Health-Care Personnel Pertussis and Tdap Vaccination

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Advisory Committee on Immunization Practices
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Evaluating Vaccinating Health-care Personnel with Tdap

- Tdap vaccine
  - Second dose of Tdap
  - Effectiveness

- Pertussis in health-care personnel (HCP)
  - Burden of disease
  - Transmission
  - Exposure management

- Impact of vaccinating HCP

- WG conclusions

- Discussion
Second dose of Tdap is safe and immunogenic.
Response to Second Tdap at 5- or 10-yr Interval Safety and Immunogenicity

Safety

- Generally comparable after first Tdap
- Majority of local and systemic adverse events: mild to moderate; self-limited
- Of few serious adverse events reported, none related to second Tdap
- Rates comparable at the 5- and 10-year interval

Immunogenicity

- Tetanus and Diphtheria – essentially 100% protected
- Pertussis
  - Response at 5 and 10 year intervals similar
  - Comparable to historic and contemporaneous first dose

Halperin 2011; Knuf 2010; Booy 2010, Halperin 2012, Mertsola 2010
Pertussis: Antibody GMCs Over 10 Years Before and After First Tdap and 1 Month After Second Tdap (Boostrix) Adults (n=164)

Pertussis GMC Concentration Before and After First and Second Tdap (Adacel) After 5-year Interval

PT: pertussis toxin; FHA: filamentous hemagglutinin; PRN: pertactin; FIM: fimbriae types 2&3

Sanofi Pasteur – revaccination with Adacel

- Adults administered 9-11 years after previous Tdap
  - US study completed and presented to WG and ACIP (2013)
  - Canadian study will finish later this year
  - Plans to submit to FDA
GSK Revaccination Program for Boostrix

- GSK is conducting clinical studies in the US for revaccination after prior vaccination with Boostrix
  - GSK recently completed a revaccination study of young adults, 20-28 years old, who were initially vaccinated 10 years earlier when they were adolescents (11-18 years old).
  - Revaccination study in adults, 28-73 years old who were initially vaccinated approximately 9 years ago, when they were 19-64 years old, will begin next year.
- Plans to submit the data to the FDA for consideration of a label update for BOOSTRIX will be dependent on pertussis epidemiology and ACIP recommendations
Tdap vaccine is effective but protection starts to wane within three years.
### Estimates of Tdap vaccine effectiveness in adolescents

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Country</th>
<th>Age Range</th>
<th>Study Design</th>
<th>Vaccine Effectiveness (95% CI)</th>
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<tbody>
<tr>
<td>Primed with mixed whole and acellular pertussis vaccines</td>
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<tr>
<td>Rank</td>
<td>2009</td>
<td>Australia</td>
<td>12-19</td>
<td>Screening</td>
<td>78 (61-88)</td>
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<td>Wei</td>
<td>2010</td>
<td>St. Croix</td>
<td>11-18</td>
<td>Cohort</td>
<td>66 (-36-91)</td>
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<tr>
<td>Skoff</td>
<td>2011</td>
<td>US</td>
<td>11-17</td>
<td>Case-Control</td>
<td>72 (39-87)</td>
</tr>
</tbody>
</table>

Tdap duration of protection among populations born during 1998-2000, that only received acellular vaccines, Wisconsin, 2012

<table>
<thead>
<tr>
<th>Year of Tdap Receipt</th>
<th>Vaccine Effectiveness, % (95% CI)</th>
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<tbody>
<tr>
<td>No Tdap</td>
<td>Reference</td>
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<tr>
<td>2012</td>
<td>75.3 (55.2-86.5)</td>
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<tr>
<td>2011</td>
<td>68.2 (60.9-74.1)</td>
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<tr>
<td>2010</td>
<td>34.5 (19.9-46.4)</td>
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<tr>
<td>2009/2008</td>
<td>11.9 (-11.1-30.1)</td>
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Tdap Vaccination: Unclear Effect on Preventing Transmission

- Vaccinated person’s symptoms not as severe – may be less likely to transmit

- Australian cocooning evaluation
  - Moderate reduction in risk of pertussis in infants – parents vaccinated at least 4 weeks before infant disease onset
  - Effect seen for mothers vaccinated post-partum
    - Unclear if infant disease risk lower because impact on transmission or lack of exposure to infants

- Baboon model
  - Acellular pertussis vaccines protect against disease but not infection
  - Bacterial colony counts comparable to unvaccinated animals
  - Transmitted pertussis to other cohoused baboons

Pertussis occurs in health-care personnel but probably not significant contribution to overall burden of disease
Pertussis in Health-care Personnel

- Occupational exposures to pertussis occur in health-care settings

- Frequency and proximity of patient interaction puts HCP at increased risk for infection with potential to expose many
Transmission of Pertussis in Health-care Setting

- **Documented nosocomial infections in health-care settings**
  - Index case: HCP, patient, visitor

- **Outbreaks in variety of health-care settings**
  - Numerous published reports
  - States recently hard hit with pertussis have not identified or reported health-care outbreaks
    - California, Wisconsin, Washington

Pertussis in Health-care Personnel

- Measured risk and burden of disease - not well defined
  - National surveillance not collect HCP status for pertussis cases
  - Estimated 1.7-fold increased risk for HCPs compared to adult population
    - Based on 384 reported adult pertussis cases; 32 (8%) were HCP
  - 1.3 to 3.6% - annual incidence in ED residents, nursing and patient-care staff
    - Based on serologic evidence; some asymptomatic

- 1-6% yearly infection rate among adolescents and adults based on serologic studies

Impact of Pertussis in Health-care Facilities

- Pertussis exposure management is complicated, time-consuming and costly

- Cost estimates for investigation and control measures can be substantial
  - $84,000-$98,000: cost of managing pertussis exposures over 12-month period
  - $74,000-$263,000 per hospital-based pertussis outbreaks

Guidance on Post-Exposure Prophylaxis for Health-care Personnel

- Based on HCP’s likely contact with patients at risk for severe disease (e.g., NICU), and not Tdap vaccination status
  - PEP for HCP likely expose patient at risk for severe pertussis (e.g., hospitalized neonates and pregnant women)
  - Other HCP either receive PEP or monitored daily for 21 days after exposure and treated at onset of signs and symptoms

- Data inconclusive on need for post-exposure prophylaxis (PEP) in Tdap-vaccinated HCP
  - Pertussis infection did not develop in
    - 38/44 (86.4%) HCP with no PEP
    - 41/42 (97.6%) HCP with PEP
  - Infection based on serologic evidence; no symptomatic pertussis
  - Predefined non-inferiority criteria not met

Tdap Vaccine for Health-care Personnel

- Since 2006, HCP recommend a single dose of Tdap and routine Td booster every 10 years

- Hospital-based Tdap coverage rates among HCP dependent on institutions Tdap vaccination program
  - 30% - campaign
  - 100% - hospital mandate

- 31.4% - Nationally reported Tdap coverage among HCP

CDC. Noninfluenza Vaccination Coverage Among Adults — United States, 2012. MMWR. 63(05);95-102.
Impact of Tdap Vaccination of Health-care Personnel on Nosocomial Transmission

- Earlier models calculated benefits and costs of vaccination program for HCP in preventing a nosocomial pertussis outbreak.
  - Inputs included Tdap vaccine efficacy estimates higher than current estimates.
  - Assumptions include vaccination would decrease transmission and prevent secondary cases.

- Vaccinating HCP substantially reduced the risk of hospital-based pertussis outbreak and was cost-effective/cost-saving.
  - No direct evidence; model update planned.

WG Uncertainties
Tdap Vaccine

- More learned about acellular pertussis vaccines
  - Acellular-primed adolescents - Tdap effective but protection wanes substantially within a few years
  - Whole-cell primed adults - Tdap protects but difficult to study
  - As population ages, will only be acellular-primed cohort

- Is assumption valid that Tdap vaccination protects contacts?

- Timing of any potential indication on additional doses of Tdap or are we compelled to make an off-label recommendation?
WG Assessments
Pertussis and Vaccinating Health-care Personnel

- Pertussis transmission occurs in health-care settings
- Frequency and proximity of patient interaction puts HCP at increased risk of exposure to pertussis
  - Unclear how much pertussis exposure results in disease
- Lack of updated disease and vaccine data specific to HCP
- No small thing to implement recommendations for HCP
- No supportive evidence that additional doses would be beneficial in prevention of disease and transmission in a health-care setting
  - Even if additional Tdap doses recommended, no change to risk management of pertussis exposures
WG Conclusions

At this time, ACIP Pertussis Vaccines WG does not propose changes to the current ACIP Tdap recommendation for HCP.

Focus on current Tdap program
- Improve adult coverage, including HCP
- Vaccinate pregnant women to protect infants
Pertussis-related Projects
MVPDB & Collaborators

- **Pertussis Vaccine**
  - Vaccine effectiveness
    - Emergence of pertactin negative strains (Vermont)
    - Cohort Study (HMOs)
    - Case-Control Study (California)
  - Clinical Characteristics of Vaccinated and Unvaccinated Pertussis Cases (EIP’s EPS)

- **Health-care personnel**
  - Incidence of pertussis in HCP (EIP’s EPS)
  - Update - cost of an outbreak and benefits of vaccinating HCP (DVD, ISD)

- **Tdap Pregnancy**
  - Cocooning/pregnancy Tdap evaluation (CA, CT, MN, NM, NY, OR)
  - Infant blood-spot study - Effectiveness of maternal antibodies against pertussis (WA, NY, CA)

EPS: Enhanced Pertussis Surveillance; ISD: Immunization Services Division; DVD: Division of Viral Diseases
**Additional CDC Activities**

- **Assessment Branch (ISD/NCIRD)**
  - Measuring Tdap coverage among pregnant women
    - PRAMS (with DRH/NCCDPHP)
    - Internet panel survey on pregnant women during influenza season

- **Immunization Safety Office (DHQP/NCEZID)**
  - Safety monitoring in pregnant women following Tdap administration
    - Vaccine Adverse Event Reporting System (VAERS)
    - Vaccine Safety Datalink (VSD)
    - Clinical Immunization Safety Assessment (CISA) Project

- **Health Communications Science Office (NCIRD)**
  - Formative Research Plans to Develop a Maternal Tdap Vaccination Campaign
DISCUSSION