

# OR models of hepatitis B prove decisive in treating millions in US, China

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With hepatitis B infecting as many as 10% of people of Asian descent, operations researchers collaborated with a liver transplant surgeon to develop mathematical models that verified the cost effectiveness of hepatitis B interventions. These interventions now successfully screen, treat, and vaccinate millions of Asian and Pacific Islander adults in the U.S. and millions of children in China, according to a paper in a journal of the Institute for Operations Research and the Management Sciences (INFORMS).

Untreated, [hepatitis B](#) can become a chronic, lifelong disease that leads to [liver cancer](#) and cirrhosis.

Chinese [health officials](#) were considering a program of catch-up vaccinations for children who had not been vaccinated at birth, but were reluctant to commit funds to a widespread hepatitis B catch-up [vaccination program](#) until analysis confirmed its [cost-effectiveness](#).

The authors' analysis of the program's cost effectiveness influenced the Chinese government's April 2009 decision to expand free catch-up vaccination to all children in China under the age of 15.

They estimate that this decision could result in almost 170 million children being vaccinated and could prevent almost 8 million acute infections, 400,000 [chronic infections](#), and almost 70,000 deaths. The vaccinations would cost the equivalent of \$540 million and save the equivalent of \$1.4 billion over the lifetime of these children, for a net

present savings of approximately \$900 million.

Additionally, they would spare hundreds of thousands of [Chinese children](#) from facing a lifetime of discrimination – those infected with hepatitis B in China, according to reports, are often denied the right to attend school or enter the workplace.

In the U.S., they evaluated four clinical strategies. Of the four, they concluded that it is most cost-effective to adopt a strategy of screening adult Asian and Pacific Islanders for chronic hepatitis B infection so that those identified can receive treatment. They also found it cost-effective to vaccinate those in close contact with the infected so they can be protected from contagion.

Using a common public health metric, they estimate that it costs \$36,000–\$40,000 per quality-adjusted life year (QALY) gained to screen and provide treatment for adult Asian and Pacific Islanders. In the U.S., an intervention that costs less than \$50,000 per QALY gained is generally considered to be cost effective.

The total cost of treating chronically infected people in the U.S. is more than 100 times greater than the cost of the initial screening program. The study provided the convincing evidence that led to the 2010 Institute of Medicine report on Hepatitis and Liver Cancer, as well as the 2011 Health and Human Services' Action Plan to combat the silent epidemic of viral hepatitis and recommend routine screening of foreign born including Asians in the U.S. for chronic hepatitis B infection.

"Doing Good with Good O.R. [Operations Research]: Supporting Cost-Effective Hepatitis B Interventions" is by David W. Hutton and Margaret L. Brandeau of the Department of Management Science and Engineering at Stanford University and Samuel K. So of the Stanford University School of Medicine's Asian Liver Center and Department of

Surgery. It appears in a special issue of the INFORMS journal *Interfaces* that is dedicated to the new, growing field of humanitarian applications in operations research, which applies analytical and mathematical models to benefit the public sector.

"Doing Good with Good O.R." is a program initiated by INFORMS that encourages operations researchers to make major improvements in the public sector using their specialized skills.

With budgets for healthcare chronically tight, the authors evaluated several potential hepatitis B screening, vaccination, and treatment interventions in order to identify the most cost-effective as measured in health benefits per dollar spent.

They used new combinations of decision analysis and Markov models to analyze several interventions.

"Increasingly in medicine, policymakers are looking for evidence of effectiveness and cost-effectiveness to support their decision making," writes Alena Groopman, Global Health Coordinator at the Asian Liver Center. "Typically, conducting clinical trials of HBV [hepatitis B] policies would take decades to gather this evidence. The work that David Hutton, Dr. Margaret Brandeau, and Dr. Sam So have done modeling this disease and these interventions has been incredibly important to accelerating policy changes to improve health related to HBV."

The team was able to achieve their results in approximately a year.

Provided by Institute for Operations Research and the Management Sciences

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