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Supplementary material to "Refusal bias in HIV data from the Demographic and Health Surveys: Evaluation, critique and recommendations"

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Adjustment of HIV prevalence estimates (excluding Lilongwe)

In the main article, we carried out analyses using MDHS data from all districts in Malawi. In 2004 MDHS, Lilongwe district has an unusually high refusal rate (54%) and low observed prevalence.[1] Here, we give results of a parallel set of analyses after removing Lilongwe from the MDHS data. After removing Lilongwe, the number of individuals in the MDHS data becomes 6287. The refusal rate is around 21.9% in MDHS, which remains considerably higher than the other two sources. For MDHS, the refusal rate for men is $610/2784 \approx 0.22$ and for women is $768/3503 \approx 0.22$ in the MDHS data after excluding Lilongwe.

We apply various estimators considered in the main article to MDHS, ANC, and MDICP data. A summary of the results is given in Table 1. For each estimator, we obtain separate HIV prevalence estimates for women and men. The estimates are then combined to derive overall estimates. We use the sampling weighting scheme described in the main article.

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Table 1. HIV prevalence estimates using MDHS, ANC and MDICP data

Estimator	Men	Women	Overall
$\hat{\pi}_{\text{CC}}$	0.1120	0.1522	0.1332
$\hat{\pi}_{\text{MSI}}$	0.1294	0.1558	0.1433
$\hat{\pi}_1$	0.1296	0.1559	0.1434
$\hat{\pi}_2$	0.1070	0.1491	0.1294
$\hat{\pi}_{\text{RE}}$	0.1210	0.1603	0.1417
$\hat{\pi}_{3-}$	0.1026	0.1341	0.1192
$\hat{\pi}_{3+}$	0.1282	0.1714	0.1510
$\hat{\pi}_4$	—	0.1550†	—
$\hat{\pi}_{5A}^{\ddagger}$	0.1308	0.1570	0.1387
$\hat{\pi}_{5B}^{\dagger\dagger}$	0.1310	0.1573	0.1449

† Based only on pregnant females in the ANC survey
‡ Stepwise regression using covariates, X_i and $\hat{\pi}_{\text{ANC}}^{c}$
†† Fixed regression using $\hat{\pi}_{\text{ANC}}^{c}$ only

Among the 4909 individuals who took HIV test, 638 (416 women and 222 men) are found to be HIV positive while 4271 (2319 women and 1952 men) are HIV negative. The (weighted) complete case estimate $\hat{\pi}_{\text{CC}}$ of HIV prevalence in women is 0.1522, and that for men is 0.1120. The overall complete case prevalence estimate is 0.1332. Other estimates are also derived in the same way as the main article, except that Lilongwe is excluded from the MDHS sample. Note that the estimate using $\hat{\pi}_4$ is identical to that in the main text as it does not depend on MDHS data.

Comparing the results here to those in the main article, where we have included Lilongwe in the MDHS data, two observations emerge. First, for both men and women, the HIV prevalence estimates becomes higher once Lilongwe is excluded. This pattern is observed for all methods considered except for $\hat{\pi}_4$, which remains unchanged as it only uses the ANC data. Second, the exclusion of Lilongwe leads to a higher increase in the estimated prevalence across all methods except for $\hat{\pi}_4$. As pointed out earlier, the observed prevalence for Lilongwe is unusually low and hence, including data from Lilongwe would place a downward bias on HIV prevalence. Furthermore, even though the refusal rates for Lilongwe men and women are similar ($105/200 \approx 53\%$ and $118/209 \approx 56\%$, respectively), among those who accept an HIV test, the observed HIV rates for men and women are quite different, $7/95 \approx 7.4\%$ and $2/91 \approx 2.2\%$, respectively. Not only the observed HIV prevalence rates are low, but more importantly, the rate for women is much *lower* than that for men. These results run counter to the well established thesis that HIV prevalence for women is higher in men. Hence, by removing these counter-intuitive results from the analysis, the exclusion of Lilongwe affects women's rates more than men's rates.

References

1. National Statistical Office and ORC Macro. *Malawi Demographic and Health Survey 2004*. National Statistical Office and ORC Macro, 2005.