

Acellular vaccines provided less protection during California pertussis outbreak

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Teenagers who received four doses of the newer acellular pertussis vaccines were nearly six times as likely to receive a diagnosis of pertussis during a recent outbreak in California than were those who received doses of the older, whole cell preparation, a new study has found.¹

After pertussis vaccines were introduced in the 1940s the annual number of cases of the disease in the United States fell from more than 100 000 to fewer than 10 000 by 1965. These vaccines were derived from whole *Bordetella pertussis* organisms and were combined with diphtheria and tetanus toxoid (in the DTwP vaccine). But because of concerns that the whole cell vaccines caused neurologic and other reactions in children, DTwP vaccines were gradually replaced in the 1980s and 1990s with an acellular preparation, designated DTaP.

However, the number of cases of pertussis began to rise in the US, reaching more than 27 000 in 2010 and topping 41 000 last year, the most since 1955. The increase in incidence has raised concerns that the acellular preparations were failing to confer long lasting protection.

In the new study researchers used a case-control design to assess the risk of pertussis among 10-17 year olds during the 2010-11 outbreak in northern California, looking at the number of whole cell and acellular vaccines they had received in the first two years of life.

The study compared the vaccine history of 138 teenagers in whom pertussis had been confirmed through polymerase chain reaction techniques with 899 who had been tested and found to be uninfected and 54 339 matched controls who had not been tested.

The cases and controls were all members of Kaiser Permanente Northern California, an integrated health system with more than 3.2 million members. The study was published in *Pediatrics*.¹

All participants had received the recommended four doses of pertussis vaccine between the ages of 1 month and 24 months and a fifth vaccine by age 7 years, and the researchers had access to a database that included type of vaccinations, laboratory tests, and any inpatient, emergency department, and outpatient diagnoses that the cases and controls may have received.

Kaiser Permanente had introduced the acellular vaccine as the fifth dose in 1991, as the fourth dose in 1992, and as the three dose primary series in 1997. As a result, participants born before 1999 received either all whole cell vaccines, all acellular vaccines, or a mix of the two.

The researchers found that teenagers who received four whole cell vaccines were nearly a sixth less likely to have been given a diagnosis of pertussis than those who had received all acellular vaccines (odds ratio 5.6 (95% confidence interval 2.6 to 12.5)) and nearly four times less likely than those who had received a mix of vaccines (3.8 (1.6 to 9)).

On average, the risk of a diagnosis of pertussis rose by 40% for each additional acellular dose a participant received instead of an additional dose of the whole cell vaccine (odds ratio 1.4 (1.2 to 1.6)).

“This study supports and highlights the need for new pertussis vaccines that provide both an improved safety profile and long-lasting immunity,” the researchers concluded.

1 Klein NP, Bartlett J, Fireman B, Rowhani-Rahbar A, Baxter R. Comparative effectiveness of acellular versus whole-cell pertussis vaccines in teenagers. *Pediatrics* 2013;131:e1716-22, doi:10.1542/peds.2012-3836.

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