

Pertussis deaths—Oregon, 2003-2007

Juventila Liko, MD, MPH, Michelle Barber, MS, Martha Skiles MPH.

Oregon Public Health Division

Objectives:

Describe the potential risk factors associated with pertussis deaths and identify key strategies to limit disease spread to vulnerable infants.

Background:

According to NIS, Oregon's coverage rate for the 3rd DTaP is 88.6 by 13 months of age. Despite high levels of immunizations, pertussis continues to cause fatal illness among vulnerable infants. Pertussis cases increased substantially since 2000 among all age groups, including infants. Although down from levels seen in 2004 and 2005, pertussis remains a problem in Oregon.

Infants have the highest risk of pertussis-related complications and deaths (4 in the past 7 years) as well as the highest reported incidence since 2000 in Oregon (Figure 1).

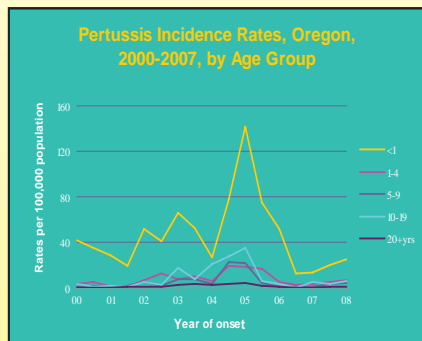


Figure 1. Incidence of Pertussis by Age Group, 2000-2007

More than 96% of hospitalizations for pertussis occurred in infants aged <6 months, a group too young to have developed adequate protection from vaccination (Figure 2).

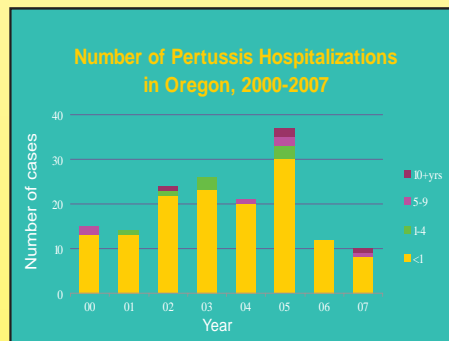


Figure 2. Number of Pertussis Hospitalizations in Oregon, 2000-2007

Methods:

Data Sources:

We identified four patients who were reported to have had pertussis with a fatal outcome between April, 2003 and September, 2007. Fatal cases occurred during substantial outbreaks in 2003 and 2005. To determine characteristics of the fatal cases, we reviewed case reports, medical records, autopsy reports, and death certificates.

Case definitions:

A death attributed to pertussis was defined as confirmed if: *B.pertussis* was isolated from a clinical specimen by either culture or PCR and clinically consistent with pertussis (paroxysmal cough, apnea, and posttussive vomiting)

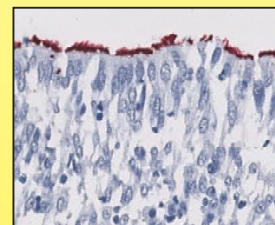
A death attributed to pertussis was defined as presumptive if: close contact of a confirmed case during the contagious period and clinically consistent with pertussis.

Results:

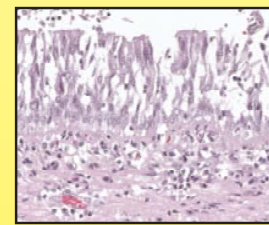
All deaths occurred among infants with onset of pertussis symptoms at age <4 months. Characteristics of the fatal cases of pertussis are listed in Table 1. Of the 4 children who died, 3 were boys and one was girl. Two of children were white, 1 was black and 1 Native-American. Only one of the children had received one dose of pertussis vaccine. Definite contact with family member with a coughing illness compatible with pertussis was reported for all infants.

Table 1. Demographic, vaccination status and exposure history of 4 fatal of pertussis in Oregon

Characteristics	Case 1	Case 2	Case 3	Case 4
Age (m)	3 months	3 months	1.5 months	1 month
Gender	Male	Male	Female	Male
Race	Native-American	Black	White	White
Ethnicity	Non-Hispanic	Hispanic	Non-Hispanic	Hispanic
Year	2003	2003	2005	2007
No. of Prior DTaP Doses	0	1	0	0
Cough illness	Grandma	Family members	Aunt	Mother, sister



Tracheal epithelium of an infant with Bordetella pertussis IHC fatal pertussis (H & E stain)



Bordetella pertussis IHC

Marked leukocytosis and lymphocytosis were noted in all the cases. Three infants were admitted to the intensive care unit, intubated, and ventilated. In addition to standard ventilation, oscillatory ventilation was used in all of them, and extracorporeal membrane oxygenation was used in 1 case.

Cough was reported in all cases. Other frequently reported symptoms were cyanosis, coryza, apnea and vomiting (Table 2). Pneumonia was the most common complication, followed by pulmonary hypertension and seizures. All the cases were confirmed by either culture or PCR.

B.pertussis DNA was detected by PCR and immunohistochemistry postmortem in one of the cases – courtesy of CDC.

Table 2. Clinical characteristics and course of 4 fatal cases of pertussis in Oregon

Characteristics	No.Present/ No.Known
Symptom or sign	
Cough	4/4
Coryza	3/4
Apnea	2/4
Cyanosis	3/4
Vomiting	2/4
Complications	
Pneumonia	3/4
Seizures	2/4
Encephalopathy	1/2
Pulmonary hypertension	2/4
Atelectasis	1/4
Laboratory results	
Culture confirmed	2/4
PCR confirmed	3/4
Leukocytosis	3/4
Lymphocytosis	3/4
Respiratory support	
Supplemental O2 without intubation	2/4
Supplemental O2 via intubation	3/4
Continuous mechanical ventilation	3/4
High Frequency Oscillatory Ventilation	3/4
Extra Corporeal Membrane Oxygenation	1/4

Conclusion:

Because pertussis often may not be considered in the differential diagnosis, it is likely that the true number of pertussis-related deaths is higher than the number of the reported deaths. Pertussis fatalities occur among infants too young to be fully protected by immunization.

Clinicians should consider pertussis as a cause of illness among vulnerable infants who present with cough illness. Timely diagnosis of pertussis in caregivers and other contacts of infants could prevent infant pertussis fatalities.

Timely vaccination of infants and implementation of the recent ACIP recommendation for adult and adolescent vaccination could substantially reduce the burden of infant pertussis. This report highlights the need for more targeted outreach and education for those in contact with young infants.

Translating findings into an effective public health response:

- Encouraging improved adherence to the current schedule
- The possibility of accelerating the schedule to deliver the first dose starting at 6 weeks of age in community outbreaks
- Focusing on education of parents and clinicians about adult and infant pertussis.
- Diminishing exposure to *B.pertussis* through immunizing the immediate households contacts
- Early diagnoses and treatment of primary cases in the household with prompt chemoprophylaxis for contacts