MedicalXpress

Resurgence of whooping cough may owe to vaccine's inability to prevent infections

September 21 2017

The startling global resurgence of pertussis, or whooping cough, in recent years can largely be attributed to the immunological failures of acellular vaccines, Boston University School of Public Health (BUSPH) researchers argue in a new journal article.

The article, published in *F1000 Research*, points to the differences in mucosal immunity between whole-cell pertussis (wP) vaccines and the newer acellular pertussis (aP) vaccines, first introduced in the 1990s, as playing a pivotal role in the resurgence of the disease.

"This disease is back because we didn't really understand how our immune defenses against whooping cough worked, and did not understand how the vaccines needed to work to prevent it," said Christopher J. Gill, associate professor of global health at BUSPH and lead author of the article. "Instead we layered assumptions upon assumptions, and are now find ourselves in the uncomfortable position of admitting that we may made some crucial errors. This is definitely not where we thought we'd be in 2017."

Up until the 1950s, there were millions of cases of whooping cough around the globe each year, with numerous fatal cases in infants. The introduction of whole-cell pertussis (wP) vaccines led to a 99 percent reduction in cases. Later, as wP vaccines raised concerns of possible rare neurologic adverse events, aP vaccines were licensed and used in a number of countries starting in the early 1990s. Since then, cases of whooping cough have risen sharply. In 2014, there were more than

32,000 cases reported in the US.

"The resurgence of pertussis in the US to its highest levels since the 1940s emphasizes the need for answers to these questions," the authors wrote.

The researchers examined mathematical models of pertussis transmission, data derived from the aP and wP vaccines responses in animals, and recent insight into the immunology of pertussis and pertussis vaccines. They found that, contrary to existing assumptions, although both vaccines blocked symptomatic disease, wP vaccines blocked also infections in animals while aP vaccines did not. Other differences included wP vaccines' ability to induce a stronger herd immunity and robust TH17 responses, which confer mucosal immunity, while aP vaccines only induced TH2 responses.

Experimental and immunologic data has shown that aP vaccines do not provide herd immunity, while mathematical models imply otherwise. The researchers proposed a hypothesis to reconcile the contradictory findings: Herd effects from aP vaccines may be the result of modifications in disease presentation that lead to reduced possibility of transmission rather than induced resistance to infection.

The researchers also considered the role of several known factors in the rise of whooping cough cases, including detection bias, waning of immunity, and evolutionary shifts in the bacteria's genome. They found that, while contributing to the increase in incidence, these factors alone do not fully explain existing epidemiologic data.

Citing the urgency of the growing health crisis, the authors emphasized the need to go beyond the limitations of animal models and provide human data to further examine the arguments put forth in their article.

"The resurgence of pertussis in the aP vaccine era is evolving into a slow-moving global public health crisis," the researchers wrote. "But, with the public's trust in vaccines waning, this has also become a public relations crisis."

Provided by Boston University School of Medicine