Cost-effective: Universal HIV testing in India

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In India most people who are HIV positive don't know it, yet testing and treatment are relatively cheap and available. It would therefore meet international standards of cost-effectiveness—and save millions of lives for decades—to test every person in the billion-plus population every five years according to a new study published in the journal *PLoS One*.

The findings are based on a careful analysis of India's HIV epidemic using the Cost-Effectiveness of Preventing AIDS Complications (CEPAC) International model, a sophisticated statistical tool that has already been used in HIV policymaking in France, South Africa, and other countries. A team of researchers at Brown, Yale, Massachusetts General Hospital, Harvard, and in Chennai, India, integrated scores of factors specific to the country to find that testing for the whole country, with greater frequency for high-risk groups and areas, would pay off despite India's huge population and even in cases where conditions are worse than the researchers assume.

"Testing even 800 million adults is a public health undertaking of a historic magnitude," said study co-lead author Dr. Kartik Venkatesh, a postdoctoral fellow at Brown University and Women & Infants Hospital. Jessica Becker of Yale University is other lead author of the study, which first appeared May 31. "But what we were able to show is that even if you increase the cost of HIV treatment and care pretty significantly and really decrease the number of individuals who would link to care, even under those dire circumstances, testing this frequently and this widely still was reasonable."

Co-author Dr. Soumya Swaminathan, director of the National Institute for Research in Tuberculosis in Chennai, India, said the projections of the model will help the country in its battle with the epidemic, one of the world's largest.

"The paper explores various strategies and suggests cost-effective options for HIV testing in India," Swaminathan said. "As India moves ahead in its HIV prevention activities and aims for zero new infections, expanding testing will be a key priority and this analysis should help policymakers make the best decisions."

Dollars per life-years saved

The main results from the model are projections of the dollar cost per year of extended lifespan. The World Health Organization's standard for cost effectiveness is an expenditure that is less than three times the per capita GDP of a country. In India in 2010, per capita GDP was $1,300. A program is therefore cost-effective in India if the expense is less than $3,900 to save a year of someone's life.

Modern antiretroviral therapies can give HIV-positive people a normal lifespan, and in India, which has a thriving generic pharmaceutical sector, first-line therapy costs only $8.61 a month (second-line therapy for those whose viruses prove resistant is $55.12 a month). HIV tests, meanwhile, cost only $3.33.

After extensive research to determine the best possible data for the country, Venkatesh, Becker, and the team coded several other parameters into the model including what percentage of people would refuse the test (18 percent), how many patients who test positive would get care (50 percent), the prevalence of HIV in the population (0.29 percent), and many other factors such as the monthly risk of opportunistic infection in positive patients, hospitalization costs, the

effectiveness rate of therapy, and the likelihood of positive patients transmitting the virus to others.

They ran the models not only for the general population but also for people in high-risk districts and high-risk groups (e.g., with a higher prevalence of the virus but with more frequent testing today).

As they ran the numbers to determine the costs and effects on patients of broader and more frequent testing, they compared the results to what would happen under the status quo, in which there is less-than-universal testing.

Here is what they found:

- Testing the general population just once would be "very cost-effective" because it would cost $1,100 per year of life saved (YLS) in general and $800 per YLS among high-risk populations.
- Testing the population every five years would be "cost-effective" with a price of $1,900 per YLS saved in general, and $1,300 per YLS among high-risk groups.
- Testing annually would not be cost-effective for the general population ($4,000/YLS), but would be for high-risk people ($1,800/YLS).

The general trends of cost effectiveness remained even after "sensitivity" analyses in which the researchers entered different statistical assumptions in the model in case their assumptions were too optimistic. But to make testing the general population every five years no longer cost-effective, the researchers had to tell the model that only 20 percent of the general population would agree to testing and only 20 percent of positive patients would get care.

Addressing an epidemic

Venkatesh said the main benefit of national testing would simply be getting more people to learn they are positive and therefore to seek effective care before they have full-blown AIDS and a complication. A secondary benefit, however, would be to curb transmission of the virus, both because behavior can change and because therapy can reduce transmissibility.

"Universal testing can have a big impact in catching a large number of individuals who are infected and getting them to seek treatment and seek services earlier in the course of their disease," said Venkatesh, who traveled to India at least once a year for all eight of his years as an M.D. and Ph.D. student at Brown from 2005 to 2013. "The classic story in India has always been patients present to care, traditionally men, with TB, the most common opportunistic disease. Then they get an HIV test and are found to be infected. At that point they bring their female partner, who happens to be infected and sometimes it's too late and a child has also been infected.

"If we tested earlier we may be able to have an impact on this kind of cascade of familial infection," Venkatesh said.

Co-author Dr. Nagalingeswaran Kumarasamy, chief medical officer of the YRG Care Medical Center, a major non-governmental HIV clinic in Chennai, India, said he thought the study could have an important influence.

"With the background wave on test and treat, this article will be a useful scientific tool for the National AIDS Control Organization of India to plan the testing strategies nationwide," he said.

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