Vaccination Back to Basics

Nadia K. Qureshi, MD, FAAP
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<table>
<thead>
<tr>
<th>Name and Credentials</th>
<th>Role in Activity</th>
<th>Was there a relevant Financial Disclosure</th>
<th>List of Mitigated Disclosures</th>
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<tbody>
<tr>
<td>Megan Kane Towle, MMS, PA-C</td>
<td>Planning Committee Member</td>
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<td>Craig Batterman, MD</td>
<td>Planning Committee Member</td>
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<td>Caroline Werenskjold, MPH</td>
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<tr>
<td>Laura Buthod, MD</td>
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<td>Magale Avitia MPH, CHES</td>
<td>Staff</td>
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<tr>
<td>Joseph Hageman, MD</td>
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<td>No</td>
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<tr>
<td>Nadia K. Qureshi, MD</td>
<td>Faculty/Presenter</td>
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<td>CME Reviewer</td>
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<td>Sharon Hovey, MD</td>
<td>Planning Committee Member</td>
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<td>Kathleen Sanabria</td>
<td>Planning Committee Member Staff Content Reviewer</td>
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<td>Staff</td>
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<tr>
<td>Erin Moore</td>
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<tr>
<td>Monica Del Ciello</td>
<td>Staff</td>
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</table>
Nadia Qureshi, MD, FAAP

- Associate Professor Pediatrics and Pediatric Infectious Disease
- Assistant Clerkship Director Pediatrics, Stritch School of Medicine
- Medical Director, Loyola Outpatient Pediatrics
- Loyola University Medical Center
Objectives

Understand basic principles and types of vaccines

Know vaccine contents and adverse effects

Know precautions and contraindications for administering vaccinations.

Know how to address vaccine hesitancy and myths

Make appropriate decisions regarding immunization in special situations (including catch-up, high risk, traveling etc.)
Outline

• Introduction
• Vaccine hesitancy
• Vaccine contents
• Types - traditional & new
• Contraindications & precautions
• CDC/ACIP schedule
• Special considerations
Introduction
What are Vaccines?

- The word “vaccine” comes from the Latin word ‘vaccinus’ which means “pertaining to cows.”

- First small pox vaccine- derived from cow pox.

- Help develop immunity by imitating an infection

- Contains antigen- Enough to elicit immune response, not enough to cause disease
What Happens in Our Body

• **Antigen**
  • a foreign substance that induces immune response

• **Antibody**
  • a protein produced in response to an antigen, and binds to it

• **Effector cells**
  • can recognize and kill antigens only if bound to antibodies
What Happens in Our Body

Memory cells

Initial exposure to antigen

Primary immune response

Second exposure to antigen

Secondary immune response

Response is larger

Response is faster

Antibody concentration

Time

Figure 49-16  Biological Science, 2/e
© 2005 Pearson Prentice Hall, Inc.
FIRST EXPOSURE TO DISEASE

YOU GET SICK

IMMUNITY

SECOND EXPOSURE TO DISEASE

YOU DON'T GET SICK

COMPLICATIONS

OR

VACCINATION

IMMUNITY

FIRST EXPOSURE TO DISEASE

YOU DON'T GET SICK
Vaccine Hesitancy
Common Myths
You are seeing a healthy 1 month old for a WCC. As you review the plans for the next visit, the parents state they are considering not immunizing their child because a relative was diagnosed with autism 2 months after receiving a vaccine.

Of the following, the MOST appropriate response to these parents is to:

A. Acknowledge their concerns and inform them that current evidence does not support such a link
B. Ask them to sign the American Academy of Pediatrics vaccine refusal form at this visit
C. Provide them with a copy of an epidemiologic study showing the absence of correlation between vaccines and autism
D. Recommend an alternative vaccine schedule that would not overwhelm the child’s immune system
E. Tell them you can no longer care for their child in your practice
Communication Strategies

• Take time to listen
• Solicit and welcome questions
• Keep the conversation going
• Science versus anecdote?
• Acknowledge benefits and risks
• Respect parents’ authority
• Reduce the stress of shots
Vaccine Resources

- CDC: Common Vaccine questions and concerns
- Vaccine Education Center
- Vaccine safety-related Q&A sheets
- Illinois Vaccinates Against COVID-19
- ICAAP Immunizations Programs
- Free Mobile App - Vaccines on the Go: What You Should Know

Vaccines on the Go

What You Should Know
The Children’s Hospital of Philadelphia
Designed for iPad

D.4 • 13 Ratings
Free
Vaccine Contents
‘Vaccines contain preservatives that are dangerous’

• Any substance —— can be toxic given a large enough dose even WATER!!

• Botox — one of the most toxic substances known to humanity -injected in small quantities into a person’s face
Vaccine Ingredients

- **Adjuvants**: To create a better immune response (aluminum salts)

- **Preservatives**: To prevent contamination (thiomersal)

- **Additives**: To help stay effective while being stored (albumin, gelatin, sucrose etc.)

- **Residuals**: Needed to make vaccines and then removed but residual amounts remain such as antibiotics, egg protein, formaldehyde etc.
**Question:** The mother of a 15-month-old boy asks about whether her son should receive the MMR vaccine. She has read on the internet that egg-allergic children should not receive MMR vaccine. The boy ate scrambled egg 4 months ago and developed generalized hives, coughing, and wheezing requiring a trip to ED

Of the following, you are MOST likely to recommend that:

A. Her son be referred to an allergist for skin testing and graded challenge to the MMR vaccine
B. Be tested to determine his current level of IgE specific to egg before receiving his MMR vaccine
C. Never receive MMR vaccine
D. Receive the MMR vaccine but remain in the clinic for 2 hours after the vaccination in case he has a reaction
E. Receive the MMR vaccine today and be discharged to home immediately after the vaccine is administered
Vaccine Ingredients

• Aluminum
• Formaldehyde
• Mercury (Thiomersal)
• Egg proteins
• Gelatin
• Yeast
• Antibiotics
• Latex packaging
Vaccine Types
# Type of Vaccines: Traditional

<table>
<thead>
<tr>
<th>Platform</th>
<th>About</th>
<th>Examples</th>
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<tbody>
<tr>
<td>Inactivated</td>
<td>Inactivated vaccines consist of the whole virus, which has been killed with heat or chemicals so that it can’t cause illness. In general, inactivated virus vaccines do not provide as strong of an immune response as live attenuated vaccines, so additional doses may be needed.</td>
<td>Hepatitis A, Flu, IPV</td>
</tr>
<tr>
<td>Live attenuated</td>
<td>Live attenuated vaccines are made up of whole viruses that have been weakened in a lab (usually through culturing). They tend to elicit a stronger immune response than inactivated vaccines.</td>
<td>MMR, Varicella</td>
</tr>
<tr>
<td>Subunit</td>
<td>Subunit vaccines introduce a fragment or portion of the virus into the body. This fragment is enough to be recognized by the immune response and stimulate immunity.</td>
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</table>

<table>
<thead>
<tr>
<th>Platform</th>
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<tbody>
<tr>
<td>Polysaccharide</td>
<td>PPSV23</td>
</tr>
<tr>
<td>Conjugate</td>
<td>PCV13, Hib, MenACWY135</td>
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<tr>
<td>Toxoid</td>
<td>Diphtheria, Tetanus</td>
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<tr>
<td>Recombinant DNA</td>
<td>HBV, HPV</td>
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### Types of Vaccines: Newer Techniques

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Viral vector</strong></td>
<td>Viral vector vaccines insert a gene for a viral protein into another, harmless virus (replicating or non-replicating). This harmless virus then delivers the viral protein to the vaccine recipient, which triggers an immune response. Replicating viral vectors are able to produce copies of the viral protein, potentially triggering an enhanced immune response.</td>
<td>Ebola, COVID (AstraZeneca, J&amp;J)</td>
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<td><strong>mRNA</strong></td>
<td>RNA vaccines work by introducing an mRNA sequence (the molecule that tells cells what to build) coded for a disease-specific antigen. Once this antigen is reproduced within the body, it is recognized and triggers an immune response.</td>
<td>COVID (Pfizer, Moderna)</td>
</tr>
<tr>
<td><strong>DNA</strong></td>
<td>DNA-based vaccines work by inserting synthetic DNA of viral gene(s) into small DNA molecules called plasmids. Cells take in the DNA plasmids and follow their instructions to build viral proteins, which are recognized by the immune system, and prepare it to respond to disease exposure.</td>
<td></td>
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</table>
‘New vaccines are being developed too quickly and have taken short-cuts in the process’
Coronavirus Vaccine Tracker

By Carl Zimmer, Jonathan Corum, Sui-Lee Wee and Matthew Kristofersen  Updated Aug. 31, 2022

This tracker is no longer being updated. It followed the development of Covid vaccines from early 2020 through August 2022. More than 120 clinical trials were underway at that time.
COVID Vaccines - Various Types

**DNA-based vaccines** work by inserting synthetic DNA of viral gene(s) into small DNA molecules (called plasmids). Cells take in the DNA plasmids and follow their instructions to build viral proteins, which are recognized by the immune system, and prepare it to respond to disease exposure.

**Viral vector vaccines** insert a gene for a viral protein into another, harmless virus (replicating or non-replicating), which delivers the viral protein to the vaccine recipient, triggering an immune response.

**RNA vaccines** introduce an mRNA sequence coded for a disease-specific antigen. Once this antigen is reproduced within the body, it is recognized and triggers an immune response.

**Subunit vaccines** introduce a fragment of the virus into the body. This fragment is enough to be recognized by the immune response and stimulate immunity.

**Inactivated vaccines** consist of the whole virus, which has been killed with heat or chemicals so it can't cause illness.

**Live attenuated vaccines** are made up of whole viruses that have weakened in a lab. They tend to elicit a stronger immune response than inactivated vaccines.
Vaccine Schedule and Catch-up
# 2022 Vaccination Schedule

## Table 1: Recommended Child and Adolescent Immunization Schedule for ages 18 years or younger, United States, 2022

These recommendations must be read with the notes that follow. For those who fall behind or start late, provide catch-up vaccination at the earliest opportunity as indicated by the green bars.

To determine minimum intervals between doses, see the catch-up schedule (Table 2).

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<th>Vaccine</th>
<th>Birth</th>
<th>1 mos</th>
<th>2 mos</th>
<th>4 mos</th>
<th>6 mos</th>
<th>9 mos</th>
<th>12 mos</th>
<th>15 mos</th>
<th>18 mos</th>
<th>19-23 mos</th>
<th>2-3 yrs</th>
<th>4-6 yrs</th>
<th>7-10 yrs</th>
<th>11-12 yrs</th>
<th>13-15 yrs</th>
<th>16 yrs</th>
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<td>Hepatitis B (HepB)</td>
<td>1st dose</td>
<td>2nd dose</td>
<td>3rd dose</td>
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<td>Rotavirus (RV)</td>
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<td>3rd dose</td>
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<tr>
<td>Diphtheria, tetanus, acellular pertussis (DTaP)</td>
<td>1st dose</td>
<td>2nd dose</td>
<td>3rd dose</td>
<td>4th dose</td>
<td>5th dose</td>
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<tr>
<td>Pneumococcal conjugate (PCV13)</td>
<td>1st dose</td>
<td>2nd dose</td>
<td>3rd dose</td>
<td>4th dose</td>
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<td>Inactivated poliovirus (IPV &lt;15 yrs)</td>
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<td>2nd dose</td>
<td>3rd dose</td>
<td>4th dose</td>
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<td>Influenza (LAIV4)</td>
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<tr>
<td>Measles, mumps, rubella (MMR)</td>
<td>See Notes</td>
<td>1st dose</td>
<td>2nd dose</td>
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<td>2nd dose</td>
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<td>Human papillomavirus (HPV)</td>
<td>See Notes</td>
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<td>2nd dose</td>
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<td>Meningococcal (MenACWY-D &lt;16 yrs, MenACWY-CRM 2&lt;16 yrs, MenACWY-TT ≥2 years)</td>
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<td>Meningococcal B (MenB-4C, MenB-PrP)</td>
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<td>Dengue (DEN4CYD: 9-16 yrs)</td>
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- Range of recommended ages for all children
- Range of recommended ages for catch-up vaccination
- Range of recommended ages for certain high-risk groups
- Recommended vaccination can begin in this age group
- Recommended vaccination based on shared clinical decision-making
- No recommendation/not applicable
‘Getting so many vaccines will overwhelm my child's immune system’

- Babies are exposed to thousands of germs and other antigens in the environment daily
NUMBER OF IMMUNOGENIC PROTEINS AND POLYSACCHARIDES CONTAINED IN VACCINES OVER THE PAST 100 YEARS

1900
200
VACCINE: Smallpox

1960
3,217
VACCINE: Smallpox
Diphtheria
Tetanus
WC-Pertussis
Polio

1980
3,041
VACCINE: Diphtheria
Tetanus
WC-Pertussis
Polio
Measles
Mumps
Rubella

2000
126
VACCINE: Diphtheria
Tetanus
AC-Pertussis
Polio
Measles
Mumps
Rubella
Hib
Varicella
Pneumococcus
Hepatitis B

Multiple vaccines but fewer antigens

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Proteins</th>
<th>Vaccine</th>
<th>Proteins</th>
<th>Vaccine</th>
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<th>Proteins</th>
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<td>Smallpox</td>
<td>~200</td>
<td>Diphtheria</td>
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<td>Total</td>
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<td></td>
<td>Tetanus</td>
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<td>Tetanus</td>
<td>1</td>
<td>WC-pertussis</td>
<td>~3000</td>
<td>AC-pertussis</td>
<td>2–5</td>
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<td>WC-pertussis</td>
<td>~3000</td>
<td>Polio</td>
<td>15</td>
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<tr>
<td>WC-pertussis</td>
<td>~3000</td>
<td>Polio</td>
<td>15</td>
<td>Measles</td>
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<td>Rubella</td>
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</table>

Adapted from Offit et al.\(^1^2\)

AC-pertussis, acellular pertussis vaccine; WC-pertussis, whole cell pertussis vaccine.

‘It’s best to wait until children are older before starting to give them vaccines.’

- Immunization schedules are designed to protect the most vulnerable patients from disease.
- If you wait to give the vaccine, you may miss the window when a child is most vulnerable
Question: A 7-year-old healthy boy comes to your office for his annual well child visit. The parents have previously refused any vaccines but are now requesting to have him vaccinated. The parents agree to vaccinate him “with everything that he needs.”

Of the following, the vaccines MOST likely to be administered at this visit are:

A. DTaP, hepatitis A, hepatitis B, IPV, MMR, varicella
B. DTaP, hepatitis A, hepatitis B, IPV, MMR, PCV13, varicella
C. Td, hepatitis A, hepatitis B, IPV, MMR, varicella
D. Tdap, hepatitis A, hepatitis B, IPV, MMR, varicella
E. Tdap, hepatitis A, hepatitis B, IPV, PCV13, varicella
**Question:** A 9-month-old infant is seen for a health supervision visit. Her initial visit was 5 weeks ago when her new adoptive parents brought her to the clinic, and she received her initial set of vaccinations including DTaP. At that time, she was well nourished and developing well. The infant’s mother has heard a news story about pertussis and inquires about when her daughter can have her second dose of DTaP.

**Of the following, the BEST response to the mother is:**

A. Today
B. In 1 week
C. At 12 months of age
D. At 15 months of age
Catch-Up Vaccines

• A vaccine series does not need to be restarted, regardless of the time that has elapsed between doses.

• Some vaccines may not be needed/ cannot be given after a certain age; such as Rota, Hib, Pneumococcal etc.

• Some can be given but either less amount or less doses required, or shortened interval (4 weeks). Tdap instead of DTaP.
Table 2: Recommended Catch-up Immunization Schedule for Children and Adolescents Who Start Late or Who Are More than 1 Month Behind, United States, 2022

The table below provides catch-up schedules and minimum intervals between doses for children whose vaccinations have been delayed. A vaccine series does not need to be restarted, regardless of the time that has elapsed between doses. Use the section appropriate for the child’s age. Always use this table in conjunction with Table 1 and the Notes that follow.

### Children age 4 months through 6 years

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Minimum Age for Dose 1</th>
<th>Minimum Interval Between Doses</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HBV</td>
<td>Birth</td>
<td>Dose 1 to Dose 2 8 weeks and at least 16 weeks after first dose</td>
<td>Dose 2 to Dose 3 minimum age for the final dose is 24 weeks</td>
<td>Dose 3 to Dose 4</td>
<td>Dose 4 to Dose 5</td>
</tr>
<tr>
<td>Rotavirus</td>
<td>6 weeks</td>
<td>Maximum age for first dose is 14 weeks, 4 days.</td>
<td>4 weeks</td>
<td>Maximum age for final dose is 8 months, 6 days.</td>
<td></td>
</tr>
<tr>
<td>Diphtheria, tetanus, and acellular pertussis</td>
<td>6 weeks</td>
<td>4 weeks</td>
<td>6 months</td>
<td>6 months</td>
<td></td>
</tr>
<tr>
<td>Haemophilus influenza type b</td>
<td>6 weeks</td>
<td>No further doses needed if first dose was given at age 13 months or older</td>
<td>6 weeks</td>
<td>No further doses needed if first dose was given at age 13 months or older</td>
<td>8 weeks (as final dose) for children age 12 through 23 months who received 5 doses before the 1st birthday</td>
</tr>
<tr>
<td>Pneumococcal conjugate</td>
<td>6 weeks</td>
<td>No further doses needed if first dose was given at age 13 months or older</td>
<td>8 weeks</td>
<td>No further doses needed if first dose was given at age 13 months or older</td>
<td>8 weeks (as final dose) for children age 12 through 23 months who received 5 doses before the 1st birthday</td>
</tr>
<tr>
<td>Haemophilus influenza type b</td>
<td>6 weeks</td>
<td>No further doses needed if first dose was given at age 13 months or older</td>
<td>8 weeks</td>
<td>No further doses needed if first dose was given at age 13 months or older</td>
<td>8 weeks (as final dose) for children age 12 through 23 months who received 5 doses before the 1st birthday</td>
</tr>
<tr>
<td>Inactivated poliovirus</td>
<td>6 weeks</td>
<td>4 weeks</td>
<td>6 months (as final dose) for healthy children</td>
<td>8 weeks</td>
<td>6 months (minimum age 4 years for final dose)</td>
</tr>
<tr>
<td>Measles, mumps, rubella</td>
<td>12 months</td>
<td>4 weeks</td>
<td>6 months (as final dose) for healthy children</td>
<td>8 weeks</td>
<td>6 months (minimum age 4 years for final dose)</td>
</tr>
<tr>
<td>Varicella</td>
<td>13 months</td>
<td>4 weeks</td>
<td>6 months (as final dose) for healthy children</td>
<td>8 weeks</td>
<td>6 months (minimum age 4 years for final dose)</td>
</tr>
<tr>
<td>Haemophilus A</td>
<td>12 months</td>
<td>3 months</td>
<td>6 months (as final dose) for healthy children</td>
<td>8 weeks</td>
<td>6 months (minimum age 4 years for final dose)</td>
</tr>
<tr>
<td>Haemophilus ACWY</td>
<td>8 weeks</td>
<td>See Notes</td>
<td>See Notes</td>
<td>See Notes</td>
<td>See Notes</td>
</tr>
</tbody>
</table>

### Children and adolescents age 7 through 18 years

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Minimum Age for Dose 1</th>
<th>Minimum Interval Between Doses</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Meningococcal ACWY</td>
<td>Not applicable-N/A</td>
<td>8 weeks</td>
<td>8 weeks</td>
<td>6 months</td>
<td>9 months</td>
</tr>
<tr>
<td>Tetanus, diphtheria, tetanus, diphtheria, and acellular pertussis</td>
<td>7 years</td>
<td>8 weeks</td>
<td>8 weeks</td>
<td>6 months</td>
<td>9 months</td>
</tr>
<tr>
<td>Human papillomavirus</td>
<td>9 years</td>
<td>Routine dosing intervals are recommended.</td>
<td>8 weeks</td>
<td>8 weeks</td>
<td>6 months</td>
</tr>
<tr>
<td>HBV</td>
<td>N/A</td>
<td>8 weeks and at least 16 weeks after first dose</td>
<td>8 weeks</td>
<td>8 weeks</td>
<td>4 months</td>
</tr>
<tr>
<td>Inactivated poliovirus</td>
<td>N/A</td>
<td>4 weeks</td>
<td>8 weeks</td>
<td>8 weeks</td>
<td>4 months</td>
</tr>
<tr>
<td>Measles, mumps, rubella</td>
<td>N/A</td>
<td>3 months</td>
<td>8 weeks</td>
<td>8 weeks</td>
<td>4 months</td>
</tr>
<tr>
<td>Varicella</td>
<td>N/A</td>
<td>3 months</td>
<td>8 weeks</td>
<td>8 weeks</td>
<td>4 months</td>
</tr>
<tr>
<td>Diphtheria</td>
<td>9 years</td>
<td>6 months</td>
<td>6 months</td>
<td>6 months</td>
<td>6 months</td>
</tr>
</tbody>
</table>

- Fourth dose of IPV is indicated if all previous doses were administered at 4 years or if the third dose was administered ≥6 months after the second dose.
- A fourth dose of DTaP/Hib is indicated if all previous doses were administered at 4 years or if the third dose was administered ≥6 months after the second dose.
Contraindications & Precautions
• **Contraindication:**
  • A condition in a patient that increases the risk of a serious adverse reaction and for whom risk outweighs the benefit of the vaccine.

• **Precaution**
  • A condition in a recipient that might increase the risk or seriousness of an adverse reaction or complicate making another diagnosis because of a possible vaccine-related reaction.
Contraindications

- The only contraindication applicable to all vaccines is a history of anaphylaxis to a previous dose or to a vaccine component.

- Encephalopathy within 7 days of a previous dose of DTP, DTaP, or Tdap.

- Live vaccines for high-risk population.

- Live vaccines (Rota, MMR, Varicella, Flumist, Oral polio, Oral typhoid, Yellow fever, BCG).
**Question:** You are seeing a 2-year-old patient who has had his immunizations delayed because he was hospitalized and treated at 12 months of age for Kawasaki disease. His hospital records indicate that he received a single dose of 2 g/kg of IVIG 12 months ago. Currently, he is healthy and not taking any medications.

Of the following, the MOST appropriate immunization strategy during this outpatient visit is:

A. Administer both varicella and MMR vaccines
B. Administer the MMR vaccine today, and the varicella vaccine in 3 months
C. Administer the varicella vaccine today, and the MMR vaccine in 2 weeks
D. Do not administer either live-virus vaccine because of the history of aspirin therapy
E. Do not administer either live-virus vaccine because of the history of IVIG therapy
Common conditions that should not delay vaccination but often are considered mistakenly to be contraindications:

• Diarrhea
• Minor URI with or without fever
• Mild to moderate local reactions to a previous dose of vaccine
• Exposure to an infectious disease
• Current antimicrobial therapy
• Allergy to an antibiotic
• Personal or FH of seizures
• FH of sudden unexpected death
• FH of an adverse event following immunization
• A stable neurologic condition
• Breastfeeding or pregnancy in a household contact
Side Effects

• Vary according to vaccines

• Mostly a sign of reactogenicity

• Common: fever, local injection site reactions

• Live viral vaccines: rashes

• Incidence with vaccine vs. natural infection (Risk vs. benefit)
<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Documented Reaction</th>
<th>Approximate Rate</th>
<th>Potential Allergen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diphtheria and tetanus toxoids and acellular pertussis (DTap)</td>
<td>Serious allergic reaction</td>
<td>1 per 1,000,000 doses</td>
<td>Infanrix syringe contains latex</td>
</tr>
<tr>
<td>Measels, mumps, and rubella</td>
<td>Immune thrombocytopenia purpura</td>
<td>1 per 1,000,000 doses</td>
<td>Contains neomycin and gelatin</td>
</tr>
<tr>
<td></td>
<td>Serious allergic reaction</td>
<td>&lt; 1 per 10,000 doses</td>
<td></td>
</tr>
<tr>
<td>Measels, mumps, rubella and varicella</td>
<td>Febrile seizures</td>
<td>8.5 per 10,000 doses</td>
<td>Contains neomycin and gelatin</td>
</tr>
<tr>
<td>Meningococcal</td>
<td>Serious allergic reaction</td>
<td>Rare</td>
<td>Menomune and Bexsero contain latex</td>
</tr>
<tr>
<td>Rotavirus</td>
<td>Intussusception</td>
<td>1 per 20,000 to 100,000 doses</td>
<td>Rotarix contains in oral applicator of diluents</td>
</tr>
</tbody>
</table>

## Risks vs Benefits

### Statistics on Measles, Mumps, Rubella, and the MMR Vaccine

<table>
<thead>
<tr>
<th>Disease Factor</th>
<th>Measles</th>
<th>Mumps</th>
<th>Rubella</th>
<th>MMR Vaccine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encephalitis risk</td>
<td>1 case per 1,000 measles cases</td>
<td>1 case per 300 to 6,000 mumps cases</td>
<td>1 case per 6,000 rubella cases</td>
<td>1 case per 3 millions vaccinations</td>
</tr>
<tr>
<td>Subacute sclerosing panencephalitis risk</td>
<td>8.5 cases per 1 million measles cases</td>
<td>Rare</td>
<td></td>
<td>0 to 0.7 cases per 1 million vaccinations</td>
</tr>
<tr>
<td>Pneumonia risk</td>
<td>1 case per 20 measles cases (most common cause of death from measles in young children)</td>
<td></td>
<td></td>
<td>2 cases per 1 million vaccinations</td>
</tr>
<tr>
<td>Thrombocytopenia risk</td>
<td></td>
<td>1 case per 3,000 rubella cases</td>
<td>1 case of immune thrombocytopenia purpura 40,000 vaccinated children (risk increased in the 6 weeks following vaccination)</td>
<td></td>
</tr>
<tr>
<td>Orchitis risk</td>
<td>3 to 10 cases per 100 adolescent and adult men with mumps</td>
<td></td>
<td></td>
<td>0.3 cases per 1 million vaccinations</td>
</tr>
<tr>
<td>Anaphylaxis risk</td>
<td></td>
<td></td>
<td></td>
<td>0.65 cases per 1 million vaccinations</td>
</tr>
</tbody>
</table>

Special Situations
Question: The parents of a 6-month-old boy who has sickle cell anemia consult you about their son’s childhood immunization. He has not received any of the routine vaccines because his parents are hesitant and prefer to delay all vaccines until after his second birthday. The mother asks if there are any other measures that can help reduce his risk of severe infections.

Of the following, the action that is MOST likely to decrease his risk of severe infections is to administer

A. All childhood vaccines by the recommended catch-up schedule for age and start daily oral penicillin prophylaxis
B. All childhood vaccines when he is 2 years old and start daily oral penicillin prophylaxis
C. All childhood vaccines when he is 2 years old and start monthly transfusions with human immune serum globulin
D. All vaccines containing viral antigens when he is 2 years old and start oral penicillin prophylaxis
E. Only age-appropriate pneumococcal and Haemophilus influenzae vaccines by the recommended catch-up schedule and defer other vaccines until he is 2 years old
Special Considerations:

• For high-risk groups for specific bacterial infections, more doses or vaccines needed. e.g., pneumococcal vaccines

• Patients with sickle cell, asplenia, immunodeficiency- high risk for infections from encapsulated organisms

• In general, for premature infants, follow the same schedule as of term baby. HepB only counts after >2 kg of weight
**Question:** You are seeing a 4-year-old girl in your office for a WCC. The patient received a renal transplant from her father 6 weeks ago and is on a steroid-free protocol. She is doing well after transplantation. Her current medications include tacrolimus, mycophenolate mofetil, atenolol, and oral supplements.

Of the following, the MOST appropriate vaccination plan for this patient is:

A. Inactivated and live attenuated vaccines may be given 6 months after transplantation  
B. Inactivated and live attenuated vaccines may be given 1 year after transplantation  
C. Inactivated vaccines may be given at this visit  
D. Inactivated vaccines may be given 6 months after transplantation  
E. Inactivated vaccines may be given today and live attenuated vaccines 1 year after transplantation
Question: A 10-year-old child who was previously fully vaccinated undergoes chemotherapy followed by a hematopoietic stem cell transplant for high-risk AML. He did not develop graft-vs-host disease, and he is now in remission and off all immunosuppressive and immunomodulating medications. His oncologists deem him safe for vaccination.

Of the following, the MOST appropriate approach in terms of Hib immunization is to:

A. Administer immune globulin instead of the vaccine
B. Give no additional immunizations
C. Obtain Hib titers to determine vaccination need
D. Revaccinate with a 3-dose regimen
Special considerations:

• For steroids >14 days- No live vaccines until 1 month after completion

• For cancer patients- vaccines: 3 months following chemotherapy

• For transplant patients: Try to give as many vaccines as possible prior to transplant at least 2 weeks (1 month for live-virus vaccines) before solid organ transplant - otherwise, only inactivated can be given usually after 6 months

• Live-virus vaccines are not routinely recommended for patients receiving immunosuppressive medications after transplantation.
Travel vaccination

• Needs to be determined depending on the country, endemic infections, timing of visit, risk factors and visiting rules etc. Examples:

• Many African countries require- Yellow fever, Meningococcal vaccines

• Middle East- Meningococcal

• Central/South America or Asia- Typhoid, Hepatitis A

• East/ Southeast Asia: Japanese Encephalitis, Rabies
Questions?

Be Wise. Immunize.
Upcoming Events

• COVID-19 Vaccine Bootcamp: In-Person, Champaign IL 1/20/23. Register here.