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Best Practices

ProHealth Care Associates Group

Preventing the
Preventable in Healthcare
Systems – Pertussis
Diagnosis
Preventing the Preventable in Healthcare Systems – Pertussis Diagnosis
ProHealth Care Associates Group
Lawrence Shulman, D.O., FCCP, Chief Medical Information Officer, ProHealth

Webinar, June 15, 2021

“The COVID vaccine conversation is right there. Why not take this opportunity to talk about the other things that we should have been talking about in all these years, like pertussis?”
— Lawrence Shulman, D.O., FCCP, Chief Medical Information Officer, ProHealth

Pertussis is one of the most poorly controlled vaccine-preventable bacterial diseases in the United States, creating unnecessary illness and related costs for healthcare systems and patients. Lawrence Shulman, D.O., FCCP, chief medical information officer of ProHealth shared information about pertussis and its diagnosis as well as strategies for improving vaccination rates in patients and healthcare providers and decreasing the costs associated with this preventable disease.

The Dangers and Costs of Pertussis

Pertussis, known most for its non-productive, seal-like barking cough is “sometimes thought of as a benign disease,” said Dr. Lawrence Schulman, a pulmonologist and sleep doctor with ProHealth Care Associates Group in New York, part of Optum and UnitedHealth Group. It can, however, lead to more serious complications. Caused by the bacterium *Bordetella pertussis*, disease complications include sinusitis, otitis media, and pneumonia. Pertussis can also lead to weight loss, fainting, and injuries such as rib fracture caused by severe pertussis coughing. Schulman noted that some patients cough so much from pertussis it causes them to vomit.

Patients with respiratory comorbidities such as asthma and chronic obstructive pulmonary disease (COPD) are at increased risk for pertussis and pertussis-related hospitalizations. “That tells us,” said Schulman, “that in those patients who have comorbidities, we need to be extra aware, even more vigilant about treating and identifying those patients with potential pertussis and potential complications from it.”

Pertussis is contagious and spreads rapidly. How contagious? $R_0$ (pronounced “r naught”) is a mathematical term that indicates how contagious a disease is. As Schulman explained, “$R_0$ is the number of people that are infected when somebody walks through a room, for example, with an active disease.” The $R_0$ for pertussis is “about 15 to 17, meaning that one person with active pertussis will infect 15 to 17 other people in the surrounding areas.” In comparison, Schulman noted that the $R_0$ for COVID-19 “is somewhere between two and seven.”

Pertussis occurs in persons of all ages. It is most highly reported in infants, perhaps due to a perception that pertussis is a childhood disease, but it affects adolescents and adults, as well. Schulman said that, in 2012, there were more than 10,000 cases of pertussis reported in people 20 years of age or older, but, he added, “many cases go under-diagnosed and under-reported.”
Pertussis diagnosis “is difficult,” said Schulman. It’s not straightforward. There is no simple blood test. It requires a polymerase chain reaction (PCR) test, a nasopharyngeal swab, that needs to be sent out. The test is most sensitive during the first three weeks of infection. “To me, this is meaningful,” Schulman noted, “because the cough for pertussis continues to go on way beyond that first three weeks.” He also acknowledged that pertussis-related coughs may be erroneously attributed to asthma, COPD, reflux post-nasal drip, and, more recently, COVID-19. As well, pertussis has a prolonged incubation period and a long duration of nonspecific respiratory symptoms. All this contributes to delayed diagnosis. Serologic studies conducted to see what percentage of patients have converted to an immune status for the bacterium show it’s almost 2% per year. “So,” said Schulman, “there is a lot of pertussis that is out there that we really just don’t see.”

As a result, said Schulman, “healthcare workers with pertussis are a huge source of transmission to other patients. Walking around with pertussis, even though they might not know that they have it, they’re going to work with cough and they are spreading that to other providers, other patients within their vicinity.” Healthcare workers thus have greater risk of contracting pertussis than the general population. A cross-sectional study over a 10-year period showed that, in one pediatric network, 219 pertussis cases led to 1,093 confirmed healthcare exposures. Seventy-one percent of those confirmed cases were based in healthcare providers caring for one of the index cases, and almost 78% of those exposures occurred within the emergency department.

The economic cost of pertussis is also of concern. Schulman noted direct medical costs, including testing the cultures, Zithromax (azithromycin) treatment, and laboratory costs, and indirect costs, such as wages, fringe benefits, and household productivity. One study regarding the costs of pertussis in adults 50-64 years of age estimated that the direct medical cost of pertussis

**Figure 1: Cost of Pertussis Disease in Adults with Chronic Respiratory Conditions**

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

<table>
<thead>
<tr>
<th>Condition</th>
<th>45 Days</th>
<th>3 Months</th>
<th>6 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>COPD</td>
<td>$4,751</td>
<td>$5,166</td>
<td>$6,154</td>
</tr>
<tr>
<td>Matched</td>
<td>$1,057</td>
<td>$993</td>
<td>$324</td>
</tr>
<tr>
<td>Difference</td>
<td>$3,694</td>
<td>$5,173</td>
<td>$6,830</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>45 Days</th>
<th>3 Months</th>
<th>6 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>$2,007</td>
<td>$2,189</td>
<td>$3,143</td>
</tr>
<tr>
<td>Matched</td>
<td>$814</td>
<td>$889</td>
<td>$1,504</td>
</tr>
<tr>
<td>Difference</td>
<td>$1,193</td>
<td>$1,301</td>
<td>$1,639</td>
</tr>
</tbody>
</table>

COPD = chronic obstructive pulmonary disease

*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.

was about $78 million per year and $107.1 million in indirect costs. Further, these costs rise in relation to patients with chronic respiratory issues. Another study compared costs of pertussis to patients age 11 and older with comorbidities to those without comorbidities, and costs to those with comorbidities were between $1,000 and $6,500 more (see Figure 1).

In 2003, said Schulman, “there were 17 cases of pertussis exposed to one infant for one day at a tertiary care facility for a cost of $75,000.00.” In 2011, 15 cases occurred among 10 healthcare professionals and five infants. “That cost was just under $100,000.” In 2004, a 38-year-old emergency room physician spread pertussis to potentially 738 people at a cost of about $263,000. In that same year, a respiratory therapist presumed to have pertussis passed the infection to 417 employees at a cost of $121,000. “So, the point,” said Schulman, “is that a generally small number of cases in the right place at the right time has an immediate and significant economic impact.”

“So,” Schulman asked, “what can we do about it?” How can we start thinking about this in terms of both practical and economic interventions? He said there are two approaches. “One is containment. You have somebody that has an outbreak, and you’re going to send them home, and you’re going to keep people away, and you’re going to do treatment.” The cost of a containment approach over a 10-year period is almost $400,000. Compare that to “trying to do something proactively to cause more people to become vaccinated,” said Schulman, and for “every dollar that you spend on a vaccination program, you’re going to save $2.40 dollars in healthcare costs associated with a containment. So, again, this is going to be leaning us in the direction of vaccinating.” (See Figure 2.)

**Strategies for Improving Vaccination Rates**

Pertussis transmission can be prevented through Tdap [Tetanus, diphtheria, acellular pertussis] immunization.

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**Figure 2: Savings from Healthcare Worker Vaccination Program Implementation**

<table>
<thead>
<tr>
<th>Healthcare Worker Vaccination Program Implementation Results in Savings</th>
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</thead>
<tbody>
<tr>
<td><strong>In a 10-year period, the value of costs® associated with¹:</strong></td>
</tr>
<tr>
<td><strong>Containment Activities:</strong></td>
</tr>
<tr>
<td><strong>Vaccination Program:</strong></td>
</tr>
</tbody>
</table>

- Introduction of a healthcare worker® 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 HCWs¹
- For every dollar spent on the vaccination program, the hospital would save ~$2.38 on control measures¹

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* 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 HCW was calculated using a probabilistic model to estimate the number of pertussis exposures that would require control measures annually
* A stable cohort of 1,000 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.

Nationally, over 90% of adolescent patients were adequately vaccinated against pertussis in 2019. Schulman pointed out that adolescents aged 13 to 17 are still going to pediatricians and are on a vaccination schedule, required by schools in all 50 states. The pertussis vaccination rate for adults age 19 and over, however, is only about 31% nationally, which Schulman described as “suboptimal coverage in adults and really a true opportunity for vaccination.” Among healthcare workers, there is a slightly higher rate of Tdap coverage among those with direct patient responsibilities, versus those without direct patient responsibilities; 60% to 46%, respectively.

Schulman provided several strategies for improving Tdap vaccination rates among healthcare workers. First, he suggests considering “the level of vaccination coverage among healthcare providers to be one measure of patient safety and quality. When we think about our patients, and we think about what we’re exposing them to and we’re thinking about masks and maybe N95s and all the things that are now top of mind, are we thinking about vaccinating our healthcare providers, our healthcare personnel to have a Tdap?” Second, because cost and access are two of the barriers to providers getting vaccines, Schulman suggests implementing healthcare clinics for Tdap to ensure that providers and personnel can get the vaccine as easily as possible. Third, he suggests a data driven campaign and/or a task force. “Where are we now? Where do we want to be?” Create an incentive program as a way for healthcare personnel to work towards vaccination goals.

These strategies work, and Schulman provided two examples. Within the Geisinger Health System, there was a mandatory Tdap employee vaccination program between 2009 and 2011. “It was targeted to high-risk areas, inpatient and outpatient areas, women’s health, pediatrics, and emergency rooms across their entire campus.” Their vaccination coverage increased from 9% at baseline to 90%. St. Jude’s Children’s Research Hospital in Memphis had an education campaign focused on engagement of healthcare personnel and improved access to vaccines. They did not impose mandates, but the quality improvement initiative increased vaccination coverage from 58% to 90%.

As for improving Tdap vaccination rates in patients, Schulman highlighted the Office for Disease Prevention and Health Promotion’s Healthy People 2030 campaign, which sets data-driven national objectives to improve health and well-being over the next decade. In terms of pertussis, this means: (1) reducing the cases of pertussis among infants through appropriate and timely vaccination; (2) increasing the proportion of adults age 19 or older who get recommended vaccines; and (3) increasing the proportion of pregnant women who receive at least one dose of Tdap during pregnancy. He provided several strategies for meeting these goals, all part of a “four pillar practice” (see Figure 3):

- Provide convenience and easy access
- Use every patient visit type as an opportunity to vaccinate,
- Offer alignment with other vaccine types, and
- Extend the influenza vaccination season

That way, said Schulman, “you’re encompassing all the different opportunities that you can possibly get to vaccinate your patient as appropriately as possible.”

Adding pertussis to the discussion of standard vaccines is important. Especially now, said Schulman, “it is a huge conversation in every exam room for every patient as a pulmonologist, as a sleep doctor who’s treating obese patients, the COVID vaccine conversation is right there. Why not take this opportunity to talk about the other things that we should have been talking about in all these years, like pertussis?” He suggested utilizing education materials within exam rooms, bringing it to the front of mind for patients, which it makes them bring it up. “You can’t
ignore a huge sign in your in your exam room that says 'pertussis.' Why is that there? Make that part of the conversation.”

He also suggested using vital signs as a key to remembering immunizations. Make a note in the electronic health record of any deferral of vaccination due to sicknesses or injuries. Use patient portals, outgoing text messages, reminders, and flags in care gaps. “Can you use things like standing orders? Future orders? Can you target the appropriate population to vaccinate without having to think about it? You know, the best way to get a doctor to do something is to take the doctor out of the picture and rely on all of our support staff, who is a heck of a lot better than we are at getting things done.”

Schulman encouraged simultaneous vaccination. If a patient is getting an influenza vaccination, they should be getting Tdap at the same time, “as long as the patients are feeling well.” He noted it is, as yet, unclear if Tdap should be administered with a COVID vaccination, but also said that is a good time to broach the subject. “Make that reminder within the electronic health record so when they come back four weeks after their second COVID shot, then we’re talking about the Tdap.”

He also recommends utilizing emergency room and urgent care settings. Eighty percent of emergency room and urgent care visits are because patients don’t have access to other providers. “So, maybe,” said Schulman, “that’s another good place to target it.” Take the opportunity while patients are there to do adequate health maintenance, including discussing pertussis vaccination.

Sharing with patients that providers are vaccinated is also helpful in swaying patients toward vaccination, especially those who may be reticent. “We know that when we got our staff vaccinated for COVID, our patients followed quickly. They are following our example.”

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**Figure 3: 4 Pillars Practice Transformation Program**

**Selected Strategies From the 4 Pillars™ Practice Transformation Program to Improve Vaccination Uptake¹**

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

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

The key is to develop “systemic and systematic processes for vaccinating every person with a vaccine need.” Schulman noted that a study on the effectiveness of the four-pillar approach in the greater Pittsburg area from June 2013 and January 2015 showed increases in Tdap (11.4%), PPSV (12.2%), and influenza (4%) vaccinations in adults age 19 to 64.

**Reducing Costs**

“What do we need,” asked Schulman, “to make sure that we’re not going to incur an additional cost to our healthcare systems while we’re doing the right thing for the patient?” He had several suggestions.

“One of the easy things to do is to avoid some of the errors in coding and billing.” Schulman reminded participants to check billing guidelines and talk with billing professionals to learn how to best code for both the vaccine and the vaccine administration. Make it as easy as possible to ensure proper billing by bundling codes within your healthcare records tools to capture all the revenue that is due to you. Also, work with vaccine manufacturers and distributors to sell back unused vaccines. Schulman also noted that ProHealth uses systems built into their electronic health record to ensure inventory is appropriately maintained. Improving efficiencies in vaccine implementation and vaccine delivery can change the fixed cost of vaccines, providing resources for related endeavors like a vaccine clinic or task force.

Schulman noted also that quality metrics for adult and pregnancy immunization, including Tdap vaccination, have been endorsed by the National Committee for Quality Assurance (NCQA) and its Healthcare Effectiveness Data and Information Set (HEDIS). Although the metrics have not specifically been adopted by Medicare and Medicaid, Schulman suggests looking to these recommendations, which he hopes “will become well known enough that it will start to drive healthcare cost savings and, therefore, healthcare costs reimbursement on a value-based metric.”

**Takeaways**

Pertussis is real, problematic, and expensive, said Schulman, but it’s also fixable. “Get motivated, said Schulman. “Create a tracking process, use feedback, and reward successful results. If you can create an incentive program—vaccines, employees, doctors—you know that the dollars to them, the swag that they’re going to get, is going to drive outcomes. We know that definitively, and we can take advantage of it.”