

# What impact would introduction of a tenofovir vaginal microbicide have on incidence of HIV in southern Africa?



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## Introduction

The CAPRISA 004 trial evaluated the effectiveness and safety of a 1% tenofovir vaginal microbicide in preventing HIV-acquisition in sexually active HIV-uninfected women aged 18 to 40 years old living in South Africa. It showed a 39% reduction in risk of HIV in women receiving tenofovir vaginal microbicide gel, compared with placebo gel.

**The aim of this modelling study is to evaluate the potential long term effect of widespread introduction of a microbicide gel on HIV incidence in both women and men in a mature heterosexual epidemic.**

## Methods

### Model

We used an existing individual-based stochastic transmission model of HIV (Phillips et al., AIDS 2011, in press) to address this question.

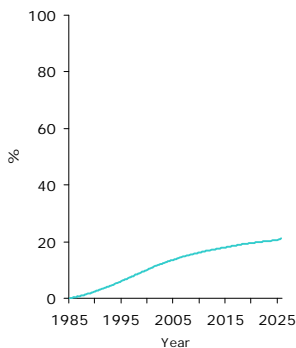
Age, gender, existence of a long term (LT) condom-unprotected (U) sex partner, and the number of short-term (ST) U-partners in each 3 month-period were among variables reflecting sexual behaviour and, for those infected, aspects of HIV and antiretroviral treatment (ART) were updated in 3 month intervals for each of 100,000 individuals.

An epidemic comparable to those experienced in southern African was generated, with HIV testing and ART introduced in 2003 and gradually scaled up by 2011 (Figure 1).

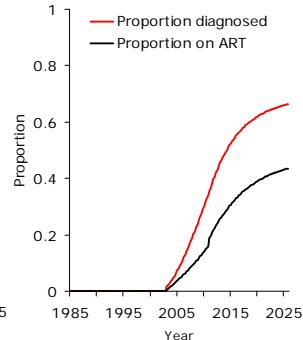
Patients were eligible to start ART if they experience WHO stage 4 condition or if CD4 falls below 200 cells/mm<sup>3</sup>, between 2003-2010 and below 350 cells/mm<sup>3</sup>, after 2010.

**Figure 1. HIV prevalence and proportion of people diagnosed and on ART**

### 1a. HIV prevalence



### 1b. HIV diagnosed and on ART



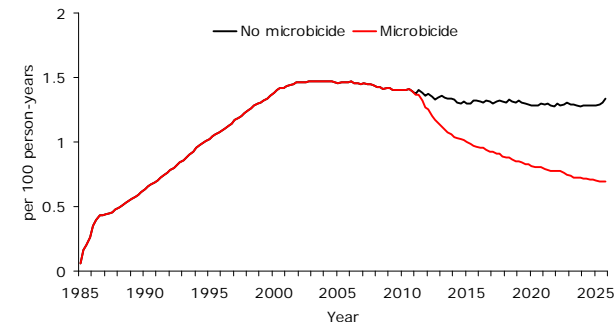
## Methods (continued)

### Key assumptions

- introduction of microbicide gel from 2011 in women 15-65 not diagnosed with HIV who were having U-sex in the current 3 months (~62%) such that 70% of women with a U-partner use the microbicide by 2015, similar to the percent of sex acts in which a condom is used in South Africa (Shishana et al., Cape Town: HSRC Press; 2009);
- The distribution of the level of adherence is as in the trial: 40% of the population would use the gel maximum 50% of the times of having an intercourse, 20% between 50 and 80% of the times and 40% at least 80% of the times.
- Interruption of microbicide use, as soon as they get diagnosed or they are 65 years old
- gel efficacy (reduction in transmission risk, for a given U-partner with a given viral load) dependent on gel adherence & based on the relative risks from the trial (54% if adherence >80%, 38% if gel adherence 50-80%, 28% if gel adherence <50%);
- gel provision is not dependent on testing HIV negative
- gel availability does not increase rates of U-sex
- rates of anal sex are low, as in the trial. (ie we assume that microbicide is as effective at reducing sexual transmission as in the trial).

## Results

**Figure 2. HIV incidence**

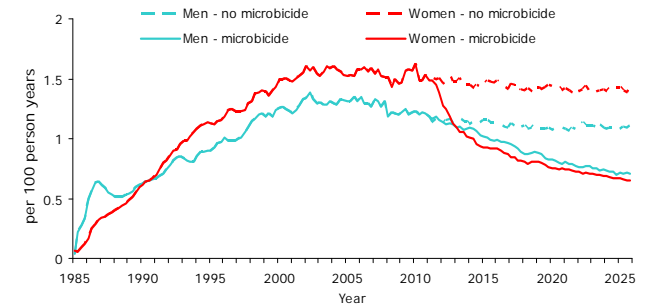


HIV incidence stabilizes due to a reduction in number of ST U-partners in the general population and reduction in U-sex with LT partners in those diagnosed with HIV.

Average HIV incidence (aged 15-65) is indicated in Figure 2 and by gender in Figure 3.

## Results (continued)

**Figure 3. HIV incidence by gender**



Mean HIV incidence over 2015-2024 if gel is not introduced, but scale up of HIV testing and provision of ART continue, is 1.30 per 100 person-years, compared with 0.83 if gel is introduced with the stated level of coverage and adherence ( $p < 0.0001$ ; Wilcoxon test).

If we consider the genders separately, mean HIV incidence over 2015-2024 is respectively 1.13 for men and 1.48 for women if gel is not introduced and 0.86 for men and 0.81 for women if gel is introduced ( $p < 0.0001$  for both genders; Wilcoxon test).

The reduction in men is secondary to reduced numbers of HIV infections in women and so is delayed by a short period and of lesser magnitude.

The effect of variations in other model assumptions are being explored in extensive sensitivity analyses.

## Conclusions

Tenofovir gel could potentially make a major, sustained impact on HIV incidence if widely (use by 70% of sexually active women, 40% of all women) used and adhered to, and if it is used only when condom-protected sex is not an option rather than as a condom substitute.

It is hoped that Tenofovir vaginal gel optimisation will lead to better efficacy rates than those demonstrated in CAPRISA 004 and knowledge of the efficacy of the gel could contribute to better adherence, but there is a concern of sexual disinhibition if the gel leads to more unsafe sex.

This could be a very important tool to curb the spread of HIV and allow women who cannot negotiate mutual monogamy or condom use to protect themselves.

### Acknowledgements

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