Medical Xpress

How to wipe out polio and prevent its reemergence

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Public health officials stand poised to eliminate polio from the planet. But a new study shows that the job won't be over when the last case of the horrible paralytic disease is recorded.

In an article publishing June 19 in the Open Access journal *PLOS Biology*, graduate research fellow Micaela Martinez-Bakker and professors Aaron A. King and Pejman Rohani of the University of Michigan Department of Ecology and Evolutionary Biology use disease-transmission models to show that silent transmission of poliovirus could continue for more than three years with no reported cases.

To ensure that the disease is truly eradicated, aggressive surveillance programs and vaccination campaigns must continue in endemic countries for years after the last reported case, they conclude.

"Using transmission models, we demonstrate that you can have sustained chains of silent transmission in populations for more than three years, without a single person ever showing up as a reported polio case," said Martinez-Bakker, who completed the six-year polio study as part of her doctoral dissertation.

"Once we've eradicated polio—or think we've eradicated polio—we probably should intensify the environmental surveillance to make sure the virus is not just lurking under the hood at very low levels," she said. "Polio eradication is about eradicating the virus. It's not about eradicating the disease paralytic polio."

Pakistan, Afghanistan and Nigeria are the only countries where polio remains endemic - down from more than 125 countries in 1988. The disease mainly affects children under 5, and one in 200 infections leads to irreversible paralysis, according to the World Health Organization, which reported 416 cases of polio worldwide in 2013.

Martinez-Bakker analyzed polio case reports from large-scale U.S. epidemics in the pre-vaccine era, along with birth statistics and census numbers from every state. This enormous data set provided a unique glimpse into the ecology of polio infection in the relative absence of human intervention.

And it led her to conclude that the leading explanation for the marked increase in U.S. polio incidence from the 1930s to the 1950s—an idea known as the hygiene hypothesis or the disease of development hypothesis—is likely wrong.

In particular, the sharp increase in cases that occurred after the mid-1940s appears to be a straightforward consequence of a surging birth rate during the post-war "baby boom," not the result of improvements in sanitation and hygiene, as textbooks currently suggest.

"If you have more kindling, you can have a much larger forest fire," Martinez-Bakker said. "The baby boom provided more kindling for polio epidemics—young children and infants over 6 months of age—so much more explosive outbreaks were now possible."

Disease transmission models allowed her to track the movement of poliovirus and reconstruct the millions of unobserved, symptomless infections that spread the disease in the first half of the 20th century.

The number of U.S. polio cases peaked in 1952 at 57,000. Three years later, mass inoculations with Jonas Salk's vaccine began after it was

declared "safe, effective and potent" during an April 1955 scientific meeting at the University of Michigan.

The new U-M research shows for the first time that more than 3 million Americans were likely infected with poliovirus during that peak year of 1952. The study also explains why U.S. polio epidemics in the pre-vaccine era were explosive, seasonal and varied geographically.

"Reaching eradication and preventing reemergence of polio requires intimate knowledge of how the virus persists," Martinez-Bakker said.

"Historical epidemics that predate the use of vaccines can be used to disentangle the epidemiology of disease from vaccine effects," she said. "They allow us to establish a baseline by studying the system in the absence of intervention."

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