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Evaluation of the impact on pertussis transmission dynamics of adult and maternal boosting programs in the province of Ontario

Pertussis, a highly contagious infection of the respiratory tract, was one of the main causes of child morbidity and mortality in developed countries, in the pre-vaccine era. Following the scale-up and roll-out of childhood vaccination programs in the 1940s–1960s, the incidence and severity of pertussis decreased drastically. However, despite high vaccination coverage rates for more than 50 years, pertussis is now still a re-emerging disease and new vaccination strategies are in demand. Here, we developed a novel age-structured mathematical model which allows progressive waning of natural and vaccine-induced immunity, and distinguishes between clinical and sub-clinical infections. Imported cases and seasonal infections from out-of-province traveling were also considered. After fitted to and validated by the age-stratified pertussis incidence data, the model was used to produce simulations to evaluate maternal immunization and repeated adult boostings in the province of Ontario.