Whooping cough immunity lasts longer than previously thought

October 29 2009

Immunity to whooping cough lasts at least 30 years on average, much longer than previously thought, according to a new study by researchers based at the University of Michigan and the University of New Mexico. Details are published October 30 in the open-access journal *PLoS Pathogens*.

Once thought to be under control following widespread childhood vaccination, whooping cough (pertussis) has been on the rise since the 1980s in the United States and several other countries. Several explanations have been proposed for the surprising increase in cases, and one leading idea is that the immunity enjoyed by vaccinated or previously exposed people is waning. It has been documented that, in some individuals, immunity has waned over time, but details of how long protection typically lasts and how its waning affects disease transmission have not been clear.

To try to answer these questions, Pejman Rohani (based at the University of Georgia during completion of this study) and Helen Wearing used mathematical models to explore various scenarios and compared the predictions generated by those models to data on whooping cough incidence.

The researchers constructed two different models based on assumptions of the effects of pertussis exposure on a person whose immunity has lapsed and that person's relative contribution to transmission. Then they compared the models' predictions to whooping cough incidence data

from England and Wales from both the pre-vaccine era (1945-1957) and the vaccine era (1958-1972).

In particular, Rohani and Wearing looked for matches in two key measures: the number of years between big outbreaks and the frequency of "extinctions"---periods of time when no whooping cough cases were reported in the population. The analysis revealed that, on average, whooping cough immunity lasts at least 30 years and perhaps as long as 70 years after natural infection.

"This is surprising because clinical epidemiologists currently believe the duration of pertussis immunity is somewhere between four and 20 years," said Rohani.

In addition, repeat infections appear to contribute relatively little to the transmission cycle, the researchers found. And when people whose immunity has waned are re-exposed to whooping cough, they rarely become infected. In fact, their immunity to the disease may be boosted by re-exposure, the study suggests. Still, the researchers are cautious about drawing conclusions about current day vaccination practices from their study of historical data.

"It's worth pointing out that in the past 20 years or so, the nature of the vaccines that have been used has changed quite fundamentally," Rohani said. The data we're using are from a time when a whole-cell vaccine was in use; now an acellular vaccine, which stimulates a different part of the immune system, is typically used, especially in North America."

In response, Rohani is doing new work using more recent data from the U.S., such as birth rates, population size, and vaccination coverage, to uncover relevant factors associated with trends in whooping cough incidence.

More information: Wearing HJ, Rohani P (2009) Estimating the Duration of Pertussis Immunity Using Epidemiological Signatures. *PLoS Pathog* 5(10): e1000647. doi:10.1371/journal.ppat.1000647

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