

Attaining Realistic and Substantial Reductions in HIV Incidence: Model Projections of Combining Microbicide and Male Circumcision interventions in Rural Uganda

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Objectives

- To explore the potential value of a combined HIV prevention approach
- Estimate the proportion of the population required to be using the intervention in order to achieve 20%, 30% and 40% relative reductions in HIV incidence per susceptible at 15 years.
 - For the introduction of a
 - Vaginal microbicide
 - Male circumcision intervention
 - Combination of both interventions
- The cumulative number of infections averted over 15 years is also reported for each scenario considered.

Parameterisation

- Behavioural and epidemiological data from a setting in South West Uganda
- Setting specific parameters derived from the General Population Cohort Study (GPC) of MRC Uganda
 - Study cohort comprising 15 villages from which HIV seroprevalence and behavioural data have been collected annually since 1989
 - An additional 10 villages were added to the cohort in 1999, for a total of 25 villages
- Non setting specific parameters derived from the literature

Setting

- HIV prevalence among 15 – 45 year olds (source: General Population Cohort Study)
 - 1992 - 10% for males and 12.2% for females
 - 2001 – 7.4% for males and 9.4% for females
 - 2007 – 8.8% for males and 10.3% for females
- Sexual Behaviour Data
 - Those reporting casual partnerships
 - 14% of males
 - 1.8% of females
- Condoms
 - Never used by 86% of individuals in their **main partnerships**
 - Never used by 13% of individuals in their **casual partnerships**

Interventions

- 15 Year Intervention (2010 – 2025)
 - Linear increase in proportion using the intervention over 10 years, constant thereafter

- Microbicide
 - Daily or monthly use microbicide by sexually active women
 - 60% efficacy per act against HIV acquisition (protecting only women)
 - 80% consistency of use
 - No efficacy against other STI's

- Male Circumcision
 - 60% efficacy per act against HIV acquisition
 - 18% of men aged 15 – 59 years already circumcised in 2010
 - No efficacy against other STIs

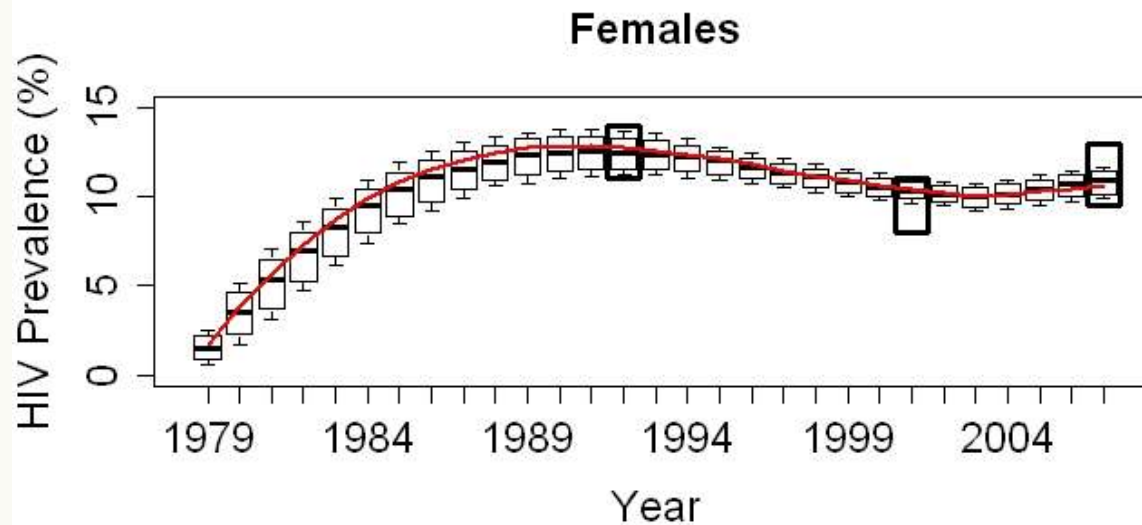
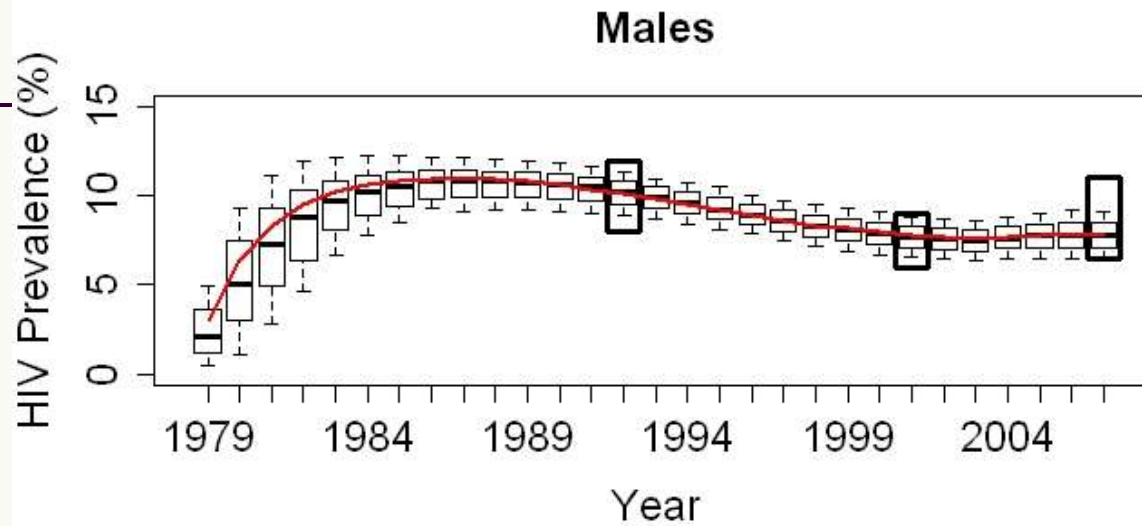
Assumptions

- ARV scale up in area since 2003/2004
 - Assumed that post-2008, ART plateaued at the 2008 empirical coverage.
- Behavioural change
 - Assumed decline in number of casual partners between 1987 and 2001, in line with empirical data (Biraro et al, 2009)

Model Fitting

- Model parameterised to behavioural data from setting and complemented by literature
- Incorporate uncertainty around key inputs
- Run model using different permutations of model inputs
- Setting-specific **prevalence data for males and females at three key time points** in the epidemic used to identify combinations of inputs that fit patterns of HIV & STI infection in that setting
- Use model '**fits**' obtained to project the impact of microbicide introduction strategies by comparing difference in projected HIV transmission with and without intervention

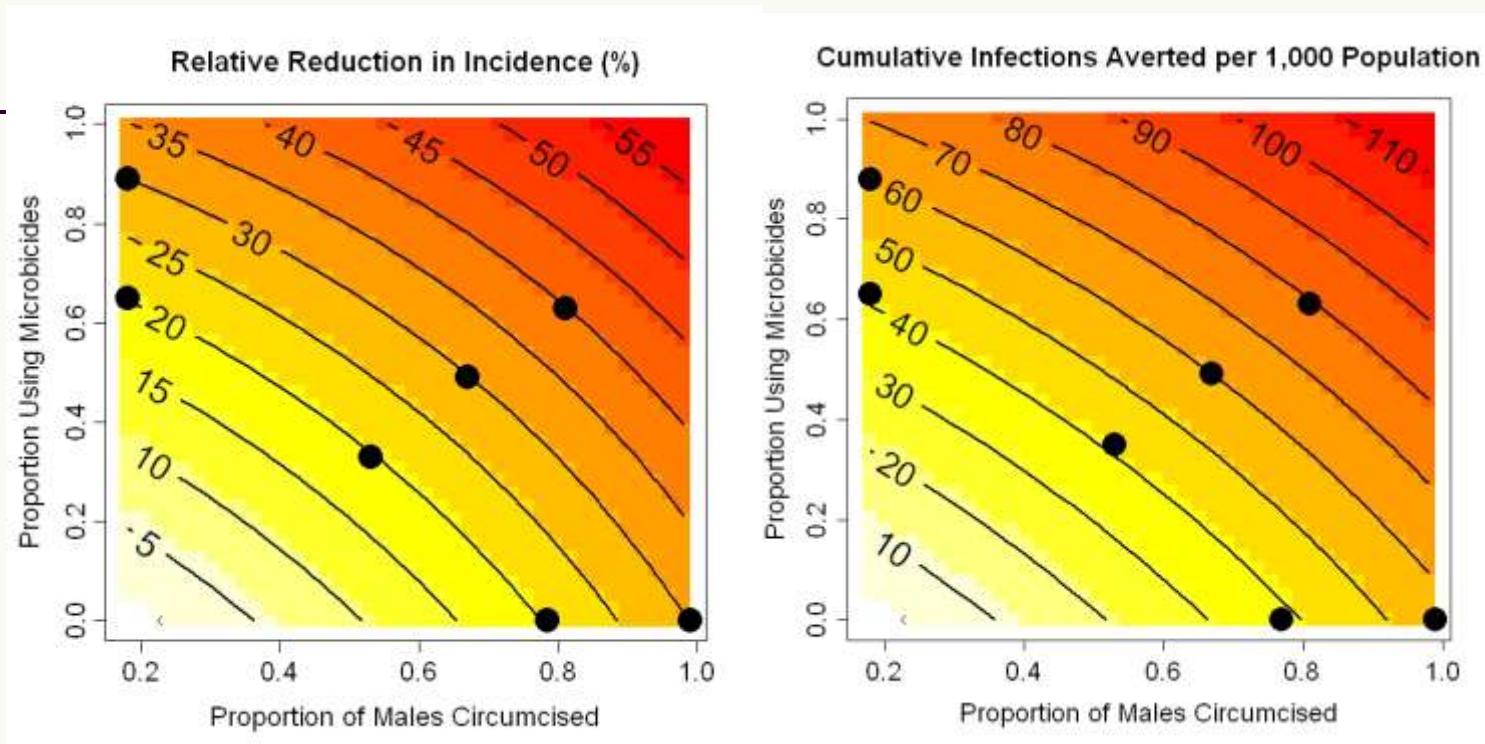
Results – 504 Model Fits to Data



Results – Specific Examples

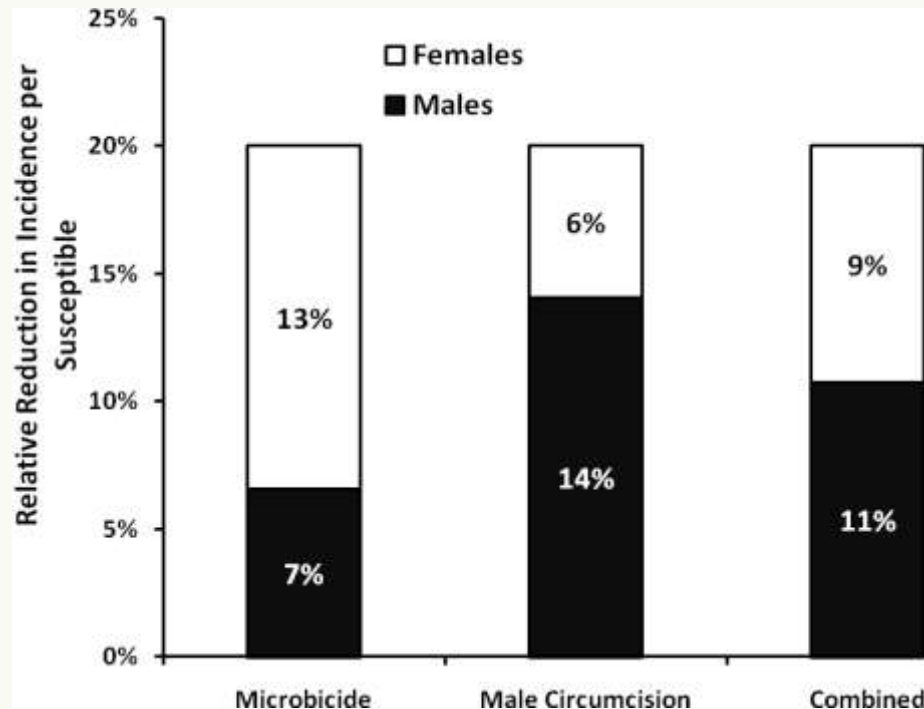
Target relative reduction in HIV incidence at 15 years	Intervention type	Required proportion using the intervention Median (2.5 & 97.5 percentiles) of 504 fits		Infections averted per 100,000 population over 15 years Median (2.5 and 97.5 percentiles) of 504 fits
		MC	Microbicide use	
20%	Microbicide only	-	0.66 (0.52 – 0.77)	4,184 (3,938 – 4,249)
	MC only	0.76 (0.64 – 0.83)	-	3,913 (3,647 – 4,090)
	Microbicide and MC	0.53 (0.44 – 0.58)	0.35 (0.26 – 0.4)	4,144 (3,808 – 4,268)
40%	Microbicide only	-	NP (0.97 - NP)	NP (7,853 – NP)
	MC Only	NP (NP - NP)	-	NP (NP - NP)
	Microbicide and MC	0.81 (0.7 – 0.89)	0.63 (0.52 – 0.71)	8,045 (7,673 – 8320)

Estimated Impact



- Many possible combinations of the proportion using each intervention can lead to the same impact
- Theoretical maximum of combined intervention approx 58% RRI per susceptible
- Black points show the scenarios examined in greater detail in the previous table

Results – Combined Interventions



More equitable reductions in incidence between males and females

- Using 20% RRI scenario as an example
- Microbicide providing only direct protection to females
- MC providing only direct protection to males the combined intervention

Key Conclusions

- Unlikely that either intervention alone could reach sufficiently high enough proportion of the population to reduce HIV incidence by 30% or more after 15 years
- May be more feasible to achieve 30% reduction by combining interventions since a smaller proportion of each population needs to be protected
- Combined intervention distributes the impact more equally between protecting males and protecting females
- Combination interventions may prove to be a more practical approach to achieving substantial reductions in HIV incidence

Limitations

- Impacts attained are setting specific
- The interventions were assumed only to provide direct protection to one gender, and to only protect against HIV
- Likely levels of efficacy and adherence for an effective microbicide are not yet known*
- Does not incorporate scale up of other future potential interventions

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