# Patterns in HIV Serodiscordance among Couples in Sub-Saharan Africa: Evidence from Ten High-Prevalence Countries

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## Abstract

HIV-1 serodiscordance—one partner HIV-positive, the other HIV-negative—is widespread among couples in sub-Saharan Africa, putting millions of uninfected partners at high risk of HIV infection.[1] To date, most analyses of cross-national patterns in couple discordance have failed to factor into account the underlying statistical predictability of observed patterns. In particular, the finding that HIV-discordant couples in sub-Saharan Africa tend to be female-positive almost as often as they are male-positive[2] should not be surprising: female HIV prevalence is higher than male prevalence in nearly every African country. We introduce two novel metrics of joint HIV status that account for expected trends in the absence of seroconversion or homogamy. Using these metrics, we analyze couples' shared and individual characteristics that may be associated with unusual differentials between observed and expected HIV status.
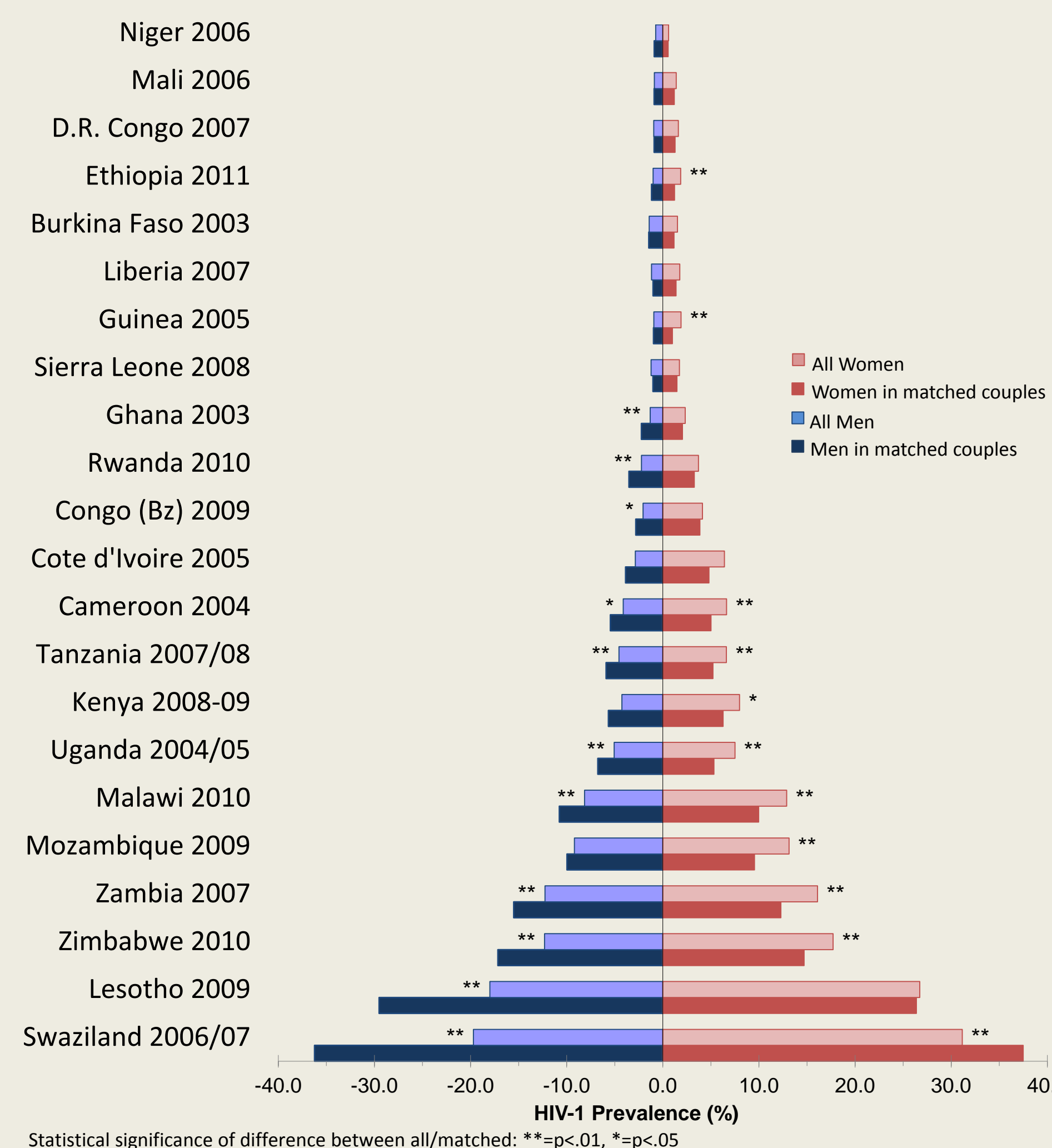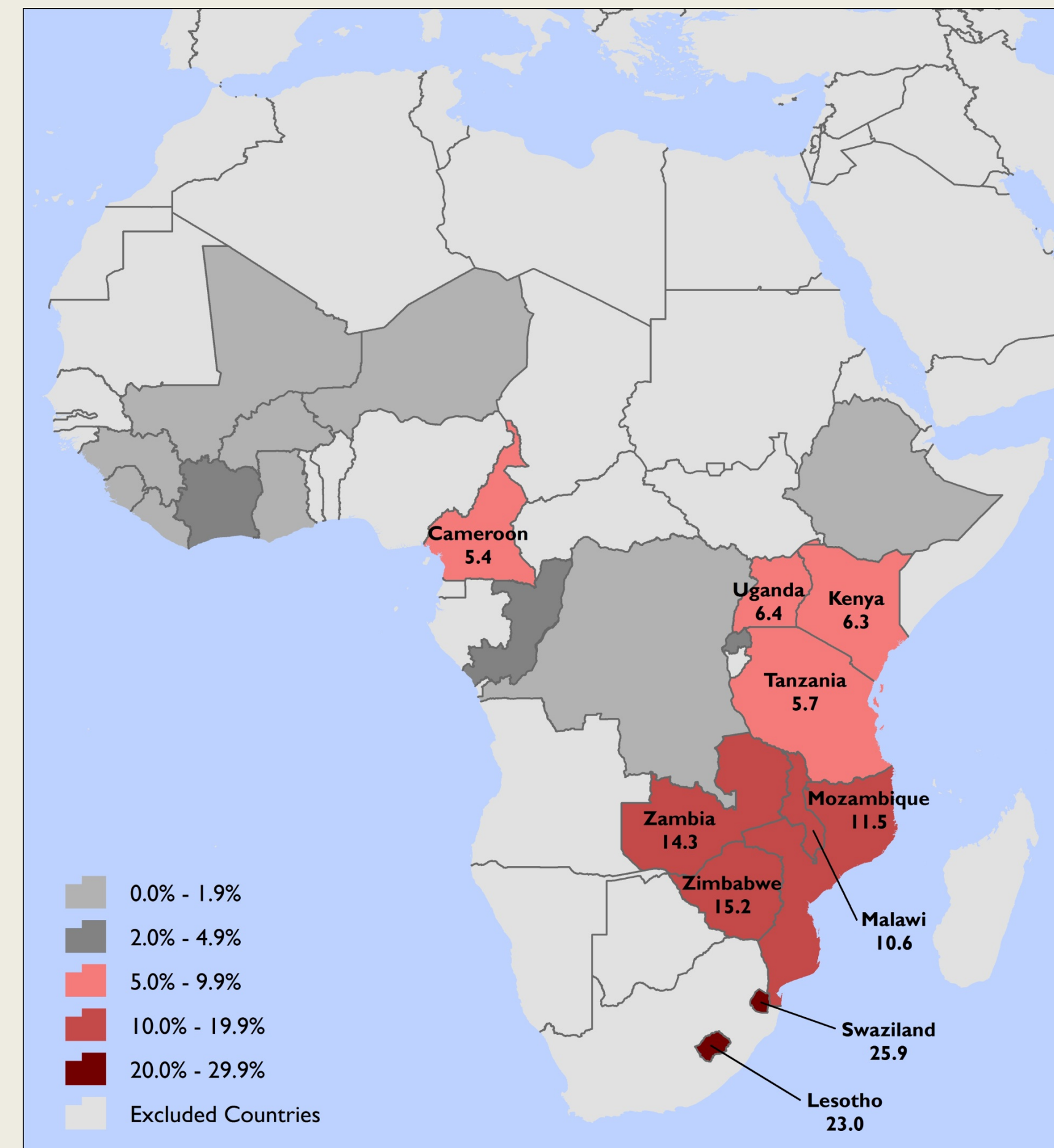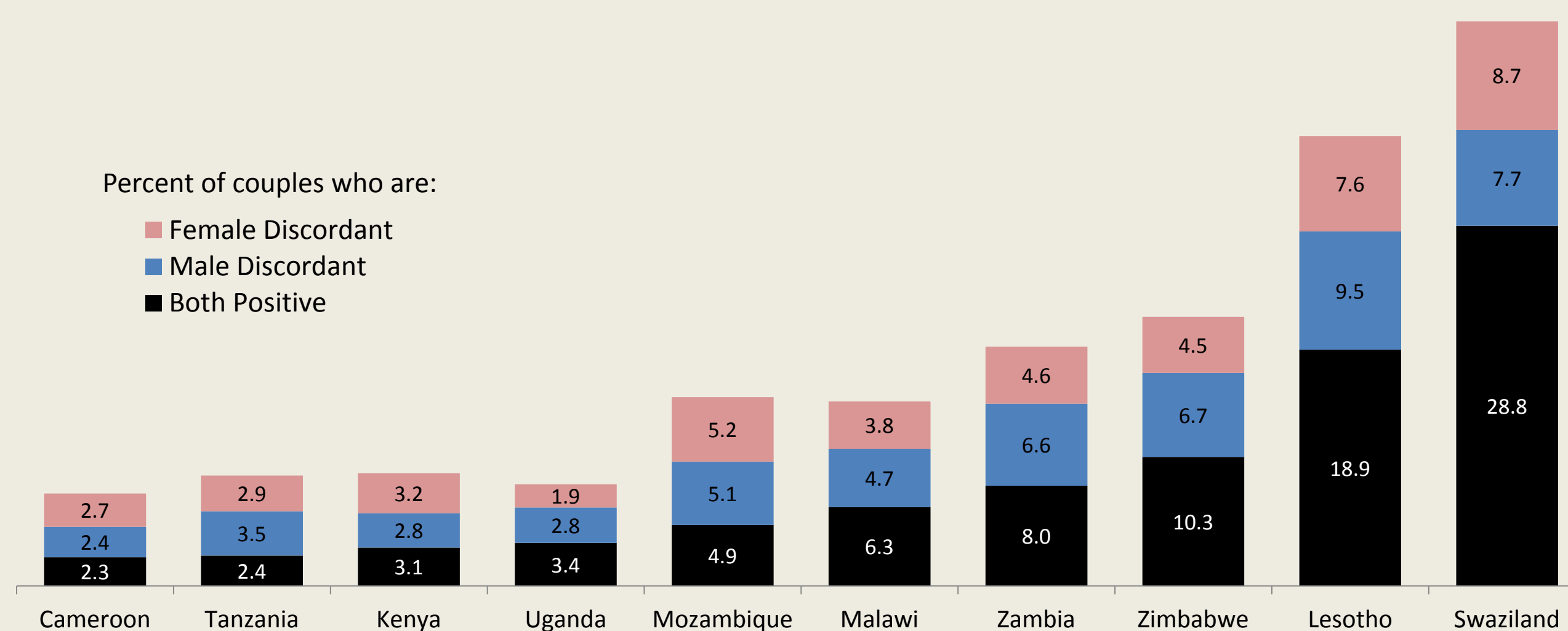
## Data

The study is based on nationally-representative samples of cohabiting couples from ten recent Demographic and Health Surveys in sub-Saharan Africa where adult HIV prevalence was above 5%—Cameroon, Kenya, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Uganda, Zambia, and Zimbabwe "Matched" couples are those where both partners were present at the time of the survey, each identified the other as husband/wife (or 'living together as husband and wife'), and both consented to an HIV test for which results were obtained.

|  | Woman HIV + $p_w$ | Woman HIV - $(1 - p_w)$ |
|---|---|---|
| **Man HIV +** $p_m$ | Positive concordant $P_e(+/+) = p_w \times p_m$ | Male discordant $P_e(+/-) = (1 - p_w) \times p_m$ |
| **Man HIV -** $(1 - p_m)$ | Female discordant $P_e(-/+) = p_w \times (1 - p_m)$ | Negative concordant $P_e(-/-) = (1 - p_w) \times (1 - p_m)$ |

## Methods

In the absence of seroconversion or homogamy, the expected distribution of couples' HIV status would simply be the product of a 2x2 table of male/female HIV prevalence. Differences between expected ($P_e$) and observed ($P_o$) proportions are difficult to interpret because there are multiple entry and exit pathways for each cell. In particular, positive concordance may be the result of seroconversion or it may have been the byproduct of HIV-related selectivity (whether implicit or explicit) in couple formation. We develop two indices to measure $P_o$ relative to $P_e$: the **conversion-homogamy index** and the **balance index**. We use these metrics to examine four types of covariates that would be 'observable' to policymakers: place of residence, age (man's, woman's, difference), education (man's, woman's, difference), and wealth



Percent of couples who are:
- Female Discordant
- Male Discordant
- Both Positive





Statistical significance of difference between all/matched: **=p<.01, *=p<.05

$$\text{Conversion-Homogamy Index} = 100 \times \frac{(P_o(+/+) - P_e(+/+))}{(P_e(-/+) + P_e(+/-))}$$

*Values above 0 indicate excess positive concordant cases per 100 expected discordant cases.*

$$\text{Balance Index} = 100 \times \frac{\left(\frac{P_o(-/+)}{P_o(+/-)}\right)}{\left(\frac{P_e(-/+)}{P_e(+/-)}\right)}$$

*Values above 100 indicate excess female-discordant couples per 100 expected male-discordant couples*

## Results

- In 19 of 22 surveyed countries in sub-Saharan Africa, adult female HIV prevalence is significantly higher than male prevalence. Among men and women in matched couples, only 3 countries had significant gender differences in HIV prevalence
- HIV prevalence is higher among men in couples than it is among men in the general population, but the reverse is true for women. This difference is statistically significant in most higher-prevalence countries.
- As expected, the Conversion-Homogamy Index was significantly greater than 0 in every country. Bivariate distributions of the index show significant and opposing trends by age and residence in Cameroon, Lesotho, Mozambique, and Zimbabwe
- While the Balance index was never significantly different from 100, there were significant and opposing trends in the distribution of the index among rural/urban couples in Cameroon, Mozambique, and Zimbabwe; and by age in Lesotho, Mozambique, and Zimbabwe.
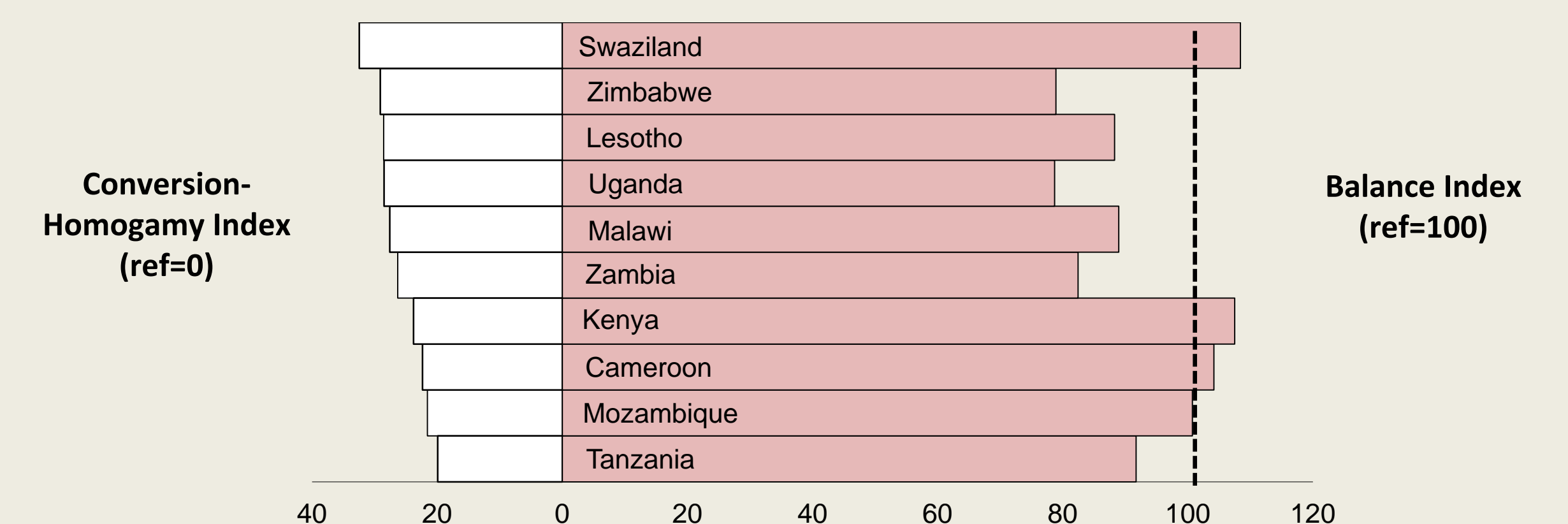


After accounting for the underlying sex ratio of HIV prevalence, we find that there is no statistically significant gender imbalance in HIV discordance among couples in all ten countries. This is true regardless of whether couples are disaggregated by place of residence, age, education, or wealth.

## Discussion

Variation in the conversion-homogamy index across countries, and among four countries by place of residence, age, and education may be indicative of differences in the underlying process of partner selection and union formation within each country and group, or of the relative success of efforts to reduce transmission within couples. The finding that the balance index is not significantly different from expected in any country across every covariate underscores the critical importance of underlying variations in the sex ratio and magnitude of HIV prevalence.

## Limitations

Cross-sectional data cannot show the ordinality of HIV infection within a positive concordant couple, specifically whether one partner seroconverted or both partners had HIV prior to union formation. Differential probabilities of union dissolution due to HIV and differential rates of seroconversion by sex are unobservable but important drivers of the distribution HIV status among couples.