



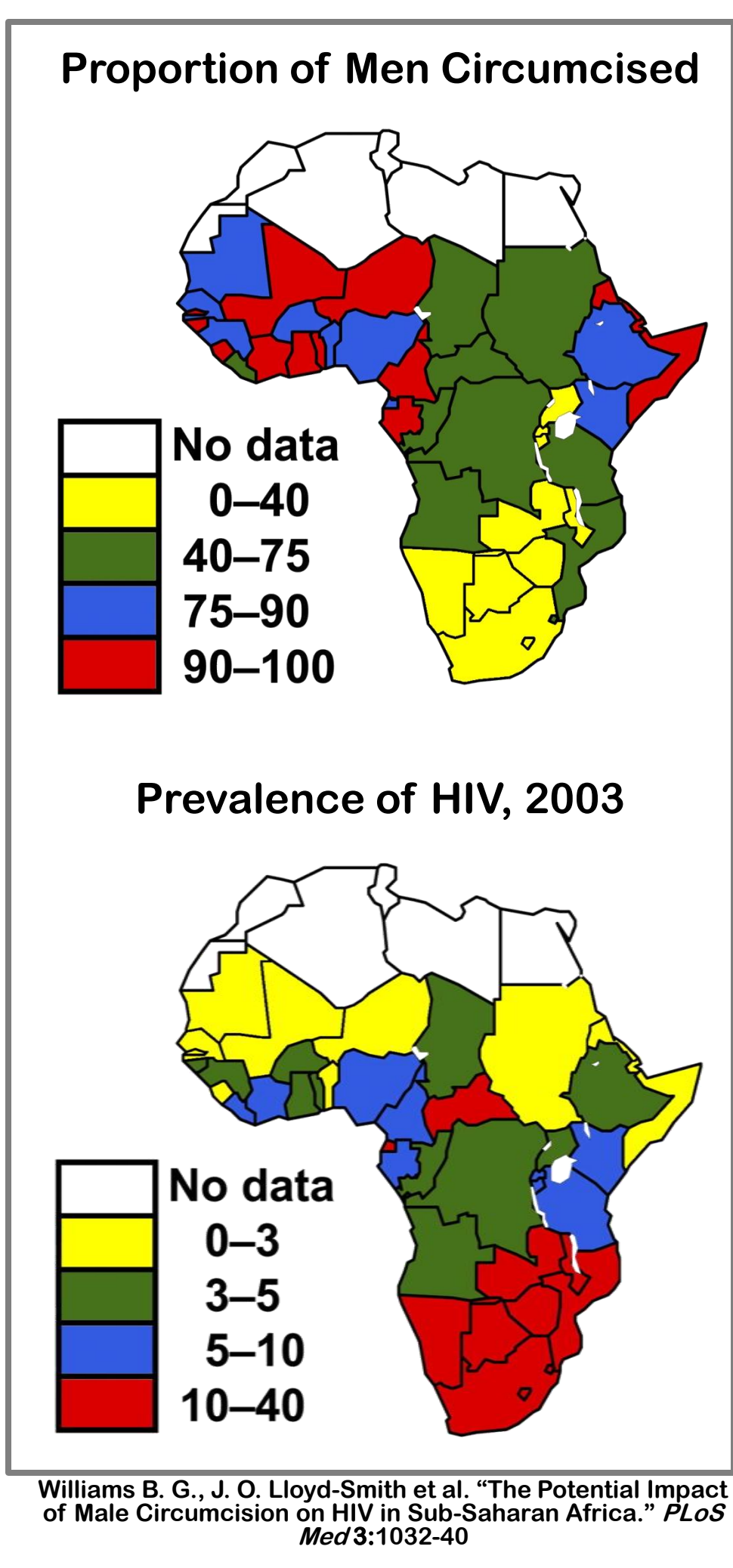
Modeling the Impact of Male Circumcision HIV Intervention Strategies

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Introduction:

- Male circumcision (MC) was first suggested as a risk factor for female → male HIV transmission by A.J. Fink in a 1986 letter to the New England Journal of Medicine, based on an ecological association.
- Biological research has shown that the inner mucosal surface of the male foreskin contains a high concentration of CD4+ target cells, making it highly susceptible to HIV infection. (Patterson et al., 2002; Donovan et al. 2006)
- A clinical trial of MC completed in South Africa in 2005 suggests that circumcision is associated with a 60% reduction in the annual risk of acquiring HIV (Auvert et al., 2005). Recently completed trials in Kenya and Uganda have found reduced risks of 53% and 48%, respectively. (Bailey et al., 2007; Gray et al., 2007)

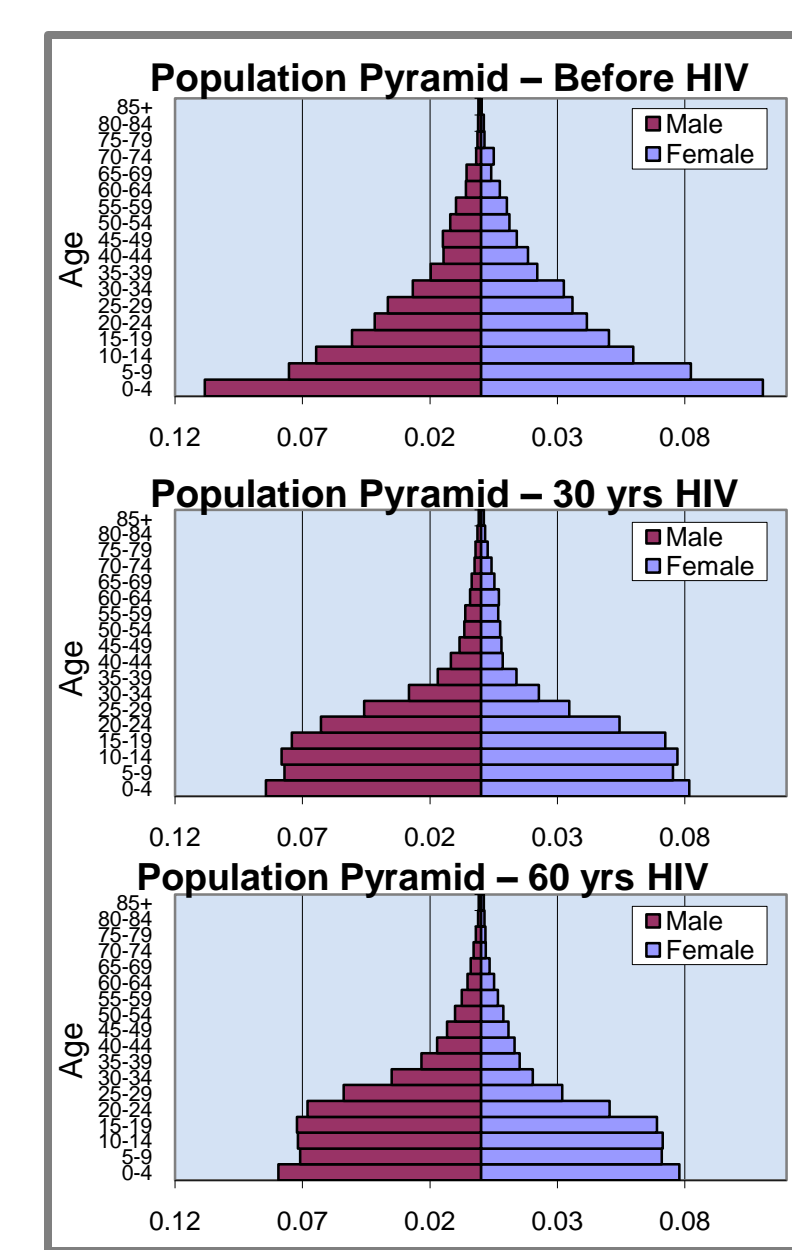
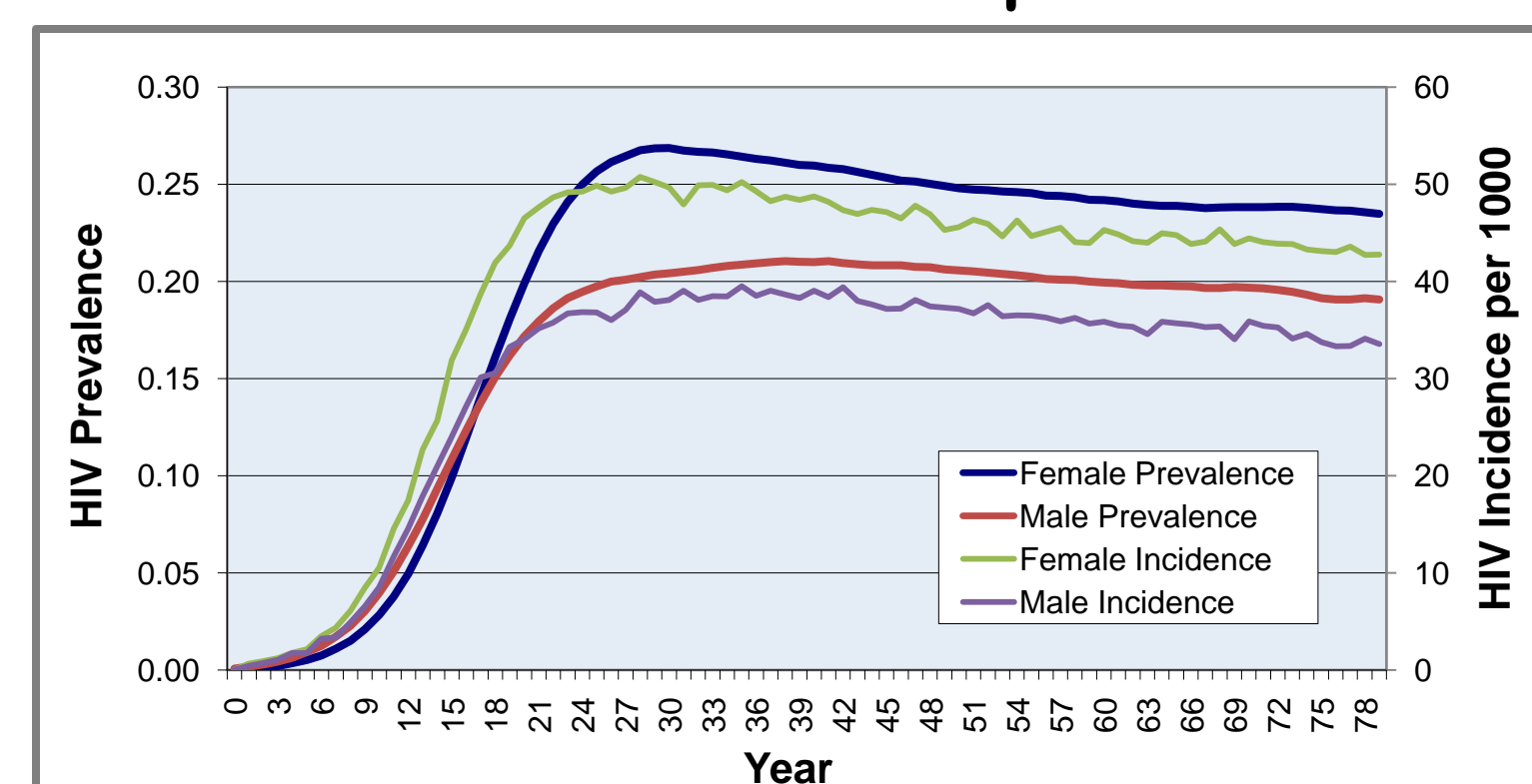


Model:

- The 'Structured Population Event History Simulator' (SPEHS) is a two-sex microsimulation model of an HIV epidemic in a polygynous southern-African population with one month time step (Clark, 2001).
- SPEHS explicitly models fertility and mortality, marital union formation and separation, non-marital unions, and vertical and horizontal transmission of HIV.
- Demographic transition probabilities are calculated from data describing a sample of the Gwembe Tonga population in Southern Zambia between 1957-1995 (Clark, 2001).
- 25% of males are assumed to be circumcised routinely without any intervention.
- Being circumcised reduces the monthly risk of female → male HIV transmission by 59.8%, in accordance with the clinical trial in South Africa (Auvert, 2005).

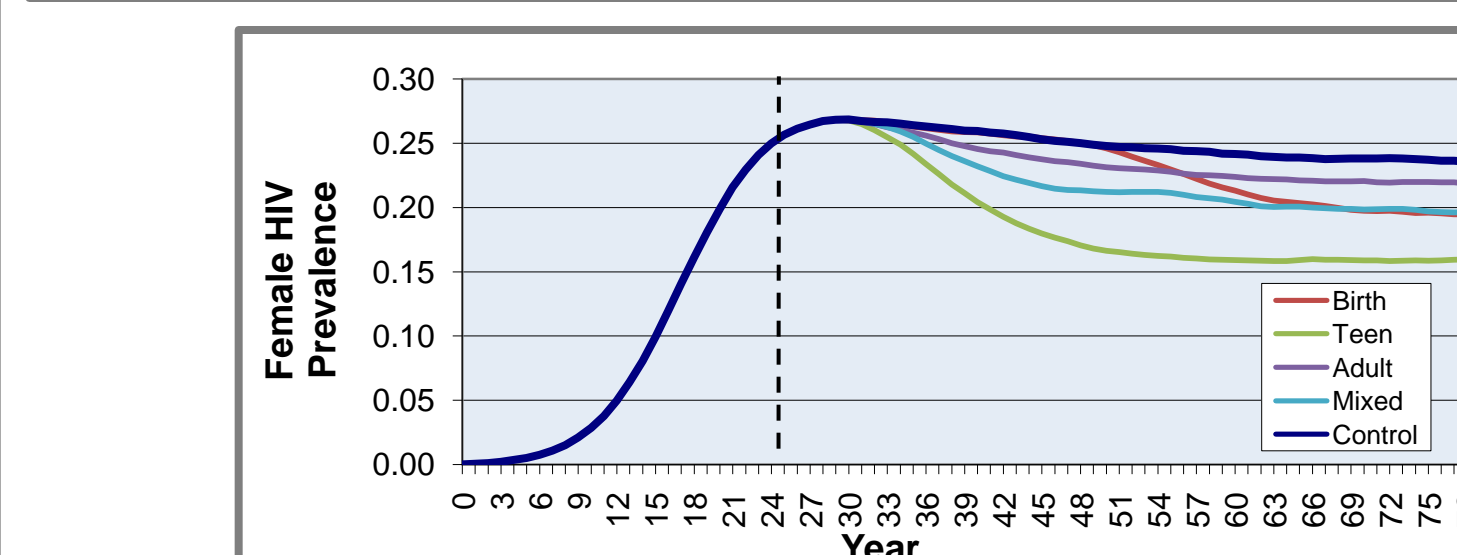
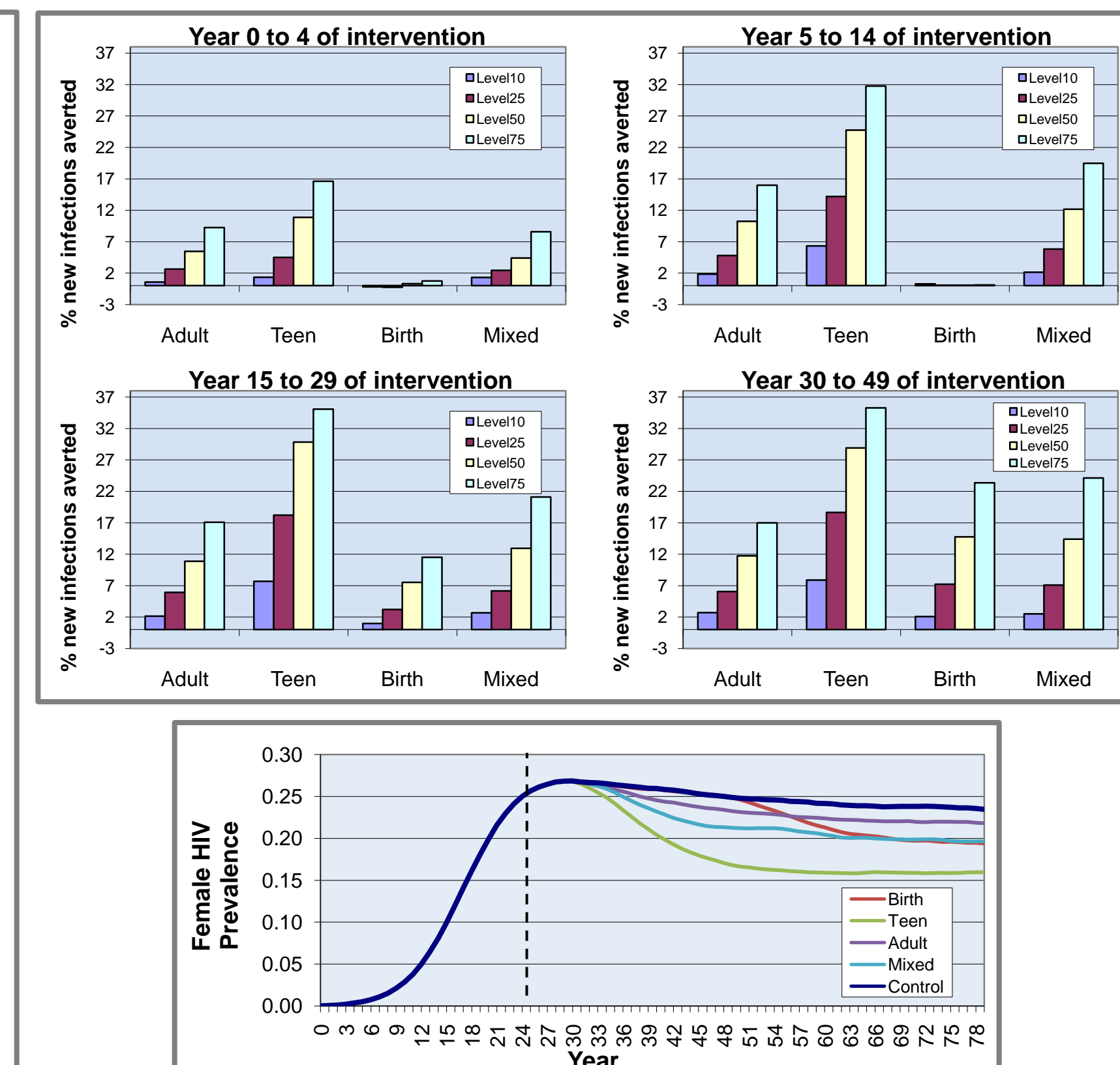
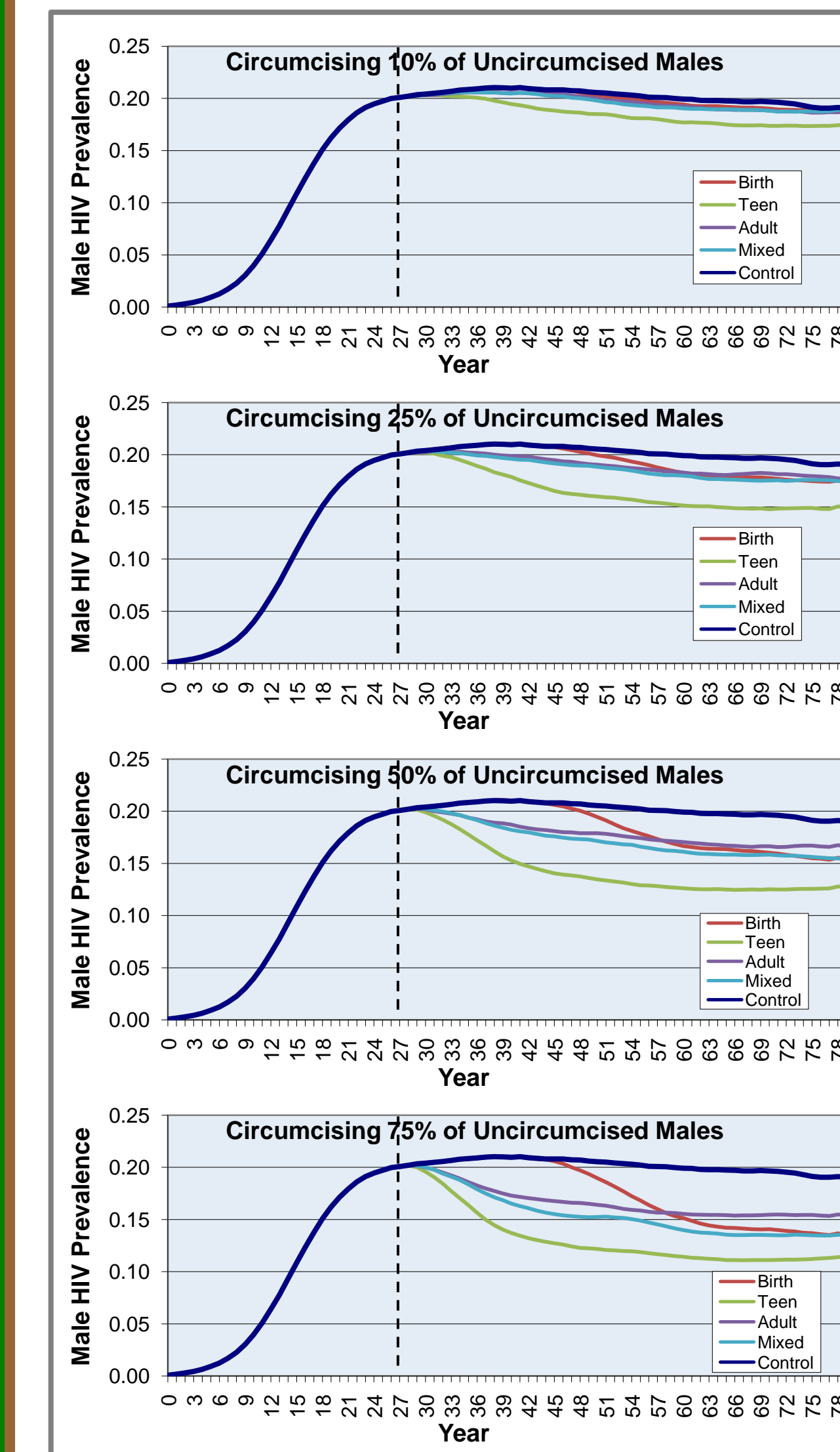
Intervention Scenarios:

- Four age groups: at birth, age 10-13, age 18-24, and mixed (at birth + 15-24 for 15 years).
- Four intervention levels: 10%, 25%, 50% and 75% of the uncircumcised population.
- Interventions are implemented 30 years after the beginning of the HIV epidemic and simulated for 50 years.
- 16 interventions x 100 replications each.



- Control epidemic created by SPEHS (left)
- Population pyramids 0, 30 and 60 years into control epidemic (above)

Results:



- Male HIV prevalence in different intervention scenarios (left)
- Percentage of all new HIV infections averted over time (above, top)
- Female HIV prevalence circumcising 50% of uncircumcised males (above, bottom)

Acceptability & Feasibility:

- Acceptability studies conducted in several southern African countries have reported between 45% and 87% of uncircumcised men would prefer to be circumcised if it might decrease the risk of HIV acquisition. Between 62% - 89% of women said they would circumcise a newborn son. (Westercamp and Bailey, 2006)
- A surgical procedure was developed and used in Kenya to circumcise 479 males between the ages 18-24. The cost was about US\$20, median operating time 30 minutes, 3.5% complication rate, and no fatalities or permanent disabilities. (Krieger et al., 2005)
- An individual-level effect does not guarantee a population-level improvement in the HIV epidemic (Garenne, 2006). To assess this we need mathematical modeling.

Conclusions & Future Directions:

- Male circumcision intervention programs are likely to produce substantial improvements in an HIV epidemic for both males and females, but alone will not end an epidemic.
- Real intervention strategies will have the most success if they reach a substantial proportion of the uncircumcised male population and target young men just before they begin sexual activity.
- Future modeling work should compare the impacts of MC on different populations and different types of epidemics and investigate combining MC programs with other types of interventions.