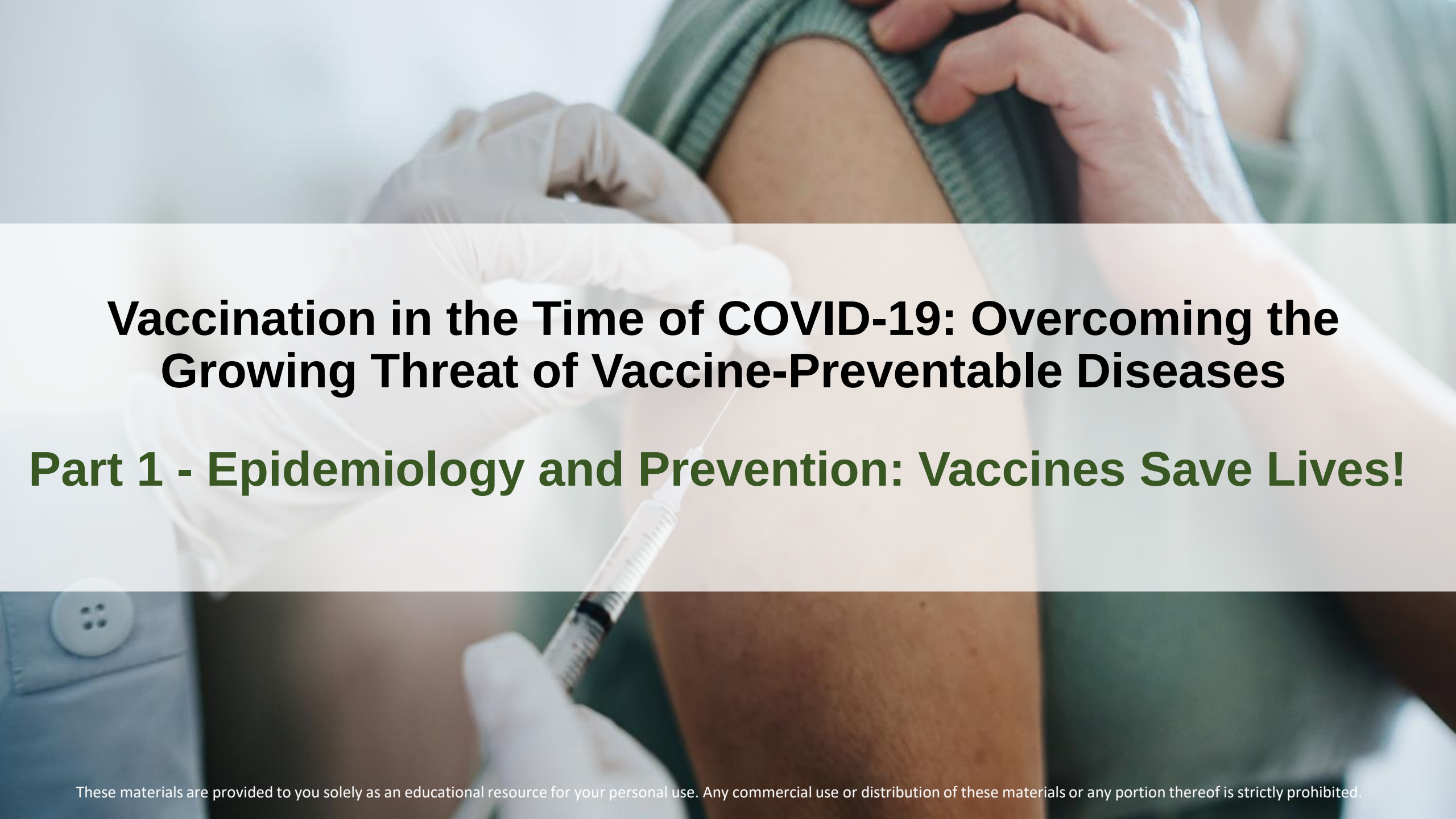

Vaccination in the Time of COVID-19: Overcoming the Growing Threat of Vaccine-Preventable Diseases

Part 1 - Epidemiology and Prevention: Vaccines Save Lives!

This educational activity is sponsored by Postgraduate Healthcare Education, LLC.

This educational activity is supported by an educational grant from GlaxoSmithKline

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Disclosures

Dr. Kebodeaux states that he has no relevant affiliation or financial relationship or relationship to products or devices with a commercial interest related to the content of this activity to disclose.

The clinical reviewer, Darrell Hulisz, RPh, PharmD, has no relevant affiliation or financial relationship or relationship to products or devices with a commercial interest related to the content of this activity to disclose.

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Accreditation

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UAN: 0430-0000-22-142-L06-P
Credits: 1.0 hour (0.10 CEU)
Type of Activity: Knowledge

Learning Objectives

At the conclusion of the activity, the learner will be better able to:

- **Describe** epidemiology of and patient populations at risk for vaccine-preventable diseases (VPD)
- **Define** the pharmacist's role in achieving public health goals for immunization
- **Discuss** current Advisory Committee on Immunization Practices (ACIP) recommendations including immunization schedules for infants, children/adolescents, and adults.

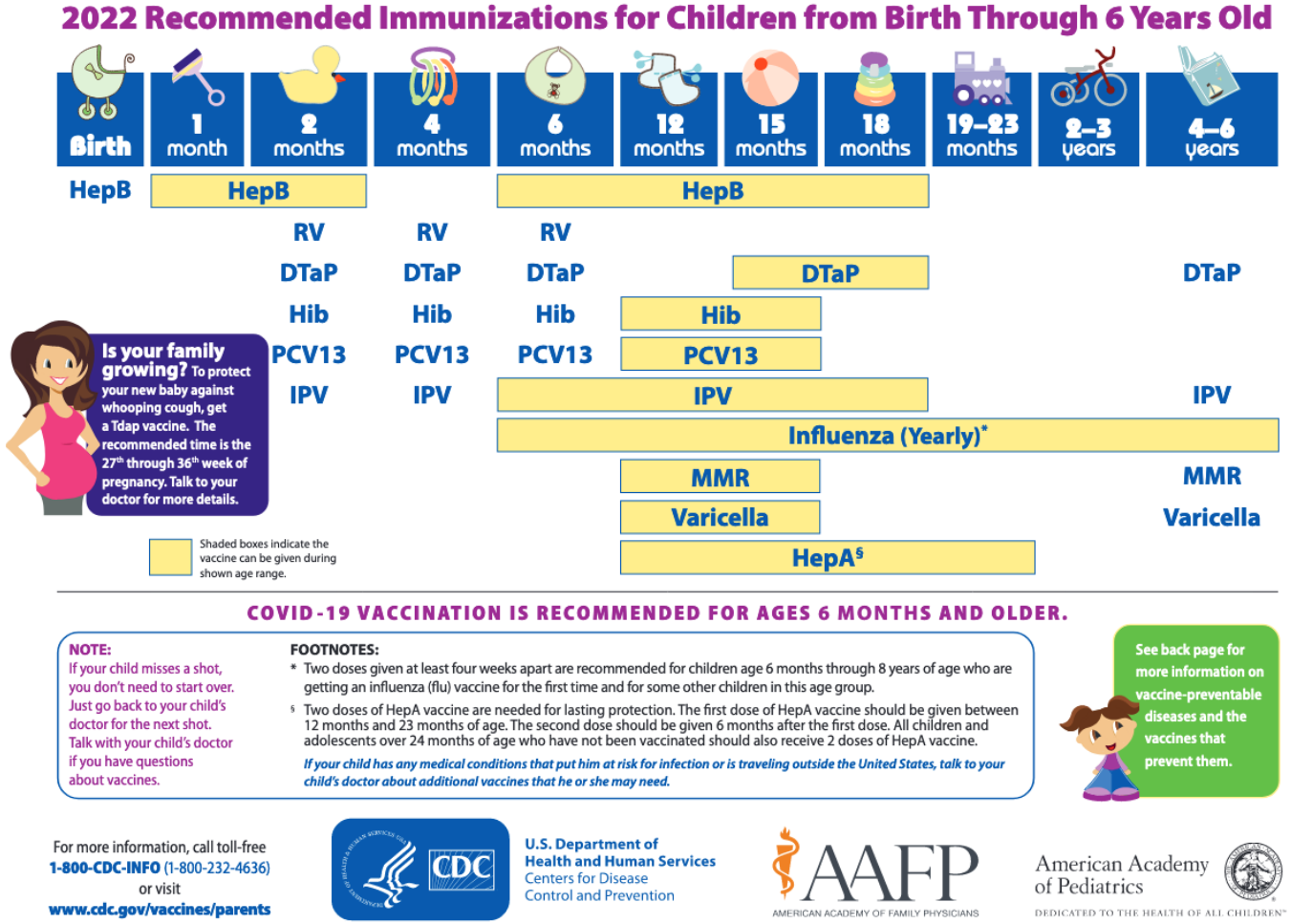
Immunization Schedules

- Updated for 2022
  - https://www.cdc.gov/vaccines/schedules/index.html
    - Note: Added for ‘For Parents’ schedules

- Download the CDC Vaccine Schedules App
  - (https://www.cdc.gov/vaccines/schedules/hcp/schedule-app.html)
    - Click link for updated download links
  - Available on the App Store and Google Play

SCAN ME

Immunization Schedules



https://www.cdc.gov/vaccines/parents/downloads/parent-ver-sch-0-6yrs.pdf. Accessed November 14th, 2022.

Immunization Schedules

Vaccine-Preventable Diseases and the Vaccines that Prevent Them

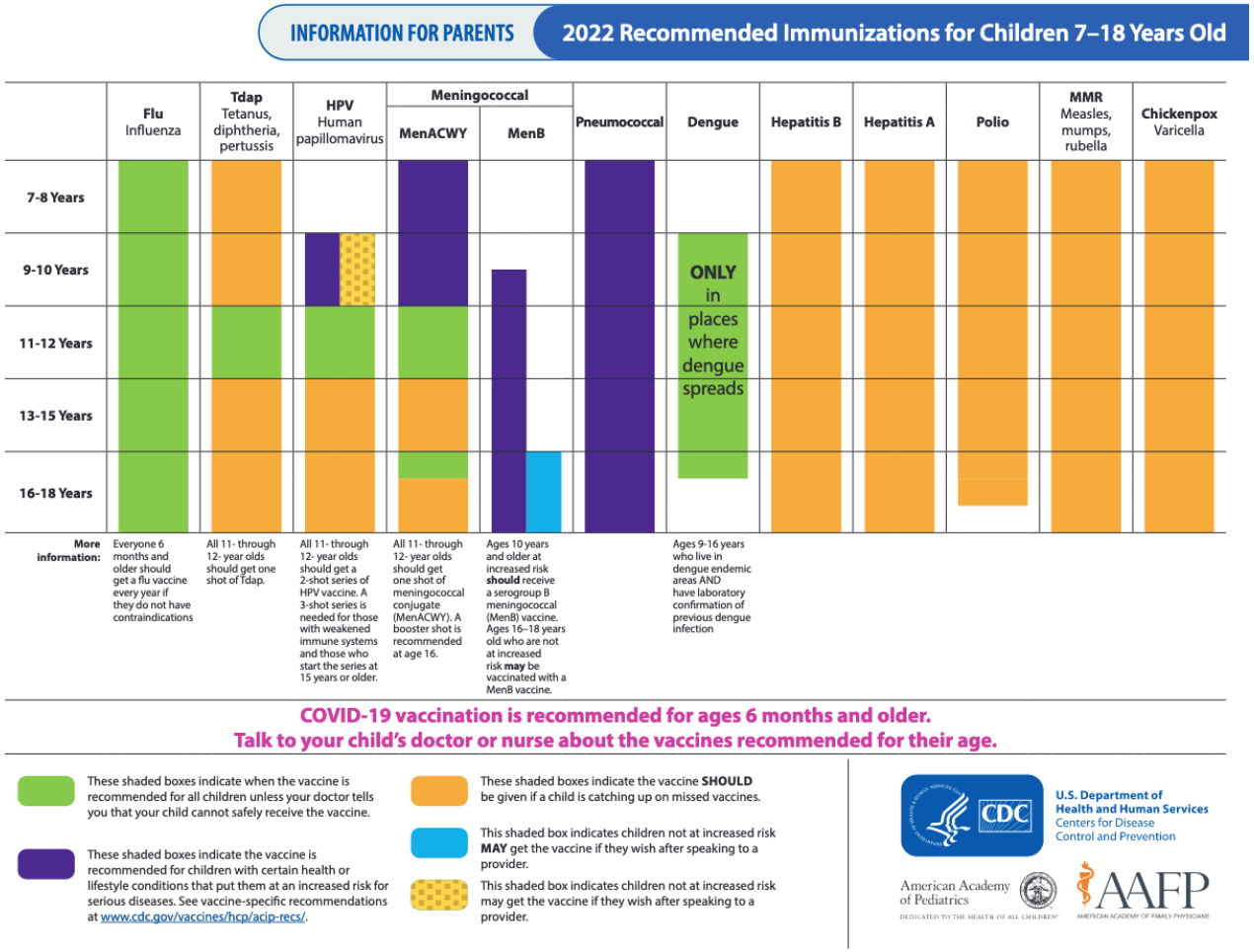
Disease	Vaccine	Disease spread by	Disease symptoms	Disease complications
Chickenpox	Varicella vaccine protects against chickenpox.	Air, direct contact	Rash, tiredness, headache, fever	Infected blisters, bleeding disorders, encephalitis (brain swelling), pneumonia (infection in the lungs), death
Diphtheria	DTaP* vaccine protects against diphtheria.	Air, direct contact	Sore throat, mild fever, weakness, swollen glands in neck	Swelling of the heart muscle, heart failure, coma, paralysis, death
Hib	Hib vaccine protects against *Haemophilus influenzae* type b.	Air, direct contact	May be no symptoms unless bacteria enter the blood	Meningitis (infection of the covering around the brain and spinal cord), intellectual disability, epiglottitis (life-threatening infection that can block the windpipe and lead to serious breathing problems), pneumonia (infection in the lungs), death
Hepatitis A	HepA vaccine protects against hepatitis A.	Direct contact, contaminated food or water	May be no symptoms, fever, stomach pain, loss of appetite, fatigue, vomiting, jaundice (yellowing of skin and eyes), dark urine	Liver failure, arthralgia (joint pain), kidney, pancreatic and blood disorders, death
Hepatitis B	HepB vaccine protects against hepatitis B.	Contact with blood or body fluids	May be no symptoms, fever, headache, weakness, vomiting, jaundice (yellowing of skin and eyes), joint pain	Chronic liver infection, liver failure, liver cancer, death
Influenza (Flu)	Flu vaccine protects against influenza.	Air, direct contact	Fever, muscle pain, sore throat, cough, extreme fatigue	Pneumonia (infection in the lungs), bronchitis, sinus infections, ear infections, death
Measles	MMR** vaccine protects against measles.	Air, direct contact	Rash, fever, cough, runny nose, pink eye	Encephalitis (brain swelling), pneumonia (infection in the lungs), death
Mumps	MMR**vaccine protects against mumps.	Air, direct contact	Swollen salivary glands (under the jaw), fever, headache, tiredness, muscle pain	Meningitis (infection of the covering around the brain and spinal cord) , encephalitis (brain swelling), inflammation of testicles or ovaries, deafness, death
Pertussis	DTaP* vaccine protects against pertussis (whooping cough).	Air, direct contact	Severe cough, runny nose, apnea (a pause in breathing in infants)	Pneumonia (infection in the lungs), death
Polio	IPV vaccine protects against polio.	Air, direct contact, through the mouth	May be no symptoms, sore throat, fever, nausea, headache	Paralysis, death
Pneumococcal	PCV13 vaccine protects against pneumococcus.	Air, direct contact	May be no symptoms, pneumonia (infection in the lungs)	Bacteremia (blood infection), meningitis (infection of the covering around the brain and spinal cord), death
Rotavirus	RV vaccine protects against rotavirus.	Through the mouth	Diarrhea, fever, vomiting	Severe diarrhea, dehydration, death
Rubella	MMR** vaccine protects against rubella.	Air, direct contact	Sometimes rash, fever, swollen lymph nodes	Very serious in pregnant women—can lead to miscarriage, stillbirth, premature delivery, birth defects
Tetanus	DTaP* vaccine protects against tetanus.	Exposure through cuts in skin	Stiffness in neck and abdominal muscles, difficulty swallowing, muscle spasms, fever	Broken bones, breathing difficulty, death

* DTaP combines protection against diphtheria, tetanus, and pertussis.
** MMR combines protection against measles, mumps, and rubella.

Last updated February 2022 • CS322257-A

https://www.cdc.gov/vaccines/parents/downloads/parent-ver-sch-0-6yrs.pdf. Accessed November 14th, 2022.

Immunization Schedules



https://www.cdc.gov/vaccines/schedules/downloads/teen/parent-version-schedule-7-18yrs.pdf. Accessed Nov 14th, 2022.

Immunization Schedules

Vaccine-Preventable Diseases and the Vaccines that Prevent Them

Disease	Vaccine	Disease spread by	Disease symptoms	Disease complications
Chickenpox	Varicella vaccine protects against chickenpox.	Air, direct contact	Rash, tiredness, headache, fever	Infected blisters, bleeding disorders, encephalitis (brain swelling), pneumonia (infection in the lungs), death
Dengue	Dengue vaccine protects against dengue.	Bite from infected mosquito	May be no symptom, fever, headache, pain behind the eyes, rash, joint pain, body ache, nausea, loss of appetite feeling tired, abdominal pain	Severe bleeding, seizures, shock, damage to liver, heart, and lungs, death
Diphtheria	Tdap* and Td** vaccines protect against diphtheria.	Air, direct contact	Sore throat, mild fever, weakness, swollen glands in neck	Swelling of the heart muscle, heart failure, coma, paralysis, death
Hepatitis A	HepA vaccine protects against hepatitis A.	Direct contact, contaminated food or water	May be no symptoms, fever, stomach pain, loss of appetite, fatigue, vomiting, jaundice (yellowing of skin and eyes), dark urine	Liver failure, arthralgia (joint pain), kidney, pancreatic and blood disorders, death
Hepatitis B	HepB vaccine protects against hepatitis B.	Contact with blood or body fluids	May be no symptoms, fever, headache, weakness, vomiting, jaundice (yellowing of skin and eyes), joint pain	Chronic liver infection, liver failure, liver cancer, death
Human Papillomavirus	HPV vaccine protects against human papillomavirus.	Direct skin contact	May be no symptoms, genital warts	Cervical, vaginal, vulvar, penile, anal, oropharyngeal cancers
Influenza (Flu)	Flu vaccine protects against influenza.	Air, direct contact	Fever, muscle pain, sore throat, cough, extreme fatigue	Pneumonia (infection in the lungs), bronchitis, sinus infections, ear infections, death
Measles	MMR*** vaccine protects against measles.	Air, direct contact	Rash, fever, cough, runny nose, pink eye	Encephalitis (brain swelling), pneumonia (infection in the lungs), death
Meningococcal Disease	MenACWY and MenB vaccines protect against meningococcal disease.	Air, direct contact	Sudden onset of fever, headache, and stiff neck, dark purple rash	Loss of limb, deafness, nervous system disorders, developmental disabilities, seizure disorder, stroke, death
Mumps	MMR*** vaccine protects against mumps.	Air, direct contact	Swollen salivary glands (under the jaw), fever, headache, tiredness, muscle pain	Meningitis (infection of the covering around the brain and spinal cord) , encephalitis (brain swelling), inflammation of testicles or ovaries, deafness, death
Pertussis	Tdap* vaccine protects against pertussis.	Air, direct contact	Severe cough, runny nose, apnea (a pause in breathing in infants)	Pneumonia (infection in the lungs), death
Pneumococcal Disease	Pneumococcal vaccine protects against pneumococcal disease.	Air, direct contact	May be no symptoms, pneumonia (infection in the lungs)	Bacteremia (blood infection), meningitis (infection of the covering around the brain and spinal cord), death
Polio	Polio vaccine protects against polio.	Air, direct contact, through the mouth	May be no symptoms, sore throat, fever, nausea, headache	Paralysis, death
Rubella	MMR*** vaccine protects against rubella.	Air, direct contact	Sometimes rash, fever, swollen lymph nodes	Very serious in pregnant women—can lead to miscarriage, stillbirth, premature delivery, birth defects
Tetanus	Tdap* and Td ** vaccines protect against tetanus.	Exposure through cuts on skin	Stiffness in neck and abdominal muscles, difficulty swallowing, muscle spasms, fever	Broken bones, breathing difficulty, death

*Tdap combines protection against diphtheria, tetanus, and pertussis.
**Td combines protection against diphtheria and tetanus.
***MMR combines protection against measles, mumps, and rubella.

If you have any questions about your child's vaccines, talk to your child's doctor or nurse.

Last updated on August 2022 • CS322257-B

https://www.cdc.gov/vaccines/schedules/downloads/teen/parent-version-schedule-7-18yrs.pdf. Accessed Nov 14th, 2022.

Immunization Schedules

Table 1 Recommended Adult Immunization Schedule by Age Group, United States, 2022

Vaccine	19–26 years	27–49 years	50–64 years	≥65 years
Influenza inactivated (IIV4) or **Influenza recombinant** (RIV4)	1 dose annually			
or	or			
Influenza live, attenuated (LAIV4)	1 dose annually			
Tetanus, diphtheria, pertussis (Tdap or Td)	1 dose Tdap each pregnancy; 1 dose Td/Tdap for wound management (see notes)			
	1 dose Tdap, then Td or Tdap booster every 10 years			
Measles, mumps, rubella (MMR)	1 or 2 doses depending on indication (if born in 1957 or later)			
Varicella (VAR)	2 doses (if born in 1980 or later)		2 doses	
Zoster recombinant (RZV)	2 doses for immunocompromising conditions (see notes)		2 doses	
Human papillomavirus (HPV)	2 or 3 doses depending on age at initial vaccination or condition	27 through 45 years		
Pneumococcal (PCV15, PCV20, PPSV23)	1 dose PCV15 followed by PPSV23 OR 1 dose PCV20 (see notes)			1 dose PCV15 followed by PPSV23 OR 1 dose PCV20
Hepatitis A (HepA)	2 or 3 doses depending on vaccine			
Hepatitis B (HepB)	2, 3, or 4 doses depending on vaccine or condition			
Meningococcal A, C, W, Y (MenACWY)	1 or 2 doses depending on indication, see notes for booster recommendations			
Meningococcal B (MenB)	2 or 3 doses depending on vaccine and indication, see notes for booster recommendations			
	19 through 23 years			
***Haemophilus influenzae* type b** (Hib)	1 or 3 doses depending on indication			

Recommended vaccination for adults who meet age requirement, lack documentation of vaccination, or lack evidence of past infection

Recommended vaccination for adults with an additional risk factor or another indication

Recommended vaccination based on shared clinical decision-making

No recommendation/ Not applicable

https://www.cdc.gov/vaccines/schedules/downloads/adult/adult-combined-schedule.pdf Accessed Nov. 14th, 2022.

Immunization Schedules

Table 2 Recommended Adult Immunization Schedule by Medical Condition or Other Indication, United States, 2022

Vaccine	Pregnancy	Immuno-compromised (excluding HIV infection)	HIV infection CD4 percentage and count: <15% or <200 mm³	HIV infection CD4 percentage and count: ≥15% and ≥200 mm³	Asplenia, complement deficiencies	End-stage renal disease, or on hemodialysis	Heart or lung disease; alcoholism[1]	Chronic liver disease	Diabetes	Health care personnel[2]	Men who have sex with men
IIV4 or RIV4	1 dose annually										
or										or	
LAIV4	Contraindicated					Precaution				1 dose annually	
Tdap or Td	1 dose Tdap each pregnancy	1 dose Tdap, then Td or Tdap booster every 10 years									
MMR	Contraindicated*	Contraindicated		1 or 2 doses depending on indication							
VAR	Contraindicated*	Contraindicated			2 doses						
RZV		2 doses at age ≥19 years			2 doses at age ≥50 years						
HPV	Not Recommended*	3 doses through age 26 years			2 or 3 doses through age 26 years depending on age at initial vaccination or condition						
Pneumococcal (PCV15, PCV20, PPSV23)		1 dose PCV15 followed by PPSV23 OR 1 dose PCV20 (see notes)									
HepA					2 or 3 doses depending on vaccine						
HepB	3 doses (see notes)	2, 3, or 4 doses depending on vaccine or condition									
MenACWY	1 or 2 doses depending on indication, see notes for booster recommendations										
MenB	Precaution	2 or 3 doses depending on vaccine and indication, see notes for booster recommendations									
Hib		3 doses HSCT[3] recipients only			1 dose						

Recommended vaccination for adults who meet age requirement, lack documentation of vaccination, or lack evidence of past infection

Recommended vaccination for adults with an additional risk factor or another indication

Recommended vaccination based on shared clinical decision-making

Precaution—vaccination might be indicated if benefit of protection outweighs risk of adverse reaction

Contraindicated or not recommended—vaccine should not be administered.

*Vaccinate after pregnancy.

No recommendation/ Not applicable

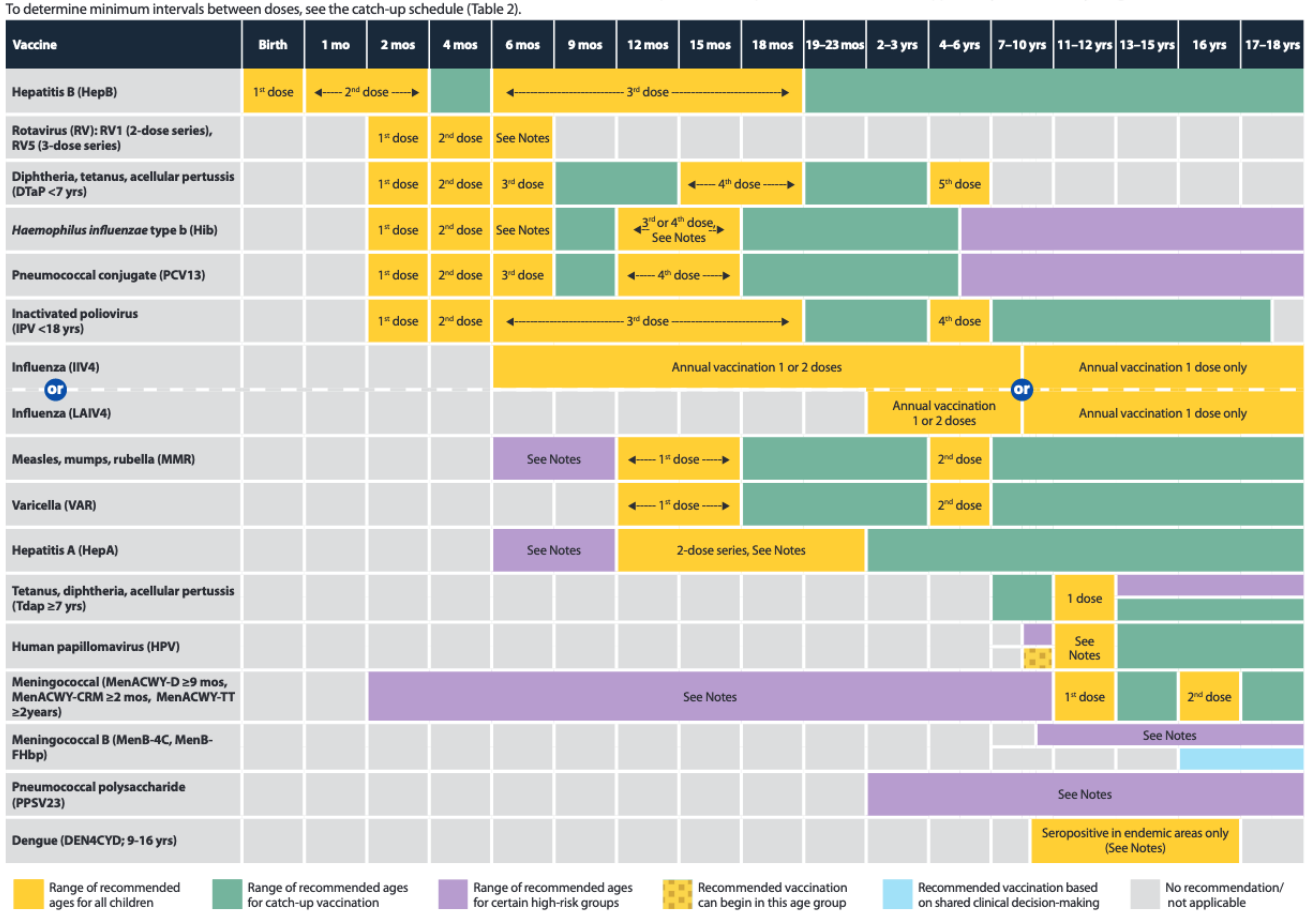
1. Precaution for LAIV4 does not apply to alcoholism. **2.** See notes for influenza; hepatitis B; measles, mumps, and rubella; and varicella vaccinations. **3.** Hematopoietic stem cell transplant.

https://www.cdc.gov/vaccines/schedules/downloads/adult/adult-combined-schedule.pdf Accessed Nov. 14th, 2022.

Immunization Schedules

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).



https://www.cdc.gov/vaccines/schedules/downloads/child/0-18yrs-child-combined-schedule.pdf. Accessed Nov. 14th, 2022.

Immunization Schedules

Table 3 Recommended Child and Adolescent Immunization Schedule by Medical Indication, United States, 2022

Always use this table in conjunction with Table 1 and the Notes that follow.

VACCINE	INDICATION										
	Pregnancy	Immunocompromised status (excluding HIV infection)	HIV infection CD4+ count[1]: <15% or total CD4 cell count of <200/mm³	HIV infection CD4+ count[1]: ≥15% and total CD4 cell count of ≥200/mm³	Kidney failure, end-stage renal disease, or on hemodialysis	Heart disease or chronic lung disease	CSF leak or cochlear implant	Asplenia or persistent complement component deficiencies	Chronic liver disease	Diabetes
Hepatitis B										
Rotavirus		SCID[2]								
Diphtheria, tetanus, and acellular pertussis (DTaP)										
Haemophilus influenzae type b										
Pneumococcal conjugate										
Inactivated poliovirus										
Influenza (IIV4)										
or										
Influenza (LAIV4)						Asthma, wheezing: 2–4yrs[3]				
Measles, mumps, rubella	*									
Varicella	*									
Hepatitis A										
Tetanus, diphtheria, and acellular pertussis (Tdap)										
Human papillomavirus	*									
Meningococcal ACWY										
Meningococcal B										
Pneumococcal polysaccharide										
Dengue										

Vaccination according to the routine schedule recommended

Recommended for persons with an additional risk factor for which the vaccine would be indicated

Vaccination is recommended, and additional doses may be necessary based on medical condition or vaccine. See Notes.

Precaution—vaccine might be indicated if benefit of protection outweighs risk of adverse reaction

Contraindicated or not recommended—vaccine should not be administered

*Vaccinate after pregnancy

No recommendation/not applicable

1 For additional information regarding HIV laboratory parameters and use of live vaccines, see the *General Best Practice Guidelines for Immunization*, "Altered Immunocompetence," at www.cdc.gov/vaccines/hcp/acip-recs/general-recs/immunocompetence.html and Table 4-1 (footnote J) at www.cdc.gov/vaccines/hcp/acip-recs/general-recs/contraindications.html.
2 Severe Combined Immunodeficiency
3 LAIV4 contraindicated for children 2–4 years of age with asthma or wheezing during the preceding 12 months

https://www.cdc.gov/vaccines/schedules/downloads/child/0-18yrs-child-combined-schedule.pdf. Accessed Nov. 14th, 2022.

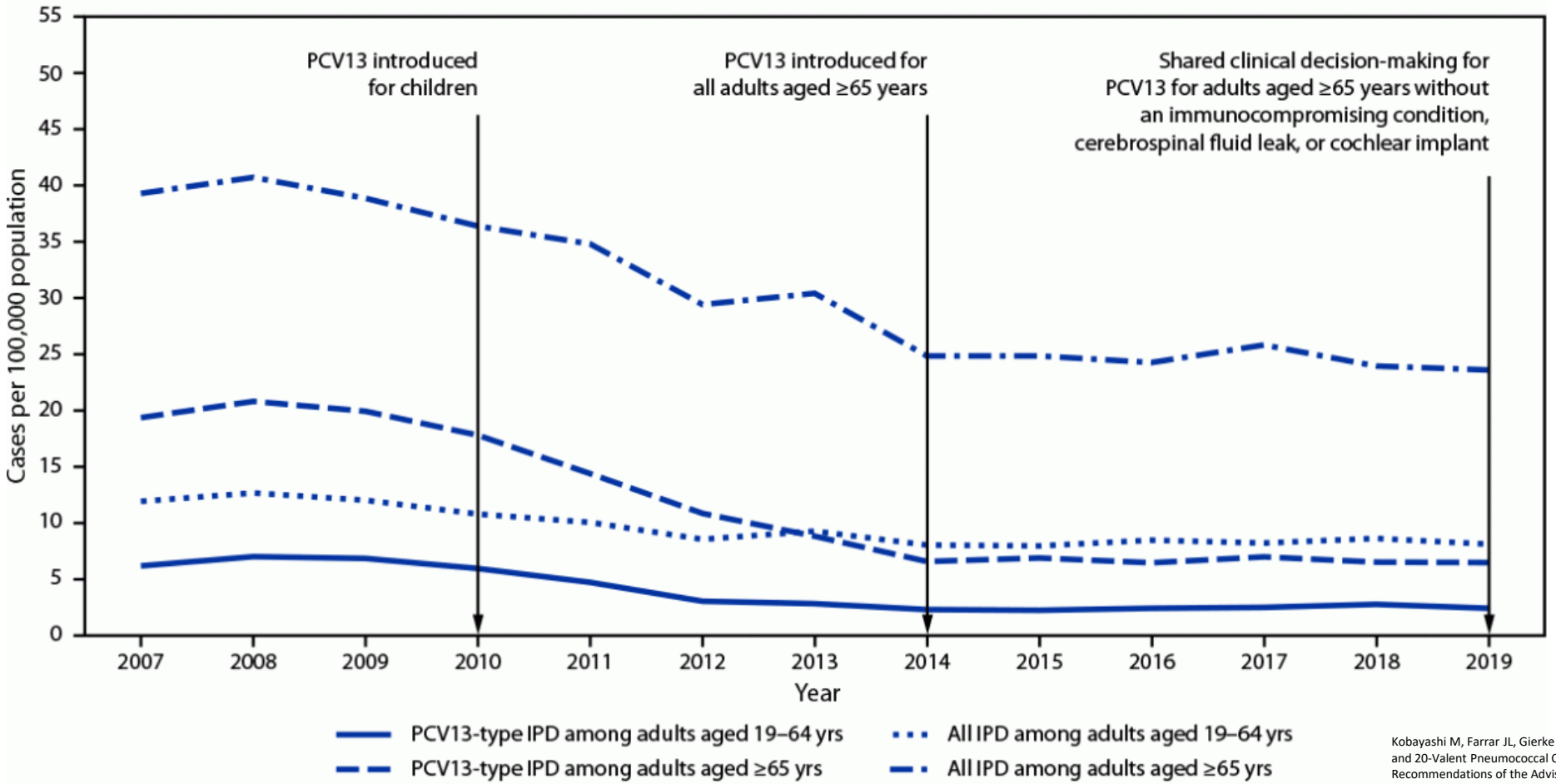
Pharmacist's Role

- Estimated during the COVID-19 Pandemic, Pharmacists:
  - Administered over 42 million COVID-19 tests
  - Administered over 270 million vaccinations including 8.1 million for long term care residents
  - Did this while still administering over 50 million OTHER vaccinations/year

Grabenstein, John D. "Essential services: Quantifying the contributions of America's pharmacists in COVID-19 clinical interventions." *Journal of the American Pharmacists Association* (2022).

Epidemiology

Pneumococcal Disease

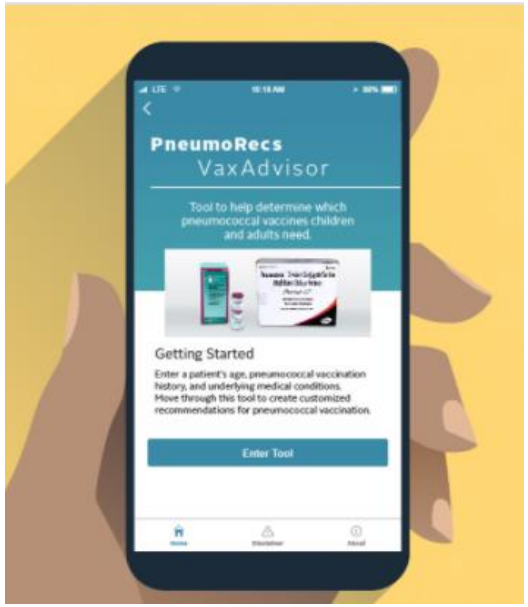


Kobayashi M, Farrar JL, Gierke R, et al. Use of 15-Valent Pneumococcal Conjugate Vaccine and 20-Valent Pneumococcal Conjugate Vaccine Among U.S. Adults: Updated Recommendations of the Advisory Committee on Immunization Practices — United States, 2022. MMWR Morb Mortal Wkly Rep 2022;71:109–117. DOI: http://dx.doi.org/10.15585/mmwr.mm7104a1 Accessed October 31, 2022.

Pneumococcal Vaccines

- Download the CDC PneumoRecs VaxAdvisor App

Available on the App Store and Google Play (https://www.cdc.gov/vaccines/vpd/pneumo/hcp/pneumoapp.html)



Herpes Zoster Vaccination

- Herpes Zoster Virus
  - 1 out of every 3 people in the United States will develop shingles in their lifetime
  - 1 million cases of shingles each year in the US

Centers for Disease Control and Prevention. (2019). Shingles (Herpes Zoster) . Retrieved from https://www.cdc.gov/shingles/about/index.html Last Accessed November 3rd, 2022.

COVID-19

- Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection
  - Responsible for the coronavirus pandemic 2019 (COVID-19)

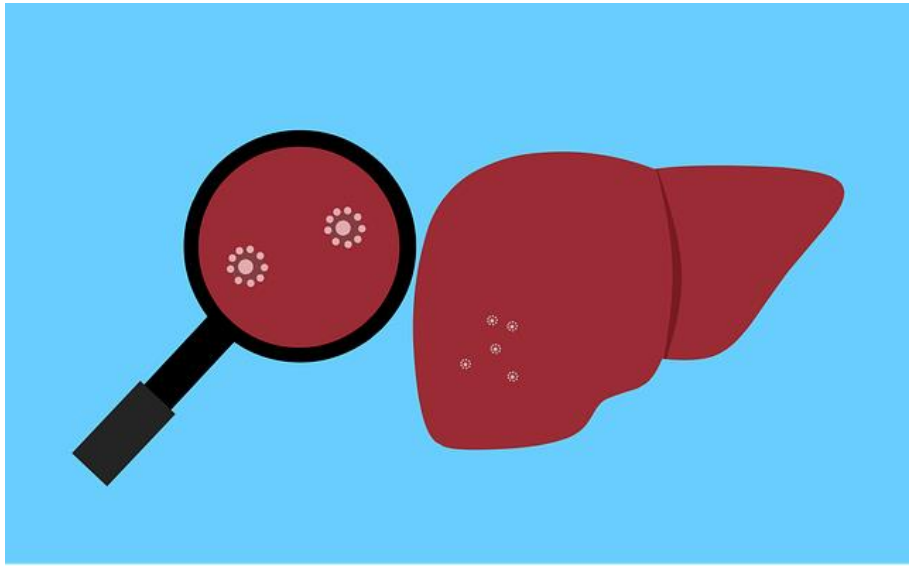
- 628 million total cases globally
  - 6.57 million deaths
    - As of November 3rd, 2022

World Health Organization (WHO). Coronavirus disease (COVID-19) Weekly Epidemiological Update and Weekly Operational Update. Accessed from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports. Last accessed: November 3rd, 2022

Viral Hepatitis

- Hepatitis A Virus (HAV) and Hepatitis B Virus (HBV) remain vaccine-preventable diseases

- New Infections/year
  - ~25,000 for HAV
  - ~23,000 for HBV



Influenza Burden

CDC estimates* that, from **October 1, 2021** through **May 21, 2022**, there have been:

7,300,000 – 12,000,000
flu **illnesses**

3,400,000 – 5,500,000
flu **medical visits**

74,000 – 150,000
flu **hospitalizations**

4,500 – 13,000
flu **deaths**

Grohskopf LA, Blanton LH, Ferdinands JM, et al. Prevention and Control of Seasonal Influenza with Vaccines: Recommendations of the Advisory Committee on Immunization Practices — United States, 2022–23 Influenza Season. MMWR Recomm Rep 2022;71(No. RR-1):1–28. DOI: http://dx.doi.org/10.15585/mmwr.rr7101a1

Influenza Burden

FLUVIEW interactive

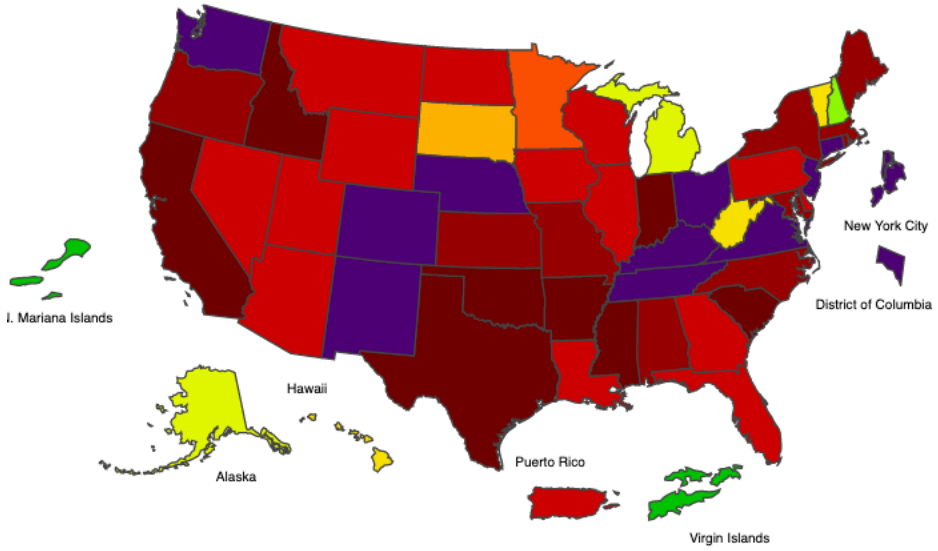
CDC

A Weekly Influenza Surveillance Report Prepared by the Influenza Division

Outpatient Respiratory Illness Activity Map Determined by Data Reported to ILINet

This system monitors visits for respiratory illness that includes fever plus a cough or sore throat, also referred to as ILI, not laboratory confirmed influenza and may capture patient visits due to other respiratory pathogens that cause similar symptoms.

2022-23 Influenza Season Week 48 ending Dec 03, 2022



Centers for Disease Control and Prevention. (2022). Fluview.. Retrieved from https://www.cdc.gov/flu/weekly/usmap.htm#print. Last Accessed December 11th, 2022 .

Epidemiology

Section 2

- Pneumococcal Disease
- Zoster Vaccine/Varicella
- COVID-19
- Hepatitis A
- Hepatitis B
- Influenza

ACIP Updates

Adults

- Tdap or Td
- Meningococcal disease
- HPV

Children/Adolescents

- Diphtheria, tetanus, & acellular pertussis (DTaP)
- Measles, mumps, rubella (MMR)
- Polio

Tdap Booster

Persons aged 11–18 years

- Single dose of Tdap at age 11–12 years
  - 1 booster dose of either **Tdap** should be administered every 10 years throughout life

Persons aged ≥19 years

- Persons aged ≥19 years who have never received a dose of Tdap should receive 1 dose of Tdap
  - Booster doses of Tdap should be administered every 10 years throughout life.
  - Women are recommended to receive a dose of Tdap during each pregnancy, which should be administered from 27 through 36 weeks' gestation, regardless of previous receipt of Tdap.

Havers FP, Moro PL, Hunter P, Hariri S, Bernstein H. Use of Tetanus Toxoid, Reduced Diphtheria Toxoid, and Acellular Pertussis Vaccines: Updated Recommendations of the Advisory Committee on Immunization Practices — United States, 2019. MMWR Morb Mortal Wkly Rep 2020;69:77–83. DOI: http://dx.doi.org/10.15585/mmwr.mm6903a5

DTaP/Tdap/Td Vaccines

	Vaccine	Notable Components	Notes	Contraindications
Protect against tetanus, diphtheria, and pertussis	**DTaP**	Diphtheria and tetanus toxoids and acellular pertussis adsorbed	Pediatric formulation – given as 5 doses to end by time of school entry	Patients who have had a severe allergic reaction (e.g., anaphylaxis) after a previous dose A person who has a severe allergy to any vaccine component Patients who developed encephalopathy not attributable to another identifiable cause within 7 days of administration of a previous dose of DTP, DTaP, or Tdap
	Tdap	Tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis adsorbed	Available as: Boostrix for ≥10 years* Adacel for 10-64 years*	
Protect against tetanus and diphtheria	**Td**	Tetanus and reduced diphtheria toxoids adsorbed	Adult – used as booster given every 10 years	
	DT	Diphtheria and tetanus toxoids adsorbed	Pediatric – used when child has a contra- indication to pertussis	Will be D/C'd in 2023

Havers FP, Moro PL, Hunter P, Hariri S, Bernstein H. Use of Tetanus Toxoid, Reduced Diphtheria Toxoid, and Acellular Pertussis Vaccines: Updated Recommendations of the Advisory Committee on Immunization Practices — United States, 2019. MMWR Morb Mortal Wkly Rep 2020;69:77–83. DOI: http://dx.doi.org/10.15585/mmwr.mm6903a5

Meningococcal Infection

Pharmacists who work around schools and colleges can have a significant impact on this patient population through effective vaccination

- Patients with anatomic asplenia, persistent complement component deficiencies, and HIV infection are at higher risk for contracting a meningococcal infection
    - N. meningitidis has 13 different serotypes, six of which (A, B, C, Y, W-135, and X) are responsible for almost all meningococcal disease in humans

Centers for Disease Control and Prevention. (2016). Meningococcal Vaccination: What Everyone Should Know. Retrieved from https://www.cdc.gov/vaccines/vpd/mening/public/index.html

Meningococcal Vaccination

- All adolescents should complete a two-dose series with the initial dose at 11-12 years of age and a booster at age 16 in order to be fully protected by the time they are at the most risk

- MCV4 and MenHibrix® (MCV4/Hib) are also recommended for all children who are between 2 months and 10 years old with the following conditions:
  - anatomic or functional asplenia
  - persistent complement deficiencies
  - who travel or reside in countries where meningococcal disease is an epidemic
  - taking eculizumacb (Soliris®)
  - HIV infection
  - part of a group at increased risk due to an outbreak

Centers for Disease Control and Prevention. (2016). Meningococcal Vaccination: What Everyone Should Know. Retrieved from https://www.cdc.gov/vaccines/vpd/mening/public/index.html

Meningococcal Vaccination

- There have been two meningococcal vaccinations that have been approved for Serogroup B
  - Bexsero® (GlaxoSmithKline)
  - Trumenba® (Pfizer)

- While these vaccines are not routinely recommended for all adolescents, these are approved for children 10 years of age and older with the following conditions:
  - anatomic or functional asplenia
  - persistent complement deficiencies, taking eculizumacb (Soliris®) , or
  - part of a group at increased risk due to an outbreak
  - Pharmacists involved in the care of these patients can make a significant impact on patient care by helping to identify appropriate opportunities for immunization since these do not fall in a routine schedule for all children

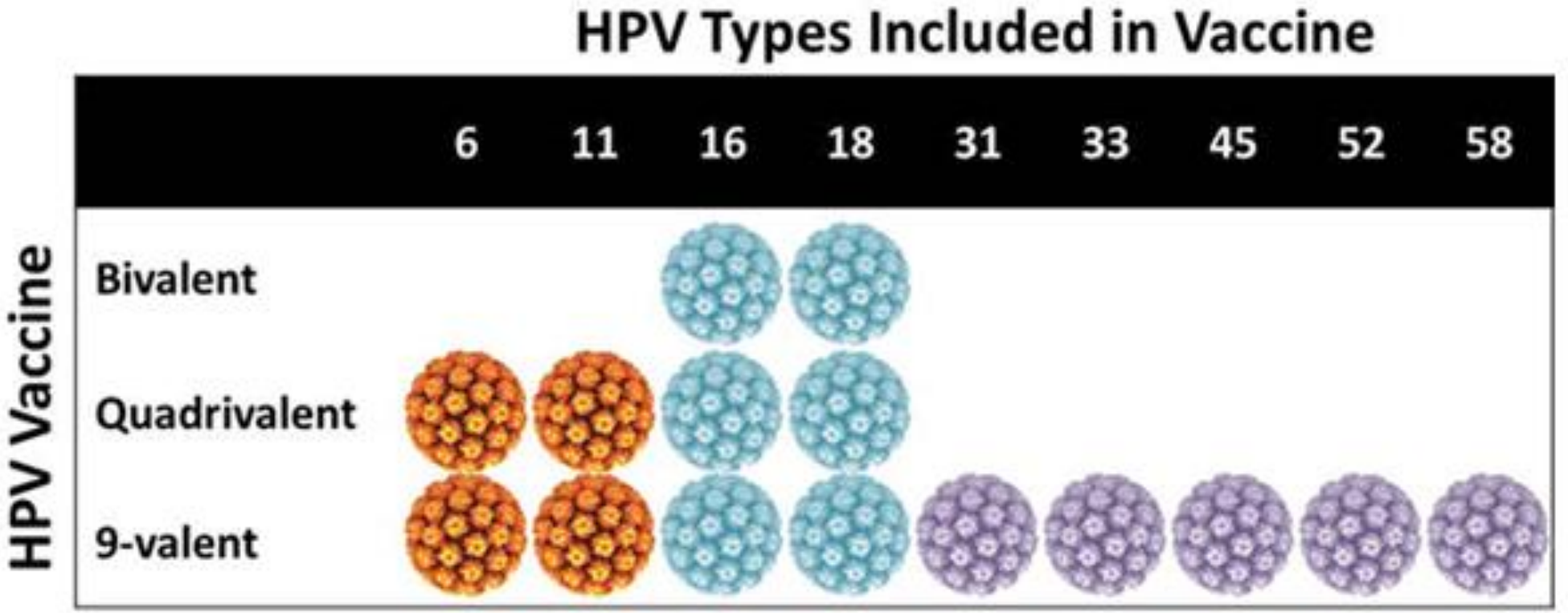
Centers for Disease Control and Prevention. (2016). Meningococcal Vaccination: What Everyone Should Know. Retrieved from https://www.cdc.gov/vaccines/vpd/mening/public/index.html

Human Papillomavirus Vaccination

- HPV immunizations:
  - Cervarix® (2vHPV, GlaxoSmithKline)
- HPV serotypes 16 and 18
  - Gardasil® (4vHPV, Merck)
- HPV serotypes 6, 11, 16, 18
  - Gardasil-9® (9vHPV, Merck)
    - 4vHPV plus serotypes (31, 33, 45, 52, and 58)

- Gardasil-9® (9vHPV, Merck) is the only HPV vaccine available on the market as of 2017

Human Papillomavirus Vaccination



Centers for Disease Control and Prevention. Image obtained from: http://www.cdc.gov/spanish/especialescdc/prevengavph/images/prevengavph_c600px.gif Accessed November 3rd, 2022.

Human Papillomavirus Vaccination

- Gardasil-9® (9vHPV, Merck)
  - Given to both males and females in a two-dose series for patients 9 years of age and older (administered IM, at 0, and 6-12 months)

- ACIP recommended that the 9vHPV immunization can be started as early as 9 years of age
  - Data published in the Fall of 2016 with 9vHPV supported a 2-dose series (administered IM, at 0 and 6 months) for patients ages 11-12 (can start at age 9) compared with older adolescents
  - If a patient does not start the series until the age of 15, the original three-dose series (0, 1, 6 month intervals) is recommended

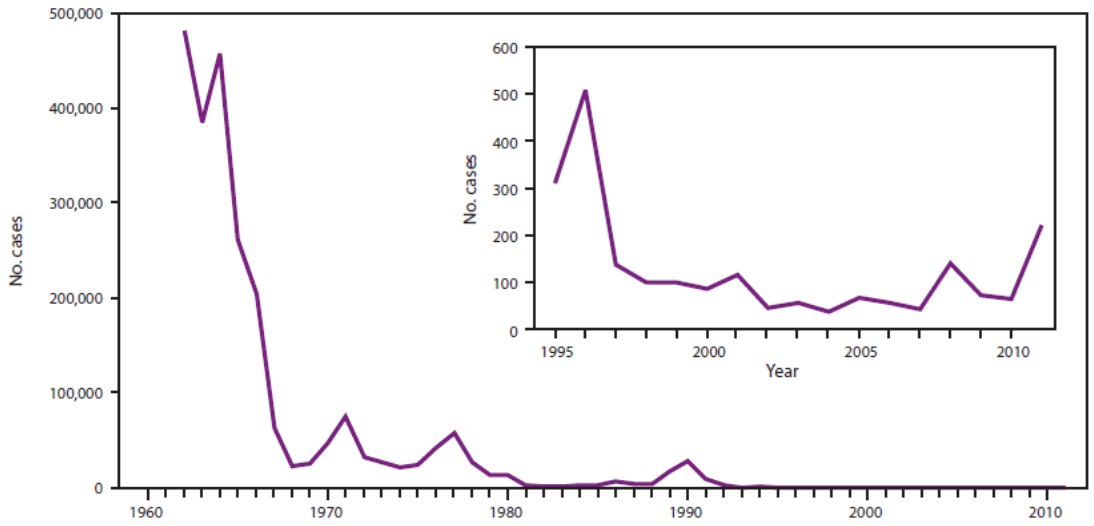
- Shared Clinical Decision Making for Adults aged > 26 years of age

Centers for Disease Control and Prevention. (2021). Human papillomavirus (HPV). Retrieved from http://www.cdc.gov/hpv/

Measles

- Respiratory transmission of virus
- Replication in nasopharynx and regional lymph nodes
  - Primary viremia 2-3 days after exposure
  - Secondary viremia 5-7 days after exposure with spread to tissues

FIGURE 1. Number of measles cases — United States, 1962–2011

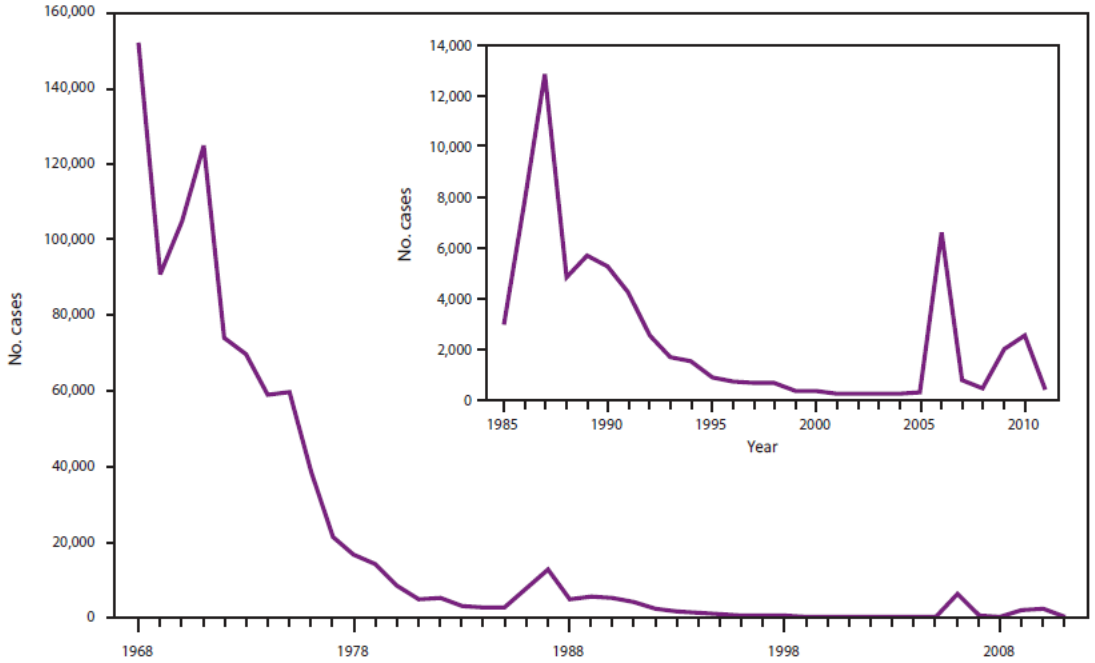


Centers for Disease Control and Prevention. (2013). Prevention of Measles, Rubella, Congenital Rubella Syndrome, and Mumps, 2013: Summary Recommendations of the Advisory Committee on Immunization Practices (ACIP) Retrieved from https://www.cdc.gov/mmwr/preview/mmwrhtml/rr6204a1.htm

Mumps

- Respiratory transmission of virus
- Replication in nasopharynx and regional lymph nodes
- Viremia 12 to 25 days after exposure with spread to tissues
  - Multiple tissues infected during viremia

FIGURE 3. Number of mumps cases — United States, 1968–2011



Centers for Disease Control and Prevention. (2013). Prevention of Measles, Rubella, Congenital Rubella Syndrome, and Mumps, 2013: Summary Recommendations of the Advisory Committee on Immunization Practices (ACIP) Retrieved from https://www.cdc.gov/mmwr/preview/mmwrhtml/rr6204a1.htm

Measles, Mumps, Rubella Vaccine

- Two total doses (SC)
  - 12 to 15 months
  - 4 to 6 years
  - Second dose is at least 28 days after the first dose

- All infants 12 months of age and older
  - Susceptible adolescents and adults without documented evidence of rubella immunity
  - Emphasis on nonpregnant women of childbearing age, particularly those born outside the U.S.
  - Emphasis on males and females in college, places of employment, and health care settings

Centers for Disease Control and Prevention. (2013). Prevention of Measles, Rubella, Congenital Rubella Syndrome, and Mumps, 2013: Summary Recommendations of the Advisory Committee on Immunization Practices (ACIP) Retrieved from https://www.cdc.gov/mmwr/preview/mmwrhtml/rr6204a1.htm

Measles, Mumps, Rubella

- Patients at increased risk for mumps during an outbreak
  - Effectiveness of 2 doses of MMR in preventing mumps is 88%
  - But 2 doses of MMR vaccine ≥13 years has 9x more risk for contracting mumps in an outbreak

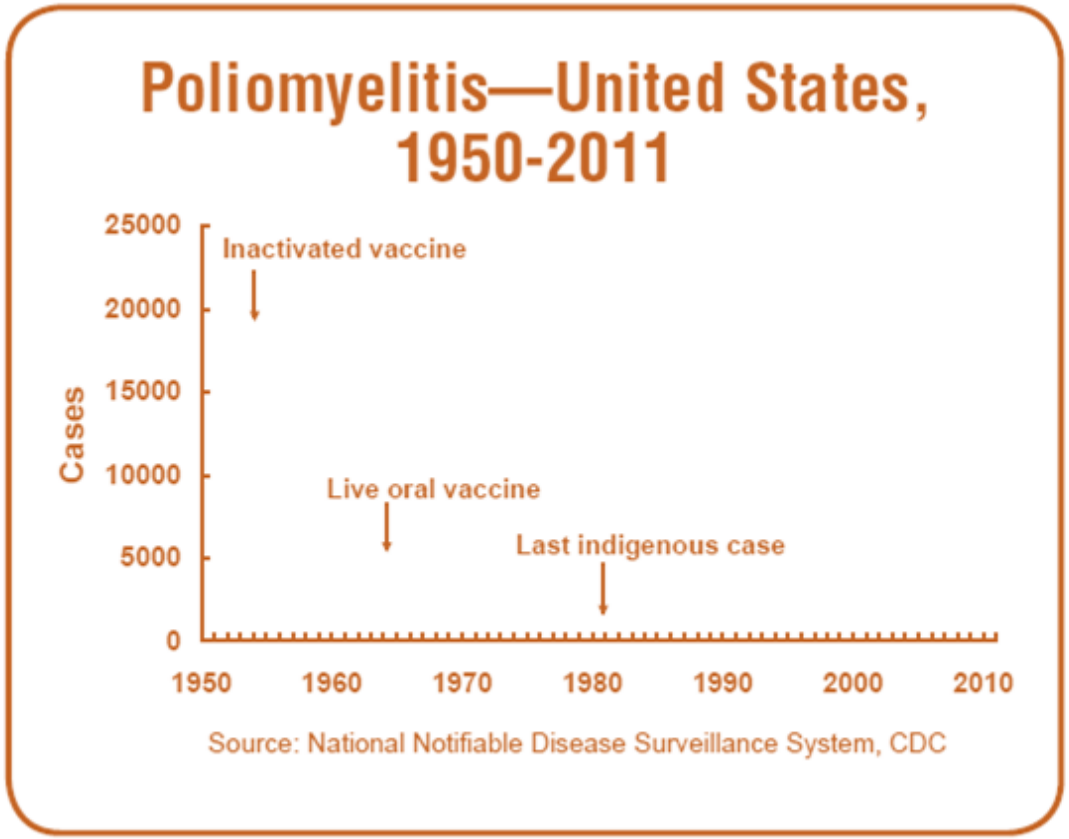
- If a patient received 2 doses of an MMR vaccine are at increased risk (as defined by a public health authority) for acquiring mumps:
  - Patients should receive a third dose of a mumps virus–containing vaccine

Marin M, Marlow M, Moore KL, Patel M. Recommendation of the Advisory Committee on Immunization Practices for Use of a Third Dose of Mumps Virus–Containing Vaccine in Persons at Increased Risk for Mumps During an Outbreak MMWR. 2018;67(1);33-8.

Polio

More than 21,000 paralytic cases reported in the U. S. in 1952

- Incidence dramatically decreased following inactivated polio vaccine (IPV) introduction in 1955
- Last cases of locally-acquired paralytic poliomyelitis caused by wild poliovirus in the U.S. reported in 1979



Centers for Disease Control and Prevention. (2022). Polio Vaccination: Information for Healthcare Professionals
Retrieved from https://www.cdc.gov/vaccines/vpd/polio/hcp/index.html

Poliovirus Vaccination

- Routine vaccination
- 4-dose series at ages:
  - 2 months, 4 months, 6–18 months, 4–6 years - administer the final dose at or after age 4 years and at least 6 months after the previous dose
- Poliovirus Vaccines
  - IPV (IPOL)
  - Combination vaccines
    - DTaP-HepB-IPV (Pediarix)
    - DTaP-IPV/Hib (Pentacel)
    - DTaP-IPV (Kinrix)

Centers for Disease Control and Prevention. (2022). Polio Vaccination: Information for Healthcare Professionals
Retrieved from https://www.cdc.gov/vaccines/vpd/polio/hcp/index.html

Ebola

ERVEBO® (Ebola Zaire Vaccine, Live)

- Indicated for the prevention of disease caused by *Zaire ebolavirus disease* (EVD) in individuals 18 years of age and older

- Preexposure vaccination is recommended for the following groups:
  - responding to an outbreak of EVD
  - Health care personnel at federal Ebola Tx centers in the US
  - Laboratory staff at biosafety level 4 facilities in the US

Choi MJ, Cossaboom CM, Whitesell AN, et al. Use of Ebola Vaccine: Recommendations of the Advisory Committee on Immunization Practices, United States, 2020. MMWR Recomm Rep 2021;70(No. RR-1):1–12. DOI: http://dx.doi.org/10.15585/mmwr.rr7001a1. Accessed September 1st, 2021.

ERVEBO® [package insert]. Whitehouse Station, NY: Merck, Inc. 2019.

Dengue

- Dengue virus is a mosquito borne illness that can spread to humans primary via the Aedes aegypeti and Aedes albopictus specifies of female mosquitos.
  - There are no antiviral options for patients infected with any serotype of dengue virus (DENV1-4)

- CYD-TDV
  - Live-attenuated vaccine that is indicated for children 9 to 16 years of age who have previously been diagnosed with dengue infection (via laboratory) and reside in endemic areas (including Puerto Rico, US Virgin Islands and other U.S. associated territories) given in a three-dose series

Paz-Bailey G, Adams L, Wong JM, et al. Dengue Vaccine: Recommendations of the Advisory Committee on Immunization Practices, United States, 2021. MMWR Recomm Rep 2021;70(No. RR-6):1–16.

Questions & Answers

Thank You!