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What impact will reducing concurrency have on decreasing the incidence of HIV in heterosexual populations?

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The importance of concurrency (i.e., multiple overlapping sexual partnerships) in driving HIV epidemics has been hotly debated in the past 20 years. Some have hypothesized that concurrency is an extremely important driver of HIV epidemics and may explain the high prevalence of HIV in the general population of many Sub-Saharan African countries. Notably, proponents of this hypothesis acknowledge a host of other factors, such as multiple sex partners, core groups and the presence of other sexually transmitted infections are also very important. A substantial amount of data have been collected on sexual behavior (e.g., the number of sex partners individuals acquire each year), but there are only very limited data on the level and/or degree of concurrency in any population [1] (Lurie and Rosenthal 2010). Consequently, it has been impossible to use empirical data to evaluate whether - or not - concurrency is a major driver of HIV epidemics. This lack of empirical evidence has led others to dispute the idea that concurrency is an important driver. Mathematical modelers, unconstrained by empirical data, have been investigating the potential impact of concurrency on HIV epidemics since the early 1990s [2] (Watts and May 1992). Modeling by Morris and Kretzschmar [3-4] (1997; 2000) has shown that if levels of concurrency in heterosexual populations are high (i.e., 50%), the prevalence of HIV could be ~10 times higher than if individuals were serially monogamous. In an article in this issue, McCreesh and colleagues [5] present a new model representing heterosexual transmission of HIV. They use their model to evaluate the potential epidemiological impact of hypothetical public health interventions that focus on reducing concurrency in heterosexual populations.

McCreesh and colleagues have developed a stochastic network model of sexual partnerships, some of which can be concurrent, in a heterosexual population where HIV is being transmitted. They used data on demography, sexual behavior, and HIV prevalence collected in 2008 in Uganda to parameterize their model. The sexual behavior data they used contained information on both the number of sex partners and the level of concurrency. These data were from the Masaka General Population Cohort study, which is a longitudinal study that has been running since 1989. Study participants are ~7,000 residents of 25 villages in the rural south-west of Uganda. Each year face-to-face interviews are conducted; blood samples are collected and tested for HIV. Concurrency data were collected from 1,214 men and 1,470 women, a subset of the cohort study. Concurrency was defined as “overlapping sexual partnerships where sexual intercourse with one partner occurs between two acts of intercourse with another partner.” Concurrency was further classified into two

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types: i) sex with spouses and exspouses, defined as concurrent partnership of long duration and ii) sex with others, defined as concurrent partnership of short duration.

The survey data, used to parameterize the model, shows that 9.6% of men in these rural villages in Uganda reported having engaged in a concurrent partnership of either type, but only 0.2% of women reported doing so. McCreesh and colleagues assumed that the concurrency level reported by women was significantly lower than the actual value. Consequently in their modeling, they increased the level of concurrency for women from the reported level of 0.2% to 2.4%, a twelve-fold increase. They then used their stochastic network model to evaluate the potential impact of hypothetical public health interventions that focus on reducing concurrency. The authors found that when concurrency was reduced by 20%, the incidence of HIV (over a 10 year period) decreased by 9.2% in women, but only by 4.1% in men. When concurrency was reduced by 50%, the incidence of HIV (over a 10 year period) decreased by 16.2% in women, but only by 6.0% in men. Notably, if the authors had not inflated the level of concurrency in women the reductions in incidence would have been substantially lower. The authors' results show that the impact of reducing concurrency on decreasing HIV incidence, and hence the importance of concurrency in driving HIV epidemics, is fairly minimal given the specified levels of concurrency in these communities.

Notably, the results of McCreesh *et al.* are in line with a recently published empirical study by Tanser *et al.* [6] in a rural area in the South African Province of KwaZulu-Natal. Tanser and colleagues estimated the effect of community level concurrency on a woman's risk of becoming infected with HIV. They found that the number of sex partners, but not concurrency, was a major risk factor for HIV infection. Both the modeling study by McCreesh *et al.* and the recent empirical study by Tanser *et al.* make a significant contribution to the debate regarding the importance of concurrency in driving HIV epidemics. Results from both of these studies indicate that concurrency is not a major driver of HIV epidemics in Sub-Saharan Africa. We note that in order for concurrency to be an important driver in generalized HIV epidemics driven by heterosexual transmission three conditions would need to be met: first, there should be many concurrent partnerships in the population; second, the number of concurrent partners should be fairly high for the average individual; and finally, the duration over which the partnerships overlap should be fairly long. To date, no heterosexual community has been identified where these conditions are met.

Since the beginning of the HIV epidemic the number of sex partners that individuals in the population acquire each year has been identified to be the major factor driving HIV epidemics and the major risk factor for an individual; the greater the number of sex partners an individual has, the greater their risk of acquiring HIV. If an individual has a high level of sex partners it does not mean that they have a high level of concurrency, however if an individual has a high level of concurrency they have to have a high number of sex partners. Therefore we recommend ending the debate on the importance of concurrency as a driver of HIV epidemics in Sub-Saharan Africa. Rather than trying to reduce concurrency, which is likely to have only a modest impact, we recommend concentrating on designing interventions that focus on decreasing the number of sex partners and/or increasing in condom usage. If concurrency is important, its' impact on transmission will also be decreased by these interventions.

Acknowledgments

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References

1. Lurie MN, Rosenthal S. The Concurrency Hypothesis in Sub-Saharan Africa: Convincing Empirical Evidence is Still Lacking. Response to Mah and Halperin, Epstein, and Morris. *AIDS Behav.* 2010; 14:34. [PubMed: 20130786]
2. Watts C, May R. The influence of concurrent partnerships on the dynamics of HIV/AIDS. *Math Biosc.* 1992; 108:89–104.
3. Morris M, Kretzschmar M. Concurrent partnerships and the spread of HIV. *AIDS.* 1997; 11:641–648. [PubMed: 9108946]
4. Morris M, Kretzschmar M. A microsimulation study of the effect of concurrent partnerships on the spread of HIV in Uganda. *Math Popul Stud.* 2000; 8:109–133.
5. McCreesh N, O'Brien K, Nsubuga RN, Shafer LA, Bakker R, Seeley J, Hayes RJ, White RG. Exploring the potential impact of a reduction in partnership concurrency on HIV incidence in rural Uganda: a modelling study. *Sex Transm Dis.* 2012 forthcoming.
6. Tanser F, Barnighausen T, Hund L, Garnett GP, McGrath N, Newell ML. Effect of concurrent sexual partnerships on rate of new HIV infections in a high-prevalence, rural South African population: a cohort study. *Lancet.* 2011; 378:247–255. [PubMed: 21763937]