Smallpox: Should Everyone Be Vaccinated?

Study Says 'Yes' -- If Biological Terrorist Attack Has Occurred

By Jeanie Davis

July 10, 2002 -- America is gearing up for the worst-case scenario - a deadly smallpox attack. The best defense is mass inoculation, with all U.S. residents rolling up their sleeves as soon as there's evidence of exposure, says one Yale epidemiologist.

The Yale report comes on the heels of a new federal announcement -- one calling for vaccination of emergency personnel and healthcare workers, some 500,000 people. Each state would designate teams to receive the shots, teams that will consist of doctors, disease trackers, nurses, lab workers, and law enforcement officers -- the first to respond in case of bioterrorism attack, according to the Department of Health and Human Services.

Volunteers at four sites around the country are already being inoculated with diluted doses of two vaccines to test their effectiveness. A vaccine known as Dryvax was made 20 years ago; 15 million doses of it are available. Another vaccine by Aventis Pasteur, Inc., was donated to the government; the company has stockpiled it for decades.

"I think it makes sense to vaccinate emergency responders pre-attack, precisely so that there will be a pool of persons who can protect the rest of us," says Edward H. Kaplan, PhD, professor of management science and public health at Yale School of Medicine, in an email interview with WebMD.

However, Kaplan takes issue with the CDC's overall plan for handling deadly outbreaks, which is known as "ring vaccination." It means vaccinating those who are exposed and others they have come in contact with -- as well as contacts of those contacts -- all of which constitutes the ring of infection.

Relying on ring vaccination would be "a huge error ... [and] will fail in all but the most meager outbreaks," Kaplan says.

Mass vaccination of the U.S. population -- on the other hand -- would result "in far fewer deaths and much faster epidemic eradication," he writes in his study of the issue, which appears in this week's Proceedings of the National Academy of Sciences.
But "ring vaccination and mass vaccination are not mutually exclusive," Jim Hughes, MD, director of the CDC's National Center for Infectious Diseases, tells WebMD.

"Ring vaccination will be part of any response in case of an attack [using an infectious agent]," he says. "It's a strategy that has been used around the world and has worked."

Smallpox was indeed eradicated worldwide in 1979, although some countries have experimented with the virus as a potential biological warfare weapon.

"Depending on the nature of the attack, the outer ring could be small or quite large," Hughes says. "It could be an entire community or -- in worst-case scenario when there's a large release in an international airport or multiple simultaneous releases -- it could mean a very large and very quick mass vaccination."

In fact, the CDC is currently considering the logistics of an emergency mass vaccination campaign, providing guidance for state and local jurisdictions. "That's more evidence that we're taking the threat quite seriously," Hughes tells WebMD.

Kaplan's study shows that emergency mass vaccinations can work. Using statistical models that predict consequences of epidemics, Kaplan and colleagues compared two alternative approaches to controlling smallpox after an exposure -- each incident beginning with 1,000 infected people in New York City.

In the first scenario, they applied the CDC's current response plan - - the ring vaccination method.

In the second scenario, everyone in the New York metropolitan area was immediately vaccinated once the exposure was identified.

Kaplan's data: With the ring vaccination approach, at 100 days after exposure, the epidemic is still growing with more than 300,000 cases of smallpox and more than 100,000 deaths. With the mass vaccination approach, there are less than 2,000 cases and about 550 deaths; at 40 days, the epidemic is over.

"Mass vaccination wins hands down," says William J. Bicknell, MD, MPH, founder of the Boston University School of Public Health and former commissioner of the Massachusetts state health department. He agreed to review the study for WebMD.

Kaplan's study was conducted "very systematically, very realistically," he tells WebMD. "He was very fair to the CDC's plan, in estimating time involved in tracing people exposed to the virus."

Mass vaccination "makes excellent sense," Bicknell tells WebMD. "It makes even better sense to vaccinate before an attack. My position is that if half the adults in the country should be vaccinated -- except those at high risk [of having a bad reaction, such as those] with HIV, or who have had an organ transplant, or who have eczema. Then you would have 140 million to 150 million people already vaccinated. Then if there is an attack, the whole country would be vaccinated in a short period of time. Mass vaccination would wipe out [the outbreak] very, very quickly.

"It would totally avoid mass hysteria, because nobody will get sick," he says. "This vaccination works, it works. The side effects are real, you do want to protect against them, but they are not quite as common as the public has been lead to believe."
The death rate from smallpox infection is about 25% in adults and 45% in young children, says Bicknell. "Of those who get the disease, 60% to 80% will be severely disfigured -- scars all over your face -- and they won't go away with makeup or cosmetic surgery."

One or two deaths per million people occur from the vaccination itself -- "pretty damn small," Bicknell tells WebMD.

Negative outcomes from the vaccination can be averted by carefully selecting those who are vaccinated, he says. Also, covering the vaccination site with a semipermeable membrane dressing will prevent the virus from the vaccination from shedding into the environment and inoculating high-risk individuals.

The smallpox virus has an incubation period of about six days before the first symptoms set in. "You get a fever, feel lousy, but you're not infectious, Bicknell tells WebMD. "As your fever starts to go down, you get a rash inside your mouth, but you don't see it -- and that's when you're highly infectious. A trained terrorist would likely be quite mobile during those early days of the incubation period, walking city streets, taking subways, flying to several cities."

It's not clear whether the vaccine can actually prevent the infection, Bicknell says. More likely, those who come in contact with the virus "may very well get smallpox but you won't die. It makes the infection less severe if you vaccinate within four days of exposure."

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