HIV and fertility in sub-Saharan Africa: are adolescents different?

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Abstract

Although regional estimates from sub-Saharan Africa show that HIV-positive women generally have lower fertility than HIV-negative women, the opposite pattern is observed among adolescents. This discrepancy is likely due to previous studies not accounting for exposure to sexual activity. Controlling for sexual activity is particularly relevant for HIV-negative adolescents because many of them have not yet initiated sexual activity and are therefore not at risk of childbearing. Except for mother-to-child transmission of HIV, they are also not at risk of HIV infection. In this paper, we use Demographic and Health Surveys data from 31 countries to examine age-specific fertility patterns by HIV status and to understand the extent to which these patterns differ between adolescent girls and women in other age groups. We first compare age-specific fertility rates by HIV status, accounting and not accounting for exposure to sexual activity. We then analyze whether fertility patterns by serostatus differ according to HIV prevalence in the country and select socio-demographic variables. With the exception of the 15–19 age group, we find that HIV-negative women have higher fertility than HIV-positive women in all age groups. The opposite pattern is observed among adolescents. However, when we account for sexual activity, HIV-positive adolescents have fertility levels similar to those of HIV-negative adolescents. Our results suggest that the fertility patterns of HIV-positive adolescent girls are not so different from their HIV-negative counterparts when exposure to sexual activity is taken into account.

Introduction

Although fertility rates and HIV prevalence have declined since the 1990s, sub-Saharan Africa (SSA) continues to have the highest levels of fertility and HIV in the world. The total fertility rate (TFR) in this region remains at 4.7 children per woman, while it is at or below replacement-levels in most other regions of the world (World Bank, 2022). The region's fertility transition is occurring at a much slower pace than that of other low- and middle-income countries, and differs with respect to the number of halts and reversals, known as fertility stalls, that have been observed in many SSA countries (Bongaarts, 2008; Sánchez-Páez & Schoumaker, 2022; Schoumaker, 2019; Shapiro & Gebreselassie, 2008). SSA is also the region of the world hardest hit by the HIV epidemic. During the 1990s, HIV was among the leading causes of death in SSA and still remains so in Eastern and Southern Africa (United Nations, 2020; WHO, 1999). Despite widespread efforts to prevent HIV transmission in the region, 67% of the world's HIV-infected people live in SSA and 860 thousand individuals are infected there every year (UNAIDS, 2022). Moreover, evidence suggests that HIV

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could be a contributing factor to the slow pace of fertility decline in SSA (Moultrie et al., 2008; Sánchez-Páez & Schoumaker, 2021; Sneeringer & Logan, 2009; Westoff & Cross, 2006). The countries most affected by HIV are also those where strong evidence of fertility stalls has been found.

In SSA, HIV and fertility are inextricably linked. In this context, HIV is primarily transmitted through heterosexual sexual activity, and as a result, has important implications for fertility. On the one hand, several studies show that HIV-positive women often exhibit behaviors that can lead to increased fertility, e.g., replacement births — replacing a child who has died with a new child —, shorter birth intervals, and shorter amenorrhea periods (Bongaarts, 2008; Houle et al., 2016; Magadi & Agwanda, 2010; Sneeringer & Logan, 2009; Westoff & Cross, 2006). On the other hand, HIV-positive women also engage in behaviors that can lead to lower fertility, such as increased use of contraceptives — especially condoms — and less frequent sexual activity (Bankole et al., 2014; Johnson et al., 2009; Magadi & Agwanda, 2010; Porter et al., 2004; Sneeringer & Logan, 2009). In addition, HIV-positive women are at increased risk of experiencing fetal death and stillbirths, which can contribute to lower fertility (Magadi & Agwanda, 2010; Sneeringer & Logan, 2009). The net effect of HIV on fertility will depend on the weight of these respective factors.

Evidence from SSA shows that HIV-positive women generally have lower fertility than their HIV-negative counterparts. However, this pattern is not always observed among adolescents. For instance, studies that have used country-level data to examine age-fertility patterns by HIV status at the regional level have showed that, on average, the age-specific fertility rate ratios of HIV-positive to HIV-negative women are greater than one among adolescents aged 15–19, suggesting that HIV-positive women have higher fertility, and less than one among older women, indicating that HIV-positive women have lower fertility (Chen & Walker, 2010; Gregson et al., 2002; Lewis et al., 2004; Marston et al., 2017). In contrast, other country-level studies suggest that this pattern does not always hold. For example, in Cameroon, a low HIV-prevalence country, the fertility of HIV-positive adolescent girls is lower than that of HIV-negative girls (Kongnyuy & Wiysonge, 2008). On the other hand, in Malawi, where HIV prevalence is much higher, the fertility ratio between HIV-positive and HIV-negative adolescents was less than one in 2004, but then increased to more than one in 2010 (Souza & Moultire, 2015). These results suggest that HIV levels could be shaping fertility patterns among HIV-positive and HIV-negative adolescents. Because previous research conducted at the regional level did not take into account variation in HIV prevalence between countries, estimates linking HIV and adolescent fertility may be masking fertility patterns that could vary by HIV prevalence. Marston et al. (2017) sought to explain these age differences in fertility patterns by grouping countries by subregions within SSA. Although HIV prevalence varies by subregion, country-level variation also exists within subregions (UNAIDS, 2022). Therefore, in addition to analyzing fertility patterns by HIV status, it is also relevant to group countries by HIV prevalence rather than by geographic proximity.

Another gap in the literature concerns the methodology used to analyze fertility patterns by HIV status. Typically, researchers have estimated age-specific fertility rates for all women in a given age group, regardless of exposure to sexual activity. However, in this context as well as in most other parts of the world, many adolescents have not yet begun engaging in sexual activity, so they are not at risk of HIV infection — except for those infected via mother-to-child transmission — or beginning childbearing. Fertility rates can vary significantly if women who are not at risk of becoming pregnant are excluded. This is particularly relevant in the case of adolescent girls, since when comparing fertility rates by HIV status, most HIV-positive girls report having engaged in sexual activity, while many HIV-negative girls report never having had sex. Using the most recent Demographic and Health Survey for each country, on average 54% of adolescent girls in SSA have not yet had sexual intercourse, though substantial variation exists across SSA, ranging from 28% in Mozambique to 85% in Burundi (ICF International, 2023). Among women aged 20–24 years and 25–29 years, 13% and 4%, respectively, of women report never having had sex. After age 30, this drops to less than 1%. Besides Marston et al. (2017) and Kongnyuy & Wiysonge (2008), who reached mixed conclusions, previous research did not account for exposure to sexual activity.

The lack of consistent evidence on the relationship between adolescent fertility and HIV suggests that these patterns should be investigated further. Thus, this paper aims to examine age-specific fertility patterns by HIV status and to understand the extent to which these patterns differ for adolescent girls compared to older women. When comparing age-specific fertility rates by HIV status, we take into account exposure to sexual activity. Second, we analyze whether fertility patterns by HIV status differ according to country-level HIV prevalence. Finally, we examine whether select socio-demographic variables, particularly place of residence and wealth, can explain the differences observed in fertility patterns by HIV status. This research contributes to understanding some of the risks adolescents face when initiating sexual activity, including HIV infection and early pregnancy.

Data and Methods

Our study draws on all available Demographic and Health Surveys (DHS) (The DHS Program, 2022) collected in SSA that include both HIV testing and birth histories. In countries where more than one survey meets inclusion criteria, we use data from all eligible surveys. In each country, HIV testing was conducted for a representative subsample of women, rather than all interviewed women. Thus, the analytic sample is restricted to women who have been tested for HIV and for whom birth history data are available. In total, we use information from 362,859 women of reproductive-age (15–49 years) from 61 surveys in 31 countries[1] (see Table 1). These surveys were conducted between 2003 and 2019.

Table 1: Demographic and Health Surveys from sub-Saharan African countries used in this study. Women aged 15-49.

Survey	Sample size with HIV testing	HIV Prevalence	TFR	TFR ratio HIV+ / HIV-
Eastern Africa				
Burundi 2010-11	4,533	1.7	6.4	0.8
Burundi 2016-17	8,496	1.2	5.5	0.5
Ethiopia 2005	5,736	1.9	5.4	0.8
Ethiopia 2011	14,695	1.9	4.8	0.4
Ethiopia 2016	13,297	1.2	4.6	0.7
Kenya 2003	3,151	8.7	4.9	0.8
Kenya 2008-09	3,641	8.0	4.6	0.9
Malawi 2004-05	2,686	13.3	6.0	0.6

[1] We do not include Uganda 2004-05 DHS since it is a restricted survey. We exclude Congo 2009, Mozambique 2009 and Tanzania 2003-04 because birth history data were not collected. We also exclude Mali 2001 and Zambia 2001-02 as it is not possible to merge HIV testing data with women's data.

Malawi 2010	7,091	12.9	5.7	0.8
Malawi 2015-16	7,737	10.8	4.4	0.8
Mozambique 2015	5,809	15.4	5.3	0.8
Rwanda 2005	5,641	3.6	6.1	0.7
Rwanda 2010-11	6,917	3.7	4.6	0.8
Rwanda 2014-15	6,752	3.6	4.2	0.9
Tanzania 2007-08	8,179	6.6	5.6	0.7
Tanzania 2011-12	9,756	6.2	5.4	0.7
Uganda 2011	1,558	8.3	6.2	1.1
Zambia 2007	5,502	16.1	6.2	0.6
Zambia 2013-14	14,719	15.1	5.3	0.7
Zambia 2018-19	12,817	14.2	4.7	0.7
Zimbabwe 2005-06	6,947	21.1	3.8	0.8
Zimbabwe 2010-11	7,313	17.7	4.1	0.8
Zimbabwe 2015	8,667	16.7	4.0	0.9
Middle Africa				
Angola 2015-16	6,387	2.6	6.2	0.8
Cameroon 2004	5,128	6.6	5.0	0.7
Cameroon 2011	7,221	5.6	5.1	0.6
Cameroon 2018-19	6,416	3.4	4.8	0.8
Chad 2014-15	5,656	1.8	6.4	0.5
Congo D.R. 2007	4,492	1.6	6.3	0.7
Congo D.R. 2013-14	9,264	1.6	6.6	0.6
Gabon 2012	5,459	5.8	4.1	0.9
Sao Tome and Principe 2008-09	2,378	1.3	4.9	1.1
Southern Africa				
Eswatini 2006-07	4,424	31.1	3.8	1.0
Lesotho 2004-05	3,030	26.3	3.5	0.8
Lesotho 2009-10	3,778	26.7	3.3	0.9
Lesotho 2014	3,175	29.7	3.3	0.8
Namibia 2013	4,051	16.9	3.6	1.0
South Africa 2016	2,485	27.3	2.6	0.9
Western Africa				
Burkina Faso 2003	4,086	1.6	5.9	0.8
Burkina Faso 2010	8,298	1.2	6.0	0.7
Cote d’Ivoire 2005	4,413	6.4	4.6	0.7
Cote d’Ivoire 2011-12	4,509	4.6	5.0	0.7
Gambia 2013	4,089	2.1	5.6	0.7
Ghana 2003	5,097	2.4	4.4	0.8
Ghana 2014	4,444	2.8	4.2	0.8
Guinea 2005	3,742	1.9	5.7	0.5
Guinea 2012	4,622	2.1	5.1	0.7
Guinea 2018	5,062	1.6	4.8	0.6
Liberia 2006-07	6,381	1.8	5.2	0.7
Liberia 2013	4,397	2.0	4.7	0.8
Mali 2006	4,528	1.4	6.6	0.7
Mali 2012-13	4,806	1.3	6.1	0.8
Niger 2006	4,406	0.7	7.0	0.5
Niger 2012	5,000	0.4	7.6	0.6
Senegal 2005	4,230	0.7	5.3	0.6
Senegal 2010-11	5,326	0.6	5.0	1.1
Senegal 2017	7,618	0.5	4.6	0.6
Sierra Leone 2008	3,448	1.7	5.1	0.7
Sierra Leone 2013	7,695	1.7	4.9	0.8
Sierra Leone 2019	6,941	2.2	4.2	0.8
Togo 2013-14	4,737	3.1	4.8	0.8

To conduct our analyses, we first estimate HIV prevalence by 5-year age group in each of the surveys. HIV prevalence is computed as the percentage of women who tested positive among the total number of women tested. Then, for each survey, we use Poisson regression to estimate age-specific fertility rates (ASFR) by HIV status for the 3-year period preceding the survey (Schoumaker, 2013). The outcome variable is the number of births in the 36-months prior to the survey and the independent variable is the woman's age group. We include exposure — women-years — as the offset in the regression models. Separate regressions are run for HIV-positive women and HIV-negative women.

Second, we use Poisson regression to estimate the association between HIV and fertility. We pool all DHS surveys and include country and year fixed effects, and the exposure as offset. In the first set of models — unadjusted estimates —, we regress the number of births on HIV status. HIV status is a binary variable that takes the value of 1 if the woman is HIV positive and 0 otherwise. We run one regression for each age group, so the fertility rate ratio of HIV-positive women to HIV-negative women is the coefficient associated with HIV status. Then, we run similar regression models in which we account for exposure to sexual activity. In these models, we exclude all women who have never had sex from the sample. This exclusion is particularly important for the 15–19 age group as a significant proportion of adolescents (in most countries) have not yet been exposed to the risk of HIV infection and childbearing. As for older women, the proportion who have never had sex is markedly lower. Thus, as a result, the number of woman-years of exposure in each age group is reduced, resulting in higher fertility rates. In the second set of regressions — adjusted estimates —, in addition to the variables included in the first set of models, we add place of residence (urban and rural), educational attainment (no education, primary education, and secondary and higher education), and wealth status[2] (poor and non-poor) as independent variables. We note that these variables represent the woman's status at the time of the survey and not necessarily at the time of HIV infection. Similarly, to the first set of models, we run two regression models, one without accounting for sexual activity and the other accounting for sexual activity.

Third, we use the second set of regressions — adjusted estimates — to address differences in the age-specific profiles of fertility by HIV status. To do so, we split countries into four groups according to their HIV prevalence: less than 2%, between 2% and 6%, between 6% and 15%, and more than 15% (see Figure 1). These ranges capture to some extent subregional or geographic patterns of HIV prevalence. We run two regressions for each HIV prevalence group, one without accounting for the exposure to sexual activity and the other accounting for the exposure to sexual activity. Then, we follow the same approach to estimate differences in age-fertility patterns by HIV status according to place of residence and wealth status.

Fourth, we also use the second set of regression to analyze the association between HIV and adolescent fertility at the country level. In countries with more than one survey, we pool all eligible surveys for the country and include survey year as a fixed effect. We exclude Niger and Sao Tome and Principe from this part of the analysis due to their small sample sizes of births to HIV-positive women.

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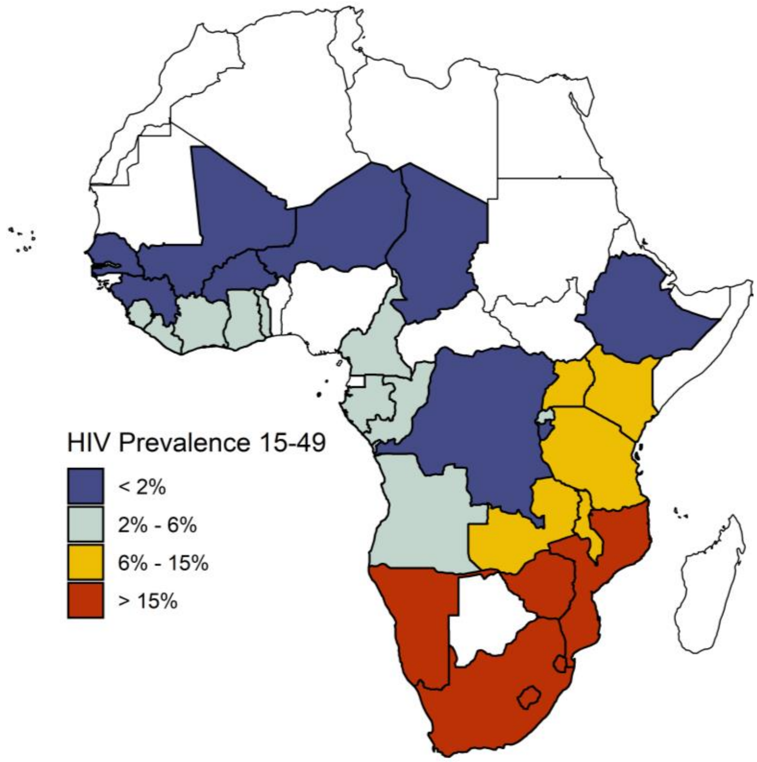
[2] Using household wealth index, we classified women living in households in the first and second quintiles as poor and those living in the third, fourth, and fifth quintiles as not poor.

Figure 1: HIV prevalence among women aged 15–49 in the most recent Demographic and Health Survey.

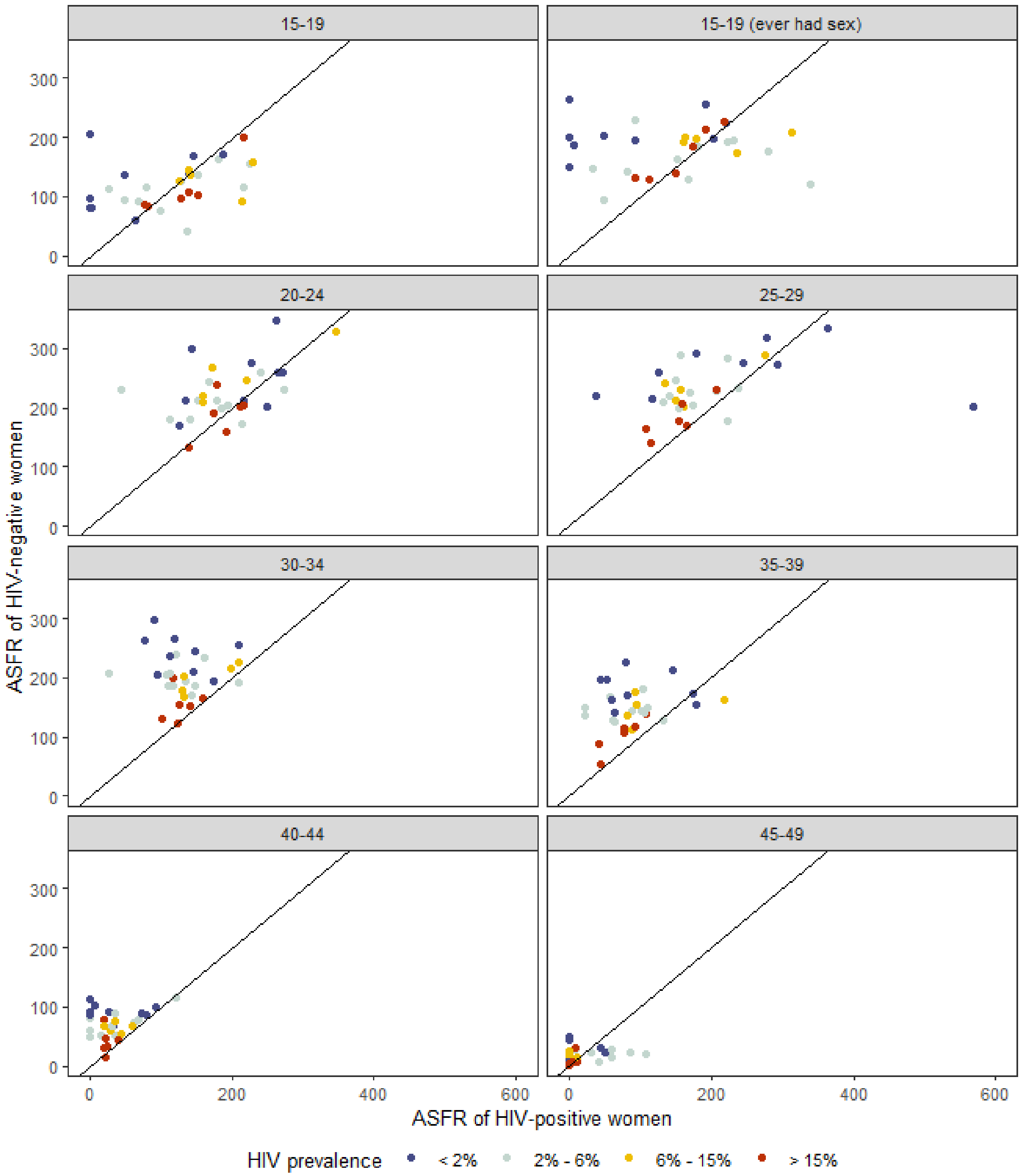


Results

Across the 31 countries included in this study, HIV prevalence among women aged 15–49 ranges from 0.4% in Niger to 31.1% in Eswatini in the most recent survey, while TFR, varies from 2.6 births per woman in South Africa to 7.6 births per woman in Niger (see Table 1). In this sample, the ratio of TFRs between HIV-positive and HIV-negative women in the most recent survey ranges from 0.5 in Burundi and Chad to 1.1 in Sao Tome and Principe and Uganda, with most ratios below 1, indicating that HIV-positive women tend to have lower fertility compared to HIV-negative women.

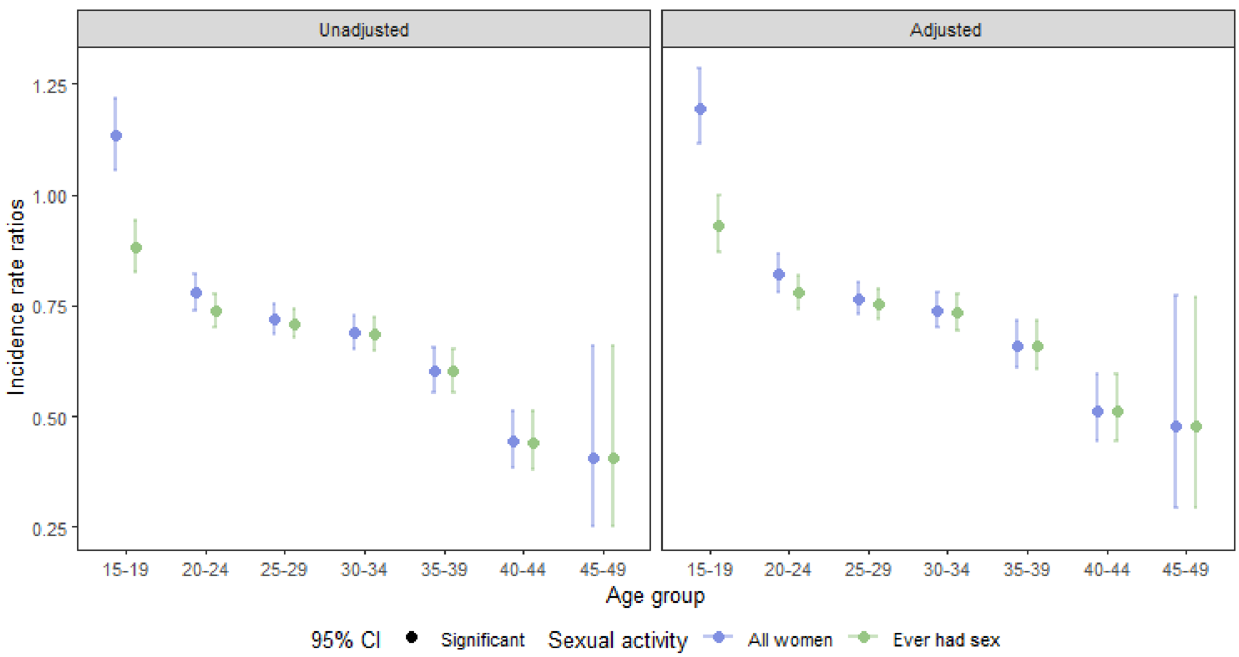
Figure 2 presents ASFR by HIV status. Each dot corresponds to the most recent survey in each country and the black diagonal line represents the symmetry of the rates. For the 15–19 age group, the majority of countries lie below the diagonal line, which signifies that the fertility of HIV-positive women is higher than that of HIV-negative women. Although this pattern is observed varying levels of HIV prevalence, it is more common in higher prevalence countries. However, when we account for exposure to sexual activity, many countries now lie above the diagonal line. The fertility of HIV-positive adolescents is now lower than that of HIV-negative adolescents, particularly in countries in the highest and lowest HIV prevalence groups. In all other age groups, most countries are above the diagonal line, indicating that HIV-negative women have higher fertility than that of HIV-positive women.

Figure 2: Age-specific fertility rates by HIV status for the most recent survey in each country.



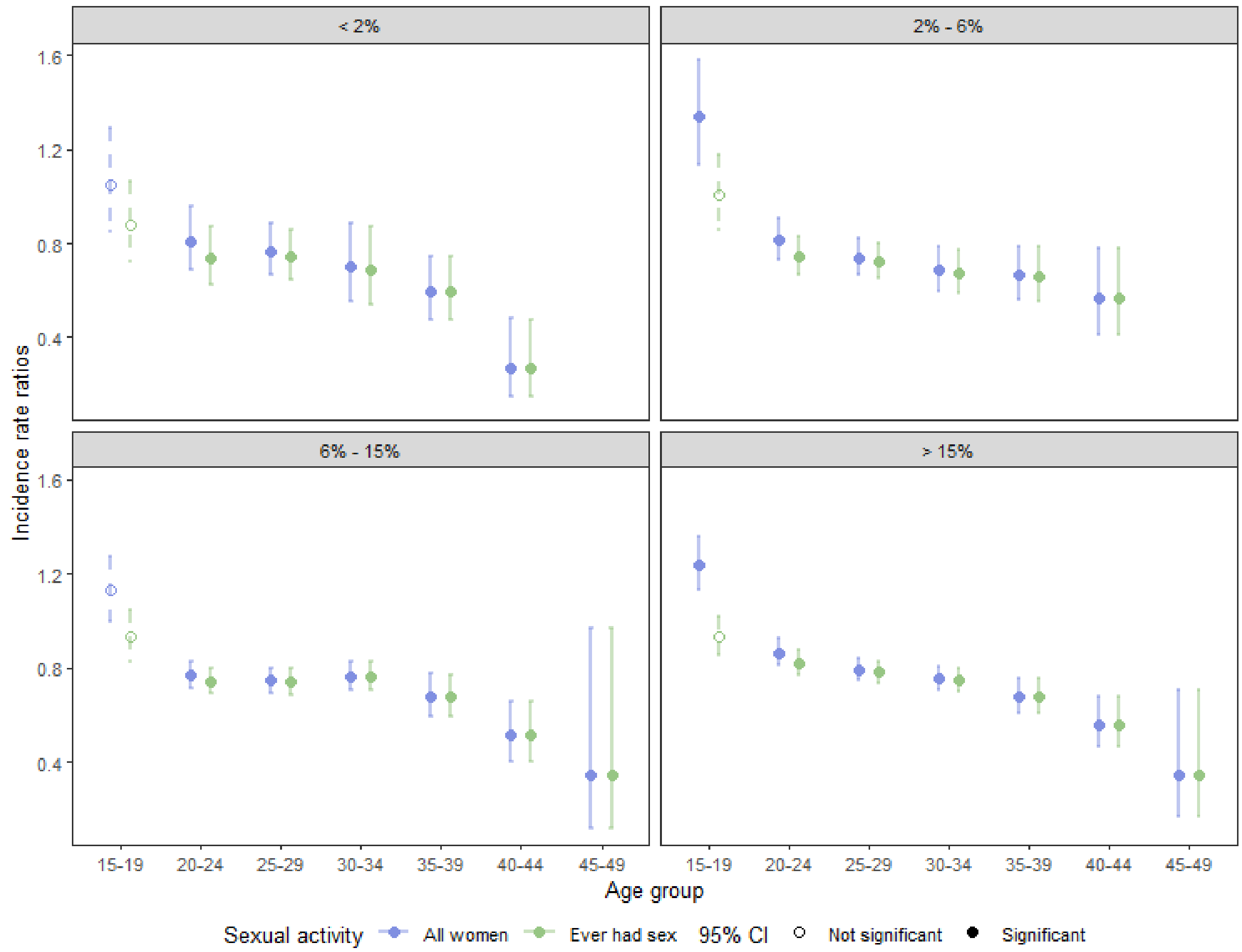
In Figure 3, we present unadjusted and adjusted (account for socio-demographic characteristics) estimates of the association between HIV and fertility by age group in the left and right panel, respectively. Unadjusted estimates that do not account for exposure to sexual activity (purple dots in left panel) show that HIV-positive adolescents' fertility rates are 1.13 times (95% confidence interval (CI): 1.06 – 1.22) higher than HIV-negative adolescents' fertility. In contrast, the opposite pattern is found among older women: HIV-positive women have lower fertility than HIV-negative women. However, when we account for sexual activity (green dots), the relationship changes for adolescents. HIV-positive adolescents now have 0.88 times (CI: 0.82 – 0.94) lower fertility than HIV-negative adolescents. Adjusted estimates (see right panel of Figure 3) present similar patterns to that of unadjusted estimates, although IRRs are smaller. Fertility among HIV-positive adolescents is 1.20 times (CI: 1.11 – 1.28) higher compared to HIV-negative adolescents. In contrast, when we account for exposure to sexual activity, HIV-positive adolescents have 0.93 times (CI: 0.87 – 0.99) lower fertility than HIV-negative adolescents. It should be noted that the upper limit of the 95% confidence interval shows a value close to 1. In fact, the IRR is no longer statistically significant if a 99% confidence level is used (IRR = 0.93; 99% CI: 0.85 – 1.02). For women aged 20 years and older, HIV-negative women are more likely to have higher fertility than HIV-positive women both when all women are considered and when only those who have ever had sex are taken into account. Also, IRRs vary from 0.82 (CI: 0.78 – 0.86) for women aged 20 to 24 years to 0.48 (CI: 0.30 – 0.77) for women aged 45 to 49 years.

Figure 3: Incidence rate ratios among HIV-positive women to HIV-negative women by age group.



We find similar patterns of the HIV-fertility association when we group surveys by HIV prevalence (groups are presented in Figure 1). Figure 4 displays adjusted IRRs of HIV-positive women to HIV-negative women by age group and HIV prevalence. In models that do not account for sexual activity (see purple dots), HIV-positive adolescents have higher fertility than HIV-negative adolescents, although this difference is not statistically significant in countries with less than 2% HIV prevalence and marginally significant in countries with HIV prevalence between 6% and 15%. In contrast, once we account for exposure to sexual activity (see the green dots), the IRRs of the 15–19 age group are no longer statistically significant. For women aged 20 years and older, HIV-positive women are more likely to have lower fertility than their HIV-negative counterparts, regardless of whether models take into account sexual activity.

Figure 4: Adjusted incidence rate ratios of HIV-positive women to HIV-negative women by age group according to HIV prevalence.



Note: Estimates could not be obtained for women in the 45–49 age group living in countries with HIV prevalence below 6% due to small sample size of births to HIV-positive women.

In Figure 5, we compare IRRs of fertility among women aged 20–49 by age group to women in the youngest age group, 15–19 years, according to HIV status. IRRs have been estimated separately for each HIV status. When IRRs are computed for all women (purple dots), we observe that HIV-positive women aged 20–29 years have significantly higher fertility than HIV-positive adolescents. Similarly, HIV-negative adolescents have significantly lower fertility than HIV-negative women aged 20–39 years. Interestingly, when exposure to sexual activity is taken into account (green dots), the reverse pattern is observed among HIV-positive women. None of the age groups have higher fertility than adolescents, which suggests that HIV-positive adolescent girls have similar fertility to that of HIV-positive women in their prime childbearing years, between the ages of 20 and 34. Estimates for HIV-negative women show that women aged 20–34 years have higher fertility than adolescents and that women aged 35 years and older have lower fertility than adolescents.

Figure 5: Adjusted incidence rate ratios of women aged 20 to 49 years to women aged 15 to 19 years by HIV status.

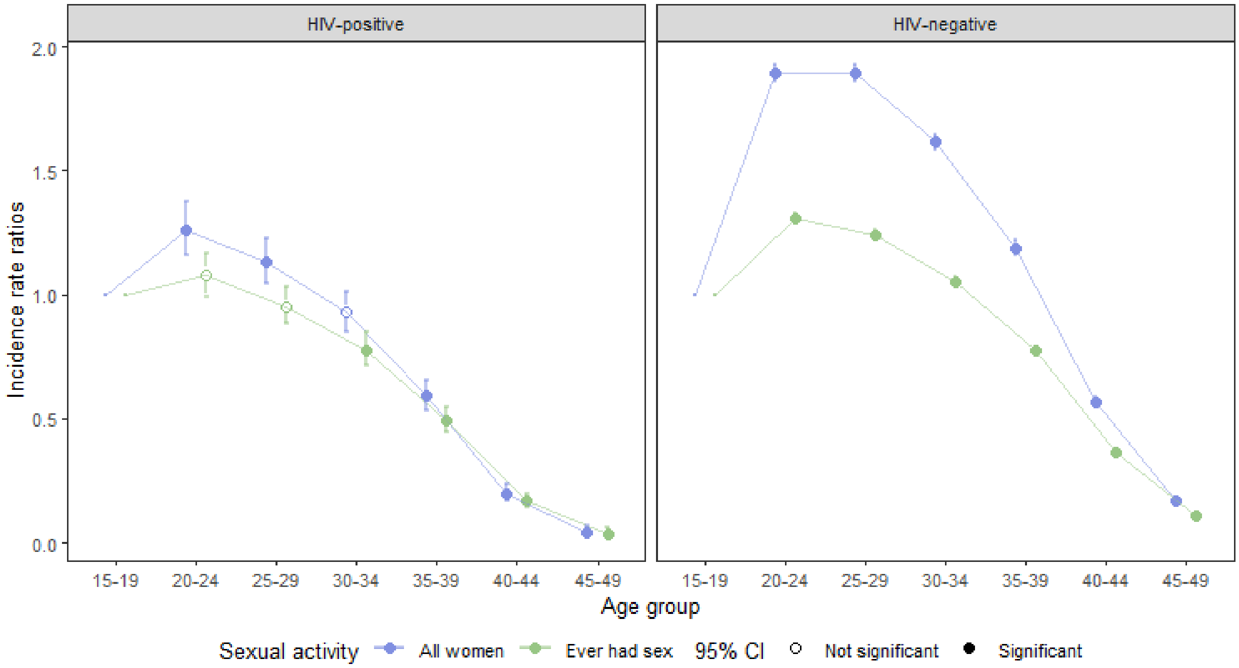
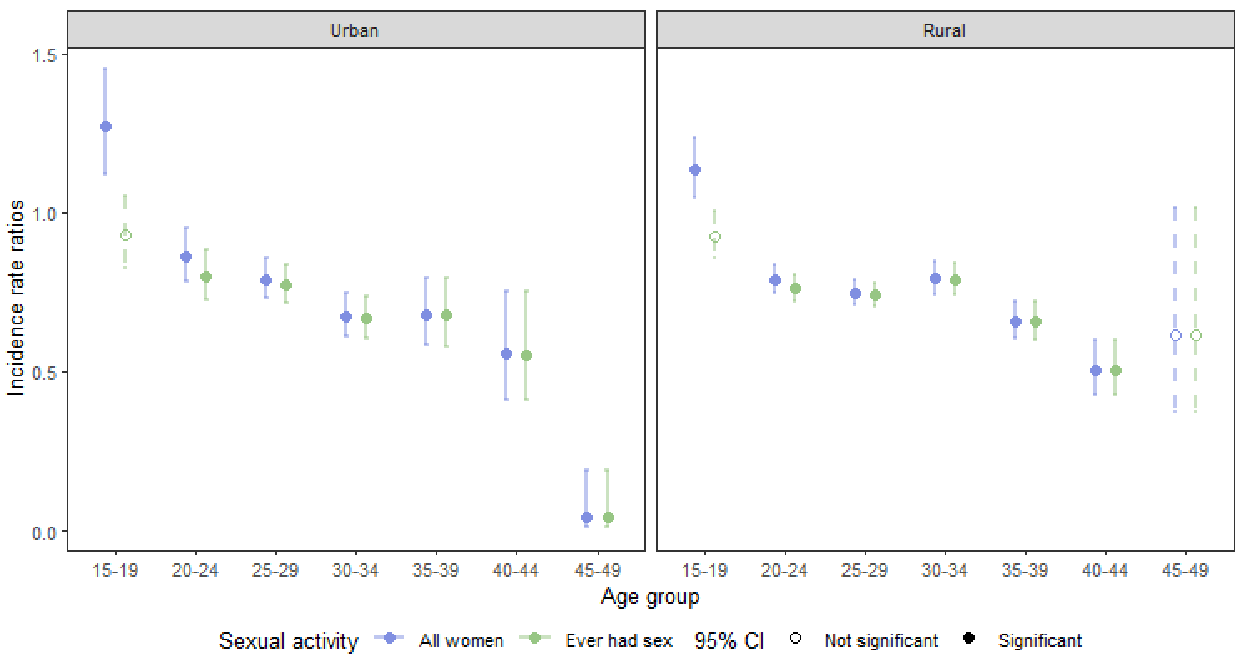


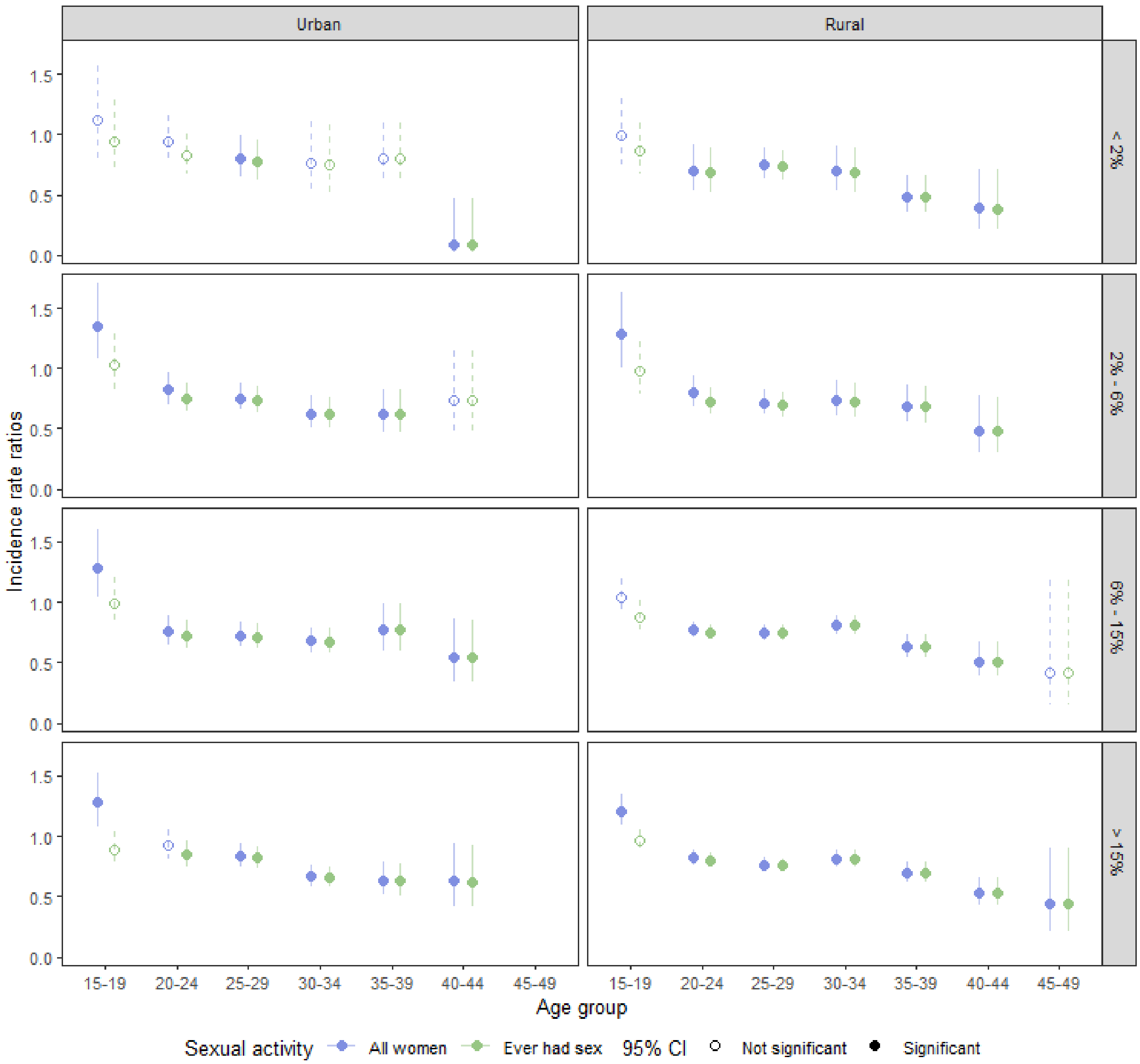
Figure 6: Adjusted incidence rate ratios of HIV-positive women to HIV-negative women by age group according to place of residence.



We also explore age-specific fertility patterns by HIV status according to place of residence. Figure 6 shows adjusted IRRs of HIV-positive women to HIV-negative women by age group in urban and rural areas. In both areas, HIV-positive adolescents are more likely to have higher fertility than their HIV-negative counterparts, 1.27 (CI: 1.12 – 1.45) times higher in urban areas and 1.14 (CI:

1.05 – 1.24) times higher in rural areas. Likewise, in both areas, the IRRs are no longer statistically significant when exposure to sexual activity is taken into account. However, we note that the IRR of adolescents living in rural areas is marginally significant (IRR = 0.93; 90% CI: 0.87 – 0.99). As for older women in urban areas, IRRs vary from 0.86 (CI: 0.78 – 0.95) for women aged 20–24 to 0.04 (CI: 0.01 – 0.19) for women aged 45–49. In rural areas, IRRs are relatively similar, between 0.75 and 0.79, for women aged 20–34, and become smaller for women aged 35 and older.

Figure 7: Adjusted incidence rate ratios of HIV-positive women to HIV-negative women by age group according to place of residence and HIV prevalence.



Note: Estimates could not be obtained for women in the 45–49 age group living in rural areas and in countries with HIV prevalence below 6%, and living in urban areas due to small sample size of births to HIV-positive women.

Age-patterns of the association between fertility and HIV by place of residence according to HIV prevalence are presented in Figure 7. In urban areas, HIV-positive adolescents are significantly more likely to have more births in the three-year period before the survey than HIV-negative adolescents, except in countries where HIV prevalence is below 2% (see purple dots). As for older women, a similar pattern is generally observed, though with a few exceptions, in all HIV prevalence groups. Once we account for exposure to sexual activity (see green dots), IRRs of adolescents are no longer statistically significant in any HIV prevalence group. We find similar patterns in rural areas (see the purple dots), though IRRs for this age group are only statistically significant in countries where HIV prevalence is between 2% and 6% or above 15%. None of the IRRs for adolescents is statistically significant when exposure to sexual activity is taken into account (see the green dots).

Adjusted IRRs of HIV-positive women to HIV-negative women by wealth status are presented in Figure 8. Estimates show that fertility among non-poor HIV-positive adolescents is 1.27 (CI: 1.17 – 1.39) higher compared to non-poor HIV-negative adolescents (see purple dots in the right panel). In contrast, the IRR between poor HIV-positive adolescents and poor HIV-negative adolescents is not statistically significant (see purple dots in the left panel). Once we account for exposure to sexual activity (see green dots), the IRR of non-poor adolescents is no longer statistically significant, which is in contrast to the IRR of poor adolescents which becomes statistically significant. Poor HIV-positive adolescents are 0.84 (CI: 0.76 – 0.94) times more likely to have lower fertility than poor HIV-negative adolescents (see the left panel). This association also holds at the 99% confidence level (IRR = 0.84; 99% CI: 0.73 – 0.97).

Figure 8: Adjusted incidence rate ratios of HIV-positive women to HIV-negative women by age group according to wealth status.

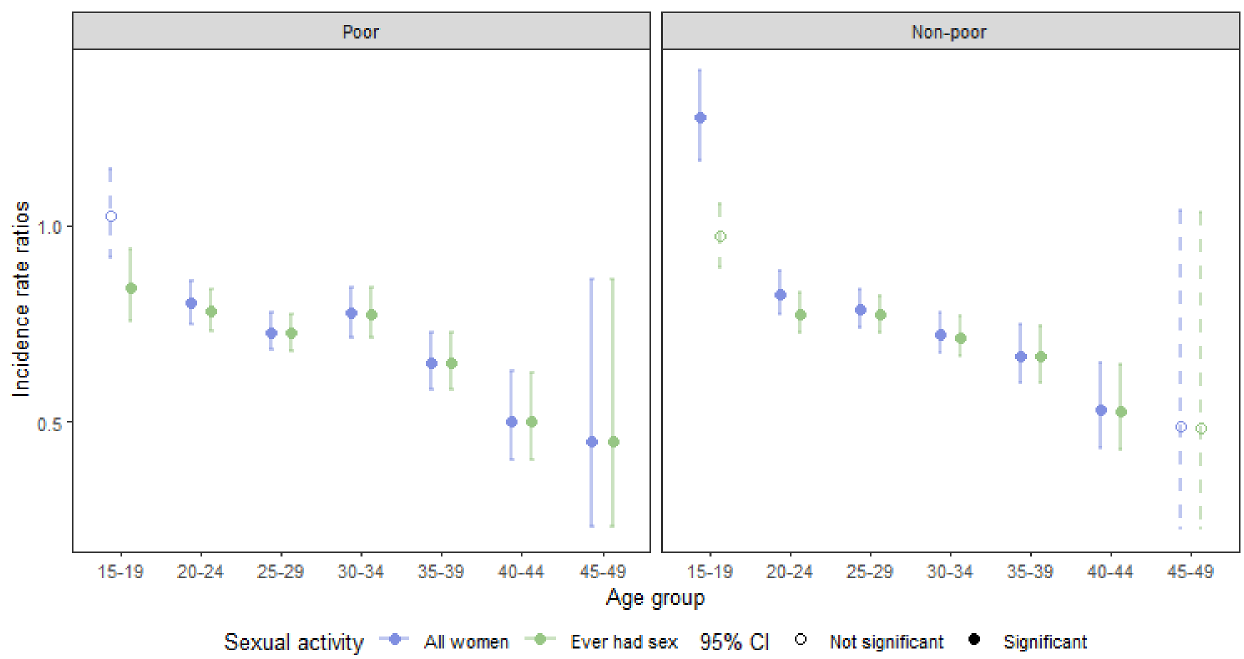
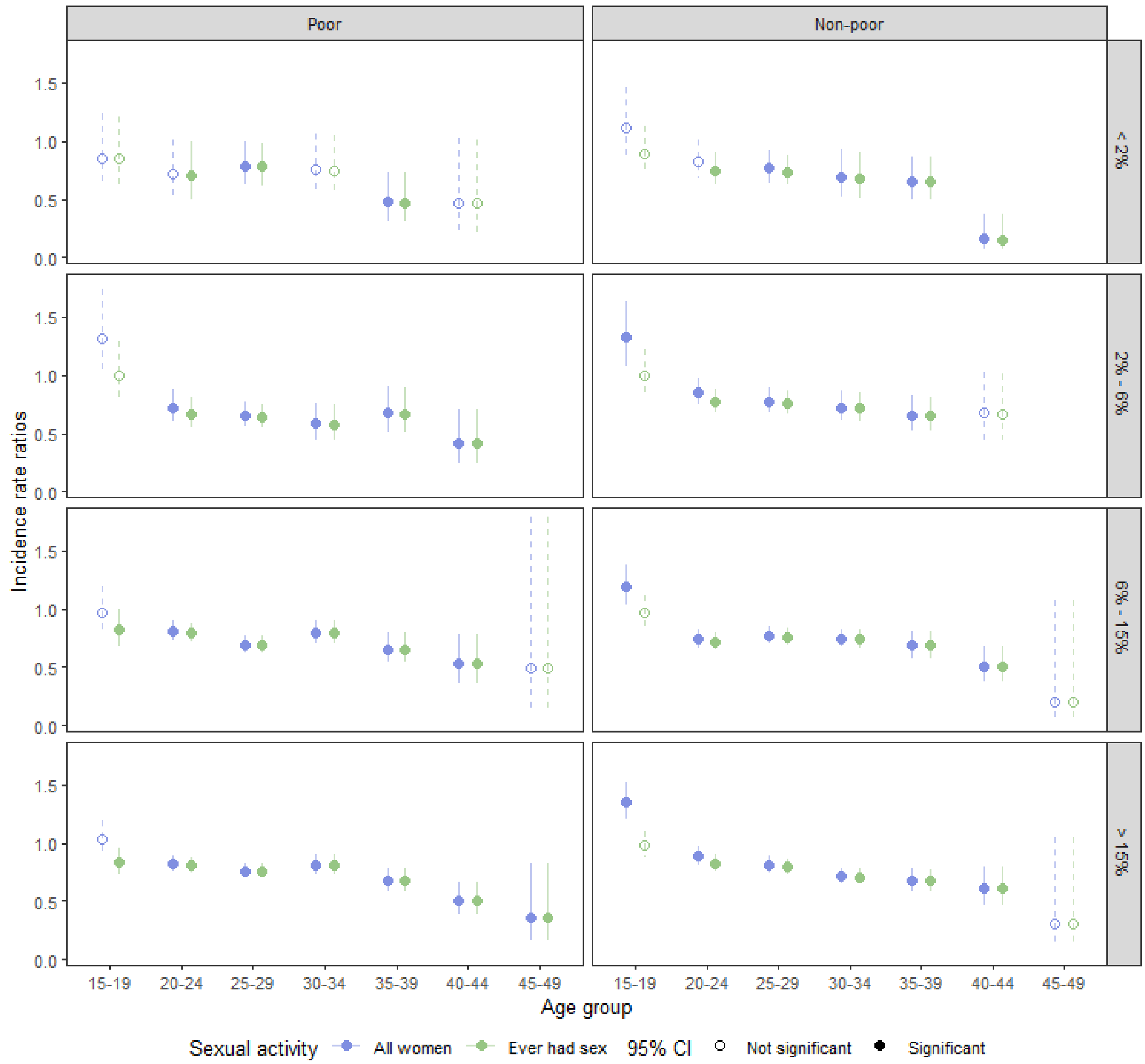


Figure 9: Adjusted incidence rate ratios of HIV-positive women to HIV-negative women by age group according to wealth status and HIV prevalence.

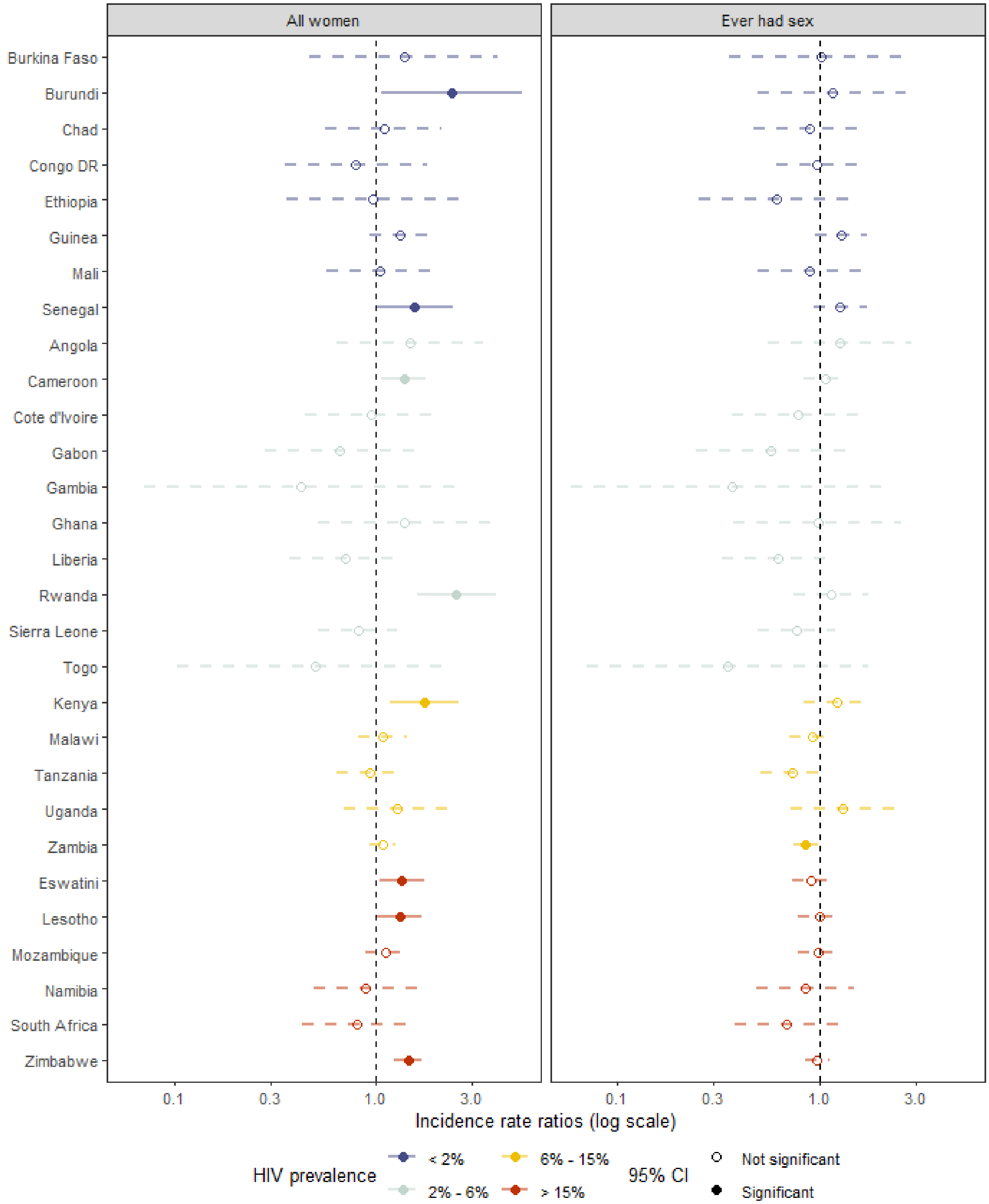


Note: Estimates could not be obtained for women in the 45–49 age group living in countries with HIV prevalence below 6% due to small sample size of births to HIV-positive women.

Figure 9 displays adjusted IRRs of HIV-positive women to HIV-negative women by age group according to wealth status and HIV prevalence. Age-specific fertility patterns by HIV status vary minimally across HIV prevalence groups (see purple dots). IRRs are similar across (most) age groups regardless of HIV prevalence and wealth status. As for poor women (see the left panel), we observe that IRRs of HIV-positive adolescents to HIV-negative adolescents are not statistically significant in any HIV prevalence group (see the purple dots). However, when we account for exposure to sexual activity (see the green dots), fertility ratios become statistically significant in two HIV prevalence groups: 6% to 15% (IRR = 0.82; CI: 0.68 – 0.99) and above 15% (IRR = 0.84; CI: 0.73 – 0.96). In these cases, HIV-positive adolescents are more likely to have lower fertility than their HIV-negative counterparts. As for non-poor women (see the right panel), HIV-positive adolescents are more likely to have higher fertility than HIV-negative adolescents (see purple dots), except in countries where HIV prevalence is less than 2%. However, once we account for exposure to sexual activity (see the green dots), no difference by HIV status is observed among adolescents in all HIV prevalence groups.

Figure 10 shows adjusted IRRs of HIV-positive adolescents to HIV-negative adolescents at the country level. In the left panel, we present results of analyses in which we do not account for exposure to sexual activity. We find that IRRs are statistically significant in only eight of the 31 countries included in this study: Burundi (IRR = 2.37; CI: 1.06 – 5.29), Cameroon (IRR = 1.38; CI: 1.07 – 1.78), Eswatini (IRR = 1.35; CI: 1.05 – 1.73), Kenya (IRR = 1.74; CI: 1.18 – 2.57), Lesotho (IRR = 1.31; CI: 1.02 – 1.69), Rwanda (IRR = 2.52; CI: 1.60 – 3.97), Senegal (IRR = 1.55; CI: 1.01 – 2.40), and Zimbabwe (IRR = 1.45; CI: 1.24 – 1.69). In all of these countries, HIV-positive adolescents are more likely to have higher fertility than HIV-negative adolescents. We note that only in Kenya (CI: 1.04 – 2.90), Rwanda (CI: 1.39 – 4.59), and Zimbabwe (CI: 1.18 – 1.78) the IRRs remain statistically significant at the 99% confidence level, which are countries classified as countries with the highest HIV prevalence. As for estimates accounting for exposure to sexual activity (see the right panel), we found statistically significant differences in only one country. In Zambia, HIV-positive adolescents are 0.86 times (CI: 0.75 - 0.99) more likely to have lower fertility than HIV-negative adolescents. However, we note that this IRR is no longer statistically significant at the 99% confidence level (CI: 0.71 – 1.03).

Figure 10: Adjusted incidence rate ratios of HIV-positive women to HIV-negative women by country for the 15–19 age group.



Discussion

In this study, we examined age-specific fertility patterns by HIV status in 31 sub-Saharan African countries to investigate whether these patterns vary for adolescent girls compared to women in other age groups. In contrast to previous studies on this topic, we took into account exposure to sexual activity, i.e., those who have ever had sex, when analyzing the association between HIV status and fertility. Specifically, we calculated fertility rates in which we included all women in calculations and then recalculated them after excluding women who report never having had sex. This approach introduced an adjustment to the exposure — woman-years — in calculations of fertility rates, resulting in higher rates of fertility as the denominators became smaller. Lastly, we grouped countries according to their HIV prevalence and analyzed fertility patterns by HIV status.

Consistent with previous research (Chen & Walker, 2010; Gregson et al., 2002; Lewis et al., 2004; Marston et al., 2017), our estimates from the pooled sample (all surveys) showed that HIV-negative women higher fertility than HIV-positive women and that this pattern is observed in all age groups except for adolescents. Among the latter, we observe the opposite pattern: fertility is higher among HIV-positive adolescents. This difference persisted even after controlling for socio-demographic characteristics, such as place of residence, educational attainment and wealth status. However, after accounting for exposure to sexual activity, we observed that, in most cases, HIV-positive adolescents have lower fertility than HIV-negative adolescents. This result suggests that adolescent girls are not so different from older women when sexual activity is taken into account. Next, we explored whether place of residence and wealth status could explain these patterns. In both urban and rural areas, HIV-positive adolescents have higher fertility than HIV-negative adolescents, while the opposite is true for older women. However, differences in fertility by HIV status for adolescents were no longer statistically significant once we accounted for exposure to sexual activity. In contrast, fertility patterns by HIV status for adolescents were different when we analyzed fertility ratios according to wealth status. Poor HIV-positive adolescents have lower fertility than their poor HIV-negative counterparts, while no difference is observed for non-poor adolescents.

Our results showed that adolescent fertility patterns by HIV status vary by country; thus, regional-level estimates may be masking country-level differences. In about a quarter of the countries analyzed in this study, and mainly in countries with higher HIV prevalence, HIV-positive adolescents have higher fertility than HIV-negative adolescents. However, once we account for exposure to sexual activity, this relationship is statistically significant in only one country.

We also found that HIV-positive adolescent girls are more likely to have higher fertility (or at least, they are not more likely to have lower fertility) than older HIV-positive women. Considering that one-third of new infections among women of reproductive age occur among girls aged 18 and below in SSA (UNAIDS, 2022) and that the median age at first sexual intercourse in the countries included in our study is 17 years (ranging from 15.9 in Niger to 20.7 in Rwanda) (ICF International, 2023), many adolescent girls initiating sexual activity are at risk of HIV infection and early pregnancy. This double burden is often the result of low levels of HIV knowledge and contraceptive use, as well as early marriage, sexual violence and traditional gender norms (Chae, 2013; Duflo et al., 2015; Norton et al., 2017; Phillips & Mbizvo, 2016; Rutenberg et al., 2003; UNFPA, 2012; Woog & Kagesten, 2017). Adolescent-focused reproductive health programs could increase both HIV awareness and knowledge about contraceptive methods, while reinforcing more equitable gender norms, which could help prevent the spread of sexually transmitted diseases and reduce the number of unintended pregnancies. Also, a legal framework that protects the sexual and reproductive rights of adolescents and strong government institutions that enforce laws against harmful traditional practices such as child marriage could help prevent this double burden.

For adolescents as they transition to adulthood, the dual burden of HIV and childbearing can have important implications for their life trajectories. In SSA, both HIV and complications from pregnancy and childbirth continue to be among the leading causes of death among adolescent girls in SSA (Ross et al., 2021). Moreover, adolescent pregnancy is associated with an increased likelihood of unsafe abortion, school dropout, reduced earning potential, worse neonatal conditions, and lower educational achievements for the present and the next generation (Ganchimeg et al., 2014; Hindin et al., 2016; Phillips & Mbizvo, 2016). HIV infection also has negative impacts on the health of adolescents and newborns, and can lead to stigmatization and social discrimination (UNAIDS, 2020; UNAIDS & UNICEF, 2016). Since adolescents are a vulnerable group from a sexual and reproductive health point of view, it is important to implement policies and programs that reduce their risk of HIV infection and early pregnancy. Future research should examine the implications of this double burden on adolescents, as well as investigate the characteristics of adolescents who are most likely to become infected with HIV, to become pregnant, or to face this double burden simultaneously.

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