Vaccine-preventable disease immunization

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Vaccine-preventable diseases, such as pertussis, are making a comeback in the United States. Updated recommendations have been issued for the tetanus-diphtheria-acellular pertussis (Tdap) vaccine and other vaccines to address these outbreaks. We give you information on vaccine safety and communication to better ensure a highly immunized population.

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Immunizations have saved countless lives, but recently vaccine-preventable diseases have reemerged in communities all across the United States. According to data from the CDC, 18,719 pertussis cases were reported in 2011. Measles outbreaks have occurred in several states, causing 222 cases in 2011. During the same time period, 370 cases of mumps were reported.

In this article, the increased incidence of vaccine-preventable diseases and updated recommendations for several vaccines will be reviewed. Strategies to improve communication about vaccines and how you can become more proactive to improve vaccine coverage will also be discussed.

All about pertussis

The bacterium *Bordetella pertussis* is the cause of the acute infectious disease pertussis, also known as whooping cough. Unvaccinated adult family members and older children are most frequently the source of infection. Pertussis was one of the most common childhood diseases in the United Sates before the introduction of a vaccine in the 1940s. More than 200,000 cases were reported annually, and the disease was a major cause of childhood mortality.

B. pertussis is a gram-negative rod that requires a special media for isolation. The bacterium contains several antigenic and biologically active components, which include pertussis toxin, filamentous hemagglutinin, agglutinogens, adenylate cyclase, pertactin, and tracheal cytotoxin. The clinical features of pertussis are caused by these components. An immune response to one or more of the components will produce immunity; however, the immunity doesn't seem to be permanent. The bacteria attach to the cilia of the respiratory epithelial cells and paralyze them, causing inflammation that inhibits clearance of pulmonary secretions.

Early symptoms of pertussis mimic several common illnesses. The onset is deceptive because it's similar to many upper respiratory infections with a nonspecific cough. The incubation period is 7 to 10 days, with a range of 4 to 21 days. If a fever occurs, it's usually minimal and lasts through the course of the illness.

Pertussis has three stages. The first, or catarrhal, stage is characterized by coryza (runny nose), sneezing, low-grade fever, and an occasional mild cough. These symptoms are similar to common upper respiratory infections and last from 1 to 2 weeks.

update

The diagnosis is usually made during the second, or paroxysmal cough, stage, which lasts from 1 to 6 weeks. The patient has paroxysms of numerous, rapid coughs, which are most likely due to difficulty clearing thick mucus from the tracheobronchial tree. A long inspiratory effort occurs at the end of the paroxysm, usually accompanied by the characteristic high-pitched "whoop." Young infants and children may become cyanotic and appear very ill and in distress. The episode is commonly followed by vomiting and exhaustion. Children often don't appear sick in between these episodes. Paroxysms can occur in infants younger than age 6 months; however, they may not possess the strength to produce the characteristic whoop.

The third, or convalescent, stage lasts from weeks to months. Recovery is gradual, with a return of paroxysms during any ensuing respiratory infection.

Immunity conferred by the vaccine wanes at ages 10 to 11 for those individuals who received the final doses of pertussis vaccine at ages 4 to 5. Adolescents and adults may experience pertussis that's milder than seen in infants, be asymptomatic, or present with classic symptoms. Even those patients with mild disease can transmit infection. Secondary bacterial pneumonia is the most common cause of death related to pertussis.

A characteristic clinical history of cough for more than 2 weeks with whoop, paroxysms, or posttussive vomiting, especially in adults, forms the basis of the diagnosis. Culture, polymerase chain reaction (PCR), direct fluorescent antibody, and serology are the lab tests used to confirm pertussis. Although culture was always considered the gold standard, many labs are now exclusively using PCR because of the

increased sensitivity and faster reporting results.

Tdap vaccine

The CDC's Advisory Committee on Immunization Practices (ACIP) has revised its recommendations for the Tdap vaccine because of the poor control of pertussis. Tdap vaccine has been shown to reduce the risk of pertussis by 60% to 80%.

Adolescents should continue to receive the Tdap vaccine at the preventive healthcare visit for 11- to 12-year-olds, followed by a Td booster every 10 years. The ACIP also recommends that children ages 7 to 10 who aren't fully immunized against pertussis (including those never vaccinated or with unknown pertussis vaccination status) should receive a single dose of the Tdap vaccine. Individuals not fully immunized include those who've received fewer than four doses of the Tdap vaccine or for whom the fourth and last dose of the vaccine was administered before age 4.

The Tdap vaccine can be administered regardless of the interval since the last tetanus- and diphtheria-containing vaccine. The ACIP concluded that although longer intervals between Td and Tdap vaccination could decrease the occurrence of local reactions, the benefits of protection against pertussis outweigh the potential risk of adverse events. Adults age 65 and older who have close contact with infants should receive the Tdap vaccine, according to the ACIP. Other adults age 65 years or older may receive the vaccine if necessary.

The ACIP also recommends Tdap vaccine for all pregnant women, during the third or late second trimester of pregnancy (after 20 weeks' gestation). The Tdap vaccine should be administered during each subsequent pregnancy because of reported rapid waning immunity, regardless of the previous number of doses the woman received. The timing of the dose is to optimize the effectiveness of the vaccine.

did you know?

The CDC's 2013-2014 immunization schedules were published on January 25. To view the schedules, visit http://www.cdc.gov/vaccines.

Other vaccines to know

PCV7 and PCV13 vaccines

In 2000, the 7-valent pneumococcal polysaccharide-protein conjugate vaccine (PCV7) was licensed for the prevention of invasive pneumococcal disease (IPD). A 99% decrease in disease caused by the seven serotypes in PCV7 and serotype 6A, a serotype against which PCV7 provides some cross-protection, resulted in the overall reduction of IPD. Increases in IPD caused by nonvaccine serotypes, in particular 19A, have partially outweighed the decreases incurred from the use of PCV7.

The 13-valent pneumococcal polysaccharide-protein conjugate vaccine (PCV13) contains the same serotypes of *Streptococcus pneumoniae* as PCV7, plus six additional serotypes (including 19A). PCV13 has been approved by the FDA for use in children ages 6 weeks to 71 months and uses the same four-dose schedule as PCV7. Complete a series started with PCV7 with PCV13 if possible.

Healthy children ages 14 months to 59 months who've received a complete age-appropriate series of PCV7 should receive a single supplemental dose of PCV13. Children ages 14 months to 71 months with an underlying medical condition (including those who've already received a dose of pneumococcal polysaccharide vaccine) should also receive a single supplemental dose.

A single dose of PCV13 may be administered to children ages 6 to 18 with conditions that increase their risk of IPD. These conditions include functional or anatomic asplenia, sickle cell disease, HIV infection, cochlear implant, cerebrospinal fluid leak, and other immunocompromising conditions. The ACIP also currently recommends a single dose of PCV13 followed by a dose of 23-valent pneumococcal polysaccharide vaccine (PPSV23) at least 8 weeks later for all adults ages 19 to 64 with the same immunocompromising conditions mentioned previously for children. A second dose of PPSV23 is recommended 5 years after the first. A third and final dose of PPSV23 is recommended at age 65 or older

as long as 5 years have elapsed since the second dose of PPSV23.

High-risk individuals previously vaccinated with PPSV23 should receive PCV13 1 year or more after the last PPSV23 dose. For those who require additional doses of PPSV23, the first dose should be administered no sooner than 8 weeks after PCV13 and at least 5 years after the most recent dose of PPSV23. Combined use of PCV13 and PPSV23 is more effective than either vaccine alone.

MCV4 vaccine

Data indicate that a single-dose, primary series of meningococcal conjugate vaccine (MCV4) may not be sufficient to confer protection against meningitis for individuals with certain high-risk conditions. Those with complement deficiencies require a very high antibody titer to mount immunity. There's evidence that individuals with anatomic or functional asplenia and HIV infection also mount a suboptimal response. Generally, HIV infection isn't an indication for MCV4; however, some individuals who are HIV-positive, such as adolescents, certain international travelers, and microbiologists, should receive the vaccine. Based on these data, the administration of two doses of MCV4 at least 8 weeks apart to people with these conditions is now recommended.

Individuals with complement component deficiency, asplenia, or HIV who previously received one dose should receive a second dose at the earliest opportunity, as long as there are 8 weeks between the first and second doses (off-label recommendation). Additionally, one dose of MCV4 is recommended every 5 years thereafter for these individuals who are age 7 and older (off-label recommendation). High-risk children ages 2 to 6 should receive a booster dose 3 years after the primary series.

The ACIP made no recommendation about revaccination with MCV4 in its 2005 recommendations for meningococcal vaccine because no data were available. However, updated serologic data indicate a significant decline in antibody 3 to 5 years after vaccination, although few "breakthrough" cases have been reported.

New recommendations advise the administration of MCV4 at age 11 or 12, with a booster dose at age 16. One dose of MCV4 should be given at ages 13 to 15 if not previously vaccinated. For individuals vaccinated at ages 13 to 15, administration of a one-time booster dose is recommended, preferably at or after ages 16 to 18 (off-label recommendation). For all circumstances, the minimum interval between doses is 8 weeks.

Healthy individuals don't need a booster dose if the first dose was administered at ages 16 to 21. A booster dose isn't recommended for healthy people age 22 or older, even if the first dose was administered at ages 11 to 15, unless they fall into one of the high-risk categories. Always use MCV4 for the booster dose; never use quadrivalent meningococcal polysaccharide vaccine. Whenever possible, the same brand of vaccine should be used for all doses of the vaccination series. Although no data are available on the interchangeability of MCV4, if the brand is unknown or the brand of vaccine previously administered isn't available, either brand of MCV4 vaccine can be used to continue or complete the series.

HPV2 and HPV4 vaccines

There are currently two types of human papilloma virus (HPV) vaccine licensed in the United States: HPV2 and HPV4. Both vaccines are licensed for girls ages 9 to 26. HPV4 is also licensed for the prevention of genital warts caused by HPV types 6 and 11.

Prevention of penile, anal, and oropharyngeal cancers and anogenital warts represents the potential benefits of the HPV vaccine in men. One study concluded that HPV4 prevents infection with HPV-6, -11, -16, and -18, and the development of related external genital lesions in males ages 16 to 27. HPV4 may be administered to males ages 11 to 12, but it can also be given as early as age 9.

Common vaccinations

cheat sheet

- Tdap (tetanus-diphtheria-acellular pertussis)
- MMR (mumps, measles, rubella)
- VAR (varicella virus)
- PCV7, PCV13, or PPSV23 (pneumococcal disease)
- MC4 (meningitis)
- HPV2 or HPV4 (human papilloma virus)
- Hepatitis B vaccine
- Influenza vaccine (IIV or LAIV)

Hepatitis B vaccine

The rate of hepatitis B in individuals with diabetes is 2.1 times higher than in those who don't have diabetes. The risk factor is the use of blood glucose monitoring devices intended for single-use only and the failure to follow basic principles of infection control by cleaning the device between uses. The ACIP recommends immunizing all patients with diabetes ages 23 to 59 with a three-dose series of hepatitis B vaccine. Individuals age 60 and older with diabetes can also be immunized at the provider's discretion.

Influenza vaccine

The FDA and CDC have identified an increase in the number of reports of febrile seizures following vaccination with trivalent inactivated influenza vaccine (IIV). This is the only influenza vaccine licensed for use in infants and children ages 6 months to 23 months. The reported febrile seizures have primarily been seen in children younger than age 2.

Further investigation is indicated based on these preliminary data from the Vaccine Adverse Events Reporting System (VAERS). Additional investigations are in progress to determine the possibility of an association between influenza vaccination and febrile seizures, or if other issues may be involved. The FDA and CDC have seen no rise in VAERS reports of febrile seizures in those older than age 2 following vaccination with IIV, and no upsurge after the administration of live attenuated influenza vaccine, or LAIV. No lasting effects have been seen in children in the cases reported. Recommendations for the use of influenza vaccine in children haven't changed.

In the past, egg allergy was listed as a contraindication for influenza vaccine because all influenza vaccine in the United States is grown in hen's eggs. The ACIP now advises that egg allergy is only a precaution and not a contraindication to the administration of influenza vaccine. The only contraindication to influenza vaccine is an anaphylactic reaction to eggs. Any individual who has an egg allergy, but has never experienced anaphylaxis, should receive the vaccine in a setting where emergency equipment, such as adrenalin, and providers trained in CPR are available. The individual should be observed for 20 minutes following administration of the vaccine.

Precautions for influenza vaccine include moderate or acute illness or history of Guillain-Barré syndrome (GBS) within 6 weeks following a previous dose of influenza vaccine. The only true contraindication is a previous severe allergic reaction to the vaccine.

Vaccine safety and communication

Many myths and misinformation circulate about vaccine safety, which can perplex parents who are trying to make appropriate decisions about immunizations for their child. Vaccines may occasionally cause reactions or illnesses following their administration; however, many of these events are unrelated and occur by coincidence after vaccination. Consequently, scientific research that attempts to differentiate true vaccine adverse events from unrelated, coincidental occurrence is imperative.

Media reports and some parent groups have linked vaccines to autism, in particular. After much discussion and scientific investigation, the study done by Andrew Wakefield linking autism to the MMR (measles, mumps, rubella) vaccine has been discredited and removed from the scientific literature. In addition, numerous studies have failed to find a link between developmental disorders and vaccines containing thimerosal.

Decisions by the U.S. Court of Federal Claims issued carefully thought-out, powerfully worded opinions rejecting claims that medical and scientific evidence could substantiate causal links between thimerosal-containing vaccines or MMR vaccination and the development of chronic health

did you know?

After thorough scientific investigation, the study done by Andrew Wakefield linking autism to the MMR vaccine has been discredited and removed from the scientific literature. The U.S. Court of Federal Claims has rejected claims that medical and scientific evidence can substantiate causal links between thimerosal-containing vaccines and the development of chronic health conditions such as autism, immune dysfunction, and gastrointestinal dysfunction.

conditions such as autism, immune dysfunction, and gastrointestinal dysfunction. The U.S. Supreme Court decided to uphold the 1986 National Childhood Vaccine Injury Act, thereby substantiating the original purpose of that law to ensure that children who suffer from vaccine injuries are compensated. At the same time, this decision eliminated frivolous suits against vaccine manufacturers, preserving our vaccine supply. Despite these definitive court decisions, parents continue to ask questions regarding the safety of immunizations.

There are very few true contraindications to immunizations. All live virus vaccines, such as MMR and VAR (varicella virus), are contraindicated in pregnancy. Encephalopathy within 7 days of receiving Td, Tdap, or DTaP vaccine is a contraindication. Severe allergic reaction to a specific vaccine is also a contraindication. Moderate or severe illness is a precaution to the administration of any other vaccine discussed in this article. The history of GBS within 6 weeks following a previous dose of Td, Tdap, or DTaP is also a precaution.

Provide information on vaccines in a proactive, rather than a reactive, atmosphere. CASE is a four-step framework for communicating immunization science:

- ***Corroborate:*** Acknowledge the parent's concerns and find some point on which to agree; this sets the tone for the discussion.
- ***About me:*** Describe what you've done to build a knowledge base and expertise.
- ***Science:*** Review what the scientific literature says.
- ***Explain/advise:*** Give advice to the parent based on the state of the science.

Anticipate parents'/patients' concerns and answer questions before they're asked. Be sure to provide the vaccine information statements supplied by the CDC, which are available for free on the CDC website (http://www.cdc.gov/vaccines), along with a wealth of information about immunizations, communication, and vaccine safety.

Aim high

Immunizations are safe and cost-effective, they promote and protect the public health, and they've saved countless lives. Vaccine-preventable diseases are making a comeback because vaccine levels are dropping in some areas of the United States. As nurses, we must learn all we can about vaccines from reliable sources, be vaccinated ourselves, and respond to the questions and concerns of our patients. Only a highly immunized public will prevent the devastation of vaccine-preventable disease. ■

Learn more about it

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memory jogger

When communicating immunization science, think **CASE:**

- ***C***orroborate: Acknowledge the parent's concerns and find some point on which to agree; this sets the tone for the discussion.
- ***A***bout me: Describe what you've done to build a knowledge base and expertise.
- ***S***cience: Review what the scientific literature says.
- ***E***xplain/advise: Give advice to the parent based on the state of the science.

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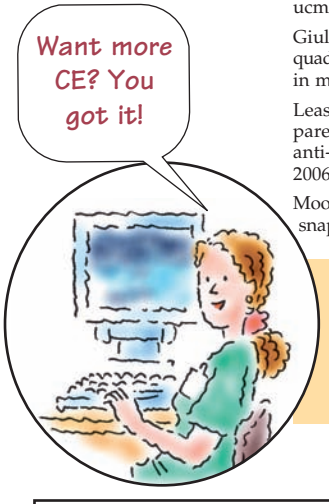

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