

COMMENT AND PERSPECTIVES**'NEW WAVE' WON'T BE A TSUNAMI: THE GENESIS OF HIGH HIV RATES IN AFRICA**

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During the past five years there have been dire predictions of a coming 'New Wave' of HIV infections that could destabilize strategically important countries in Asia and Eastern Europe. Certainly the epidemic in East and Southern Africa is horrifying. In most countries some 20-40 percent of adults are HIV positive and the long-term social consequences of this disaster are still being analyzed. Approximately 1 percent of adults in India, China and Russia are already infected with HIV. Although this percentage is small, this amounts to millions of people. The prospect of an explosive "New Wave" on the scale of Africa's in these countries-all growing economic and military powers-is frightening. The CIA was the first to issue warnings about the "New Wave" epidemics and stated that such a prospect should be considered as a threat to US security. But will the "New Wave" ever occur?

There are compelling reasons to believe that it will not. AIDS is already a crisis in the countries concerned, but HIV is still largely confined to high-risk groups-injecting drug users and sex workers and their partners and HIV rates are low in the general population. UNAIDS itself predicts that it is highly unlikely that infection rates in these countries will ever approach those in East and southern Africa, and there are good reasons to trust their assessment.

To understand why, it is necessary to understand the epidemiology of HIV and why it is spreading so rapidly in Africa. Surveys conducted over the past twenty years show that people in East and southern Africa do not have more sex partners, on average, than people in other regions of the world. Indeed, over a lifetime, they tend to have fewer than people in many Western countries do. This led some investigators to speculate that, when it comes to HIV risk, it is not only the number of sex partners that matters in

Africa, but the nature of the prevailing sexual networks and the tendency of people there to have more than one long term relationship at a time.

Further research has supported the idea that a tradition of polygamy, along with widespread poverty-especially among women-has give rise to a system of sexual networking in which a significant number of men and women have a small number -perhaps two or three-ongoing sexual partnerships at a time, and this links people up in a giant web of relationships that is extremely conducive to the spread of HIV. Research carried by the World Health Organization, as well as other, independent surveys, suggests that around 20-50 percent of men in many African countries have a small number--perhaps two or three--wives or girlfriends. A smaller proportion, perhaps 5-15 percent of women in turn have ongoing sexual relationships with more than one man.

This is generally not considered unusual or deviant behavior, and it has a powerful economic basis. In these societies, a man who has the ability to support several women is often expected to do so, and may even be seen as failing in his social duty if he does not. At the same time, because so many African women are so poor, they often must rely on more than one man to support them and their children. However, if a woman is accepting gifts or support from a man, she is generally expected to sleep with him and may suffer abuse or violence if she refuses.

Such widespread "concurrent" partnering -in which a relatively large proportion of people are having regular sexual contact with more than one person-creates ideal conditions for the spread of HIV. If only one member of such a network becomes infected, everyone else in the network will become infected very rapidly, as if they were all on a "superhighway" for the

virus. During the 1980s and 90s, surveys of sexual behavior conducted by the World Health Organization and other agencies showed that while long-term concurrency was very common in Africa, it was much less so in Europe, where the norm is to practice "serial monogamy."

Surveys of sexual behavior in the "New Wave" countries of China, India and Russia suggest that while men do have affairs, they tend to be short-term liaisons with prostitutes, rather than ongoing relationships with co-wives or concubines. Such short-term relationships are generally safer -when it comes to HIV- because they involve only a single act of sex, rather than an ongoing relationship involving repeated exposure to any pathogens either partner may carry. In addition, condoms are increasingly used in such short-term relationships, but they are seldom used in longer-term relationships.

Although concurrency does occur in the Middle East, where polygamy is permitted, it is not nearly as common as in Africa, and is confined to men. Women throughout South Asia tend to be under strict surveillance by their relatives and are thus much less likely to have concurrent affairs than African women. Some Asian women do contract HIV if their husbands or boyfriends are IV drug users or go to brothels and do not use condoms, but these women are unlikely to pass the virus on to anyone else. Therefore, the potential for a "concurrency" network to emerge is very low.

The effect of concurrency is exacerbated by the biology of HIV and its behavior in an infected person. This was revealed in a series of studies conducted in Uganda during the past 15 years. Researchers from Johns Hopkins University, Columbia University and their Ugandan collaborators had been studying the HIV epidemic in Rakai, a district in southern Uganda that has been hard hit by AIDS. About five years ago, they found something puzzling. They were trying to understand how the virus spread, using the classic math model used to describe epidemics: $R_0 = tdx$, where t is the likelihood that the virus will be transmitted during a given sexual act, d is the duration of exposure-in this case the number of sexual acts per year-and x is the number of years a person is infectious. R_0 is the epidemic potential-if it is 1 or greater, an epidemic will result.

If R_0 is less than 1, the epidemic will die away. Using data they had been collecting in the field, they estimated that people had about 108 sexual episodes a year. Infected people lived about 8 years with HIV,

and the likelihood of transmission per sexual act was about one in a thousand, or 0.0011. When they did their calculation, it didn't make sense: R_0 came to 0.9504, which is less than one. Based on this, HIV should have died out in Uganda. However, although HIV rates have fallen in recent years, the epidemic is far from over.

What the researchers did not consider at first was that a person is much more likely to transmit HIV during the first month or so after infection. (YES, going back to the short-term nature of encounters in Asia. During this time a person's immune system has not yet responded to the presence of the virus, and it proliferates rapidly in the blood. The Rakai researchers later reanalyzed their data and found that people who had been recently infected were much more likely to pass the virus on to their other partners than someone who had been infected for a long time. Myron Cohen at Johns Hopkins University has estimated that during this early or "viremic" stage-also known as the "window period"- the likelihood of transmission is actually much higher than one in a thousand, and may even be as high as 7 - 24 percent. After that, cells and antibodies emerge which reduce the concentration of the virus in the blood and this in turn reduces the risk of transmission. Typically the presence of HIV in an individual is assessed not by checking for the virus, but rather for the antibodies produced in response to infection.

Consequently an antibody test will fail to detect infection during the precise period-or "window" when they are at their most infectious. More sophisticated models, which take factor in both the window period and concurrency, explain why HIV rates in Rakai remain so high. In addition to the "network" factors discussed above, the "viremic window" may also help explain Asia's relatively low HIV rates. Ironically, sex with an infected prostitute may actually be safer than sex with someone in a network of long term concurrent relationships. This is because there is a good chance that the prostitute has been infected for a while, and will thus have passed out of the "window period"- unless she has only recently begun to practice sex work, or unless it is very early in the epidemic in general. Thus the chances that she will transmit the virus during a given sexual act are often quite low.

The role of STIs and circumcision in shaping the global HIV epidemic are controversial. It is not clear quite how STIs and HIV interact. The Rakai researchers found evidence to suggest that ulcerative STIs increase the likelihood of transmission, although it is also possible that the same behaviors that place

people at risk for HIV also place them at risk of other STIs. Circumcision has a clearer effect. A recent randomized, controlled trial of circumcision among men aged 18-24 in South Africa found that circumcision reduced the men's likelihood of contracting HIV during a given sexual act by 65 percent.. Along with the strong proscriptions on women's sexual behavior mentioned above, this may partly explain why HIV rates are so low in the Muslim world, despite high rates of polygamy. In many East and Southern African countries male circumcision is rare, and this may further explain why the epidemic has been so severe in the region.

HIV surveillance data from India suggest that HIV prevention efforts should continue to be targeted at IV drug users and sex workers and that the risk of a full-blown epidemic in the general population is small. The infection rate in India has been tracked through

surveys in antenatal clinics -which provide a reasonably good estimate of the infection rate in the general, non-drug using, non-sex worker population. The data seem to show a highly stable sometimes declining epidemic. UNAIDS now projects that the national HIV rate in India is unlikely to exceed 1 percent. This is nothing to celebrate -after all, 1 percent of India is ten million people-but it is not a potential crisis on a scale of the epidemic in Africa. Indeed, the "New Wave" has already arrived, and it is big enough. We should address the considerable problem we have, rather than gaze into the distance and worry about a tsunami that is unlikely ever to arrive.

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