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HIV care could save lives and billions of dollars, computer model predicts

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A computer model developed by Johns Hopkins health care delivery specialists predicts that strengthening a handful of efforts to keep people with HIV in lifetime care, along with more rigorous testing, would potentially avert a projected 752,000 new HIV infections and 276,000 AIDS deaths in the United States alone over the next 20 years.

In a report on their HIV epidemic-economic model, published online in October by the journal *Clinical Infectious Diseases*, the researchers say that efforts to encourage people with HIV to follow up regularly with their provider and maintain long-term drug therapy may be more fruitful in preventing HIV transmission than efforts to increase HIV testing alone. Encouraging patient engagement with care is known as retention in care. Combining increased retention among those diagnosed with increased HIV screening and rapid enrollment into care among high-risk groups would have even greater impact.

Such comprehensive improvements would cost an estimated $96 billion, according to the model, but could reduce HIV incidence in the U.S. by 54 percent and the mortality rate by 64 percent, at a cost-effectiveness ratio of $45,300 per quality-adjusted life year, or QALY, a standard economic measure of the value of a medical intervention. Spending $50,000 or less per QALY is widely considered a good value, the Johns Hopkins team reports.

By contrast, the model predicts that continuing the current levels of HIV "care engagement" in the U.S. would lead to 1.39 million new HIV

infections and 435,000 AIDS deaths, at a cost of $256 billion over the next two decades.

"Despite having good treatments available, current reports suggest that fewer than half of individuals who need therapy are actually getting appropriate HIV medicine to control their virus, leading to more transmission of disease," says lead study author Maunank Shah, M.D., Ph.D., an assistant professor of medicine at the Johns Hopkins University School of Medicine. "The engagement in care of individuals infected with HIV is not what it could or should be."

Shah noted that public health experts recently have placed efforts on increased screening, particularly among those at high risk of HIV, such as men who have sex with men, people who inject drugs and heterosexuals ages 15 to 24.

"However," Shah says, "while continued HIV screening in high-risk groups is extremely important, our model suggests that you get the most bang for your buck targeting retention in care." Spending more resources that way, he says, "could transform our HIV epidemic, potentially reducing our future cases by more than 50 percent and saving thousands of lives every year."

For the study, Shah and his colleagues designed a computer model based on currently published HIV epidemiological data from scientific literature and national surveillance reports from a number of institutions, including the Centers for Disease Control and Prevention, the U.S. Census Bureau, and the U.S. Department of Health and Human Services. The model simulates HIV transmission and HIV care in the U.S., estimates the economic and epidemiologic consequences of incomplete or intermittent care, and explores the potential impact of different interventions versus the status quo in care. They estimated health care costs, HIV incidence, AIDS mortality rate and QALYs over a 20-year

time period.

The researchers divided the U.S. population into subgroups based on historic data and risk estimates, then introduced HIV transmission and interventions throughout the population to predict what might happen over time as individuals become infected and engage in care.

Using the computer model, they examined the following "enhanced" interventions:

- Annual testing for high-risk individuals
- Annual testing for high-risk individuals, plus testing every three years for the general population ages 25 to 65
- Raising the proportion of newly diagnosed people completing an HIV care visit within three months of diagnosis from the current level of about 70 percent to 90 percent
- Implementing programs that achieve a 50 percent reduction in the yearly rate of disengagement from care, plus a 50 percent increased yearly rate of return to care for those who have dropped out

What the modeling showed, Shah says, is that strategies focused on increasing testing alone had only modest benefits in reducing new infections, deaths and costs. Annual targeted screening of high-risk individuals would avert 215,000 new HIV infections over the next 20 years at a cost of $49.2 billion, or $84,700 per QALY gained. Screening the entire population every three years would require an additional $21.9 billion over 20 years to avert only 11,600 additional infections. Overall, enhanced population screening averted 18 to 21 percent of AIDS-related deaths.

Increasing the proportion of people linked to care engagement protocols

within three months of a new HIV diagnosis to 90 percent, coupled with targeted yearly screening of high-risk individuals, would avert an estimated 292,000 HIV infections and 107,000 AIDS-related deaths, at an incremental cost of $52.9 billion, or $65,700 per QALY gained.

By contrast, interventions targeting retention and re-engagement in care by reducing disengagement from care and increasing re-engagement of care by 50 percent were projected by the model to avert 494,000 HIV infections over 20 years, a 36 percent reduction. The cost-effectiveness ratio of this intervention was $33,700 per QALY gained.

And, Shah says, a comprehensive package of interventions that coupled targeted screening of high-risk groups, improved linkage to care, and enhanced retention and re-engagement in care was projected to have the greatest benefit, averting a projected 752,000 new HIV infections and 276,000 AIDS deaths at a cost of $96 billion over 20 years, or $45,300 per QALY gained.

As with any modeling analysis, the study had some limitations, the authors noted. Researchers did not look at detailed costs of specific interventions, which can differ by location. They used population averages to estimate sexual partnerships, needle sharing and other risk behaviors. The model used a fixed time horizon of 20 years to estimate costs and effects, which is likely to give conservative estimates of cost-effectiveness of the interventions.

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