

AMD Projects

Innovate • Transform • Protect

CDC's Advanced Molecular Detection (AMD) initiative fosters scientific innovation in genomic sequencing, epidemiology, and bioinformatics to transform public health and protect people from disease threats.

AMD Projects: Silencing the 100-day Cough

Using AMD technologies to understand changes in virulence of *Bordetella pertussis* and find effective vaccine components and diagnostic markers

Thought to be a disease of the past, whooping cough (pertussis) has returned with a vengeance. Following a low of about 1,000 cases reported in the 1970s, the disease recently rebounded to between 10,000 and over 48,000 reported cases in the United States each year since 2012. Known as the "100-day cough," pertussis can cause serious illness in people of all ages and can be deadly for babies. The recent increase in this disease is likely because the newer and safer vaccine introduced in the 1990s does not provide long-lasting protection. The pertussis bacteria have also changed over time and this also could be contributing to this unusual situation.

CDC has been working to understand what is driving the reemergence of pertussis. A recent analysis showed that one component targeted by the vaccine, pertactin, is now



CDC and the American Academy of Pediatrics (AAP) recommend that preteens get several vaccines at their 11- or 12-year old check-up, including the tetanus-diphtheria-acellular pertussis vaccine (Tdap).



missing in at least 90% of *Bordetella pertussis* isolated from people sick with pertussis in the United States. Pertactin, a protein believed to help the bacteria attach to cells in the throat, is one of several components of all pertussis vaccines. Researchers wondered if the bacteria's missing pertactin affects how well the vaccine protects against the disease. To find out, CDC's Pertussis and Diphtheria Laboratory is mapping the complete genome of historical and currently circulating strains of *B. pertussis* to determine if these genetic changes are contributing to the reemergence of pertussis.

CDC's advanced molecular detection (AMD) technologies are essential for controlling pertussis in the United States. The answers can inform development of new pertussis vaccines to help protect people from this illness.

For more information on whooping cough (pertussis), please visit <http://www.cdc.gov/pertussis/>.



2016 Update

In the project's first two years, investigators analyzed circulating strains of *B. pertussis* with the goal of identifying potential targets for future vaccines. They discovered pertussis is far more genetically diverse and the genetic changes occur much more frequently than previously thought. With AMD, investigators were able to characterize *B. pertussis* directly from patient samples without having to grow the bacteria first, saving time and money on additional steps in the laboratory. This means Enhanced Pertussis Surveillance (EPS) sites around the country can submit either patient samples or cultured specimens for molecular typing, thus improving and simplifying surveillance efforts.

Investigators also developed a computer system, the *Bordetella* Genome Informatics Platform (BGIP), to help bridge data from old and new molecular typing methods. The BGIP analyzes 7 specific sections of *B. pertussis* DNA and can distinguish 60 strains.

In the coming year, investigators will continue researching pertactin-negative pertussis strains by integrating the BGIP and new typing methods and expand partnerships with EPS sites to evaluate vaccine effectiveness. Additionally, CDC will continue to use AMD methods to analyze samples from outbreaks and compare them with historical strains to better understand the evolution of *B. pertussis* and its pattern of genetic changes, information that could help develop new, more effective pertussis vaccines.