Helping to Prevent the Preventable in Healthcare Systems – Pertussis Disease

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Today’s Presenter

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Webinar Particulars

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Helping to Prevent the Preventable in Healthcare Systems—Pertussis Disease

AMGA Webinar, Dr. Lawrence Shulman
Outline

• Pertussis Disease Overview
• Economic Impact of Pertussis Transmission in Health Systems
• Improving Tdap Immunization Rates in Health Systems
• Key Takeaways
Pertussis: Highly Communicable Disease

- Acute respiratory infection caused by the *Bordetella pertussis* bacterium
- Highly contagious and spread directly from person to person through contact with airborne droplets
- High reproductive number ($R_0$) of 15-17
  - Compare with COVID-19 $R_0$ of 2–7
- Incidence occurs in all ages, however it is reported as highest in infants
- In 2012 epidemic year more than 10,000 cases were reported in persons 20 years of age and older

References:
Severe Pertussis Infections Can Cause Complications in Adolescents and Adults

<table>
<thead>
<tr>
<th>COMPLICATIONS&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Sinusitis</td>
</tr>
<tr>
<td>• Otitis media</td>
</tr>
<tr>
<td>• Pneumonia</td>
</tr>
<tr>
<td>• Weight loss</td>
</tr>
<tr>
<td>• Fainting</td>
</tr>
<tr>
<td>• Rib fracture</td>
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</table>

In a study that examined the effect of age on the clinical presentation of pertussis, complications were more frequent in adults compared to adolescents<sup>1</sup>

**Adults 28% vs Adolescents 16%**

RIB FRACTURE FOLLOWING PERSISTENT COUGH AND CULTURE-CONFIRMED *B. PERTUSSIS* DISEASE IN A FEMALE PATIENT<sup>2</sup>

Images from *The New England Journal of Medicine*. Copyright © 2018 Massachusetts Medical Society. Reprinted with permission from Massachusetts Medical Society.<sup>2</sup>

Rib fracture occurs in rare cases.<sup>1</sup>

**References:**
Pertussis can be a Burden to Adolescents and Adults with Chronic Respiratory Comorbidities

Among 15,942 pertussis cases reported, 515 patients were hospitalized\(^2\)

Percentage of hospitalized pertussis patients compared to US average rates for asthma and COPD in adolescents (12-20, n=23) and adults (21-64, n=76)\(^2\)

- Adolescents and adults with asthma are at an increased risk of pertussis and pertussis-related hospitalizations compared to individuals without asthma\(^2,3\)
- Adults with COPD are potentially at increased risk of pertussis diagnosis or pertussis-related hospitalizations compared to adults without COPD\(^2,3\)

Pertussis: Underdiagnosed and Not Tested For

• Studies of prolonged cough illnesses in adults reveal that 13% to 20% are a result of *B pertussis* infection¹
• Serologic studies suggest that the rate of *B pertussis* infection is 2.0% per year¹
• Can be overlooked, especially among adults²
• Perception that pertussis is a childhood disease leads to frequent misdiagnoses of older age groups²
• Diagnosed by culture or polymerase chain reaction (PCR)³
• PCR has optimal sensitivity during the first 3 weeks of cough⁴

References:

Image from *The New England Journal of Medicine. NEJM Procedure: Collection of Nasopharyngeal Specimens with the Swab Technique*
Adult Immunization Rates Suboptimal in Comparison to Adolescents

**ADOLESCENTS (AGES 13-17)**

National Immunization Survey-Teen (2019)¹

Estimated Tdap vaccination coverage of US adolescents (n=18,788) in 2019: **90.2%**

- More-established vaccination schedule
- School requirements in all 50 states²

ACIP recommendation for persons aged 13–17 years: These persons should receive a single dose of Tdap, preferably at a preventive care visit at age 11–12 years. To ensure continued protection against tetanus and diphtheria, 1 booster dose of either Td or Tdap should be administered every 10 years throughout life.⁴

**ADULTS (AGES 19+)**

National Health Interview Survey (2018)³

Estimated vaccination coverage of US adults (n=15,118) who in the past 10 years received Tdap: **31.2%**

- Suboptimal coverage in adults
- Opportunity for vaccination

ACIP recommendation for persons aged ≥19 years: Regardless of the interval since their last tetanus or diphtheria toxoid–containing vaccine, persons aged ≥19 years who have never received a dose of Tdap should receive 1 dose of Tdap. To ensure continued protection against tetanus and diphtheria, booster doses of either Td or Tdap should be administered every 10 years throughout life.⁴

HCPs are at Increased Risk and are a Source of Pertussis Transmission

- HCP with unrecognized pertussis infection are a source of transmission to susceptible patients\(^1\)
  - Pertussis has a prolonged incubation period and a long duration of nonspecific respiratory symptoms, which may delay diagnosis\(^1\)
  - 1.7-fold greater risk for acquiring pertussis compared to the general population\(^2\)

One method of preventing workplace pertussis transmission is through Tdap immunization\(^3\)

Tdap Immunization Rates Among HCPs Remain Low, Despite an ACIP Recommendation in Place Since 2006¹

**THE NATIONAL HEALTH INTERVIEW SURVEY**

**Tdap COVERAGE RATES AMONG HCP IN 2018**

<table>
<thead>
<tr>
<th>HCP ≥19 years of age with direct patient responsibilities</th>
<th>Coverage Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=982</td>
<td>60.3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HCP ≥19 years of age without direct patient responsibilities</th>
<th>Coverage Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=525</td>
<td>46.6%</td>
</tr>
</tbody>
</table>

HCP=Health Care Provider

Occupational Exposure to Pertussis Occurs Across Health Care Settings

A CROSS-SECTIONAL STUDY FROM 2002 THROUGH 2011 FOUND THAT 219 PERTUSSIS CASES IN ONE PEDIATRIC CARE NETWORK LED TO 1193 CONFIRMED HCP EXPOSURES ¹

71.1% exposures occurred while the HCP was providing care for an index case* who presented with respiratory symptoms¹

77.5% of exposures occurred in the Emergency Department (ED) and in ambulatory sites¹

*An index case was defined as any patient who had a laboratory-confirmed diagnosis of pertussis that also resulted in an HCW exposure

Economic Impact of Pertussis Transmission in Health Systems
Annual Cost of Pertussis Disease Among Adults in the United States Is Significant

Analysis of the estimated annual human and economic burden of pertussis in the United States, 2013, among adults 50 to 64 years of age\(^1\), *

<table>
<thead>
<tr>
<th></th>
<th>Medical Costs</th>
<th>Indirect Costs(^\dagger)</th>
<th>Total Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$78.0M</td>
<td>$107.1M</td>
<td>$185.1M</td>
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</tbody>
</table>

\(*\text{Based on an estimated 180,568 annual pertussis disease cases among adults aged 50 to 64 years of age.}\)

\(^\dagger\text{Indirect (non-medical) costs were estimated by combining work-loss data with economic productivity data, including wages, fringe benefits/supplements, and household productivity.}\)

Pertussis Disease in Adults with Chronic Respiratory Conditions Can be Even More Costly

Compared with matched patients, patients with pertussis and pre-existing COPD or asthma aged ≥11 years accrued greater all-cause adjusted costs across study period.

**COPD**
- 45 Days: $4,751 Matched, $3,694 Difference
- 3 Months: $5,166 Matched, $4,173 Difference
- 6 Months: $6,478 Matched, $6,154 Difference

**Asthma**
- 45 Days: $2,007 Matched, $814 Difference
- 3 Months: $2,189 Matched, $889 Difference
- 6 Months: $3,143 Matched, $1,504 Difference

**COPD = chronic obstructive pulmonary disease**

P < 0.0001 for all differences

Patients aged ≥11 years with diagnosed pertussis and pre-existing COPD (n = 343) or asthma (n = 1041) were matched 1:1 to patients with diagnosed pertussis but without COPD or asthma.

All-cause health care costs included all medical and pharmacy costs, regardless of the corresponding diagnoses or prescriptions.

## Pertussis Outbreaks in Health Care Facilities Incur Significant Costs

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2011:</strong></td>
<td>15 cases of pertussis occurred among 10 health care professionals and 5 infants in an Arizona hospital</td>
<td>$97,745(^1)</td>
</tr>
</tbody>
</table>
| **2004:** | 2 nosocomial outbreaks at a tertiary care hospital (A) and a pediatric hospital (B) | (A): $263,357\(^2\)  
(B): $121,130\(^2\) |
| - Hospital A reported that a 38-year-old emergency room physician was diagnosed with pertussis, and identified 738 persons (hospital staff, patients, and visitors) as potentially being exposed to the physician  
- Hospital B reported that a 38-year-old respiratory therapist was presumed to have pertussis and identified 417 employees as potentially exposed |
| **2003:** | 17 cases of pertussis occurred among HCP exposed to 1 infant for 1 day in a tertiary health care facility for pediatric and adult patients | $74,870\(^3\) |

### Types of Direct and Indirect Costs to a Hospital as a Result of a Pertussis Outbreak

<table>
<thead>
<tr>
<th>Type of Cost and Activity</th>
<th>Resource Used</th>
<th>Unit Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct costs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molecular laboratory tests</td>
<td>PCR test</td>
<td>$286</td>
</tr>
<tr>
<td>Culture laboratory tests</td>
<td>Culture tests&lt;sup&gt;a&lt;/sup&gt;</td>
<td>$17</td>
</tr>
<tr>
<td>Treatment and prophylaxis</td>
<td>Azithromycin courses</td>
<td>$35</td>
</tr>
</tbody>
</table>
| Additional activities<sup>b</sup> | • Identification of cases and contacts  
                                | • Pertussis related counseling  
                                | • Conducting of laboratory tests  
                                | • Management of a telephone hotline for community inquires | Labor hours | $11-$124 |
| Information dissemination | Letters                                                            | $0.6-$4   |
| **Indirect costs**       |                                                                    |           |
| HCWs’ furlough<sup>c</sup> | Administrative-leave hours                                        | $20       |

<sup>a</sup> Culture tests of nasopharyngeal secretions.

<sup>b</sup> Additional activities included, but were not limited to, identification of cases and contacts, pertussis-related counseling, conducting of laboratory tests, and management of a telephone hotline for community inquiries.

<sup>c</sup> A total of 17 health care workers (HCWs) were placed on administrative leave; an average hourly earnings estimate of $20/h was used.

Healthcare Worker Vaccination Program Implementation Results in Savings

IN A 10-YEAR PERIOD, THE VALUE OF COSTS\textsuperscript{a} ASSOCIATED WITH\textsuperscript{1}:

\begin{align*}
\text{Containment Activities:} & \quad \sim \$388,000 \\
\text{Vaccination Program:} & \quad \sim \$69,000
\end{align*}

- Introduction of a healthcare worker\textsuperscript{b} vaccination program could result in a net savings as high as \$535,000 and a benefit-cost ratio of 2.38 for a hospital with 1,000 HCWs\textsuperscript{1}
- For every dollar spent on the vaccination program, the hospital would save $2.38 on control measures\textsuperscript{1}

\textsuperscript{a} Costs were determined by interviewing infection-control and hospital personnel, reviewing billing records, and surveying symptomatic HCW. Benefits and costs of a vaccination program for HCWs was calculated using a probabilistic model to estimate the number of pertussis exposures that would require control measures annually.

\textsuperscript{b} A stable cohort of 1000 HCWs is followed for 10 years, both with and without a pertussis vaccination program.

Limitation: model may not have accounted for cost of booster doses, program acceptance, hospital organizational culture.

Improving Tdap Immunization Rates in Health Systems
Healthy People 2030 Goals

HEALTHY PEOPLE 2030 SETS DATA-DRIVEN NATIONAL OBJECTIVES TO IMPROVE HEALTH AND WELL-BEING OVER THE NEXT DECADE

Reduce cases of pertussis among infants (IID-05: baseline only)

Increase the proportion of adults age 19 years or older who get recommended vaccines (IID-D03: in development status)

Increase the proportion of pregnant women who receive 1 dose of the tetanus-diphtheria-acellular pertussis (Tdap) vaccine during pregnancy (IID-D01: in development status)

Recommended Strategies to Increase Vaccine Coverage

**FOR EMPLOYEES**

- Consider the level of vaccination coverage among HCP to be **one measure of patient safety and quality**¹
- Implement **employee health clinics** for Tdap immunization¹
- **Measure employee immunization rates** and compare data to a desired target¹
- **Provide vaccinations to employees at minimal or no cost¹**
- Create a **task force** to communicate with individual staff members to champion Tdap immunization²

**FOR PATIENTS**

- Utilize **education materials** such as posters, pamphlets, brochures⁴
- **Vaccination opportunities at the time of physical examinations or sick visits for minor illness or injury⁴**
- If vaccination is deferred because of more serious illness, vaccinate **as soon as the acute illness has improved⁴**
- Use **reminder-recall systems, standing orders and immunization information systems³**
- **Recommend simultaneous vaccination** if timing aligns (eg, offer other vaccines at the time of influenza vaccination)⁴

**References:**
Help Increase Tdap Vaccination Rates in Adults by Utilizing Emergency Care Settings

- Emergency care plays a significant role in healthcare delivery and is utilized as an access point for primary care\(^1\)

- In a CDC study, ~80% of ER visits by adults were due to lack of access to other providers\(^2\)

As per NHIS 2017 data, Tdap vaccination coverage among adults is \(\sim 32\%\)\(^3\)

ER visits can be utilized as opportunities for Tdap immunization in eligible patients

Multiple Approaches to Reduce Costs while Implementing Vaccination Strategies

Avoiding errors in coding and billing\(^1\)
- Remember to bill for both the vaccine and vaccine administration
- Review vaccine manufacturer billing and coding guides
- Consider 2021 E&M Codes for information on billing for vaccine counseling

Many vaccine manufacturers offer **vaccine return programs** to decrease the risk of losing money from expired vaccines\(^1\)

Routinely updating drop-down menus and other electronic health record tools\(^1\)
- Preventing errors improves patient care and reduces claims rejections

**Improving efficiency of vaccination implementation and vaccine delivery** can reduce the fixed costs per vaccine administered\(^1\)

**Quality measures** can be tied to insurance payment\(^1\)

**HEDIS Quality Measures Related to Tdap Immunization**

**Endorsed by NCQA in 2019**

**Adult Immunization Status:** The percentage of members **19 years of age and older who are up to date on recommended routine vaccines** for influenza, **Td or Tdap**, zoster, and pneumococcal.

**Endorsed by NCQA in 2019**

**Pregnancy Immunization Status:** The percentage of deliveries in the measurement period in which women received influenza and **tetanus, diphtheria toxoids and acellular pertussis (Tdap) vaccinations**.

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Strategies for Improving Tdap Vaccination Rates in Health Care Settings are Shown to Increase Coverage

MANDATED MEASURES

Mandatory Tdap Employee Vaccination Program:
2009-2011; n=15,267

• High-risk areas: inpatient and outpatient areas of women’s health, pediatrics, emergency department
• All clinical campuses and buildings

Vaccination coverage increased from:
9% to 90%

Geisinger Health System (Danville, PA)

QUALITY IMPROVEMENT INITIATIVE

Improvement Effort Included:
2014-2017; n=1,090

• Changes to Occupational Health Program processes
• Education campaign
• Improved access to vaccine
• Personal engagement of HCP by task force members

Vaccination coverage increased from:
58% to 90%

St. Jude Children’s Research Hospital (Memphis, TN)

Key Takeaways

- Pertussis is a highly infectious respiratory disease that continues to cause significant morbidity in adults and adolescents\(^1,2\)
  - HCPs are at a 1.7-fold greater risk for acquiring pertussis than the general population\(^3\)
- Vaccination coverage among adults and healthcare providers in the United States is still relatively low and needs improvement\(^4\)
  - Many cases often go underdiagnosed or underreported\(^1\)
- Pertussis outbreaks in healthcare facilities can incur significant costs\(^5\)
- Many strategies to help increase vaccination rates for both healthcare providers and patients can be implemented in your healthcare facility

Selected Strategies From the 4 Pillars™ Practice Transformation Program to Improve Vaccination Uptake

1. **Provide convenience and easy access**
   - Use every patient visit type as an opportunity to vaccinate
   - Offer other vaccines at the time of influenza vaccination if timing aligns
   - Extend the influenza vaccination season
     - Vaccinate as soon as supplies arrive and continue to vaccinate as long as influenza is circulating

2. **Communicate with patients**
   - Inform about VPDs at start of every visit
   - Train staff to discuss vaccines during routine processes
   - Promote vaccination among staff to set a good example

3. **Enhance systems to facilitate vaccination**
   - Review accurate EMR vaccination record keeping
   - Assess immunizations as part of vital signs
   - Develop systematic processes for vaccinating every person with a vaccination need (eg, standing orders)

4. **Get motivated**
   - Create a chart to track progress
   - Provide ongoing feedback to staff on vaccination progress
   - Reward successful results

EMR=electronic medical record; VPDs=vaccine-preventable diseases

Effectiveness of the 4 Pillars™ Practice Transformation Program in Increasing Uptake of Adult Vaccines

Posthoc analysis* of a trial to compare the effect of the 4 Pillars program on vaccination rates in patients aged 18–64 years with common high-risk medical conditions† (June 2013-January 2015; n=4737)

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Uptake Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tdap</td>
<td>11.4%</td>
</tr>
<tr>
<td>PPSV</td>
<td>12.2%</td>
</tr>
<tr>
<td>Influenza</td>
<td>4.8%</td>
</tr>
</tbody>
</table>

Uptake increased significantly ($P<0.001$) for Tdap, PPSV, and influenza vaccination

The overall uptake of recommended vaccines for those with high-risk conditions remained below national goals

*Posthoc analysis of data from a randomized controlled cluster trial

†High-risk medical conditions included diabetes (n=1999), chronic lung disease (n=1682), chronic heart disease (n=658) or another high-risk condition (n=764)

PPSV=pneumococcal polysaccharide vaccine; Tdap=tetanus, diphtheria, and acellular pertussis vaccine.

Limitation: Population limited to greater Pittsburg region. Analysis compared intervention effect on adults with common high-risk conditions rather than demonstrate effectiveness against no program

THANK YOU!

For supporting resources, please visit Vaccine Shoppe US Site
BACK UP