PCA components identify no components significantly correlated with relative risk of HIV prevalence (Table 5b). The variables that do not have high loadings on any of the retained components in PCA (indicating that they do not contribute much variance in data) include ‘percent in commercial sex’ in age 15-19, 20-24, and 30-34, and relative values of ‘percent with multiple partners’ and ‘condom use among those with non-marital partners’ for men in some of the older age groups. For men, as was the case for women, ‘condom use at last sex’ correlates with ‘percent with non-marital partners’, but only at age 30-34 and younger age groups.

Table 3.1w. Behavioral data extracted from DHS datasets for women: percent with non-marital partners

Country	Year of survey	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Burkina Faso	2010	32.44	14.82	6.09	2.94	1.57	1.07	1.78
Burkina Faso	2003	39.17	15.78	6.47	3.76	3.62	2.37	1.17
Burundi	2010	24.13	3.94	3.11	1.78	2.41	3.08	1.13
Cameroon	2011	60.21	39.81	25.56	18.21	17.13	14.99	14.44
Cameroon	2004	58.24	38.55	23.49	19.15	18.42	16.70	16.06
DRC	2007	60.06	26.83	15.09	10.60	7.64	9.78	7.30
Ethiopia	2011	8.87	7.23	3.46	2.24	3.08	1.39	3.72
Ethiopia	2005	7.73	6.51	2.21	2.71	1.84	2.35	2.01
Ghana	2003	77.59	41.96	18.81	8.12	8.11	8.40	7.41
Guinea	2005	52.03	31.48	13.06	9.73	5.75	7.56	4.70
Kenya	2008-09	54.62	24.18	14.01	11.65	9.30	12.82	9.28
Kenya	2003	46.71	21.43	13.78	10.04	10.93	10.95	10.25
Lesotho	2009	65.46	37.20	30.66	30.22	26.99	29.41	28.20
Lesotho	2003	58.48	38.22	33.80	29.85	33.87	36.61	30.32
Liberia	2007	79.76	51.52	31.90	22.12	14.74	15.80	12.15
Malawi	2010	35.89	9.60	5.30	5.62	4.44	4.54	3.79
Malawi	2004	28.65	8.10	5.47	5.17	4.41	3.40	3.16
Mali	2006	20.41	9.86	3.40	2.83	1.04	1.46	1.41
Niger	2006	0.86	1.34	1.12	0.97	1.11	0.25	0.25
Rwanda	2010	55.33	14.73	6.66	4.59	5.15	6.92	6.30
Rwanda	2005	51.99	8.60	5.37	5.04	6.96	6.75	3.44
Senegal	2011	15.08	8.36	3.92	3.80	4.09	2.51	1.16
Senegal	2005	13.38	8.81	6.20	4.04	4.06	3.55	1.36
Sierra Leone	2008	64.02	37.50	18.83	18.77	11.38	12.65	9.66
Swaziland	2006-07	82.39	60.22	40.19	31.73	21.64	20.14	17.95
Zambia	2007	51.80	19.73	12.79	11.04	8.22	10.92	4.14
Zimbabwe	2010-11	21.58	13.20	10.94	10.28	9.00	10.23	8.27
Zimbabwe	2005-06	24.08	12.97	8.29	9.46	9.45	7.91	6.58

*Un-weighted sample size less than 25, and hence, was excluded from analysis; NA: not available

Table 3.2w. Behavioral data extracted from DHS datasets for women: Percent with multiple partners

Country	Year of survey	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Burkina Faso	2010	0.93	0.95	0.56	0.47	0.24	0.14	0.08
Burkina Faso	2003	1.63	1.52	0.74	1.33	0.56	0.63	0.11
Burundi	2010	0.29	0.30	0.42	0.36	0.34	0.11	0.00
Cameroon	2011	4.05	9.05	8.43	5.48	5.84	4.18	2.58
Cameroon	2004	5.55	8.42	6.65	5.16	4.69	3.98	4.05
DRC	2007	3.24	3.96	3.47	2.95	3.48	2.69	3.34
Ethiopia	2011	0.31	0.80	0.63	0.42	0.44	0.20	0.44
Ethiopia	2005	13.28	37.60	49.00	52.26	51.40	51.87	54.34
Ghana	2003	1.54	1.95	0.38	0.61	1.71	0.54	0.25
Guinea	2005	2.96	2.35	2.68	2.40	1.66	1.58	1.61
Kenya	2008-09	1.29	1.92	1.40	1.31	2.28	0.47	0.38
Kenya	2003	1.55	1.80	2.43	1.80	2.07	2.66	2.61
Lesotho	2009	2.61	7.03	9.92	11.27	9.32	11.15	9.19
Lesotho	2003	2.83	6.48	9.85	12.44	10.03	9.81	9.88
Liberia	2007	9.07	10.03	11.02	8.28	7.08	7.75	6.39
Malawi	2010	0.81	0.96	0.77	0.86	0.74	0.60	0.97
Malawi	2004	1.02	1.26	0.88	0.58	0.59	0.44	0.22
Mali	2006	1.97	1.59	0.56	1.98	0.46	1.71	0.78
Niger	2006	0.71	0.99	1.03	1.13	0.85	1.13	0.24
Rwanda	2010	0.32	0.88	0.68	0.48	0.58	0.52	0.96
Rwanda	2005	0.13	0.48	0.40	0.54	0.37	0.22	0.12
Senegal	2011	0.12	0.50	0.65	0.60	0.91	0.26	0.18
Senegal	2005	1.02	1.37	1.82	1.52	1.93	2.42	2.81
Sierra Leone	2008	4.20	5.37	6.54	7.06	7.19	7.25	6.47
Swaziland	2006-07	1.35	3.05	2.32	1.48	0.73	0.52	0.26
Zambia	2007	1.90	0.95	1.16	1.20	1.54	1.20	0.15
Zimbabwe	2010-11	1.68	2.91	2.03	1.60	2.02	3.20	3.53
Zimbabwe	2005-06	0.90	1.12	1.06	1.09	0.87	0.59	0.34

*Un-weighted sample size less than 25, and hence, was excluded from analysis; NA: not available

Table 3.3w. Behavioral data extracted from DHS datasets for women: Percent using condom at last sex with non-marital partner among those with non-marital partner in past 12 months

Country	Year of survey	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Burkina Faso	2010	52.44	70.39	59.26	55.11	52.12	16.68	22.73
Burkina Faso	2003	46.43	67.40	56.19	70.57	25.99	38.26	6.62
Burundi	2010	21.59	32.45	15.10	28.82	*	*	*
Cameroon	2011	56.17	56.13	50.79	34.70	32.28	25.44	27.20
Cameroon	2004	47.09	45.44	39.76	34.23	27.75	23.13	10.72
DRC	2007	12.41	22.23	14.36	16.90	11.61	15.39	11.68
Ethiopia	2011	40.63	27.61	28.95	32.57	5.06	*	*
Ethiopia	2005	24.85	23.00	25.53	*	*	*	*
Ghana	2003	33.50	31.95	27.40	15.40	10.46	10.66	11.92
Guinea	2005	24.24	28.42	32.22	25.44	17.10	9.40	16.70
Kenya	2008-09	40.49	37.23	31.86	27.25	29.45	29.45	19.84
Kenya	2003	23.42	27.63	25.77	22.77	22.96	23.67	0.00
Lesotho	2009	62.09	65.81	72.86	69.03	65.50	59.01	41.92
Lesotho	2003	48.09	50.84	47.26	36.83	26.84	23.39	15.54
Liberia	2007	11.77	16.05	16.74	15.50	7.19	13.27	2.29
Malawi	2010	43.55	49.26	45.52	21.15	41.67	27.77	51.04
Malawi	2004	34.88	35.39	26.59	22.89	8.87	13.40	*
Mali	2006	13.64	19.23	17.65	15.78	18.48	*	*
Niger	2006	*	*	*	*	*	*	*
Rwanda	2010	40.96	39.26	36.28	38.29	21.43	20.25	19.62
Rwanda	2005	26.13	24.02	19.43	16.09	13.92	4.54	*
Senegal	2011	37.69	44.96	41.33	37.87	38.43	53.82	*
Senegal	2005	30.50	37.66	44.47	32.21	33.94	37.69	*
Sierra Leone	2008	7.43	11.74	5.51	2.37	4.46	1.13	1.37
Swaziland	2006-07	51.55	55.41	62.11	52.83	49.10	46.64	33.00
Zambia	2007	36.27	40.64	43.49	33.31	31.76	30.35	*
Zimbabwe	2010-11	38.51	53.80	63.82	70.67	68.09	51.18	53.55
Zimbabwe	2005-06	40.11	41.35	53.18	59.33	38.88	44.73	38.49

*Un-weighted sample size less than 25, and hence, was excluded from analysis; NA: not available

Table 3.4w. Behavioral data extracted from DHS datasets for women: Percent using condom at last sex with any partner among those with non-marital partner in past 12 months

Country	Year of survey	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Burkina Faso	2010	52.44	70.39	59.26	55.11	52.12	13.68	22.73
Burkina Faso	2003	45.25	65.69	54.84	69.64	24.15	*	*
Burundi	2010	22.22	32.45	18.85	28.82	*	*	*
Cameroon	2011	54.96	52.85	45.37	31.02	23.55	21.40	24.19
Cameroon	2004	47.26	44.31	36.26	32.36	23.13	21.95	8.76
DRC	2007	11.83	21.07	14.33	17.19	11.38	12.79	11.68
Ethiopia	2011	40.63	27.61	28.95	32.57	5.06	*	*
Ethiopia	2005	24.95	23.38	5.50	*	*	*	*
Ghana	2003	33.50	31.95	27.40	15.40	10.46	10.66	11.92
Guinea	2005	24.07	29.13	29.50	17.86	18.49	9.25	11.86
Kenya	2008-09	40.83	38.02	31.86	32.04	27.16	29.45	19.84
Kenya	2003	22.53	25.71	22.43	21.20	21.31	20.31	0.00
Lesotho	2009	60.59	63.74	62.97	61.90	58.14	52.98	41.51
Lesotho	2003	46.50	46.38	38.66	25.88	22.38	18.60	9.38
Liberia	2007	11.72	14.89	13.55	10.22	8.01	5.89	2.29
Malawi	2010	43.16	48.04	45.33	49.10	40.61	27.77	30.10
Malawi	2004	34.25	33.78	23.21	22.20	8.87	13.40	*
Mali	2006	13.50	19.28	16.54	14.93	17.12	*	*
Niger	2006	*	*	*	*	*	*	*
Rwanda	2010	40.90	39.45	38.27	38.29	21.38	19.97	24.07
Rwanda	2005	27.61	24.59	21.04	14.11	13.92	5.86	*
Senegal	2011	37.69	44.40	42.18	35.82	37.56	50.04	*
Senegal	2005	29.67	36.97	43.57	31.26	35.27	35.71	*
Sierra Leone	2008	7.43	10.97	4.69	1.44	3.58	1.13	2.88
Swaziland	2006-07	51.55	54.76	62.36	51.75	48.79	46.64	33.00
Zambia	2007	35.92	39.50	43.78	33.31	28.93	30.35	*
Zimbabwe	2010-11	36.78	52.16	62.53	69.47	73.64	54.38	53.55
Zimbabwe	2005-06	38.39	40.94	53.18	57.31	42.90	44.73	38.49

*Un-weighted sample size less than 25, and hence, was excluded from analysis; NA: not available

Table 3.5w. Behavioral data extracted from DHS datasets for women: Percent using condom at last sex with any partner among those who had sex in past 12 months

Country	Year of survey	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Burkina Faso	2010	21.04	15.73	9.39	5.10	4.56	2.77	2.36
Burkina Faso	2003	21.42	17.53	7.84	6.44	2.76	2.40	1.42
Burundi	2010	6.56	2.49	2.98	2.06	1.91	2.82	0.61
Cameroon	2011	38.81	29.90	19.51	14.57	9.53	7.27	5.74
Cameroon	2004	32.40	23.63	14.73	10.27	7.32	6.68	3.95
DRC	2007	8.53	8.42	4.96	3.13	3.70	3.30	3.05
Ethiopia	2011	4.79	2.79	2.14	1.57	0.82	1.56	1.07
Ethiopia	2005	1.95	1.65	0.99	0.48	0.69	0.72	0.66
Ghana	2003	27.16	18.35	8.69	4.96	4.56	2.52	1.89
Guinea	2005	14.31	11.04	6.13	2.86	2.03	1.45	0.54
Kenya	2008-09	25.62	13.15	7.24	6.05	5.25	5.46	5.09
Kenya	2003	13.09	7.38	4.60	4.12	5.38	3.74	1.08
Lesotho	2009	49.74	43.49	40.21	39.02	34.36	32.80	26.32
Lesotho	2003	34.07	28.79	23.89	18.98	16.81	12.93	7.00
Liberia	2007	11.38	10.73	7.26	5.77	3.67	1.98	0.61
Malawi	2010	22.45	10.17	8.00	8.61	7.13	6.51	5.14
Malawi	2004	14.33	7.10	4.68	3.04	2.59	1.82	0.94
Mali	2006	4.33	3.48	1.56	1.24	1.01	0.87	0.28
Niger	2006	0.39	0.63	0.19	0.41	0.47	0.66	0.20
Rwanda	2010	27.85	11.06	7.45	6.96	8.33	5.79	5.36
Rwanda	2005	17.79	3.37	2.71	2.40	1.86	1.65	0.40
Senegal	2011	8.24	6.08	4.29	3.01	2.74	2.02	1.18
Senegal	2005	5.66	5.45	4.40	2.66	2.86	2.61	0.11
Sierra Leone	2008	5.54	5.49	1.97	1.87	1.20	1.79	1.25
Swaziland	2006-07	48.20	45.15	41.52	36.88	33.19	23.24	17.86
Zambia	2007	24.63	15.84	12.72	10.61	8.04	9.12	2.67
Zimbabwe	2010-11	13.11	12.36	12.69	17.70	17.74	19.02	15.49
Zimbabwe	2005-06	11.83	8.05	6.82	10.29	9.47	7.58	4.98

*Un-weighted sample size less than 25, and hence, was excluded from analysis; NA: not available

Table 3.6w. Behavioral data extracted from DHS datasets for young women

Country	Year of survey	Percent sex before 18	Percent sex before 15		Percent unmarried sexually active		Percent with partners 10 or more years older	
		20-24	15-19	20-24	15-19	20-24	15-19	20-24
Burkina Faso	2010	60.1	7.7	10.9	17.6	60.0	33.7	39.4
Burkina Faso	2003	62.0	7.3	7.1	23.9	67.3	NA	NA
Burundi	2010	23.4	3.5	3.1	7.1	18.0	10.7	12.3
Cameroon	2011	59.6	15.0	18.0	33.1	77.0	27.2	32.1
Cameroon	2004	68.2	18.0	21.6	32.7	73.4	1.4	0.9
DRC	2007	62.0	17.9	18.5	36.9	68.4	7.2	3.9
Ethiopia	2011	42.4	7.1	16.1	2.7	15.1	21.0	22.0
Ethiopia	2005	48.6	11.1	21.9	2.5	9.7	0.1	NA
Ghana	2003	43.1	7.4	7.5	29.4	62.7	3.7	0.0
Guinea	2005	69.7	19.7	25.2	35.5	67.3	5.9	3.5
Kenya	2008-09	47.8	11.5	10.4	27.4	63.1	2.1	0.9
Kenya	2003	48.1	14.5	12.8	27.5	58.6	1.7	NA
Lesotho	2009	45.4	8.5	6.9	35.4	80.3	6.8	13.8
Lesotho	2003	NA	NA	NA	NA	NA	NA	NA
Liberia	2007	79.8	18.7	15.8	66.4	97.6	4.2	3.9
Malawi	2010	59.5	12.1	16.7	24.1	57.1	0.6	0.2
Malawi	2004	57.1	14.1	15.5	25.2	62.9	0.4	0.5
Mali	2006	73.0	23.5	26.1	8.1	28.8	5.2	1.8
Niger	2006	72.9	25.7	33.9	1.1	9.1	0.1	0.0
Rwanda	2010	16.0	4.8	2.8	11.5	28.1	6.0	11.3
Rwanda	2005	19.1	5.2	2.6	9.4	22.6	4.6	0.9
Senegal	2011	NA	NA	NA	NA	NA	NA	NA
Senegal	2005	36.9	9.1	9.7	3.0	7.9	2.6	1.7
Sierra Leone	2008	NA	NA	NA	NA	NA	NA	NA
Swaziland	2006-07	46.3	7.4	6.4	36.8	84.7	5.9	7.4
Zambia	2007	59.8	12.3	14.8	35.5	72.8	2.3	2.2
Zimbabwe	2010-11	38.0	3.9	3.7	11.1	40.0	15.3	14.4
Zimbabwe	2005-06	37.0	4.9	5.8	11.1	42.0	12.5	14.3

*Un-weighted sample size less than 25, and hence, was excluded from analysis; NA: not available

Table 3.1m. Behavioral data extracted from DHS datasets for men: Percent with non-marital partners

Country	Year of survey	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Burkina Faso	2010	94.25	65.98	33.55	21.66	11.21	6.32	4.44
Burkina Faso	2003	97.64	67.37	46.34	26.10	17.63	15.04	4.32
Burundi	2010	71.47	18.15	7.41	6.49	3.48	4.56	0.93
Cameroon	2011	98.28	86.86	65.13	48.90	39.39	35.13	27.58
Cameroon	2004	96.18	86.76	62.65	48.21	44.13	37.21	35.43
DRC	2007	93.46	74.60	44.59	29.19	17.11	14.30	15.40
Ethiopia	2011	72.46	32.16	13.86	5.14	3.03	1.97	2.04
Ethiopia	2005	68.00	30.80	9.33	4.75	2.11	2.01	0.96
Ghana	2003	97.93	76.20	50.00	28.57	21.72	13.00	12.01
Guinea	2005	98.26	90.65	60.33	41.07	30.41	18.56	16.03
Kenya	2008-09	98.04	75.88	34.40	17.74	18.36	8.94	6.17
Kenya	2003	96.57	77.15	35.11	22.42	15.02	9.96	7.38
Lesotho	2009	97.52	84.06	62.42	45.09	40.26	43.91	41.12
Lesotho	2003	97.07	82.43	55.52	49.85	43.11	42.42	37.87
Liberia	2007	96.13	82.99	56.56	42.81	34.50	29.86	21.78
Malawi	2010	92.84	50.75	21.09	14.52	9.88	8.08	11.47
Malawi	2004	94.49	44.82	20.43	12.79	8.12	4.23	4.29
Mali	2006	92.49	63.41	31.66	15.00	8.55	8.07	4.25
Niger	2006	76.27	29.04	10.27	6.13	4.53	2.72	2.63
Rwanda	2010	96.06	46.67	20.02	9.82	7.60	5.77	4.76
Rwanda	2005	96.37	39.84	15.98	10.01	8.83	8.14	8.75
Senegal	2011	92.59	88.12	45.36	25.79	15.38	10.04	8.66
Senegal	2005	96.31	85.56	54.75	32.81	19.86	16.60	7.11
Sierra Leone	2008	89.27	77.68	54.67	38.45	30.51	30.23	21.05
Swaziland	2006-07	98.06	89.89	63.89	46.73	32.54	23.27	26.95
Zambia	2007	95.85	64.50	40.57	23.96	17.45	12.64	14.15
Zimbabwe	2010-11	95.13	66.94	36.00	23.18	16.65	12.60	9.72
Zimbabwe	2005-06	96.24	69.89	34.08	17.85	14.77	11.03	9.89

*Un-weighted sample size less than 25, and hence, was excluded from analysis; NA: not available

Table 3.2m. Behavioral data extracted from DHS datasets for men: Percent with multiple partners

Country	Year of survey	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Burkina Faso	2010	1.99	11.50	15.90	23.35	24.26	26.11	29.20
Burkina Faso	2003	4.53	16.09	16.74	18.95	19.37	27.41	17.83
Burundi	2010	0.75	1.58	3.53	4.46	4.20	7.57	3.26
Cameroon	2011	9.52	30.45	38.61	38.99	40.72	32.98	31.76
Cameroon	2004	12.98	34.89	36.62	38.98	38.21	36.27	37.78
DRC	2007	10.27	20.38	22.65	17.34	18.51	19.61	16.00
Ethiopia	2011	0.54	1.70	2.88	4.45	6.35	7.33	9.75
Ethiopia	2005	0.23	1.92	2.26	3.19	4.20	4.84	4.78
Ghana	2003	2.38	10.73	13.78	13.82	13.37	11.32	10.85
Guinea	2005	13.95	27.83	31.05	24.64	32.24	25.40	32.06
Kenya	2008-09	4.31	11.80	10.18	11.82	14.03	10.63	6.72
Kenya	2003	7.26	16.38	13.08	11.02	14.44	10.53	10.11
Lesotho	2009	13.78	30.99	28.79	28.06	23.54	25.62	15.65
Lesotho	2003	11.70	28.06	28.09	29.66	21.72	20.67	12.82
Liberia	2007	7.66	24.41	25.49	23.43	22.84	18.96	14.71
Malawi	2010	4.98	8.93	10.97	10.34	10.59	12.50	15.88
Malawi	2004	4.94	9.38	10.22	11.33	9.20	11.94	11.01
Mali	2006	4.33	9.59	16.28	18.62	24.80	26.31	29.70
Niger	2006	2.23	3.75	7.18	16.59	22.71	24.39	25.71
Rwanda	2010	0.45	3.18	5.70	6.64	5.77	4.65	6.36
Rwanda	2005	0.27	1.41	3.52	4.63	4.64	4.55	6.09
Senegal	2011	1.33	3.90	8.56	11.40	10.46	20.50	26.65
Senegal	2005	4.59	9.32	12.12	10.10	20.21	22.08	31.86
Sierra Leone	2008	4.90	20.15	26.37	23.72	25.94	26.84	24.11
Swaziland	2006-07	3.81	18.91	22.80	20.06	15.77	12.73	18.00
Zambia	2007	4.62	15.19	20.41	19.02	19.33	13.83	17.64
Zimbabwe	2010-11	3.31	14.66	15.80	16.02	14.06	10.22	10.62
Zimbabwe	2005-06	2.82	12.76	13.86	10.97	8.86	9.00	9.50

*Un-weighted sample size less than 25, and hence, was excluded from analysis; NA: not available

Table 3.3m. Behavioral data extracted from DHS datasets for men: Percent using condom at last sex with non-marital partner among those with non-marital partners in past 12 months

Country	Year of survey	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Burkina Faso	2010	68.63	79.62	79.98	75.03	76.36	70.18	55.09
Burkina Faso	2003	61.55	71.35	71.63	79.23	71.07	72.77	*
Burundi	2010	37.27	52.85	50.90	46.38	*	*	*
Cameroon	2011	68.80	72.74	69.09	65.76	60.56	53.90	46.34
Cameroon	2004	55.66	58.45	60.16	49.99	49.37	40.05	40.51
DRC	2007	20.91	28.93	28.04	26.84	22.76	16.81	12.31
Ethiopia	2011	57.16	66.86	63.77	65.33	39.04	53.54	35.80
Ethiopia	2005	43.97	51.98	46.06	49.70	*	*	*
Ghana	2003	46.16	54.44	43.19	39.30	33.46	38.91	38.73
Guinea	2005	34.09	39.96	43.31	38.88	38.09	50.35	46.22
Kenya	2008-09	55.32	70.03	64.40	48.03	62.46	42.87	54.79
Kenya	2003	40.98	50.69	51.53	37.54	39.50	55.12	*
Lesotho	2009	63.12	66.98	64.32	70.82	62.67	53.60	54.36
Lesotho	2003	NA	NA	NA	NA	NA	NA	NA
Liberia	2007	15.89	25.83	26.69	33.02	26.00	28.10	18.67
Malawi	2010	46.82	59.43	66.12	49.33	45.67	37.94	33.87
Malawi	2004	35.56	58.47	55.46	40.13	33.18	*	*
Mali	2006	31.04	40.00	37.38	50.31	46.61	40.39	*
Niger	2006	28.45	38.29	58.87	65.30	*	*	*
Rwanda	2010	57.50	68.19	65.32	57.85	49.65	60.65	*
Rwanda	2005	37.02	38.35	57.83	22.92	26.97	10.91	9.23
Senegal	2011	55.57	67.89	70.17	59.56	63.00	46.66	*
Senegal	2005	44.05	59.64	70.66	75.10	73.48	65.42	*
Sierra Leone	2008	14.41	27.54	22.28	17.25	22.05	18.67	21.20
Swaziland	2006-07	68.41	69.53	70.46	65.2	62.28	55.43	47.92
Zambia	2007	42.63	53.16	55.82	49.91	49.75	50.60	42.26
Zimbabwe	2010-11	66.06	76.12	79.93	76.32	72.62	73.09	79.00
Zimbabwe	2005-06	54.25	74.47	77.04	77.44	69.01	55.57	51.52

*Un-weighted sample size less than 25, and hence, was excluded from analysis; NA: not available

Table 3.4m. Behavioral data extracted from DHS datasets for men: Percent using condom at last sex with any partner among those with non-marital partners in past 12 months

Country	Year of survey	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Burkina Faso	2010	68.63	79.34	72.46	56.44	55.61	45.49	34.73
Burkina Faso	2003	62.07	70.19	67.25	59.10	55.37	29.29	*
Burundi	2010	37.27	51.72	41.36	39.18	*	*	*
Cameroon	2011	68.80	69.45	57.45	42.72	37.42	29.86	18.06
Cameroon	2004	56.14	57.69	50.97	35.69	32.84	23.64	24.27
DRC	2007	21.04	26.81	21.31	16.63	10.74	9.91	0.14
Ethiopia	2011	58.60	66.86	61.05	63.48	41.22	38.79	27
Ethiopia	2005	43.97	48.16	44.99	54.30	*	*	*
Ghana	2003	46.16	52.18	40.79	26.04	20.31	16.51	23.24
Guinea	2005	34.09	38.04	39.93	32.54	21.76	28.06	24.16
Kenya	2008-09	55.32	68.74	56.78	31.98	33.90	23.26	56.00
Kenya	2003	40.37	48.76	41.42	25.09	14.31	35.79	*
Lesotho	2009	61.91	64.43	56.66	57.38	43.05	35.72	43.94
Lesotho	2003	NA	NA	NA	NA	NA	NA	NA
Liberia	2007	15.34	22.99	26.46	24.35	18.15	16.63	15.76
Malawi	2010	45.48	54.83	50.19	29.64	22.44	24.64	26.05
Malawi	2004	35.56	52.80	47.96	20.65	21.16	*	*
Mali	2006	30.43	37.59	33.70	29.58	25.76	20.89	*
Niger	2006	30.33	40.85	57.56	47.92	*	*	*
Rwanda	2010	57.51	66.42	53.44	42.74	40.07	45.93	*
Rwanda	2005	37.02	37.03	43.57	13.36	17.50	8.63	4.08
Senegal	2011	55.01	67.23	66.76	53.54	55.61	30.38	*
Senegal	2005	44.05	58.89	67.85	62.01	54.45	53.58	*
Sierra Leone	2008	13.59	26.82	18.33	13.55	15.53	13.27	16.04
Swaziland	2006-07	68.96	69.78	66.15	58.20	53.54	38.96	30.10
Zambia	2007	41.68	48.82	41.48	28.11	25.39	23.51	29.47
Zimbabwe	2010-11	63.96	67.19	58.90	45.41	36.75	45.95	60.84
Zimbabwe	2005-06	53.16	69.67	54.57	49.51	41.16	29.47	23.89

*Un-weighted sample size less than 25, and hence, was excluded from analysis; NA: not available

Table 3.5m. Behavioral data extracted from DHS datasets for men: Percent using condom at last sex with any partner among those with multiple partners

Country	Year of survey	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Burkina Faso	2010	76.36	74.24	44.86	25.24	13.47	8.65	5.81
Burkina Faso	2003	74.39	69.37	61.72	40.12	26.30	10.55	16.81
Burundi	2010	*	*	*	*	*	*	*
Cameroon	2011	69.59	65.25	52.22	33.73	29.91	21.65	9.38
Cameroon	2004	56.56	56.27	41.75	28.39	24.67	15.06	16.60
DRC	2007	27.04	19.48	22.74	8.55	5.53	4.96	9.88
Ethiopia	2011	*	36.93	47.12	15.06	1.93	5.53	0.18
Ethiopia	2005	*	23.89	6.88	10.39	3.48	*	*
Ghana	2003	59.12	42.75	23.42	17.22	12.71	4.86	2.93
Guinea	2005	38.25	38.98	32.92	19.50	12.83	11.30	8.72
Kenya	2008-09	69.05	66.52	39.86	19.92	15.37	9.80	8.67
Kenya	2003	54.34	50.92	23.18	20.66	9.62	23.64	*
Lesotho	2009	60.19	60.29	52.46	49.35	41	28.17	38.90
Lesotho	2003	NA	NA	NA	NA	NA	NA	NA
Liberia	2007	29.62	27.35	29.15	20.59	12.09	14.73	17.52
Malawi	2010	36.10	43.95	30.96	13.99	12.95	12.34	8.85
Malawi	2004	31.44	36.32	22.94	11.86	13.67	4.16	*
Mali	2006	20.06	33.07	22.16	13.65	8.45	4.94	1.44
Niger	2006	38.05	45.06	30.34	6.04	1.87	0.00	0.00
Rwanda	2010	*	53.03	32.45	18.93	14.28	*	*
Rwanda	2005	*	*	*	*	*	*	*
Senegal	2011	*	44.72	52.07	22.71	9.94	0.79	3.43
Senegal	2005	56.46	69.09	58.92	33.51	9.31	9.97	3.17
Sierra Leone	2008	16.65	33.46	22.63	12.78	8.67	10.96	4.15
Swaziland	2006-07	74.76	64.66	61.24	50.14	50.48	30.88	22.44
Zambia	2007	48.99	40.61	30.67	19.48	20.87	17.64	17.63
Zimbabwe	2010-11	66.21	46.99	34.15	20.96	17.00	17.00	32.92
Zimbabwe	2005-06	70.28	56.21	28.06	23.82	18.25	14.85	6.58

*Un-weighted sample size less than 25, and hence, was excluded from analysis; NA: not available

Table 3.6m. Behavioral data extracted from DHS datasets for men: Percent using condom at last sex with any partner among those who had sex in past 12 months

Country	Year of survey	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Burkina Faso	2010	64.96	55.37	33.57	21.42	12.92	7.67	6.68
Burkina Faso	2003	60.61	50.24	39.61	25.41	20.46	12.05	6.65
Burundi	2010	26.64	10.46	5.72	5.54	1.79	4.13	1.64
Cameroon	2011	67.85	62.00	41.92	27.84	20.18	15.06	8.88
Cameroon	2004	54.14	51.18	35.32	22.80	19.87	12.45	11.73
DRC	2007	19.66	20.85	11.62	7.44	3.89	2.56	4.68
Ethiopia	2011	42.56	21.79	9.23	4.59	2.57	3.27	1.09
Ethiopia	2005	29.90	14.95	6.35	3.28	1.34	1.77	0.76
Ghana	2003	45.90	43.98	25.75	14.77	9.54	7.57	7.67
Guinea	2005	33.93	35.23	26.31	16.02	10.00	7.73	4.66
Kenya	2008-09	54.86	56.76	26.94	8.93	11.04	8.09	7.26
Kenya	2003	39.48	39.34	17.23	7.24	4.32	6.39	2.83
Lesotho	2009	62.25	58.03	47.27	43.69	37.92	34.26	34.04
Lesotho	2003	NA	NA	NA	NA	NA	NA	NA
Liberia	2007	15.23	20.44	17.51	14.29	8.90	8.83	5.75
Malawi	2010	42.79	33.16	19.24	11.74	11.10	9.04	11.28
Malawi	2004	34.45	30.12	15.40	10.46	8.64	2.61	1.70
Mali	2006	29.86	28.40	13.55	6.24	4.25	3.29	2.11
Niger	2006	23.13	11.86	6.72	3.55	1.24	0.25	0.18
Rwanda	2010	56.42	33.61	15.77	9.51	9.67	8.37	7.17
Rwanda	2005	35.68	14.81	7.95	2.64	2.80	3.41	1.33
Senegal	2011	51.64	59.24	31.91	16.40	10.30	5.45	6.45
Senegal	2005	43.28	50.83	38.10	23.93	13.92	11.12	4.06
Sierra Leone	2008	12.73	21.70	11.23	7.14	6.32	5.53	4.86
Swaziland	2006-07	69.03	66.39	55.76	44.25	35.07	30.03	25.85
Zambia	2007	40.66	37.71	27.56	16.36	16.51	11.51	9.68
Zimbabwe	2010-11	61.44	48.44	25.77	16.38	13.76	19.22	20.39
Zimbabwe	2005-06	52.73	51.11	22.86	12.98	14.35	11.23	10.29

*Un-weighted sample size less than 25, and hence, was excluded from analysis; NA: not available

Table 3.7m. Behavioral data extracted from DHS datasets for men: Percent in commercial sex

Country	Year of survey	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Burkina Faso	2010	0.17	1.46	2.53	1.35	0.98	1.25	1.04
Burkina Faso	2003	0.46	0.12	0.12	0.00	0.00	0.00	0.00
Burundi	2010	0.08	0.16	0.37	0.97	0.23	0.59	0.17
Cameroon	2011	1.62	5.56	5.27	5.07	4.38	3.56	4.62
Cameroon	2004	1.39	5.50	3.68	3.75	3.64	2.13	1.71
DRC	2007	7.29	13.22	8.15	9.19	5.42	4.48	4.25
Ethiopia	2011	0.44	1.62	1.68	1.29	1.45	0.58	0.86
Ethiopia	2005	0.28	0.44	0.63	0.47	0.58	0.01	0.09
Ghana	2003	0.00	0.16	0.29	0.00	0.21	0.25	0.00
Guinea	2005	0.28	0.22	0.87	0.30	0.34	0.32	0.00
Kenya	2008-09	1.38	1.57	1.92	1.21	1.67	0.41	0.95
Kenya	2003	3.56	3.49	2.57	3.64	1.65	1.01	3.60
Lesotho	2009	0.77	2.62	1.10	1.86	2.35	3.48	3.54
Lesotho	2003	0.53	2.04	1.78	1.56	4.35	2.90	0.15
Liberia	2007	0.83	4.40	2.84	2.84	1.71	1.49	0.53
Malawi	2010	5.09	4.68	4.20	4.60	3.15	3.30	3.29
Malawi	2004	8.19	5.81	3.89	6.62	3.88	1.56	1.99
Mali	2006	0.83	2.42	2.99	0.99	1.27	2.32	0.53
Niger	2006	1.16	2.41	0.79	1.92	1.22	0.97	0.00
Rwanda	2010	0.46	1.32	2.26	1.72	1.74	1.71	0.93
Rwanda	2005	0.24	0.10	0.26	0.17	0.39	0.00	0.64
Senegal	2011	0.16	0.66	1.64	1.17	0.43	0.88	0.00
Senegal	2005	0.07	0.00	0.19	1.70	0.75	0.23	0.40
Sierra Leone	2008	0.53	1.97	2.97	2.39	1.94	2.15	0.00
Swaziland	2006-07	NA	NA	NA	NA	NA	NA	NA
Zambia	2007	4.06	4.72	4.25	3.78	2.28	1.05	2.38
Zimbabwe	2010-11	1.15	4.13	5.50	3.37	3.15	1.65	1.53
Zimbabwe	2005-06	0.79	4.84	2.84	2.91	2.26	2.48	2.50

*Un-weighted sample size less than 25, and hence, was excluded from analysis; NA: not available

Table 3.8m. Behavioral data extracted from DHS datasets for young men

Country	Year of survey	Percent sex before 18	Percent sex before 15		Percent unmarried sexually active	
		20-24	15-19	20-24	15-19	20-24
Burkina Faso	2010	23.2	1.6	2.3	17.9	66.2
Burkina Faso	2003	31.8	4.7	2.5	25.6	67.2
Burundi	2010	19.2	9.3	7.2	16.1	33.4
Cameroon	2011	49.0	11.2	10.5	37.5	78.2
Cameroon	2004	50.4	11.5	10.7	37.7	80.0
DRC	2007	54.6	18.3	17.0	47.4	86.5
Ethiopia	2011	13.9	1.2	1.3	6.2	24.0
Ethiopia	2005	14.1	1.7	1.7	5.4	24.1
Ghana	2003	25.7	3.9	3.9	19.2	61.7
Guinea	2005	54.4	17.9	16.0	49.1	84.7
Kenya	2008-09	58.2	22.3	22.0	43.6	85.1
Kenya	2003	61.2	30.9	26.2	49.5	83.3
Lesotho	2009	61.0	25.5	17.6	59.0	90.0
Lesotho	2003	NA	NA	NA	NA	NA
Liberia	2007	53.6	8.6	8.3	46.7	91.9
Malawi	2010	49.5	26.4	16.0	53.2	77.9
Malawi	2004	47.7	18.0	9.1	50.8	78.6
Mali	2006	27.4	6.3	4.2	15.4	36.7
Niger	2006	22.7	5.3	4.7	13.3	36.2
Rwanda	2010	26.4	13.3	8.8	21.4	50.6
Rwanda	2005	26.3	15.3	10.8	22.5	48.2
Senegal	2011	NA	NA	NA	NA	NA
Senegal	2005	37.9	12.7	11.9	25.5	52.8
Sierra Leone	2008	NA	NA	NA	NA	NA
Swaziland	2006-07	36.7	4.9	4.7	21.4	76.6
Zambia	2007	50.6	16.2	15.7	44.0	80.0
Zimbabwe	2010-11	22.9	3.6	4.2	23.8	62.2
Zimbabwe	2005-06	26.2	5.2	3.6	27.0	68.7

*Un-weighted sample size less than 25, and hence, was excluded from analysis; NA: not available

Table 4w. Simple regression (single independent variable) of relative risks with behavioral factors for women

Independent variables	Age groups: women									
	15-19	20-24	30-34	35-39	40-44	45-49	Coefficient value	p-value	Coefficient value	p-value
<u>Dependent variable: relative risk of HIV prevalence in age group</u>										
Percent sex before 18	na	0.03	na	na	na	na	na	na	na	na
Percent sex before 15	0.04	0.07	na	na	na	na	na	na	na	na
Percent unmarried sexually active	0.08	-0.06	na	na	na	na	na	na	na	na
Age mixing	-0.03	-0.12	na	na	na	na	na	na	na	na
Percent non-marital partners	0.01	-0.06	-0.04	0.23	0.21	0.06	0.06	0.21	0.06	-0.18
Percent multiple partners	0.01	-0.06	0.00	0.02	-0.14	0.87	0.22	-0.14	0.22	-0.09
Condom use at last sex with non-marital partner among those with non-marital	-0.02	0.06	0.12	0.03	0.12	0.81	0.31	0.12	0.31	0.15
Condom use at last sex with any partner among those with non-marital partners	0.01	0.05	0.09	0.01	0.11	0.94	0.32	0.11	0.32	0.06
Condom use at last sex with any partner among those who had sex	0.00	0.09	0.09	0.13	-0.01	0.29	0.96	-0.01	0.96	-0.18
Year of survey	-0.01	-0.05	0.14	0.20	0.29	0.10	0.008*	0.29	0.008*	0.36
Years since ART introduction	-0.02	-0.05	0.13	0.18	0.29	0.15	0.009*	0.29	0.009*	0.42

*Significant at level 0.05; na - not applicable

Table 4m. Simple regression (single independent variable) of relative risks with behavioral factors for men

Independent variables	Age groups: men									
	15-19	20-24	30-34	35-39	40-44	45-49	Coefficient value	p-value	Coefficient value	p-value
<u>Dependent variable: Relative risk of HIV prevalence in age group</u>										
Percent sex before 18	na	-0.02	na	na	na	na	na	na	na	na
Percent sex before 15	-0.01	-0.04	na	na	na	na	na	na	na	na
Percent unmarried sexually active	0.02	-0.03	na	na	na	na	na	na	na	na
Age mixing	0.06	0.02	0.01	0.20	0.01	0.01	0.19	0.01	0.96	0.36
Percent non-marital partners	-0.02	-0.01	-0.10	-0.24	-0.18	-0.18	0.08	-0.18	0.50	0.03
Percent multiple partners	0.06	-0.01	0.27	0.22	0.60	0.60	0.29	0.60	0.06	0.07
Condom use at last sex with non-marital partner among those with non-marital	-0.05	0.02	0.19	-0.28	-0.28	-0.28	0.06	-0.28	0.25	-0.06
Condom use at last sex with any partner among those with non-marital partners	0.02	0.01	0.10	-0.10	-0.12	-0.12	0.51	-0.12	0.64	0.12
Condom use at last sex with any partner among those with multiple partners	-0.09	0.03	0.33	-0.02	-0.27	-0.27	0.91	-0.27	0.23	0.09
Condom use at last sex with any partner among those who had sex	-0.04	0.02	0.04	-0.04	0.27	0.27	0.79	0.27	0.35	0.35
Percent in commercial sex	-0.01	-0.03	-0.06	0.10	-0.01	-0.01	0.66	-0.01	0.10	0.16
Year of survey	0.01	-0.01	-0.09	0.21	0.24	0.24	0.12	0.24	0.36	0.49
Years since ART introduction	0.07	0.01	0.05	0.21	0.31	0.31	0.13	0.31	0.22	0.40

*Significant at level 0.05; na - not applicable

Table 5w. Principal component analysis (PCA) for women

Independent variables	Age groups: women																						
	15-19			20-24			30-34			35-39			40-44			45-49							
	c1	c2	c3	c4	c1	c2	c3	c4	c5	c1	c2	c3	c1	c2	c3	c1	c2	c3	c1	c2	c3		
<u>Loadings (coefficients) of the original parameters on the PCA components c1, c2, c3, or c4</u>																							
Percent sex before 18	na	na	na	0.28	-0.01	0.00	0.51	-0.23	na	na	na	na	na	na	na	na	na	na	na	na	na	na	
Percent sex before 15	-0.14	0.06	0.57	0.36	0.45	-0.06	0.06	0.20	-0.41	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Percent unmarried sexually active	-0.02	-0.07	0.66	-0.05	-0.13	0.03	-0.02	0.78	0.14	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Age mixing	0.46	-0.06	-0.09	-0.16	0.04	0.60	0.00	0.10	0.21	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Percent non-marital partners	0.06	0.60	-0.03	0.04	0.63	0.09	-0.05	-0.25	0.12	0.02	-0.11	0.69	-0.17	0.02	0.79	-0.05	0.59	-0.04	-0.07	-0.17	0.69	-0.07	-0.17
Percent multiple partners	-0.15	0.01	-0.08	-0.74	0.10	-0.01	0.02	0.10	0.79	-0.53	0.21	-0.10	-0.14	-0.26	-0.11	-0.26	0.50	0.07	-0.17	0.33	0.48	-0.17	0.33
Condom use at last sex with non-marital partner among those with non-marital	-0.01	0.51	-0.10	0.08	0.00	0.01	0.70	-0.06	-0.03	0.02	0.67	0.00	0.64	0.02	-0.03	0.04	-0.03	0.70	0.04	0.60	0.02	0.04	0.60
Condom use at last sex with any partner among those with non-marital partners	-0.32	-0.05	-0.45	0.48	-0.01	-0.01	0.71	0.04	0.05	0.01	0.68	0.03	0.66	-0.02	-0.07	-0.04	0.02	0.71	0.00	0.71	-0.10	0.00	0.71
Condom use at last sex with any partner among those who had sex	-0.05	0.60	0.09	-0.12	0.54	-0.07	0.01	0.02	0.20	-0.03	0.13	0.71	0.31	-0.06	0.60	0.23	0.62	0.00	0.32	0.04	0.51	0.32	0.04
Year of survey	0.58	0.06	0.00	0.13	-0.06	0.56	-0.03	-0.02	-0.09	0.59	0.06	0.02	-0.04	0.69	0.06	0.68	0.10	-0.06	0.64	-0.01	0.05	0.64	-0.01
Years since ART introduction	0.55	-0.03	-0.04	0.15	0.04	0.55	0.04	-0.06	-0.17	0.61	0.10	-0.10	0.02	0.67	-0.08	0.65	-0.06	0.08	0.67	0.02	-0.09	0.67	0.02
<u>Multiple regression (dependent variable: relative risk of prevalence; Independent variables: PCA components)</u>																							
Coefficient	-0.02	0.00	0.05	-0.01	-0.05	-0.06	0.08	0.01	-0.03	0.07	0.09	-0.02	-0.05	0.10	0.12	0.17	0.02	-0.02	0.11	0.06	-0.06	0.11	0.06
p-value	0.34	0.75	0.006*	0.07	0.14	0.08	0.04*	0.82	0.50	0.21	0.12	0.80	0.52	0.19	0.17	0.031*	0.78	0.80	0.17	0.48	0.44	0.17	0.48

*Significant at level 0.01; Bold: Parameters with high loading on the PCA components; na- not applicable

Table 5m. Principal component analysis (PCA) for men

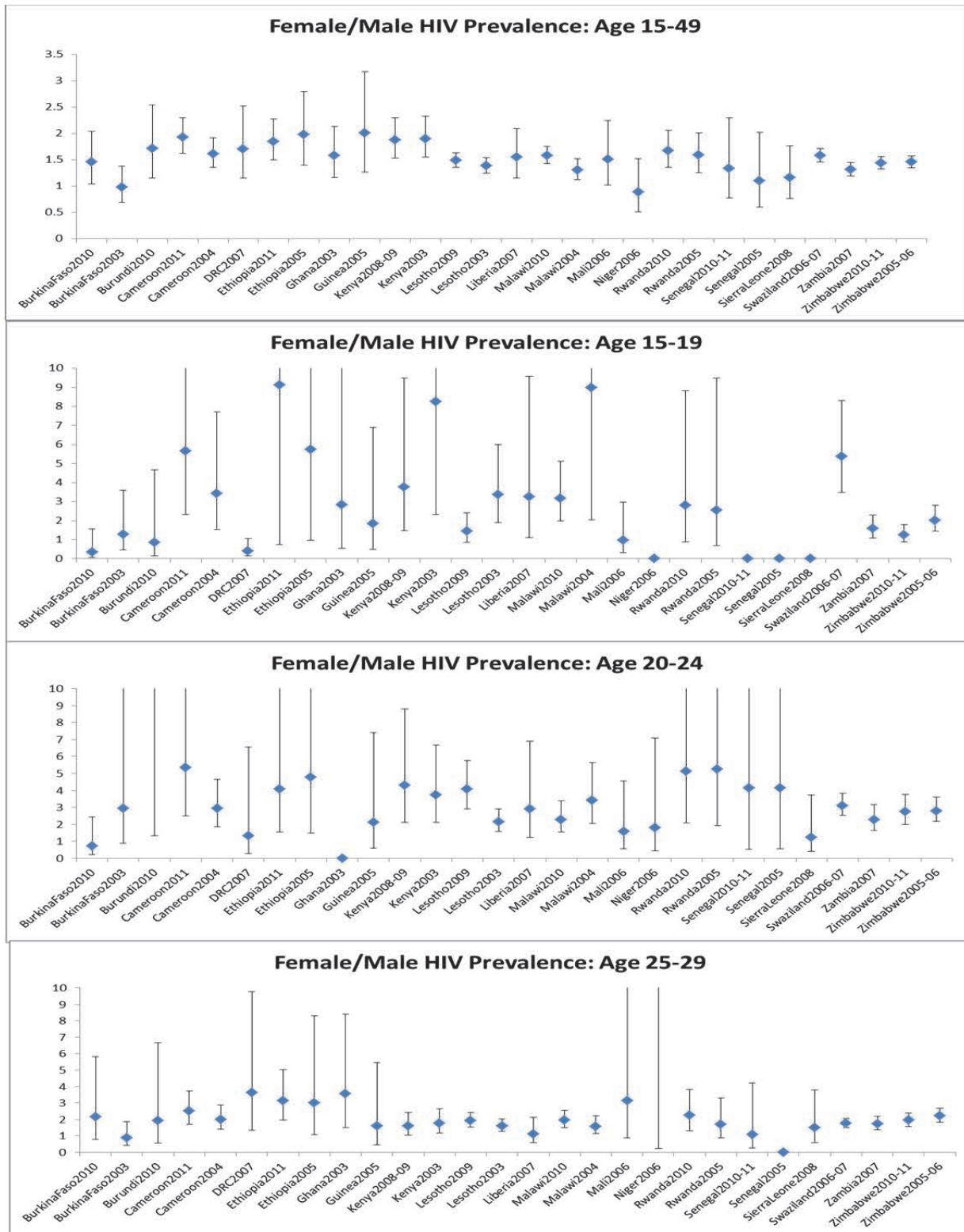
Independent variables	Age groups: men																																				
	15-19			20-24			30-34			35-39			40-44			45-49																					
	c1	c2	c3	c1	c2	c3	c1	c2	c3	c1	c2	c3	c1	c2	c3	c1	c2	c3	c1	c2	c3	c1	c2	c3	c1	c2	c3	c1	c2	c3	c1	c2	c3	c1	c2	c3	
Loadings (coefficients) of the original parameters on the PCA components c1, c2, c3, or c4																																					
Percent sex before																																					
18	na	na	na	0.51	-0.10	0.00	-0.05	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Percent sex before																																					
15	0.60	0.04	0.07	0.07	0.60	0.14	0.11	-0.10	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Percent unmarried sexually active																																					
	0.54	0.06	-0.13	0.00	0.41	-0.23	-0.02	0.09	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Percent non-marital partners																																					
	0.06	0.00	0.60	-0.18	0.02	0.60	0.02	-0.21	-0.13	-0.04	0.66	-0.01	-0.13	-0.04	0.66	-0.01	0.42	0.04	-0.11	0.50	0.00	-0.16	-0.08	0.32	-0.03	-0.53	0.15	0.06	0.00	0.60	-0.18	0.02	0.60	-0.21	-0.13	-0.04	
Percent multiple partners																																					
	0.57	-0.09	0.07	-0.08	0.43	0.07	-0.16	0.15	0.21	-0.11	-0.12	-0.67	-0.45	0.13	0.01	-0.46	0.21	0.12	-0.05	-0.40	0.32	0.05	-0.10	0.06	0.05	-0.10	0.06	0.05	-0.10	0.06	0.05	-0.10	0.06	0.05	-0.10		
Condom use at last sex with non-marital partner among those with non-marital																																					
	0.10	-0.02	-0.21	0.52	-0.09	-0.05	-0.09	0.68	0.61	-0.12	0.12	-0.09	-0.18	-0.08	0.48	-0.21	-0.17	0.54	-0.37	0.03	-0.06	0.70	-0.02	0.03	-0.06	0.70	-0.02	0.03	-0.06	0.70	-0.02	0.03	-0.06				
Condom use at last sex with any partner among those with non-marital partners																																					
	0.03	0.14	-0.09	0.57	0.07	0.04	0.15	0.64	0.59	0.09	0.01	0.16	0.13	0.11	0.63	0.07	0.08	0.75	0.17	0.37	0.09	0.47	0.26	0.37	0.09	0.47	0.26	0.37	0.09	0.47	0.26						
Condom use at last sex with any partner among those with multiple partners																																					
	-0.09	-0.15	0.31	0.58	0.02	0.49	-0.21	0.15	0.19	-0.11	-0.10	0.71	0.50	-0.10	0.00	0.41	-0.14	0.29	0.10	0.54	0.00	0.04	-0.36	0.54	0.00	0.04	-0.36	0.54	0.00	0.04	-0.36						
Condom use at last sex with any partner among those who had sex																																					
	0.00	0.04	0.68	0.12	0.02	0.54	0.08	0.16	0.16	0.04	0.71	0.00	0.55	0.12	0.12	0.55	0.19	0.14	-0.14	0.55	0.12	0.04	0.04	0.55	0.12	-0.05	0.04	0.55	0.12	-0.05	0.04						
Percent in commercial sex																																					
	0.07	-0.43	-0.08	-0.10	0.11	-0.14	-0.32	0.02	-0.40	-0.14	0.15	0.08	0.01	0.09	-0.58	-0.04	-0.02	0.06	0.89	-0.01	0.00	-0.01	0.87	-0.01	0.00	-0.01	0.87	-0.01	0.00	-0.01	0.87						
Year of survey																																					
	0.05	0.62	0.06	-0.04	0.06	0.03	0.63	0.00	-0.01	0.67	0.05	-0.04	0.04	0.70	-0.02	0.08	0.67	0.02	-0.02	0.07	0.67	-0.01	0.02	0.07	0.67	-0.01	0.02	0.07	0.67								
Years since ART introduction																																					
	-0.03	0.61	-0.05	-0.01	-0.01	-0.06	0.62	0.05	0.01	0.69	-0.03	0.02	-0.05	0.66	0.03	-0.07	0.64	0.01	0.01	-0.02	0.65	-0.02	-0.01	-0.02	0.65	-0.02	-0.01	-0.02	0.65								
Multiple regression (dependent variable: relative risk of prevalence; independent variables: PCA components)																																					
Coefficient	-0.05	0.07	-0.10	-0.03	-0.05	0.00	-0.01	-0.02	-0.04	0.11	-0.12	0.19	-0.04	0.22	-0.23	-0.21	0.14	0.01	0.30	0.15	0.25	-0.04	0.08	0.15	0.25	-0.04	0.08	0.15	0.25								
p-value	0.61	0.46	0.41	0.84	0.23	0.95	0.67	0.83	0.74	0.64	0.37	0.45	0.64	0.06	0.06	0.19	0.41	0.94	0.22	0.28	0.11	0.81	0.66	0.28	0.11	0.81	0.66										

*Significant at level 0.05; Bold: Parameters with high loading on the PCA components; na: not applicable

Ratio of Female to Male HIV Prevalence in Each Age Group

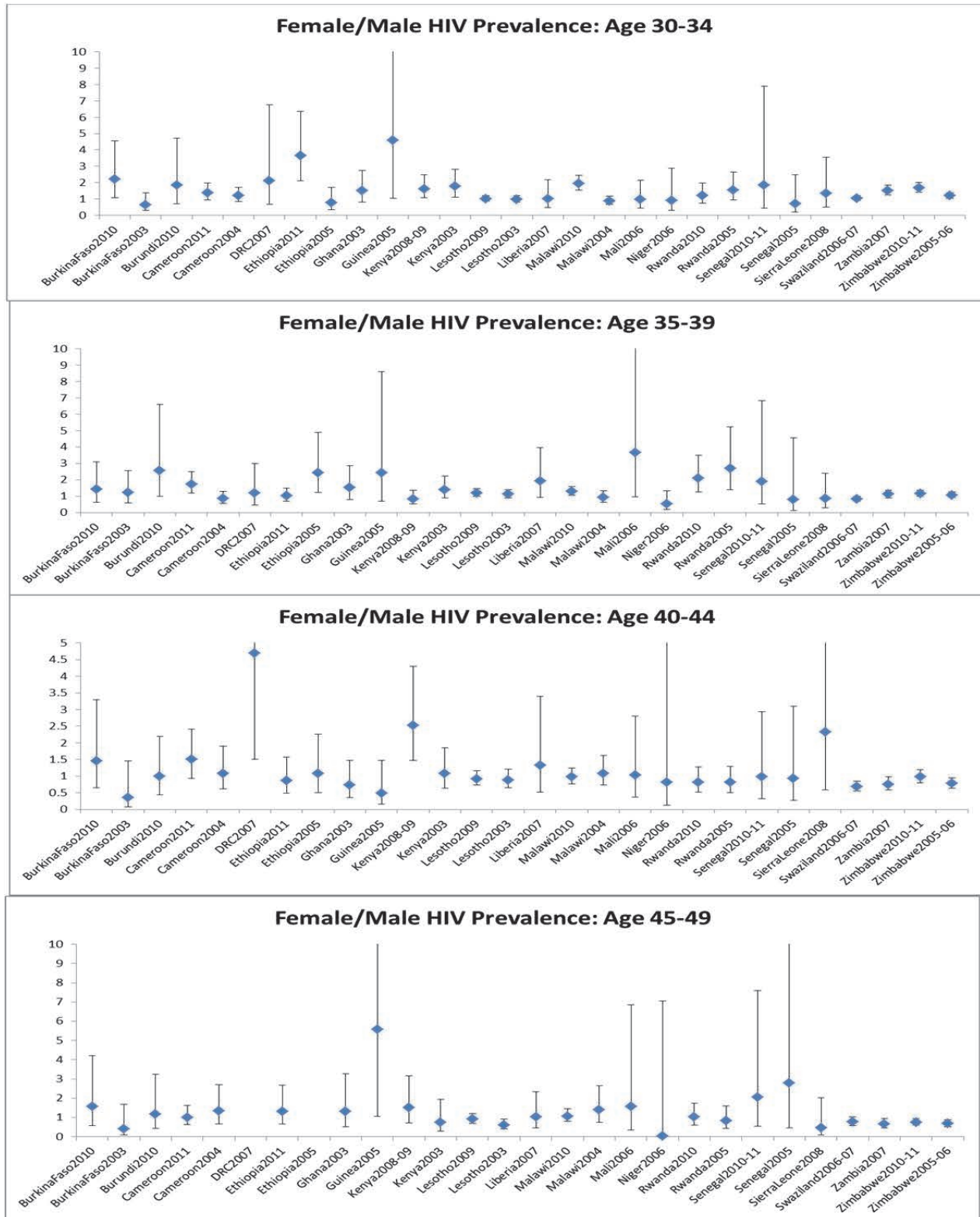
The ratio of female to male HIV prevalence in age 15-49 ranges from 0.88 to 2.0 across countries, with all but two countries (Niger, 2006, and Burkina Faso, 2003) having a ratio greater than 1, indicating significantly higher HIV prevalence among women than men (Figure 3). Comparing female to male ratios of HIV prevalence within five-year age groups, younger age groups have a larger ratio than older age groups. While in several countries younger age groups have significantly higher HIV prevalence among women compared with men, this pattern decreases among older age groups, and at age 45-49 only one country shows a significant difference between women and men in HIV prevalence.

Figure 3. Female to male ratio of HIV prevalence by age group



Note: As confidence bounds are very wide in some countries we have restricted the y-axis scale to provide better visual presentation

Figure 3. (cont.) Female to male ratio of HIV prevalence by age group



Note: As confidence bounds are very wide in some countries we have restricted the y-axis scale to provide better visual presentation

Conclusions

In most countries HIV prevalence is significantly lower among people under age 30, and in most cases prevalence is lowest in age 15-19. For age 30-34 and older there is no specific pattern in HIV prevalence. Although a few countries show HIV prevalence continuing to increase with age, most show it reaching a peak and then decreasing, for both men and women. Prevalence peaks at age 25-29 or 35-39 for women and at age 30-34 or 40-44 for men.

The average of relative risk of HIV prevalence across all countries falls within the confidence bounds of relative risk of HIV prevalence in individual countries in most cases, indicating, with the currently available data, we cannot conclude significant differences among countries in patterns of HIV prevalence. In some cases, however, the average falls outside the confidence bounds in individual countries, mostly in the older age groups and, in some instances in the younger age groups, indicating a significant difference across countries in these cases. Our analysis identifies a few dependent factors significantly correlated with relative risk of HIV prevalence across countries in some of these age groups. Years since ART and timing of the survey identifies as significant factors correlated with relative risk of HIV prevalence across countries for age 40-44 and age 45-49 for women, and age 45-49 for men. These results probably reflect the effects of ART—that is, HIV-positive people receiving treatment are living longer, resulting in higher HIV prevalence in older age groups. We would expect these effects to continue in the future, as more countries scale up HIV treatment. In the younger age groups, the analysis identifies sexual activity or condom use as significant factors correlated with relative risk of HIV prevalence across countries for women. For men, however, the analysis did not identify any of the observed variables as significant factors.

This study is subject to certain limitations. The data are obtained from household surveys, which could contain errors in recording, over-reporting or under-reporting of behavior among respondents, and errors in reporting age and other characteristics. While the analysis focuses only on behavioral variables, other factors such as migration may play a role in HIV prevalence patterns. We have a small number of observations (19 countries) for comparing prevalence patterns and in some cases up to 13 independent variables thus giving a small proportion of observations to variables. However, we used multiple surveys increasing the number of observations to 28, which we considered as independent observations as we are comparing relative values instead of absolute values of prevalence and including timing of survey as an independent variable. Also, use of PCA analysis is suitable under limited observations as it transforms original correlated variables into a reduced set of uncorrelated variables. Our final analysis thus consisted of 28 observations and up to five independent variables. Limitations also include missing data corresponding to non-availability or very small sample size; in the latter case the data are not included in the analysis.

HIV incidence patterns by age are widely used in HIV modeling for strategy analysis. We believe that sexual behavioral factors could significantly affect HIV incidence, but since incidence patterns cannot be directly measured, it would be valuable to identify the factors that significantly affect HIV prevalence patterns, for use in model-based approaches to analyzing incidence patterns.

The results from this analysis—specifically the significance of sexual activity and condom use on age patterns of HIV prevalence in younger age groups—most likely indicates that these factors also play a role in HIV incidence patterns. The magnitude of the impact should be explored further. Results from this analysis also identify the interdependence of behavior across age groups on HIV prevalence patterns. Hence, supplementing these findings from statistical analysis with detailed dynamic modeling should be considered in analyzing how behavioral factors affect age patterns of HIV incidence.

Understanding the role of behavioral factors in age patterns of HIV incidence could become more important as countries scale up prevention efforts that include behavioral interventions.[10-13] The effectiveness of behavioral interventions could vary across age groups and could have short-term or long-term impacts, thus possibly altering the incidence pattern over time.

The significance of ART on HIV prevalence patterns underscores the particular need for frequent analysis of HIV prevalence patterns. Dynamic models usually capture this change in prevalence from HIV infected persons living longer on ART, including in Spectrum where the prevalence patterns change over time. However, as HIV-infected persons receiving treatment live longer, it leads to a longer duration of exposure for onward transmission.[14, 15] Therefore, a reduction in new infections from prevention effects of ART could also be accompanied by delay in new infections, which could alter the incidence pattern over time. Changes might become more prominent with early ART and ART delivered to specific populations under the 2013 WHO guidelines, including pregnant women, who are likely to be younger, and serodiscordant couples.[16] A shift in HIV prevalence patterns over time in itself might have an effect on incidence patterns. Timely analysis of prevalence patterns using statistical analysis along with dynamic modeling to simulate reduction and delay in new infections due to prevention scale-up could provide a better understanding of how HIV incidence patterns could change over time.

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