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BACKGROUND

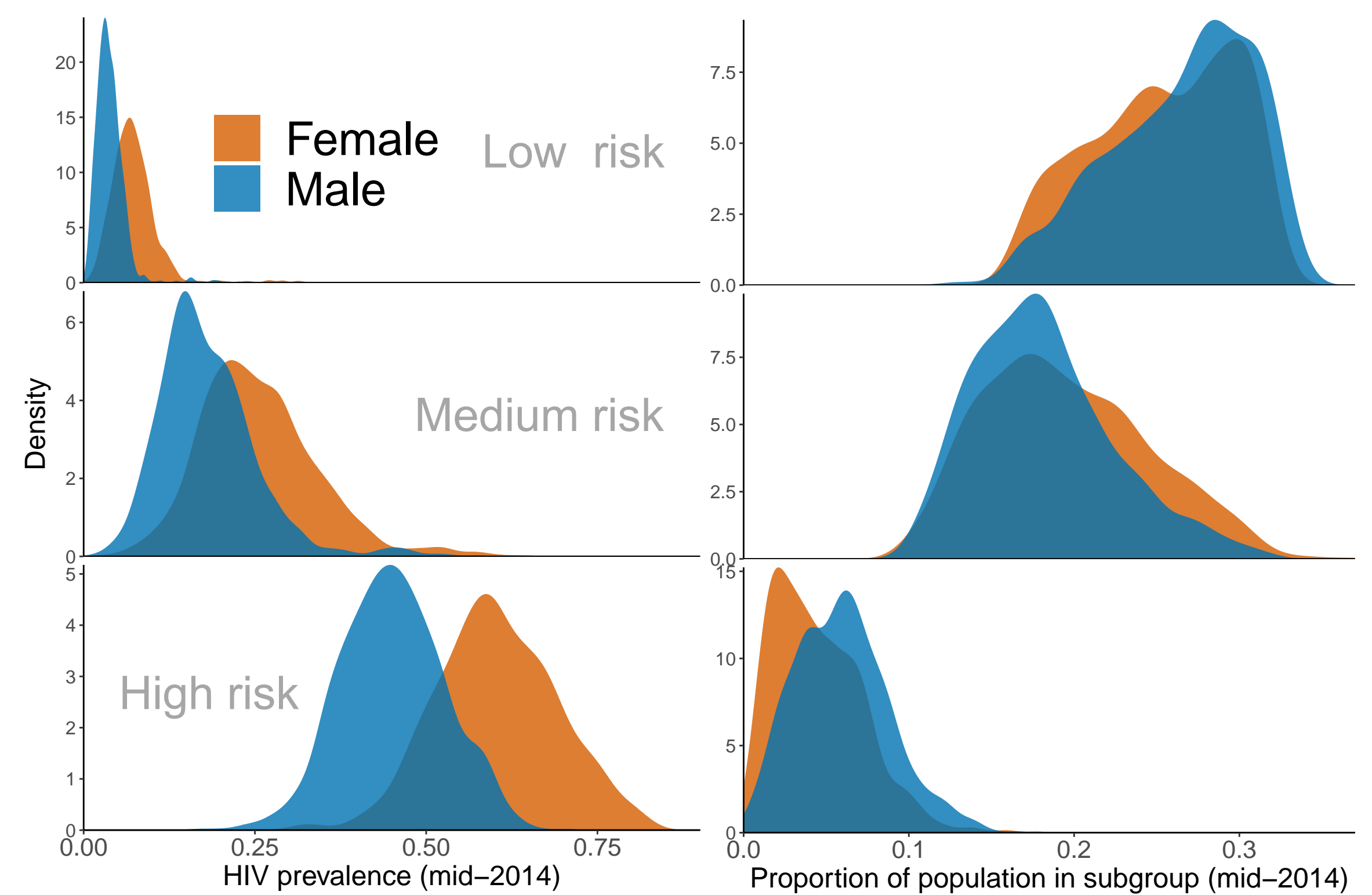
Universal HIV testing-and-treatment (UTT) has been shown to be effective in high prevalence areas in sub-Saharan Africa (SSA) to reduce HIV incidence. Community-wide interventions may change the contribution of groups with different sexual risk-taking behaviour to ongoing HIV incidence and transmission. Understanding these changes will inform future policy towards achieving zero new infections in the context of UTT.

METHODS

Using an individual-based model (PopART-IBM), developed as part of the HPTN 071 (PopART) trial, we project the impact of four scenarios of UTT to 2030, stratified by categories of sexual risk-taking behaviour. The model was calibrated to an intervention community in Zambia using trial data. Categories of sexual risk-taking behavior were derived from trial data from surveys of sexual behavior on reported number of lifetime sexual partners and age.

Projected scenarios were : 1) Simulation of the PopART trial and continuation of a CHiPs intervention after the trial; 2) Discontinuation of a CHiPs intervention after the trial; 3) Simulation of nationwide CHiPs intervention in communities where the trial did not take place; 4) No simulated trial and no CHiPs intervention (counterfactual).

FIGURE 1. HIV prevalence at trial start (mid-2014) (left-hand panel) and proportion of the entire population (14+ years old; right-hand panel) in each subgroup. Distribution is over 1000 parameter sets from model calibration.



Continuation of a UTT approach to 2030 predicts both a substantial drop in incidence and an epidemic that will become more concentrated in those with the highest levels of sexual risk-taking behaviour.

RESULTS – CHARACTERISTICS AT TRIAL START

At trial start (mid-2014.5) mean HIV prevalence in the risk groups was 6% (low), 22% (medium), and 53% (high). The proportion of the 14+ year old population in each group was 52% (low), 38% (medium) 10% (high). Predicted female-to-male HIV prevalence ratio decreased with increasing risk group (Fig. 1).

RESULTS – PREDICTED PATTERNS DURING THE TRIAL

Incidence was predicted to be higher in the high-risk group but differences in the size of these populations meant the largest proportion of transmissions was between those in the medium risk groups (Figs. 1,2,3). The overall probability of onwards transmission was similar between medium- and high-risk groups (Fig. 2).

FIGURE 2. Predicted incidence (left-hand panels) and predicted probability of transmitting HIV at least once (right-hand panels), over the trial period stratified by sex and sexual risk-taking behaviour. Distribution over 1000 parameter sets from model calibration.

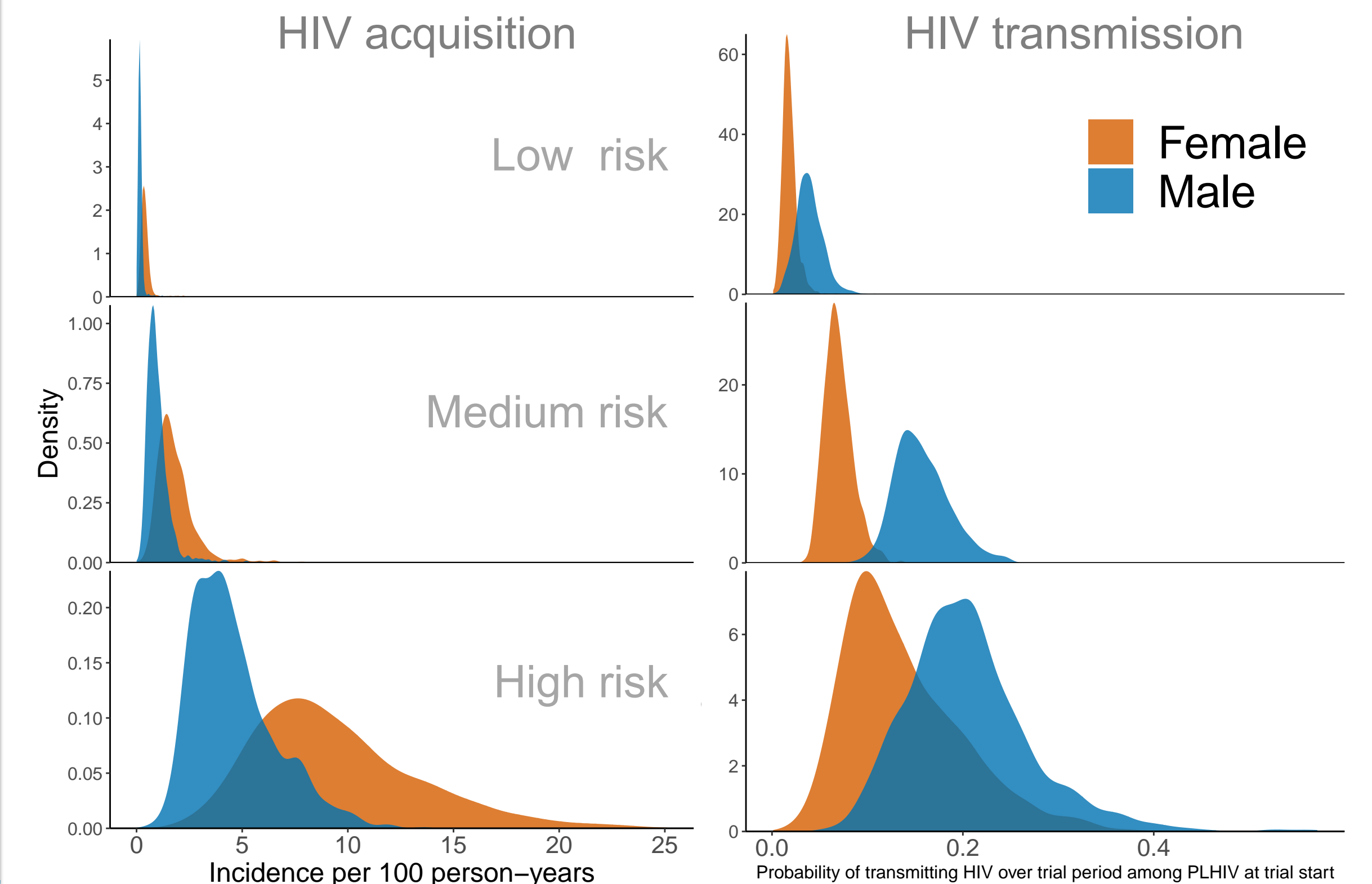
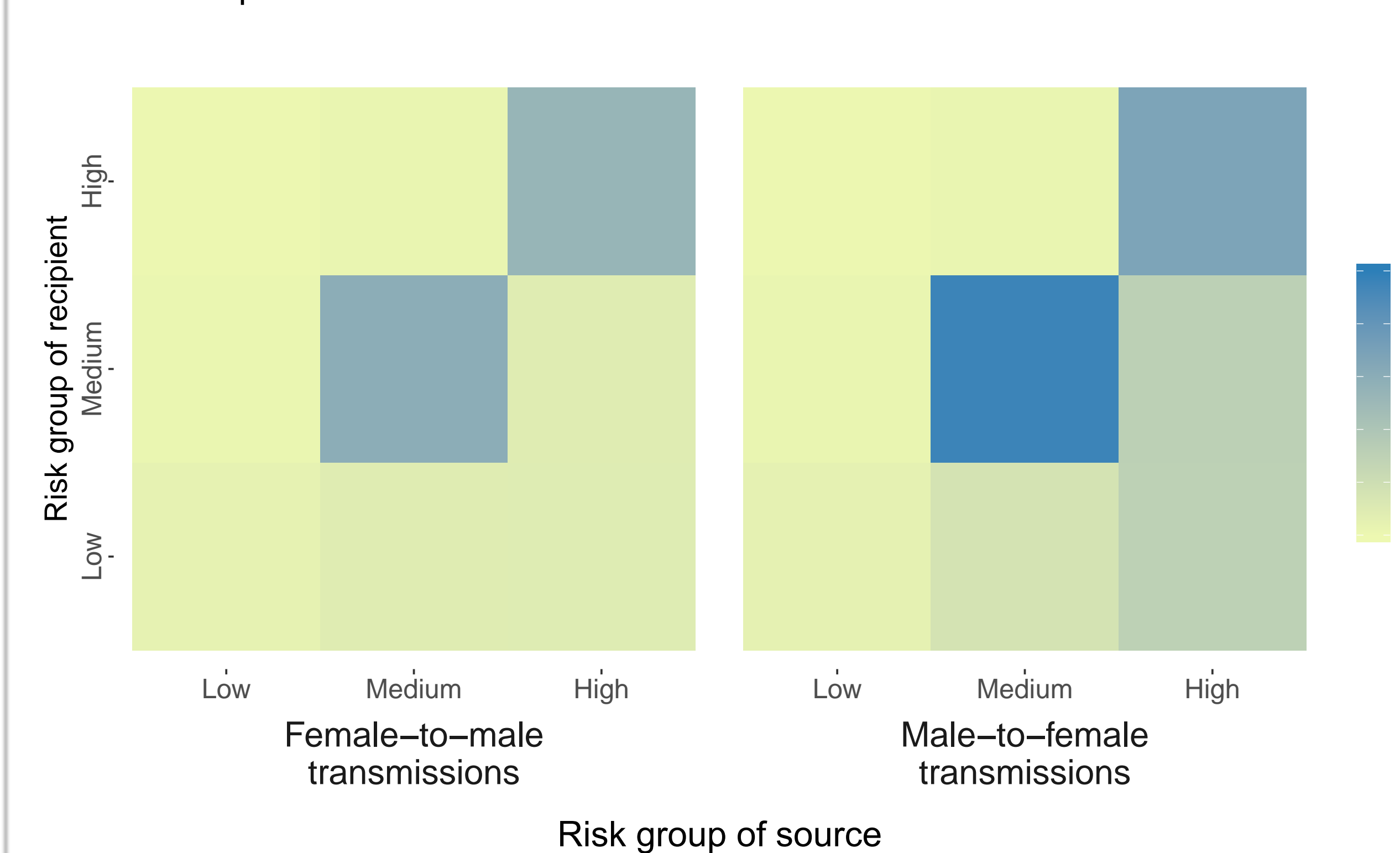


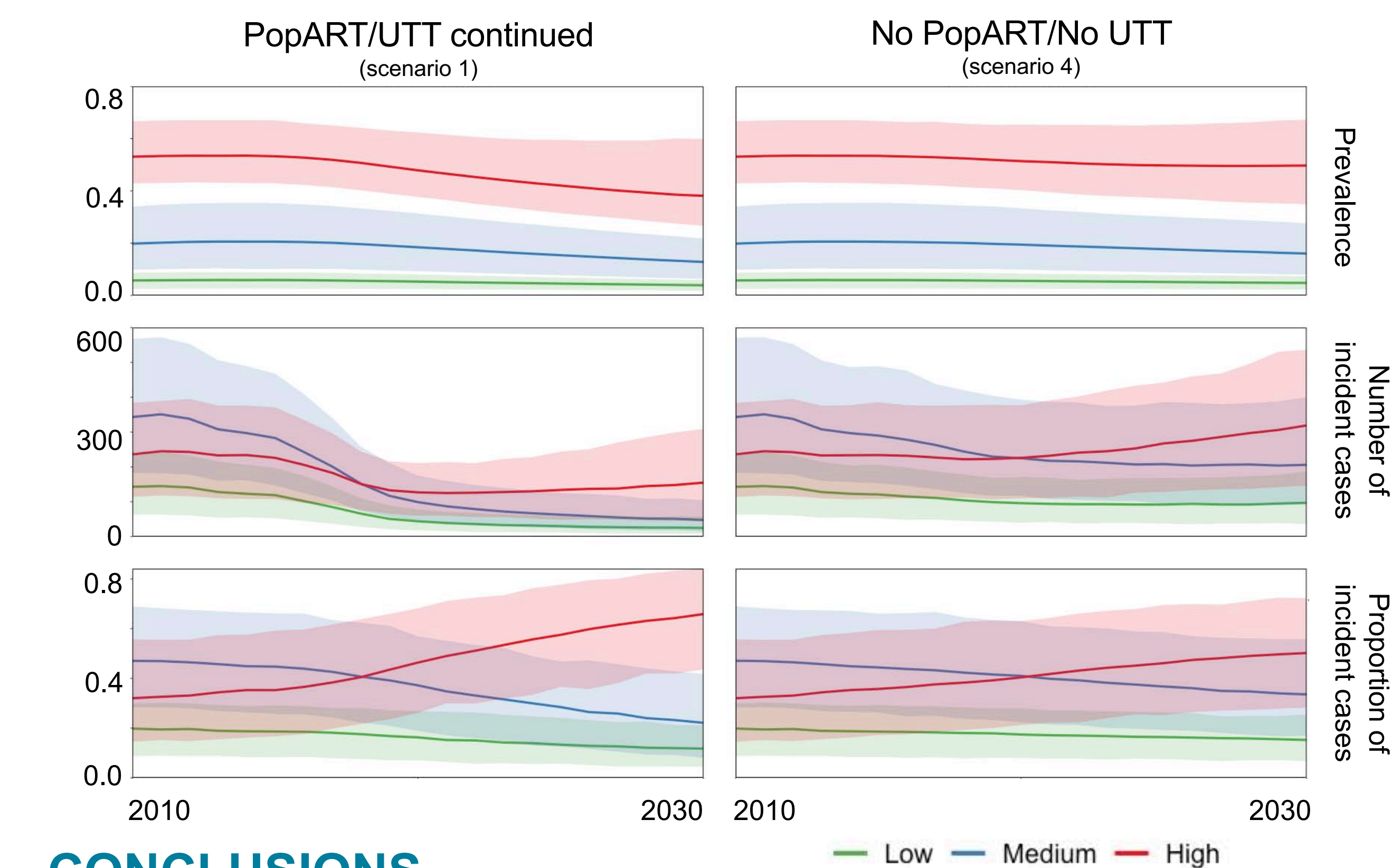
FIGURE 3. Average proportion of total transmissions over trial period (2014.5-2018) between individuals in different groups of sexual risk-taking behavior and stratified by the sex of the source of transmission. Denominator is total number of transmissions over the trial period.



RESULTS - PROJECTIONS TO 2030

Making ART universally accessible to all who are HIV-positive in the PopART community would lead to a substantial decline in incidence in all risk groups but would concentrate new cases in those with the highest levels of risk-taking behaviour (65% of incident cases vs 54% if no UTT was implemented; Fig. 4). While population HIV incidence to 2030 decreases substantially, the model predicts continued persistence of an HIV epidemic in the high-risk subpopulation in all scenarios unless nationwide UTT is adopted.

FIGURE 4. Projections of different scenarios of UTT from 2020-2030 stratified by sexual risk-taking behaviour. Shaded area is 95% quantiles of model output.



CONCLUSIONS

Our results highlight that continuation of a UTT approach to 2030 has the capacity to confer dramatic reductions in new HIV infections. Targeting of high-risk individuals for HIV and STI prevention, testing, and treatment may be necessary following successful UTT interventions in order to eliminate HIV as a public health issue in SSA.

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