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DTap and Tdap Effectiveness in Children — Alaska, May 1–November 30, 2024

Introduction

Pertussis is a highly contagious respiratory infection caused by the bacterium *Bordetella pertussis*. Pertussis cases tend to peak cyclically every 3–5 years in the United States. Before widespread vaccination, more than 200,000 cases and 9,000 deaths were attributable to pertussis in U.S. children annually.[1] Following low pertussis case counts during the COVID-19 pandemic, the incidence of pertussis increased considerably in 2024 in Alaska and nationally.[2,3] This surge in activity has prompted questions about the efficacy of Tdap and DTaP vaccines. The purpose of this evaluation is to assess the real-world effectiveness of the acellular pertussis vaccine in Alaska children during 2024.

Methods

We conducted a population-based case-control analysis to assess the association between receipt of acellular pertussis vaccine (i.e., DTaP and/or Tdap) and the risk of pertussis disease in 2024. Cases included all first-time laboratory-confirmed pertussis cases among children aged 2 months to 17 years reported in Alaska during May 1 to November 30, 2024. Controls were randomly selected from test reports of children of the same age who were tested for respiratory viral pathogens at the same healthcare facility as the corresponding pertussis case during the analysis period, but who had no known current or prior diagnosis of pertussis. For each case, we randomly selected three controls matched by age (in years) and healthcare facility.

Vaccine status was assessed for each child through linkage with VacTrAK, Alaska's immunization information system. The total number of DTaP/Tdap doses received was determined for each child. Children were classified as fully vaccinated (or "up to date") if their VacTrAK records showed DTaP and Tdap doses consistent with the ACIP age-specific recommendations at the time of specimen collection. Those with no doses recorded were categorized as unvaccinated, and those with partial doses but who were not up to date were classified as partially vaccinated. To ensure accurate childhood vaccination data, the analysis was restricted to children born in Alaska. Doses administered within 2 weeks prior to specimen collection were excluded from the total dose count due to insufficient time to achieve an immune response. Cases and controls with more than five recorded DTaP doses or a history of pertussis were excluded from the analysis.

To estimate the association between vaccination and pertussis diagnosis, we used conditional logistic regression to calculate odds ratios, accounting for matching factors (facility and birth year). Vaccine effectiveness (VE) was calculated as: 1 − odds ratio × 100%. Regression models were adjusted for race and calendar month, with age and healthcare facility controlled through the matched design. Unvaccinated children served as the reference group in all models. Standard errors were adjusted to account for clustering by facility.

Results

A total of 120 cases and 344 controls from 17 healthcare facilities across Alaska were included in the final analysis. Cases were more likely than controls to be unvaccinated (43.8% [n=52] vs. 9.3% [n=32]; P<.001) and less likely to be fully vaccinated (42.5% [n=51] vs. 71.2% [n=245]; P<.001) (Table 1). Unvaccinated children were >13 times more likely to contract pertussis compared to those who received the age-specific acellular pertussis vaccine dose (95% CI: 7.6–24.7).

Among children who were fully vaccinated, the vaccine effectiveness against pertussis was 92.7% (95% CI: 86.8%–95.9%) (Table 2). For children who had received acellular pertussis vaccination but were not yet considered fully vaccinated according to their age at the time of specimen collection, the vaccine effectiveness was 85.4% (95% CI: 71.2%–92.6%).

Table 1. Pertussis Vaccine Dose Status of Cases and Controls During the 2024 Alaska Pertussis Outbreak — Alaska, May 1 through November 30, 2024

Vaccine Status	Cases (%) n = 120	Controls (%) n = 344
Fully Vaccinated	51 (42.5%)	245 (71.2%)
Partially Vaccinated	17 (14.2%)	67 (19.5%)
Unvaccinated	52 (43.3%)	32 (9.3%)

Table 2. Estimated Pertussis Vaccine Effectiveness (VE) — Alaska, May 1 through November 30, 2024

Vaccine Status	Unadjusted Estimated VE % (95% CI)	Adjusted* Estimated VE % (95% CI)
Fully Vaccinated	90.9%; (84.6%–94.6%)	92.7% (86.8%–95.9%)
Partially Vaccinated	82.6% (66.3%–91.0%)	85.4% (71.2%–92.6%)
Unvaccinated	Reference	Reference

**Adjusted for race and calendar month of visit/diagnosis.*

Discussion

During Alaska's recent pertussis outbreak, unvaccinated children were more than 13 times as likely to be diagnosed with pertussis compared to those who were up to date with their acellular pertussis vaccination. While this analysis focused on a subset of pertussis cases from the 2024 outbreak, the vaccine effectiveness estimates presented here align closely with those from larger studies and prelicensure estimates.[4,5]

The matched case-control design helped reduce biases related to testing rates or healthcare access. However, due to the small sample size, we could not assess waning immunity, which several studies have suggested may contribute to cyclical pertussis outbreaks.[5]

Overall, pertussis immunization at the recommended schedule helped provide strong protection against pertussis during this recent statewide outbreak.

Recommendations

1. Young children should be up to date with the DTaP vaccine (doses at 2, 4, 6, and 15–18 months, with a booster dose at 4–6 years).
2. Adolescents/adults should be up to date with the Tdap vaccine (given at 11–12 years and every 10 years thereafter).
3. Pregnant women should receive one dose of Tdap vaccine at 27–36 weeks of each pregnancy to protect the infant at birth.
4. The Alaska Immunization Program Helpline is available: 907-269-8088 or visit https://health.alaska.gov/dph/Epi/iz.

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