Pertussis in the Elderly

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Equity in Disease Prevention: Vaccines for the Elderly
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Presentation Outline

I. Pertussis Overview
Images of Pertussis Disease

Video courtesy of the California Department of Health Services, UCLA’s Dr. James Cherry, and the Immunization Action Coalition. Available at: http://www.vaccineinformation.org/video/pertussis.asp. Last accessed on 08 June 2014.
Pertussis Disease Manifestations

- **Incubation period:** 7 - 10 days (range 4 - 21)
- **Stages**
  - Catarrhal: runny nose, sneezing, low-grade fever, mild cough
  - Paroxysmal: severe spasms of cough, thick mucous, whoops, vomiting, exhaustion
  - Convalescent: gradual recovery with less frequent & less severe coughing

Child with subconjunctival hemorrhages and facial ecchymoses due to pertussis coughing.

Pertussis Stages, Period of Communicability

- **Catarrhal Stage**: Weeks -2 to -1
- **Paroxysmal Stage**: Weeks 0 to 3
- **Convalescent Stage**: Weeks 3 to 12

**Period of Communicability**: Weeks -1 to 3

Exposure

Paroxysmal Cough Onset

Presentation Outline

I. Pertussis Overview

II. Prior to Pertussis Vaccines
Reported Pertussis Cases by Year
United States, 1922 – 1941

CDC. Pertussis – United States, 1997-2000. MMWR 2002;51:73-76. [Data for 1922-1941 from CDC’s T Murphy, personal communication, 2001.]
Adult Pertussis in the Pre-Vaccine Era

- Relatively little on clinical aspects of adult pertussis; rarely reported in adults
- Madsen described “grandmother’s cough”; thought to be 2nd attack of pertussis, always lighter, of shorter duration than 1st attacks
- Friedlander noted that even older adults had pertussis, but clinical diagnosis in this age group was difficult because paroxysms were mild and there was no definite whoop

Personal communication from J Cherry, June 2014.
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I. Pertussis Overview

II. Prior to Pertussis Vaccines

III. Changes with Widespread Vaccination of Infants / Young Children
Reported Pertussis Cases by Year
United States, 1922 – 1976

DTP vaccine introduced

Reported Pertussis Cases by Year
United States, 1922 – 2005

Reported Pertussis Cases by Year
United States, 1981 – 2005

2004: 25,872

Reports of Pertussis in the U.S.

Australia Also Experienced Surge in Adults

- From 1995 thru 2007, pertussis rates in persons 20-59 and ≥ 60 years generally < 20/100,000
- Changed in 2008; rate in both 20-59 and ≥ 60 years age groups approached 50/100,000
- Increased further in 2009 for both these age groups to almost 100/100,000
- In 2010 the rate in those ≥ 60 years climbed to ~ 125/100,000

Personal communication from J Cherry, June 2014, concerning National Pertussis Workshop sponsored by the National Center for Immunization Research and Surveillance in Sydney, Australia, 25-26 August, 2011.
Incidence Rates of Reported Pertussis
United States, 2005

Hospitalizations and complications among infants aged <1 year with pertussis, US, 2000-2009

<table>
<thead>
<tr>
<th></th>
<th>N = 25,179</th>
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<tbody>
<tr>
<td><strong>Total</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Hospitalized</strong></td>
<td>11,571 (63.3%)</td>
</tr>
<tr>
<td><strong>Apnea</strong></td>
<td>10,127 (58.0%)</td>
</tr>
<tr>
<td><strong>Pneumonia</strong></td>
<td>1,875 (19.2%)</td>
</tr>
<tr>
<td><strong>Seizure</strong></td>
<td>202 (1.2%)</td>
</tr>
</tbody>
</table>

CDC, National Notifiable Diseases Surveillance System and Supplemental Pertussis Surveillance System, 2000-2009. 2009 Data are provisional. Percentages are based on total number with information. For 19% of infant cases, no information was available on hospitalization or apnea; for 21% no information was available on seizure; and for 34%, no information was available on pneumonia.

* Radiographically confirmed.
Pertussis Deaths by Decade and Age Group

Includes one case of unknown age.


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III. Changes with Widespread Vaccination of Infants / Young Children

IV. Reasons for Changing Epidemiology
## Estimated Duration of Immunity After Pertussis Infection or Vaccination, Summary

<table>
<thead>
<tr>
<th>Source of Immunity</th>
<th>Duration</th>
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<tbody>
<tr>
<td>Natural infection</td>
<td>4 – 20 years</td>
</tr>
<tr>
<td>Whole-cell vaccination</td>
<td>4 – 14 years</td>
</tr>
<tr>
<td>Acellular vaccination</td>
<td>3 – 10 years</td>
</tr>
</tbody>
</table>

Before generalized use of pertussis vaccine

After generalized use of pertussis vaccine in children

Reported Pertussis Cases by Year
United States, 1922 – 2013*

* 2013 data are provisional


Reported Pertussis Cases by Year
United States, 1966 – 2000


CDC. Summary of notifiable diseases – US, 2011. MMWR 2011;60(53):100,102,104.
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V. Pertussis Manifestations in and Transmission from the Elderly
Whooping Cough in an Adult


Vignette: 71-Year-Old Physician Case Illustrates Challenges of Diagnosis, Treatment and Recovery

- At age 5 years, subject developed pertussis; wife had pertussis in late 1980s.

- The subject was assumed to have been exposed on an airplane on July 5, 2009. Onset of cough illness occurred on July 15, sweating episode July 18, first whooping episode occurred July 29.

- An internist diagnosed “cough variant asthma” on August 3 and decided to rule out insulinoma; treated with prednisone. On August 7, otorhinolaryngologist diagnosed Wegener granulomatosis; underwent head and neck CT scan.

- Positive PCR results obtained on August 14.

- Coughing continued through October without improvement. Relapse occurred during a cold in November 2009.

Clinical Characteristics and Complications of Pertussis in Adults

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<tbody>
<tr>
<td></td>
<td>19 – 64 years (n = 18,243)</td>
<td>≥ 65 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(n = 984)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥ 18 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(n = 384)</td>
</tr>
<tr>
<td>Paroxysmal cough</td>
<td>89%</td>
<td>86%</td>
</tr>
<tr>
<td>Apnea</td>
<td>32%</td>
<td>32%</td>
</tr>
<tr>
<td>Post-tussive vomiting</td>
<td>45%</td>
<td>27%</td>
</tr>
<tr>
<td>Whoop</td>
<td>37%</td>
<td>33%</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>3%</td>
<td>8%</td>
</tr>
<tr>
<td>Seizure</td>
<td>0.6%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Hospitalization</td>
<td>3%</td>
<td>12%</td>
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## Cough Duration in Adults With Pertussis

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<thead>
<tr>
<th></th>
<th>Quebec (n=384)</th>
<th>Sweden (n=155)</th>
<th>Germany (n=79)</th>
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<tbody>
<tr>
<td>Cough ≥3 weeks</td>
<td>97%</td>
<td>-</td>
<td>80%</td>
</tr>
<tr>
<td>Cough ≥9 weeks</td>
<td>55%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Median or mean duration</td>
<td>12 wks</td>
<td>8 wks</td>
<td>7 wks</td>
</tr>
<tr>
<td>Maximum duration</td>
<td>-</td>
<td>26 wks</td>
<td>32 wks</td>
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CDC Study – Infant Pertussis: Who Was the Source?

- 774 infant cases from 4 states
- 264 cases had source identified
- Sources:
  - Mother 32%
  - Father 15%
  - Siblings 20%
  - Grandparents 8%
  - Others 25%

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VI. Tdap Vaccination in the Elderly
Studies of Tdap Vaccines in Elderly: Immunosenescence, Antibody Responses Consistent With Protection

1. Tdap5-IPV in Austrian elderly: “…humoral immune response to booster immunization is lower in older age than in young persons…”

2. Tdap3 in US elderly: “…Tdap vaccine was shown to be immunogenic in this age group, with robust increases in antibodies…”

3. Tdap5 in US elderly: “…pertussis antibodies increased by at least 4.4-fold…suggesting an improved degree of protection against pertussis”

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VI. Tdap Vaccination in the Elderly

VII. Summary
Summary

- With widespread use of pertussis vaccines in multiple countries beginning mid-20th century, pertussis dramatically decreased, but was not eliminated.

- In recent years, pertussis reports have increased:
  - Only to fraction of pre-vaccination levels;
  - Adolescents / adults (including elderly), newborns / young infants disproportionately affected.

- Waning of infection- and vaccine-induced protection one of important reasons for increasing reports of pertussis and changes in age distribution of cases.

- Tdap vaccines induce good anti-pertussis responses in older adults, and definitely should be offered to those in this age group.