

Whooping cough bacterium evolves in Australia

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Gram stain of the bacteria *Bordetella pertussis*. Credit: CDC

The bacterium that causes whooping cough, *Bordetella pertussis*, has changed in Australia - most likely in response to the vaccine used to prevent the disease - with a possible reduced effectiveness of the vaccine as a result, a new study shows.

A UNSW-led team of researchers analysed strains of *Bordetella pertussis* from across Australia and found that many strains no longer produce a key surface protein called pertactin.

About 80 per cent of the 2012 [whooping cough](#) cases in Australia studied by the team were caused by pertactin-free strains. Pertactin is one of the three proteins, made from purified extracts of *Bordetella pertussis* bacteria, which are present in the [vaccine](#) currently used in Australia. The other two are [pertussis](#) toxin and filamentous

haemagglutinin.

"It's like a game of hide and seek. It is harder for the antibodies made by the body's immune system in response to vaccination to 'search and destroy' the whooping cough bacteria which lack pertactin," says the senior author of the study, Associate Professor Ruiting Lan, of the UNSW School of Biotechnology and Biomolecular Sciences.

"This could mean that these pertactin-free strains have gained a selective advantage over bacterial strains with the pertactin protein."

The study is published in the journal *Emerging Infectious Diseases*.

Australia has only recently emerged from an epidemic of whooping cough that went on for an unusually long period – with about 142,000 cases from 2008 to 2012. Although the number of cases identified was greatly increased by more and better testing, the epidemic was still a major one. Nine babies died of whooping cough during the five years.

The research, led by UNSW PhD student Connie Lam, involved the analysis of 320 bacteria samples from patients with whooping cough obtained during 2008-2012 from five states – NSW, Victoria, Queensland, South Australia and Western Australia.

The proportion of pertactin-free bacteria rose from five per cent of cases tested in 2008 to 78 per cent in 2012. Pertactin-free strains of pertussis have also been detected overseas, including in countries such as France and the United States.

"The fact that they have arisen independently in different countries suggests this is in response to the vaccine," says Associate Professor Lan.

There is no evidence that the pertactin-free strains

are more harmful than other [strains](#), and it is not yet clear whether they reduce the effectiveness of the vaccine in the short or long term.

"More studies are needed to better understand the effects of vaccination on the evolution of the organism," says Associate Professor Lan.

The current acellular vaccine, purified down to three antigens, was introduced in 1997 to replace the previous whole-cell vaccine, after side effects such as fever and crying dissuaded many parents from starting or completing the three doses of vaccine required by six months of age.

"The acellular pertussis vaccine produces antibodies against pertussis toxin which is the main cause of severe disease symptoms produced by the whooping cough bacterium. Vaccination is still the only way to protect against whooping cough, especially for the youngest babies who are most at risk of severe illness," stressed Associate Professor Lan.

Babies need to be immunised at six to eight weeks of age, four months and six months, with a booster at four years.

Provided by University of New South Wales

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