Don't Forget Us: ACIP Changes to Hepatitis B and Pneumococcal Vaccine Recommendations

DANI S. DOLIN, PHARMD, CDCES

Objectives

1. Describe new recommendations regarding universal hepatitis B recommendations
2. Identify differences between current and proposed pneumococcal vaccination recommendations
3. Understand the rationale for these updates and their implementation in practice

Hepatitis B Vaccination

Hepatitis B

- Over 1 billion dollars spent on Hep B-related hospitalizations annually
- Association with >50% of hepatocellular carcinomas
- Increased morbidity and mortality in patients with chronic liver disease with diabetes or advanced age
- 25% of those infected as kids and 15% infected as adults will die prematurely from cirrhosis or cancer

Corte et al. J Gastroenterol Hepatol. 2014
Image: https://www.niddk.nih.gov/health-information/liver-disease
https://www.cdc.gov/vaccines/pubs/pinkbook/hepb.html#Virus
Schillie, et al. MMWR Recomm Rep. 2018 Jan 12;67(1):1-31.
https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2021-11-2-3/02-HepWG-weng-508.pdf

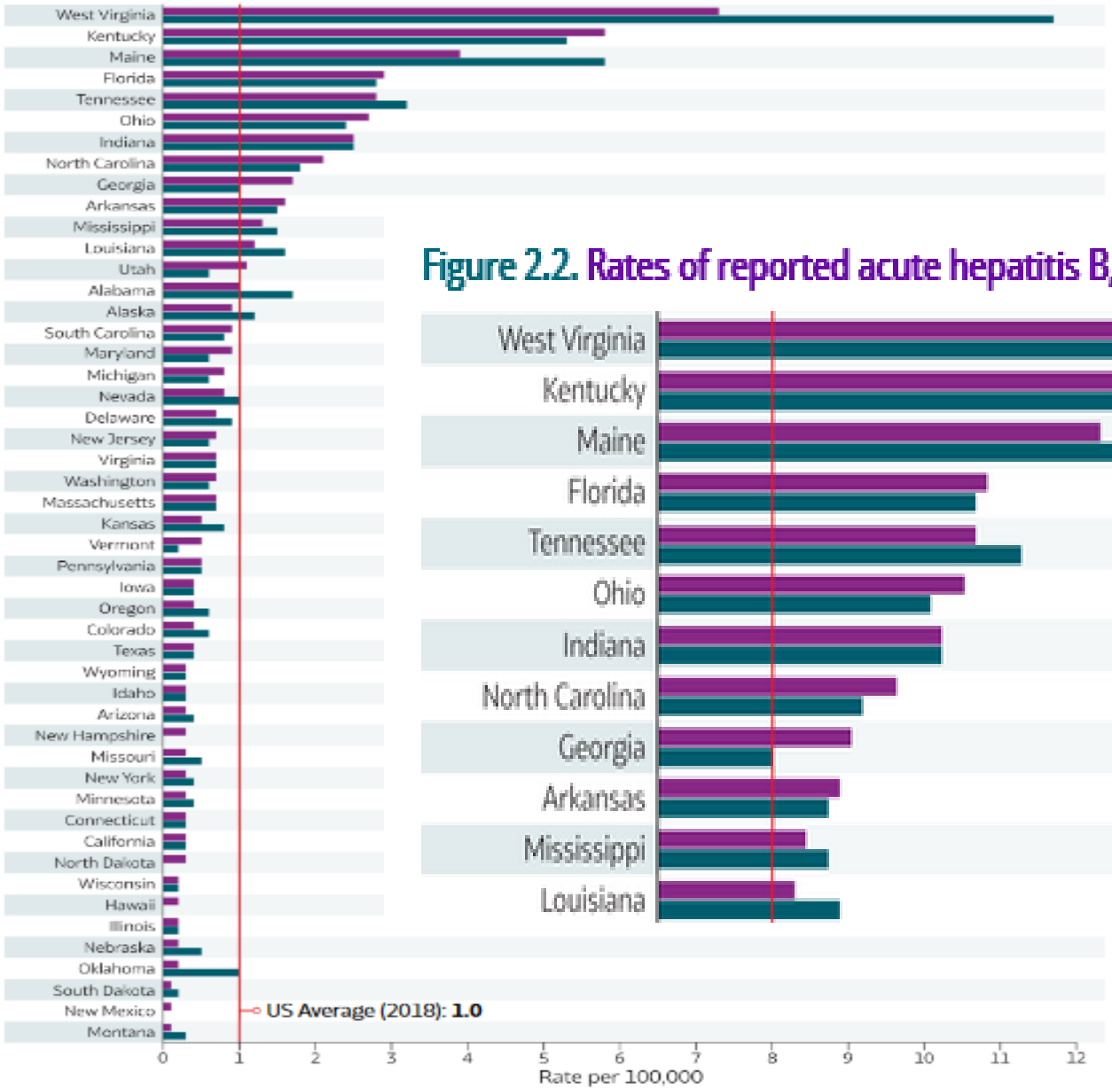
Hepatitis B

- 88.5% decrease in reported acute HBV infections since recommendations for Hep B vaccination began
  - 9.6 cases per 100,000 population in 1982 to 1.1 cases per 100,000 population in 2015
- 114% increase in acute HBV in KY, TN, and WV (combined) from 2009–2013
  - Associated with increasing injection-drug use
- 850,000 – 2.2 million cases of chronic hepatitis

https://www.cdc.gov/mmwr/volumes/67/rr/rr6701a1.htm

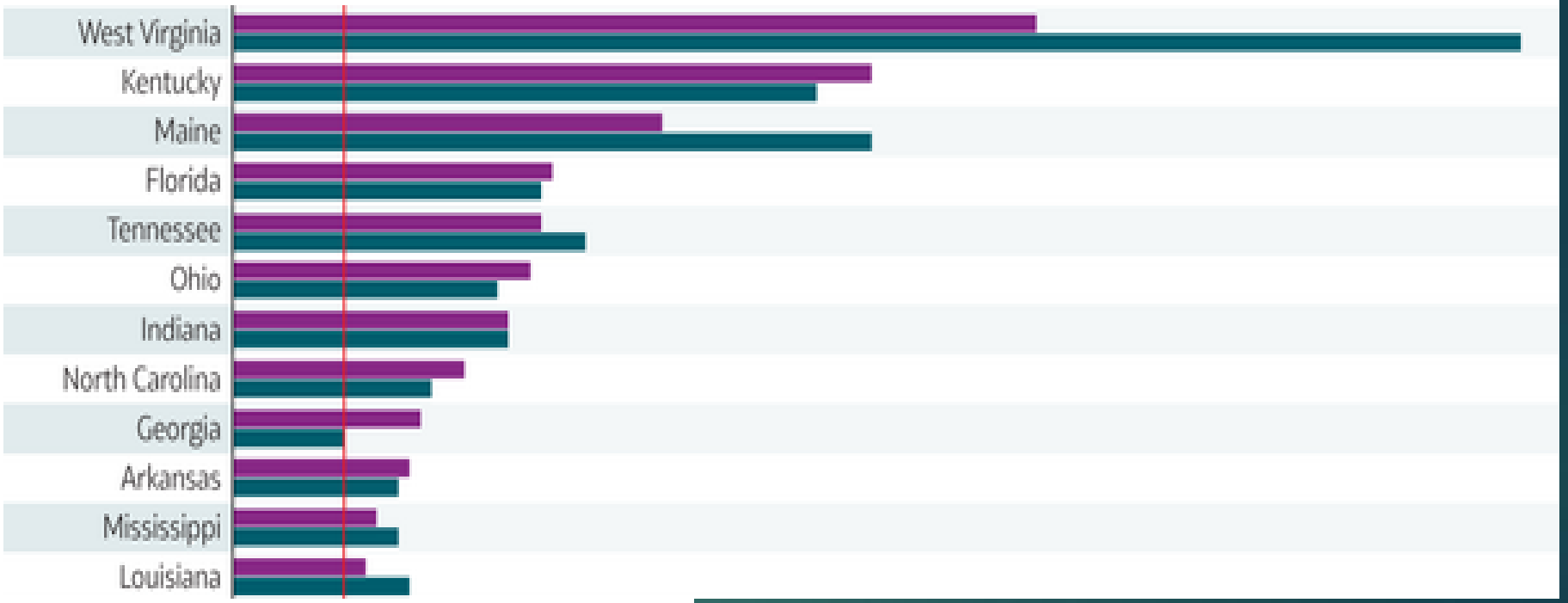
VIRAL HEPATITIS SURVEILLANCE

Figure 2.2. Rates of reported acute hepatitis B, by state* — United States, 2017–2018



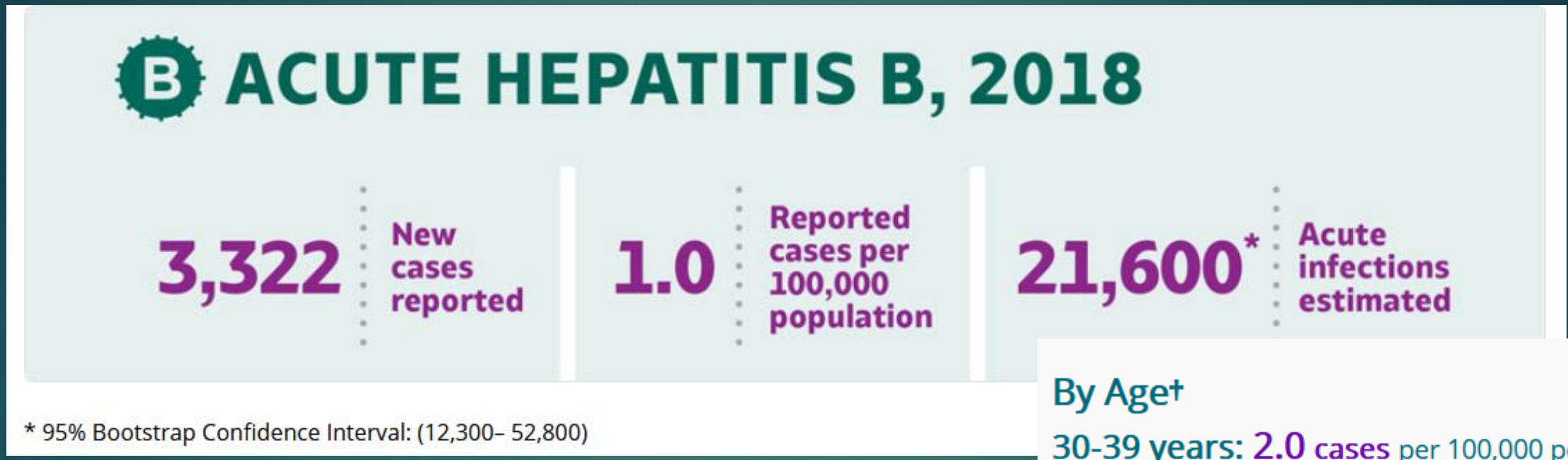
Source: CDC, National Notifiable Diseases Surveillance System.
* Excludes District of Columbia and Rhode Island

Figure 2.2. Rates of reported acute hepatitis B, by state — United States, 2017–2018



https://www.cdc.gov/hepatitis/statistics/2018surveillance/pdfs/HBV_Surv-2018_Figure2.2.pdf, accessed 2/27/22

Hepatitis B



https://www.cdc.gov/hepatitis/statistics/2018surveillance/HepB.htm#Figure2.2, accessed 2/19/22

Hepatitis B

- HHS: Goal to eliminate threat of viral hepatitis by 2030
- How
  - Vaccination
  - Expand and simplify Hep B vaccination
  - Increase uptake
  - Prevention

https://www.hhs.gov/sites/default/files/Viral-Hepatitis-National-Strategic-Plan-2021-2025.pdf

ACIP Hepatitis Workgroup

1. Can universal recommendations increase vaccine uptake among people with risk factors?

Vaccine Date of relevant recommendation	Risk-based Cohort	Coverage (95% CI)	"Universal" Cohort	Coverage (95% CI)	
Flu **2010**	25–64y +high risk conditions[1] 2009-10 season	28.6% (±1.1)	51.0% (± 1.4)	18–64 years +high risk conditions[1] 2020-21 season
Pneumococcal **2012**	19–64y at increased risk[2] 2018	23.3% (22.0-24.6)	69.0% (67.5-70.4)	≥65y[2] 2018
HepB-BD **2005**	Newborns[3] 1/2003 – 6/2005	50.1% (±1.1)	79.6% (78-81)	birth year 2018[4]

[1]CDC FluVaxView
[2] NHIS 2018. NHIS captures "any" pneumococcal vaccination; risk-based recommendation includes groups with different pneumococcal recommendations.
[3] Allred, NJ et al CDC *MMWR* 2008. Birth Dose, to 3 days from birth
[4] CDC ChildVaxView, HepB Birth Dose by Age 0-3 Days

https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2021-11-2-3/01-HepWG-ault-508.pdf, accessed 2/27/22

Hepatitis B Vaccination Target Groups

- All infants at birth
- All unvaccinated children and adolescents aged <19 years
  - Catch up dosing if needed
- All adults requesting protection from HBV infection
- Pregnant women at risk during pregnancy
  - > 1 sex partner during the previous 6 months, evaluation or treatment for STI, recent or current injection-drug use, or HBsAg-positive sex partner
- High risk adults

Schillie S, Vellozzi C, Reingold A, et al. Prevention of Hepatitis B Virus Infection in the United States: Recommendations of the Advisory Committee on Immunization Practices. MMWR Recomm Rep 2018;67(No. RR-1):1–31. DOI: http://dx.doi.org/10.15585/mmwr.rr6701a1

Hepatitis B

HEPATITIS B – RISK BEHAVIORS AND EXPOSURES

Figure 2.7. Availability of information on risk behaviors/exposures* associated with reported cases of acute hepatitis B — United States, 2018

https://www.cdc.gov/hepatitis/statistics/2018surveillance/HepB.htm#Figure2.2,accessed 2/20/22

Hepatitis B Vaccine coverage

2015 data

- Children 19–35 months: 90.5%
- Adolescents 13-17 years: 91.4%
- Adults:
  - Chronic liver disease: 27.4%
  - Travelers to outside US to countries other than Europe, Japan, Australia, New Zealand, or Canada: 31.6%
  - Diabetes ages 19-59 years: 24.4%
  - Diabetes aged ≥60 years: 12.6%
  - HCP 64.7%

Schillie S, Vellozzi C, Reingold A, et al. Prevention of Hepatitis B Virus Infection in the United States: Recommendations of the Advisory Committee on Immunization Practices. MMWR Recomm Rep 2018;67(No. RR-1):1–31. DOI: http://dx.doi.org/10.15585/mmwr.rr6701a1

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				
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 2/19/22

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 2/19/22

Hepatitis B Vaccination Recommendations

- **Age 19 through 59 years:** complete a 2- or 3-, or 4-dose series
  - 2-dose series only applies when 2 doses of Heplisav-B* are used at least 4 weeks apart
  - 3-dose series Engerix-B or Recombivax HB at 0, 1, 6 months [minimum intervals: dose 1 to dose 2: 4 weeks / dose 2 to dose 3: 8 weeks / dose 1 to dose 3: 16 weeks])
  - 3-dose series HepA-HepB (Twinrix at 0, 1, 6 months [minimum intervals: dose 1 to dose 2: 4 weeks / dose 2 to dose 3: 5 months])
  - 4-dose series HepA-HepB (Twinrix) accelerated schedule of 3 doses at 0, 7, and 21–30 days, followed by a booster dose at 12 months
  - 4-dose series Engerix-B at 0, 1, 2, and 6 months for persons on adult hemodialysis (note: each dosage is double that of normal adult dose, i.e., 2 mL instead of 1 mL)

***Note**: Heplisav-B not recommended in pregnancy due to lack of safety data in pregnant women

https://www.cdc.gov/vaccines/schedules/downloads/adult/adult-combined-schedule.pdf, accessed 2/19/22

Hepatitis B Vaccination Recommendations

- **Age 60 years or older* and at risk for hepatitis B virus infection:** 2-dose (Heplisav-B) or 3-dose (Engerix-B, Recombivax HB) series or 3-dose series HepA-HepB (Twinrix) as above
  - **Chronic liver disease** (e.g., persons with hepatitis C, cirrhosis, fatty liver disease, alcoholic liver disease, autoimmune hepatitis, alanine aminotransferase [ALT] or aspartate aminotransferase [AST] level greater than twice upper limit of normal)
  - **HIV infection**
  - **Sexual exposure risk** (e.g., sex partners of hepatitis B surface antigen [HBsAg]-positive persons; sexually active persons not in mutually monogamous relationships; persons seeking evaluation or treatment for a sexually transmitted infection; men who have sex with men)
  - **Current or recent injection drug use**
  - **Percutaneous or mucosal risk for exposure to blood** (e.g., household contacts of HBsAg-positive persons; residents and staff of facilities for developmentally disabled persons; health care and public safety personnel with reasonably anticipated risk for exposure to blood or blood-contaminated body fluids; hemodialysis, peritoneal dialysis, home dialysis, and predialysis patients; patients with diabetes)
  - **Incarcerated persons**
  - **Travel in countries with high or intermediate endemic hepatitis B**

*__Note__: Anyone age 60 years or older who does not meet risk-based recommendations may still receive Hepatitis B vaccination.

https://www.cdc.gov/vaccines/schedules/downloads/adult/adult-combined-schedule.pdf, accessed 2/19/22

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).

Vaccine	Birth	1 mo	2 mos	4 mos	6 mos	9 mos	12 mos	15 mos	18 mos	19–23 mos	2–3 yrs	4–6 yrs	7–10 yrs	11–12 yrs	13–15 yrs	16 yrs	17–18 yrs
Hepatitis B (HepB)	1st dose	◄— 2nd dose —►			◄— 3rd dose —►												
Rotavirus (RV): RV1 (2-dose series), RV5 (3-dose series)			1st dose	2nd dose	See Notes												
Diphtheria, tetanus, acellular pertussis (DTaP <7 yrs)			1st dose	2nd dose	3rd dose			◄— 4th dose —►				5th dose					
Haemophilus influenzae type b (Hib)			1st dose	2nd dose	See Notes		◄— 3rd or 4th dose, See Notes —►										
Pneumococcal conjugate (PCV13)			1st dose	2nd dose	3rd dose		◄— 4th dose —►										
Inactivated poliovirus (IPV <18 yrs)			1st dose	2nd dose	◄— 3rd dose —►							4th dose					
Influenza (IIV4)					Annual vaccination 1 or 2 doses								or	Annual vaccination 1 dose only			
or																	
Influenza (LAIV4)											Annual vaccination 1 or 2 doses			Annual vaccination 1 dose only			
Measles, mumps, rubella (MMR)					See Notes		◄— 1st dose —►					2nd dose					
Varicella (VAR)							◄— 1st dose —►					2nd dose					
Hepatitis A (HepA)					See Notes		2-dose series, See Notes										
Tetanus, diphtheria, acellular pertussis (Tdap ≥7 yrs)														1 dose			
Human papillomavirus (HPV)														See Notes			
Meningococcal (MenACWY-D ≥9 mos, MenACWY-CRM ≥2 mos, MenACWY-TT ≥2years)			See Notes											1st dose		2nd dose	
Meningococcal B (MenB-4C, MenB-FHbp)														See Notes			
Pneumococcal polysaccharide (PPSV23)											See Notes						
Dengue (DEN4CYD; 9-16 yrs)														Seropositive in endemic areas only (See Notes)			

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

https://www.cdc.gov/vaccines/schedules/downloads/child/0-18yrs-child-combined-schedule.pdf, accessed 2/20/22

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]		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
			<15% or total CD4 cell count of <200/mm³	≥15% and total CD4 cell count of ≥200/mm³						
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
- No recommendation/not applicable

*Vaccinate after pregnancy

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 2/20/22

Hepatitis B-containing vaccines

Vaccine	Age	Vol/Site	Schedule	Notes
HBsAg-Eng(Engerix-B®)	Birth-19 years	0.5ml IM (10mcg)	0, 1, 6mo	
	≥ 20 years	1ml IM (20mcg)	0, 1, 6mo	
	Dialysis ≥ 20 years	2ml IM (40mcg)	0, 1, 2, 6mo	4-dose series
HepB, recombinant (Recombivax HB®)	Birth-19 years	0.5ml IM (5mcg)	0, 1, 6mo	
	11-15 years	1ml IM (10mcg)	0, 4-6 mo	2-dose series
	≥ 20 years	1ml IM (10mcg)	0, 1, 6mo	
Hep B, recombinant (Recombivax HB® dialysis formulation)	≥ 20 years	1ml IM (40mcg)	0, 1, 6mo	
HepB-CpG (HEPLISAV-B™)	≥ 18 years	0.5ml IM (20mcg)	0, 1mo	
HepA/HepB, recombinant (Twinrix®)	≥ 18 years	1.0ml IM (20mcg)	0, 1, 6mo	Hep A and B
			0, 7d, 21-30d, +12mo booster	Accelerated schedule

https://www.cdc.gov/mmwr/volumes/67/rr/rr6701a1.htm, adaptation

Hepatitis B
New(ish) vaccine

- HepB-CpG (HEPLISAV-B™) (approved 11/17)
- 20mcg recombinant-derived hepatitis B surface antigen in yeast + 3000mcg cytidine-phosphate-guanosine oligodeoxynucleotide (CpG-ODN) adjuvant
  - stimulates a directed immune response to hepatitis B surface antigen
  - Adjuvant
- Approved as a 2-dose series
- Goal: better adherence, improved response in high risk groups

MMWR, April 20, 2018, Vol 67,(15);455-8

HepB-CpG (HEPLISAV-B™) Clinical Trials

- **Jackson, et al. Vaccine. 2018 Jan 29;36(5):668-674**

- Phase 3 observer–blinded, randomized trial
- 8,374 adults age 18-70 years
- Primary endpoint: noninferiority of the seroprotection in type 2 diabetes mellitus
- Secondary endpoints: seroprotection rates in the total trial population and by age, sex, body mass index, and smoking status

Seroprotection rates at week 28 for HBsAg-1018 and HBsAg-Eng in pre-specified populations

Population	HBsAg-1018 (2 Doses)		HBsAg-Eng (3 Doses)		Difference in SPR (95% CI)
	N	SPR (%)	N	SPR (%)	
All Subjects	4376	95.40%	2289	81.30%	14.20% (12.5%-15.9%)
18—29 years	174	100.00%	99	93.90%	6.10% (2.8%-12.6%)
30—39 years	632	98.90%	326	92.00%	6.90% (4.2%-10.4%)
40—49 years	974	97.20%	518	84.20%	13.10% (9.9%-16.6%)
50—59 years	1439	95.20%	758	79.70%	15.50% (12.6%-18.7%)
60—70 years	1157	91.60%	588	72.60%	19.00% (15.2%-23.0%)
Men	2203	94.50%	1150	78.80%	15.70% (13.2%-18.3%)
Women	2173	96.40%	1139	83.80%	12.60% (10.4%-15.0%)
Diabetes[a]	640	90.00%	321	65.10%	24.90% (19.3%-30.7%)
No diabetes	3762	96.20%	1968	83.90%	12.30% (10.6%-14.1%)
Obese[b]	2165	94.70%	1076	75.40%	19.40% (16.7%-22.2%)
Non-obese	2208	96.10%	1212	86.60%	9.60% (7.6%-11.7%)
Smoker	1371	95.90%	711	78.60%	17.30% (14.2%-20.6%)
Non-smoker	3005	95.20%	1578	82.40%	12.80% (10.8%-14.8%)

Note: all comparisons $p < 0.0000001$

https://www.fda.gov/downloads/AdvisoryCommittees/CommitteesMeetingMaterials/BloodVaccinesandOtherBiologics/VaccinesandRelatedBiologicalProductsAdvisoryCommittee/UCM568489.pdf

HepB-CpG (HEPLISAV-B™) Clinical Trials

ADR:

- Injection site pain (23-39%)
- Fatigue (11-17%)
- Headache (8-17%)
- Similar in HepB-CpG and comparator
- No increased risk of acute MI (post marketing data)

https://www.fda.gov/downloads/AdvisoryCommittees/CommitteesMeetingMaterials/BloodVaccinesandOtherBiologics/VaccinesandRelatedBiologicalProductsAdvisoryCommittee/UCM568489.pdf
https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2021-09-29/02-hepb-Bruxvoort-508.pdf, accessed 2/20/22

Hepatitis B
ACIP recommendations

- Added as a Hepatitis B vaccination option
  - Ages ≥18 years
- No preferential recommendation
- 2 doses given at least 4 weeks apart (0, 28d)
  - It can be used as a substitute in a 3-dose series with a different hepatitis B vaccine, but a valid 2-dose series requires 2 doses of Heplisav-B ™ with at least 4 weeks between doses

MMWR Morb Mortal Wkly Rep 2019;68:115–118.

Hepatitis B
New vaccine

New vaccine: PreHevbrio™

- 3-antigen vaccine
- Approved 11/30/2021
- Indicated for adults ≥18 years
- 1ml IM 0, 1mo, 6mo
- Single dose vials
- Store in a refrigerator at 2°C to 8°C (36°F to 46°F). Protect from light.

https://www.prehevbrio.com/wp-content/uploads/2021/11/PreHevbrio-Full-Prescribing-Information.pdf, 11/21/21. Accessed 2/24/22.

Hepatitis B New Vaccine

- PROTECT phase 3

	PreHevbrio ™ (TAV)	Engerix B ® (MAV)	Difference	
SPR ≥10 mIU/mL				
Age 18+ per protocol	91.4%	76.5%	14.9% 95% CI [11.2-18.6]	Met noninferiority criteria
Age 45+ full analysis	89.4%	73.1%	16.4% 95% CI [12.2-20.7]	Met superiority criteria
ADR				
Injection site pain	63.2%	36.3%		
Tenderness	60.8%	34.8%		

Vesikari, et al. Lancet. 2021 Sep 1; 21(9):1271-1281.

Hepatitis B New Vaccine

Population	# of Subjects (N)		Seroprotection Rates (SPR)	
	PreHevbrio (VBI)	Engerix-B (EB)	VBI	EB
All Subjects	**718**	**723**	**91.4%**	**76.5%**
Age				
18-39 years	71	72	100.0%	93.1%
40-49 years	158	143	98.7%	89.5%
50-59 years	153	164	92.8%	78.1%
60-69 years	221	229	89.1%	72.1%
>=70 years	115	115	78.3%	56.5%
Diabetes				
Yes	54	60	83.3%	58.3%
No	664	663	92.0%	78.1%
BMI				
> 30 kg/m2	269	254	89.2%	68.1%
≤ 30 kg/m2	449	469	92.7%	81.0%

Population	# of Subjects (N)		Seroprotection Rates (SPR)	
	PreHevbrio (VBI)	Engerix-B (EB)	VBI	EB
Daily Alcohol Consumption				
0-1 Drinks	663	662	91.0%	77.0%
2-3 Drinks	51	57	100%	70.2%
Smoking Status				
Current Smoker	92	95	85.9%	70.5%
Past Smoker	187	198	89.3%	77.3%
Non-Smoker	439	430	93.4%	77.4%
Gender				
Male	282	269	86.9%	69.5%
Female	436	454	94.3%	80.6%

Vesikari, et al. Lancet. 2021 Sep 1; 21(9):1271-1281.

Pneumococcal

Pneumococcal Disease New Vaccines

Approved 2021

- For patients ≥18 years
- PCV15 (VAXNEUVANCE ™)
  - To prevent IPD caused by the *Streptococcus pneumoniae* (pneumococcus) serotypes in the vaccine
- PCV20 (PREVNAR 20™)
  - To prevent IPD **and pneumonia** caused by the *Streptococcus pneumoniae* (pneumococcus) serotypes in the vaccine

Pneumococcal

Pneumococcal Vaccine Recommendations

- Simplify
- Timely recommendations post licensure
- Evidence-based
- Address disparities in pneumococcal disease burden and vaccination rates

https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2021-10-20-21/01-Pneumococcal-Poehling-508.pdf, accessed 2/20/22

Pneumococcal Vaccines

- Simplify

PCV13
2019 Recommendation

Continue to vaccinate

- Childhood schedule
- High risk populations ≥19 years
  - Chronic renal failure •Cochlear implants•CSF leaks••Nephrotic syndrome •Immunodeficiency •Iatrogenic immunosuppression•HIV•Generalized malignancy•Hodgkin disease•Leukemia or Lymphoma•Multiple myeloma•Solid organ transplants•Congenital or acquired asplenia•Sickle cell disease or other hemoglobinopathies

Clinical decision making

- Adults ≥65 years who **are not immune compromised** and are PCV13 naive

Matanock A, et al. MMWR Morb Mortal Wkly Rep 2019;68:1069–1075

Pneumococcal (PPSV 23)

Target groups

- Adults ≥65 years old
- Adults ≥19 years old
  - with asthma
  - who smoke
- Individuals ≥ 2 years old with chronic illnesses
- Residents of long term care facilities

Timing of doses

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6204a2.htm#tab1

Pneumococcal Recommendations

- Timely

Pneumococcal Vaccine 2022 Recommendations

- **Adults aged ≥65 years.**
  - PCV naïve or unknown status: 1 dose of either (PCV20) or (PCV15 followed by PPSV23 1 year later)
- **Adults aged 19–64 years with certain underlying medical conditions or other risk factors.**
  - PCV naïve or unknown status: 1 dose of either (PCV20) or (PCV15 followed by PPSV23 1 year later)
  - Underlying medical conditions or other risk factors: alcoholism, chronic heart/liver/lung disease, chronic renal failure, cigarette smoking, cochlear implant, congenital or acquired asplenia, CSF leak, diabetes mellitus, generalized malignancy, HIV, Hodgkin disease, immunodeficiency, iatrogenic immunosuppression, leukemia, lymphoma, multiple myeloma, nephrotic syndrome, solid organ transplants, or sickle cell disease or other hemoglobinopathies.

Kobayashi, et al. *MMWR* / January 28, 2022 / 71(4);109–117

Pneumococcal Recommendations Clinical Guidance

- Adults with immunocompromising conditions*, cochlear implant, or cerebrospinal fluid leak
  - If choosing PCV15 + PPSV23: Can consider a minimum interval of 8 weeks
  - *Immunocompromising conditions: chronic renal failure, nephrotic syndrome, immunodeficiency, iatrogenic immunosuppression, generalized malignancy, human immunodeficiency virus, Hodgkin disease, leukemia, lymphoma, multiple myeloma, solid organ transplants, congenital or acquired asplenia, sickle cell disease, or other hemoglobinopathies

Kobayashi, et al. *MMWR* / January 28, 2022 / 71(4);109–117

Pneumococcal Recommendations

- Frank is a 66-year old male who presents to your office for a 3-month follow up. He has a history of HTN, dyslipidemia, GERD, and prediabetes.
- His chart notes indicate he is due for IIV, and he has never had a pneumococcal vaccine.
- What should you recommend?

a) PPSV23

b) PCV13 upon shared decision making

c) PCV15+PPSV23 1 year later

d) PCV20

e) Patient counseling

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 2/19/22

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.
- No recommendation/ Not applicable

*Vaccinate after pregnancy.

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 2/19/22

Pneumococcal Recommendations

- Frank asks if he can receive both his pneumococcal vaccine and his flu vaccine at the same visit.

- Can he get IIV and PCV15 or PCV20 same day?

Pneumococcal Vaccine Clinical Guidance

- **Coadministration with other vaccines:**
  - IIV4, aIIV4
  - No data on other vaccines
  - COVID 19 vaccine being studied

Kobayashi, et al. *MMWR* / January 28, 2022 / 71(4);109–117

Pneumococcal Recommendations

Frank's wife calls the office and asks if she should have "the new pneumonia vaccine." She had a dose of PCV13 at the beginning of the pandemic and wants to make sure she is up to date. She is 64 and has diabetes.

What is your recommendation?

- For MenB **booster dose recommendations** for groups listed under "Special situations" and in an outbreak setting (e.g., in community or organizational settings and among men who have sex with men) and additional meningococcal vaccination information, see www.cdc.gov/mmwr/volumes/69/rr/rr6909a1.htm

Note: MenB vaccines may be administered simultaneously with MenACWY vaccines if indicated, but at a different anatomic site, if feasible.

Pneumococcal vaccination

Routine vaccination

- **Age 65 years or older** who have not previously received a pneumococcal conjugate vaccine or whose previous vaccination history is unknown: 1 dose PCV15 or 1 dose PCV20. If PCV15 is used, this should be followed by a dose of PPSV23 given at least 1 year after the PCV15 dose. A minimum interval of 8 weeks between PCV15 and PPSV23 can be considered for adults with an immunocompromising condition,* cochlear implant, or cerebrospinal fluid leak to minimize the risk of invasive pneumococcal disease caused by serotypes unique to PPSV23 in these vulnerable groups.
- For guidance for patients who have already received a previous dose of PCV13 and/or PPSV23, see www.cdc.gov/mmwr/volumes/71/wr/mm7104a1.htm.

Special situations

- **Age 19–64 years** with certain underlying medical conditions or other risk factors** who have not previously received a pneumococcal conjugate vaccine or whose previous vaccination history is unknown: 1 dose PCV15 or 1 dose PCV20. If PCV15 is used, this should be followed by a dose of PPSV23 given at least 1 year after the PCV15 dose. A minimum interval of 8 weeks between PCV15 and PPSV23 can be considered for adults with an immunocompromising condition,* cochlear implant, or cerebrospinal fluid leak to minimize the risk of invasive pneumococcal disease caused by serotypes unique to PPSV23 in these vulnerable groups.
- For guidance for patients who have already received a previous dose of PCV13 and/or PPSV23, see www.cdc.gov/mmwr/volumes/71/wr/mm7104a1.htm.

human immunodeficiency virus, Hodgkin disease, leukemia, lymphoma, multiple myeloma, solid organ transplants, congenital or acquired asplenia, sickle cell disease, or other hemoglobinopathies.

****Note:** Underlying medical conditions or other risk factors include alcoholism, chronic heart/liver/lung disease, chronic renal failure, cigarette smoking, cochlear implant, congenital or acquired asplenia, CSF leak, diabetes mellitus, generalized malignancy, HIV, Hodgkin disease, immunodeficiency, iatrogenic immunosuppression, leukemia, lymphoma, multiple myeloma, nephrotic syndrome, solid organ transplants, or sickle cell disease or other hemoglobinopathies.

Tetanus, diphtheria, and pertussis vaccination

Routine vaccination

- **Previously did not receive Tdap at or after age 11 years:** 1 dose Tdap, then Td or Tdap every 10 years

Special situations

- **Previously did not receive primary vaccination series for tetanus, diphtheria, or pertussis:** 1 dose Tdap followed by 1 dose Td or Tdap at least 4 weeks after Tdap and another dose Td or Tdap 6–12 months after last Td or Tdap (Tdap can be substituted for any Td dose, but preferred as first dose), Td or Tdap every 10 years thereafter
- **Pregnancy:** 1 dose Tdap during each pregnancy, preferably in early part of gestational weeks 27–36
- **Wound management:** Persons with 3 or more doses of tetanus-toxoid-containing vaccine: For clean and minor wounds, administer Tdap or Td if more than 10 years since last dose of tetanus-toxoid-containing vaccine; for all other wounds, administer Tdap or Td if more than 5 years since last dose of tetanus-toxoid-containing vaccine. Tdap is preferred for persons who have not previously received Tdap or whose Tdap history is unknown. If a tetanus-toxoid-containing vaccine is indicated for a pregnant woman, use Tdap. For detailed information, see www.cdc.gov/mmwr/volumes/69/wr/mm6903a5.htm

Varicella vaccination

Routine vaccination

- **No evidence of immunity to varicella:** 2-dose series 4–8 weeks apart if previously did not receive varicella-containing vaccine (VAR or MMRV [measles-mumps-rubella-varicella vaccine] for children); if previously received 1 dose varicella-containing vaccine, 1 dose at least 4 weeks after first dose at least 4 weeks apart, diagnosis or verification of history of varicella or herpes zoster by a health care provider, laboratory evidence of immunity or disease

Special situations

- **Pregnancy with no evidence of immunity to varicella:** VAR contraindicated during pregnancy; after pregnancy (before discharge from health care facility), 1 dose if previously received 1 dose varicella-containing vaccine or dose 1 of 2-dose series (dose 2: 4–8 weeks later) if previously did not receive any varicella-containing vaccine, regardless of whether U.S.-born before 1980
- **Health care personnel with no evidence of immunity to varicella:** 1 dose if previously received 1 dose varicella-containing vaccine; 2-dose series 4–8 weeks apart if previously did not receive any varicella-containing vaccine, regardless of whether U.S.-born before 1980
- **HIV infection with CD4 percentages ≥15% and CD4 count ≥200 cells/mm³ with no evidence of immunity:** Vaccination may be considered (2 doses 3 months apart); VAR contraindicated for HIV infection with CD4 percentage <15% or CD4 count <200 cells/mm³
- **Severe immunocompromising conditions:** VAR contraindicated

Zoster vaccination

Routine vaccination

- **Age 50 years or older:** 2-dose series RZV (Shingrix) 2–6 months apart (minimum interval: 4 weeks; repeat dose if administered too soon), regardless of previous herpes zoster or history of zoster vaccine live (ZVL, Zostavax) vaccination (administer RZV at least 2 months after ZVL)

Special situations

- **Pregnancy:** There is currently no ACIP recommendation for RZV use in pregnancy. Consider delaying RZV until after pregnancy.
- **Immunocompromising conditions (including HIV):** RZV recommended for use in persons age 19 years or older who are or will be immunodeficient or immunosuppressed because of disease or therapy. For detailed information, see www.cdc.gov/mmwr/volumes/71/wr/mm7103a2.htm.

https://www.cdc.gov/vaccines/schedules/downloads/adult/adult-combined-schedule.pdf, accessed 2/19/22

Pneumococcal Recommendations Clinical Guidance

Adults with previous PPSV23 only. Adults who have only received PPSV23 may receive a PCV (either PCV20 or PCV15) ≥1 year after their last PPSV23 dose. When PCV15 is used in those with history of PPSV23 receipt, it need not be followed by another dose of PPSV23.

Adults with previous PCV13. The incremental public health benefits of providing PCV15 or PCV20 to adults who have received PCV13 only or both PCV13 and PPSV23 have not been evaluated. These adults should complete the previously recommended PPSV23[†††††] series (

Kobayashi, et al. *MMWR* / January 28, 2022 / 71(4);109–117

* Alcoholism; chronic heart, liver, or lung disease; chronic renal failure; cigarette smoking; cochlear implant; congenital or acquired asplenia; cerebrospinal fluid leak; diabetes mellitus; generalized malignancy; HIV; Hodgkin disease; immunodeficiency; iatrogenic immunosuppression; leukemia, lymphoma, or multiple myeloma; nephrotic syndrome; solid organ transplant; sickle cell disease; or other hemoglobinopathies.

† https://www.cdc.gov/vaccines/acip/recs/grade/downloads/acip-evidence-recs-framework.pdf

§ https://www.cdc.gov/vaccines/acip/recs/grade/about-grade.html

¶ Immunocompromising conditions are defined as chronic renal failure, nephrotic syndrome, immunodeficiency, iatrogenic immunosuppression, generalized malignancy, HIV, Hodgkin disease, leukemia, lymphoma, multiple myeloma, solid organ transplant, congenital or acquired asplenia, sickle cell disease, or other hemoglobinopathies.

** The case definition used by CDC's Active Bacterial Core surveillance is isolation of *S. pneumoniae* from a normally sterile site or pathogen-specific nucleic acid in a specimen obtained from a normally sterile body site using a validated molecular test. https://www.cdc.gov/abcs/methodology/case-def-ascertain.html

†† Alcoholism; chronic heart, liver, or lung disease; cigarette smoking; or diabetes mellitus.

§§ https://www.cdc.gov/vaccines/acip/recs/grade/pneumo-PCV20-risk-based.html; https://www.cdc.gov/vaccines/acip/recs/grade/pneumo-PCV15-PPSV23-risk-based.html; https://www.cdc.gov/vaccines/acip/recs/grade/pneumo-PCV20-age-based.html; https://www.cdc.gov/vaccines/acip/recs/grade/pneumo-PCV15-PPSV23-age-based.html

¶¶ https://www.cdc.gov/vaccines/acip/recs/grade/pneumo-PCV20-risk-based-etr.html; https://www.cdc.gov/vaccines/acip/recs/grade/pneumo-PCV20-age-based-etr.html; https://www.cdc.gov/vaccines/acip/recs/grade/pneumo-PCV15-PPSV23-risk-based-etr.html; https://www.cdc.gov/vaccines/acip/recs/grade/pneumo-PCV15-PPSV23-age-based-etr.html

*** Serotypes 22F and 33F, in addition to PCV13 serotypes.

††† Serotypes 8, 10A, 11A, 12F, 15B, 22F, and 33F, in addition to PCV13 serotypes.

§§§ Serotypes 2, 8, 9N, 10A, 11A, 12F, 15B, 17F, 20, 22F, and 33F, in addition to PCV13 serotypes.

¶¶¶ Lower bound of the two-sided 95% CI of the OPA GMT ratio (PCV15 / PCV13) to be >0.5.

**** For PCV15-unique serotypes 22F and 33F, defined as the lower bound of the two-sided 95% CI of the OPA GMT ratio (V114 / PCV13) to be >2.0 and the lower bound of the two-sided 95% CI of the differences (V114 – PCV13) between the percentages of participants with a fourfold rise to be >0.1. For serotype 3, defined as the lower bound of the two-sided 95% CI of the OPA GMT ratio (V114 / PCV13) to be >1.2 and the lower bound of the two-sided 95% CI of the differences (V114 – PCV13) between the percentages of participants with a fourfold rise to be >0.

†††† Range reflects the difference in results across studies.

§§§§ Subjects with a fourfold or larger rise in OPA GMT titer postvaccination compared with prevaccination.

¶¶¶¶ Defined as the lower bound of the two-sided 95% CI of the ratio (PCV20 / PCV13) of opsonophagocytic geometric mean titers being >0.5.

***** Lower cost and improved health outcomes compared with previous recommendations.

††††† For adults who have received PCV13 but have not completed their recommended pneumococcal vaccine series with PPSV23, one dose of PCV20 may be used if PPSV23 is not available.

Kobayashi, et al. *MMWR* / January 28, 2022 / 71(4);109–117

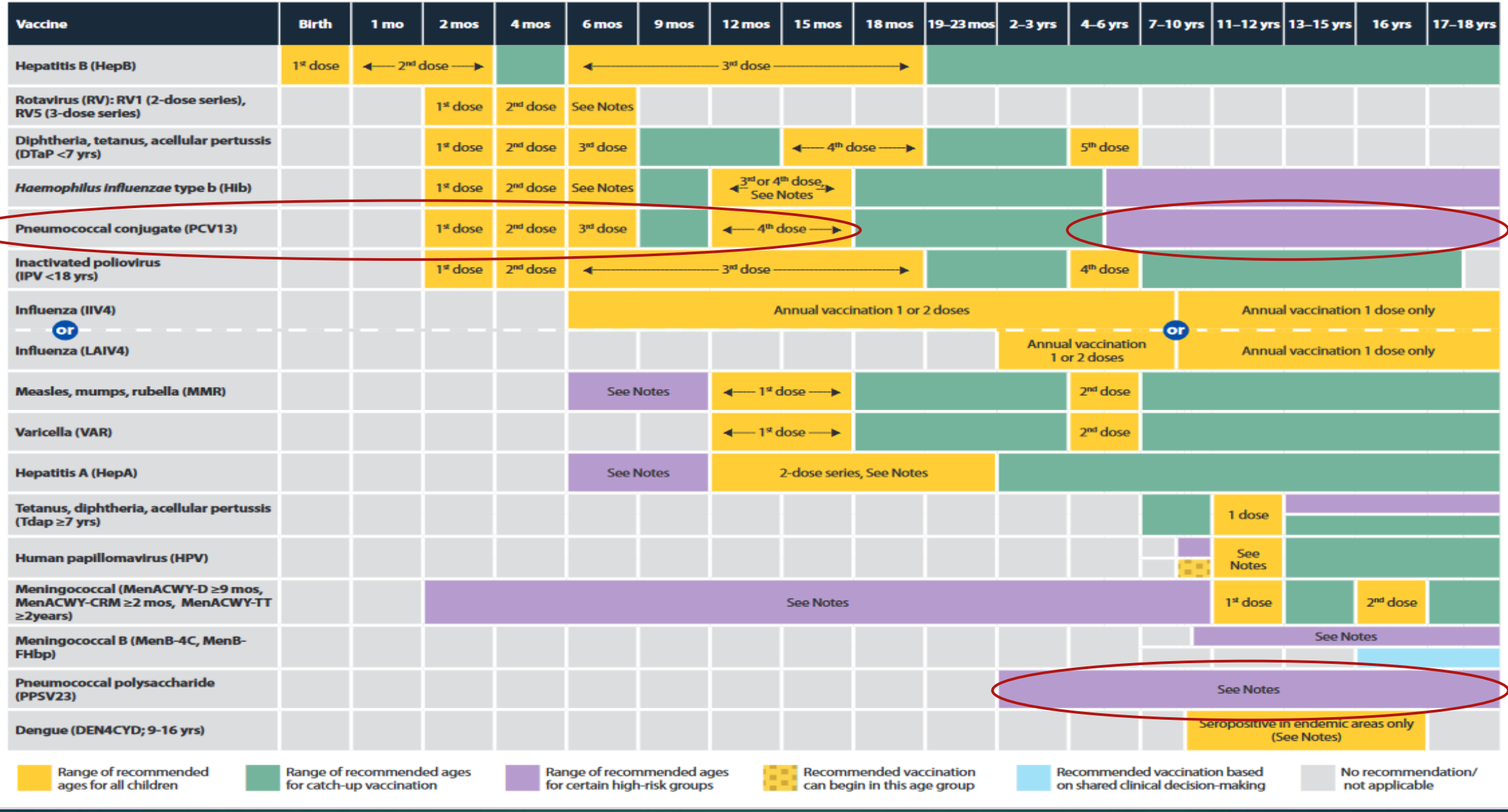
Pneumococcal Recommendations

†††† For adults who have received PCV13 but have not completed their recommended pneumococcal vaccine series with PPSV23, one dose of PCV20 may be used if PPSV23 is not available.

Kobayashi, et al. *MMWR* / January 28, 2022 / 71(4);109–117

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 2/18/22

Notes

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

Meningococcal serogroup A,C,W,Y vaccination (minimum age: 2 months [MenACWY-CRM, Menveo], 9 months [MenACWY-D, Menactra], 2 years [MenACWY-TT, MenQuadfi])

Routine vaccination
- 2-dose series at age 11–12 years; 16 years

Catch-up vaccination
- Age 13–15 years: 1 dose now and booster at age 16–18 years (minimum interval: 8 weeks)
- Age 16–18 years: 1 dose

Special situations
Anatomic or functional asplenia (including sickle cell disease), HIV infection, persistent complement component deficiency, complement inhibitor (e.g., eculizumab, ravulizumab) use:
- **Menveo**
  - Dose 1 at age 2 months: 4-dose series (additional 3 doses at age 4, 6 and 12 months)
  - Dose 1 at age 3–6 months: 3- or 4- dose series (dose 2 [and dose 3 if applicable] at least 8 weeks after previous dose until a dose is received at age 7 months or older, followed by an additional dose at least 12 weeks later and after age 12 months)
  - Dose 1 at age 7–23 months: 2-dose series (dose 2 at least 12 weeks after dose 1 and after age 12 months)
  - Dose 1 at age 24 months or older: 2-dose series at least 8 weeks apart
- **Menactra**
  - **Persistent complement component deficiency or complement inhibitor use:**
    - Age 9–23 months: 2-dose series at least 12 weeks apart
    - Age 24 months or older: 2-dose series at least 8 weeks apart
  - **Anatomic or functional asplenia, sickle cell disease, or HIV infection:**
    - Age 9–23 months: Not recommended
    - Age 24 months or older: 2-dose series at least 8 weeks apart
    - **Menactra®** must be administered at least 4 weeks after completion of PCV13 series.
- **MenQuadfi®**
  - Dose 1 at age 24 months or older: 2-dose series at least 8 weeks apart

Travel in countries with hyperendemic or epidemic meningococcal disease, including countries in the African meningitis belt or during the Hajj (www.cdc.gov/travel/):
- Children less than age 24 months:
  - **Menveo® (age 2–23 months)**
    - Dose 1 at age 2 months: 4-dose series (additional 3 doses at age 4, 6 and 12 months)
    - Dose 1 at age 3–6 months: 3- or 4- dose series (dose 2 [and dose 3 if applicable] at least 8 weeks after previous dose until a dose is received at age 7 months or older, followed by an additional dose at least 12 weeks later and after age 12 months)
    - Dose 1 at age 7–23 months: 2-dose series (dose 2 at least 12 weeks after dose 1 and after age 12 months)
  - **Menactra® (age 9–23 months)**
    - 2-dose series (dose 2 at least 12 weeks after dose 1; dose 2 may be administered as early as 8 weeks after dose 1 in travelers)
- Children age 2 years or older: 1 dose Menveo®, Menactra®, or MenQuadfi®

First-year college students who live in residential housing (if not previously vaccinated at age 16 years or older) or military recruits:
- 1 dose **Menveo®, Menactra®,** or **MenQuadfi®**

Adolescent vaccination of children who received MenACWY prior to age 10 years:
- **Children for whom boosters are recommended** because of an ongoing increased risk of meningococcal disease (e.g., those with complement deficiency, HIV, or asplenia): Follow the booster schedule for persons at increased risk.
- **Children for whom boosters are not recommended** (e.g., a healthy child who received a single dose for travel to a country where meningococcal disease is endemic): Administer MenACWY according to the recommended adolescent schedule with dose 1 at age 11–12 years and dose 2 at age 16 years.

Note: Menactra® should be administered either before or at the same time as DTaP. MenACWY vaccines may be administered simultaneously with MenB vaccines if indicated, but at a different anatomic site, if feasible.

For MenACWY **booster dose recommendations** for groups listed under "Special situations" and in an outbreak setting and additional meningococcal vaccination information, see www.cdc.gov/mmwr/volumes/69/rr/rr6909a1.htm.

Meningococcal serogroup B vaccination (minimum age: 10 years [MenB-4C, Bexsero®; MenB-FHbp, Trumenba®])

Shared clinical decision-making
- **Adolescents not at increased risk** age 16–23 years (preferred age 16–18 years) based on shared clinical decision-making:
  - **Bexsero®:** 2-dose series at least 1 month apart
  - **Trumenba®:** 2-dose series at least 6 months apart; if dose 2 is administered earlier than 6 months, administer a 3rd dose at least 4 months after dose 2.

Special situations
Anatomic or functional asplenia (including sickle cell disease), persistent complement component deficiency, complement inhibitor (e.g., eculizumab, ravulizumab) use:
- **Bexsero®:** 2-dose series at least 1 month apart
- **Trumenba®:** 3-dose series at 0, 1–2, 6 months

Note: Bexsero® and **Trumenba®** are not interchangeable; the same product should be used for all doses in a series.

For MenB **booster dose recommendations** for groups listed under "Special situations" and in an outbreak setting and additional meningococcal vaccination information, see www.cdc.gov/mmwr/volumes/69/rr/rr6909a1.htm.

Pneumococcal vaccination (minimum age: 6 weeks [PCV13], 2 years [PPSV23])

Routine vaccination with PCV13
- 4-dose series at age 2, 4, 6, 12–15 months

Catch-up vaccination with PCV13
- 1 dose for healthy children age 24–59 months with any incomplete* PCV13 series
- For other catch-up guidance, see Table 2.

Special situations
Underlying conditions below: When both PCV13 and PPSV23 are indicated, administer PCV13 first. PCV13 and PPSV23 should not be administered during same visit.

Chronic heart disease (particularly cyanotic congenital heart disease and cardiac failure); chronic lung disease (including asthma treated with high-dose, oral corticosteroids); diabetes mellitus:

Age 2–5 years
- Any incomplete* series with:
  - 3 PCV13 doses: 1 dose PCV13 (at least 8 weeks after any prior PCV13 dose)
  - Less than 3 PCV13 doses: 2 doses PCV13 (8 weeks after the most recent dose and administered 8 weeks apart)
- No history of PPSV23: 1 dose PPSV23 (at least 8 weeks after completing all recommended PCV13 doses)

Age 6–18 years
- No history of PPSV23: 1 dose PPSV23 (at least 8 weeks after completing all recommended PCV13 doses)

Cerebrospinal fluid leak, cochlear implant:

Age 2–5 years
- Any incomplete* series with:
  - 3 PCV13 doses: 1 dose PCV13 (at least 8 weeks after any prior PCV13 dose)
  - Less than 3 PCV13 doses: 2 doses PCV13 (8 weeks after the most recent dose and administered 8 weeks apart)
- No history of PPSV23: 1 dose PPSV23 (at least 8 weeks after any prior PCV13 dose)

Age 6–18 years
- No history of either PCV13 or PPSV23: 1 dose PCV13, 1 dose PPSV23 at least 8 weeks later
- Any PCV13 but no PPSV23: 1 dose PPSV23 at least 8 weeks after the most recent dose of PCV13
- PPSV23 but no PCV13: 1 dose PCV13 at least 8 weeks after the most recent dose of PPSV23

Sickle cell disease and other hemoglobinopathies; anatomic or functional asplenia; congenital or acquired immunodeficiency; HIV infection; chronic renal failure; nephrotic syndrome; malignant neoplasms, leukemias, lymphomas, Hodgkin disease, and other diseases associated with treatment with immunosuppressive drugs or radiation therapy; solid organ transplantation; multiple myeloma:

Age 2–5 years
- Any incomplete* series with:
  - 3 PCV13 doses: 1 dose PCV13 (at least 8 weeks after any prior PCV13 dose)
  - Less than 3 PCV13 doses: 2 doses PCV13 (8 weeks after the most recent dose and administered 8 weeks apart)
- No history of PPSV23: 1 dose PPSV23 (at least 8 weeks after any prior PCV13 dose) and a dose 2 of PPSV23 5 years later

Age 6–18 years
- No history of either PCV13 or PPSV23: 1 dose PCV13, 2 doses PPSV23 (dose 1 of PPSV23 administered 8 weeks after PCV13 and dose 2 of PPSV23 administered at least 5 years after dose 1 of PPSV23)
- Any PCV13 but no PPSV23: 2 doses PPSV23 (dose 1 of PPSV23 administered 8 weeks after the most recent dose of PCV13 and dose 2 of PPSV23 administered at least 5 years after dose 1 of PPSV23)
- PPSV23 but no PCV13: 1 dose PCV13 at least 8 weeks after the most recent PPSV23 dose and a dose 2 of PPSV23 administered 5 years after dose 1 of PPSV23 and at least 8 weeks after a dose of PCV13

https://www.cdc.gov/vaccines/schedules/downloads/child/0-18yrs-child-combined-schedule.pdf, accessed 2/19/22

Pneumococcal Vaccine

PCV in children

- PCV15 and PCV20 being studied
- ACIP to consider:
  - Clinical data
  - Direct and Indirect benefit
  - Disease burden
  - Cost effectiveness

https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2022-01-12/02-Pneumococcal-Kobayashi-508.pdf, accessed 2/25/22

PCV15, PCV20 vaccines

- Dose: 0.5ml IM
- Supplied as single dose or 10 pack prefilled syringes
- Suspension: Hold the prefilled syringe horizontally and shake vigorously immediately prior to use to obtain an opalescent suspension
- Store refrigerated at 2°C to 8°C (36°F to 46°F)
  Do not freeze. Protect from light (PCV15)
- CI: a severe allergic reaction (e.g., anaphylaxis) to any component of the vaccine or to diphtheria toxoid
- No latex in cap
- ADR: Injection site pain, myalgias, fatigue, HA

https://www.merck.com/product/usa/pi_circulars/v/vaxneuvance/vaxneuvance_pi.pdf. Package insert. Vaxneuvance. Merck. Accessed 2/20/22
https://labeling.pfizer.com/ShowLabeling.aspx?id=15428. Package insert. Prevnar 20. Wyeth. 6/21. accessed 2/20/22

Pneumococcal Recommendations

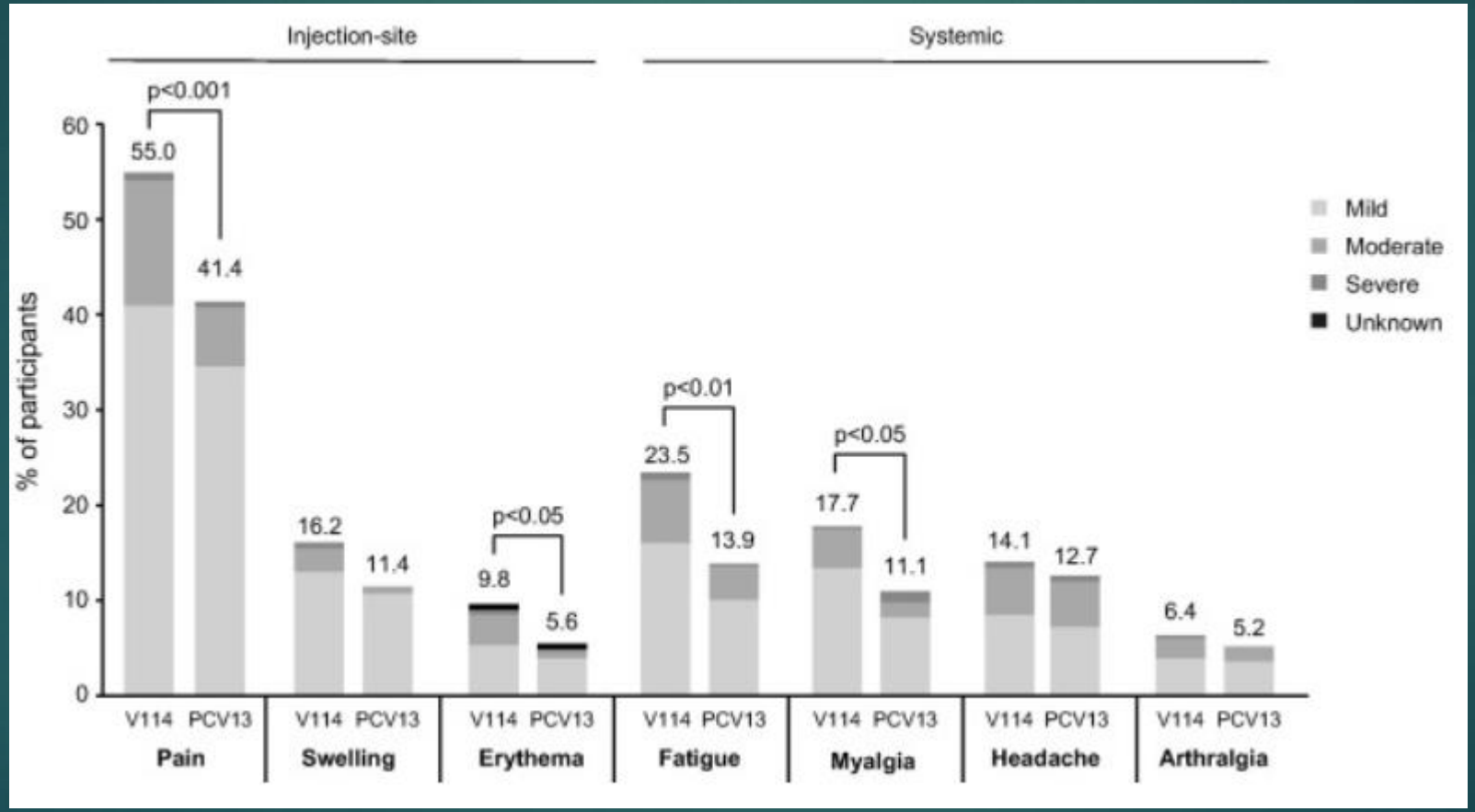
- Evidence based

PCV15 Clinical Trials

- Evaluated healthy adults ≥50, healthy adults ≥50 + PPSV23 at 1 year, adults 18-49 years who are Native American or who have ≥1 risk factor + PPSV23 at 6mo, adults ≥18 years with HIV
- Serum opsonophagocytic activity (OPA) geometric mean titers (GMT) and immunoglobulin G geometric mean concentrations (GMC) were comparable for PCV13 containing serotypes
  - Met noninferiority criteria
  - Superiority criteria for nonPCV strains + serogroup 3

Platt HL, Cardona JF, Haranaka M, et al. PNEU-AGE. Vaccine 2022;40:162–72. https://doi.org/10.1016/j.vaccine.2021.08.049
Merck Sharp & Dohme Corp. PNEU-DAY. Bethesda, MD: US National Library of Medicine; 2021. https://ClinicalTrials.gov/show/NCT03547167
Mohap, et al. AIDS 2021. Epub11/22/21. https://journals.lww.com/aidsonline/Abstract/9000/Safety_and_immunogenicity_of_V114,_a_15_valent.96271.aspx
Song JY, et al. PNEU-PATH. Vaccine 2021;39:6422–36. https://doi.org/10.1016/j.vaccine.2021.08.038
Kobayashi, et al. MMWR Morb Mortal Wkly Rep 2022;71:109–117.

PCV15
Clinical Trials



Song, et al. Vaccine. Volume 30, Issue 43, 15 October 2021, Pages 6422-6436

PCV20 Clinical Trials

- All PCV13 serotypes noninferior
- Of the additional strains, type 8 did not meet noninferiority criteria
  - Compared with PPSV23 recipients, PCV20 recipients had numerically higher GMTs and a higher percentage of seroresponders to six of seven (not serotype 8) shared non-PCV13 serotypes
- Did not look at immune compromised patients

Essink B, et al. Open Forum Infect Dis 2020;7(Supplement_1):S2. https://doi.org/10.1093/ofid/ofaa417.002
Klein NP, et al. Vaccine 2021;39:5428–35. https://doi.org/10.1016/j.vaccine.2021.07.004
Hurley D, et al. Clin Infect Dis 2021;73:e1489–97. https://doi.org/10.1093/cid/ciaa1045e

Pneumococcal Recommendations

- Address disparities in pneumococcal disease burden and vaccination rates

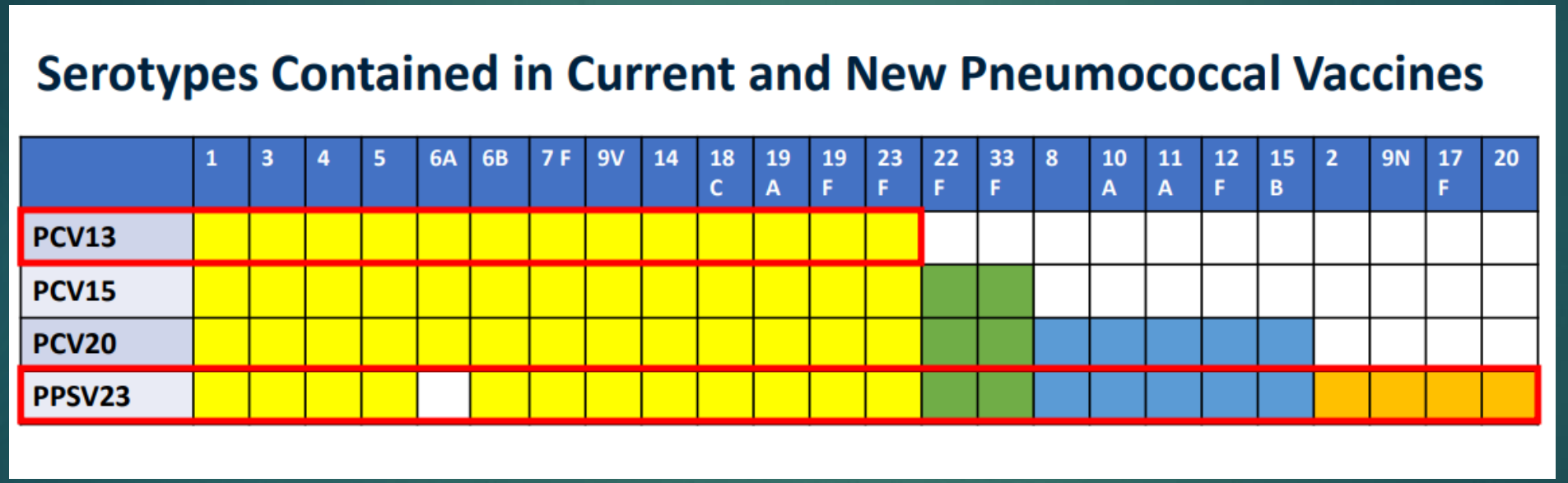
Pneumococcal Disease

Streptococcus pneumoniae, a bacteria with > 100 serotypes

- Invasive Disease (IPD)
  - 2019: ~30,000 cases
    - ~43% in ages ≥65
    - ~48% in ages 18-64 with risk factor
    - ~3000 deaths
  - Pneumococcal bacteremia
    - 5,000 cases/year
    - Fatality 12%
  - Pneumococcal meningitis
    - 2000 cases/year
    - Fatality 12-14%
- Non-invasive disease
  - Pneumococcal pneumonia
    - 155,000 hx/year
    - 5-7% fatality
  - Otitis media

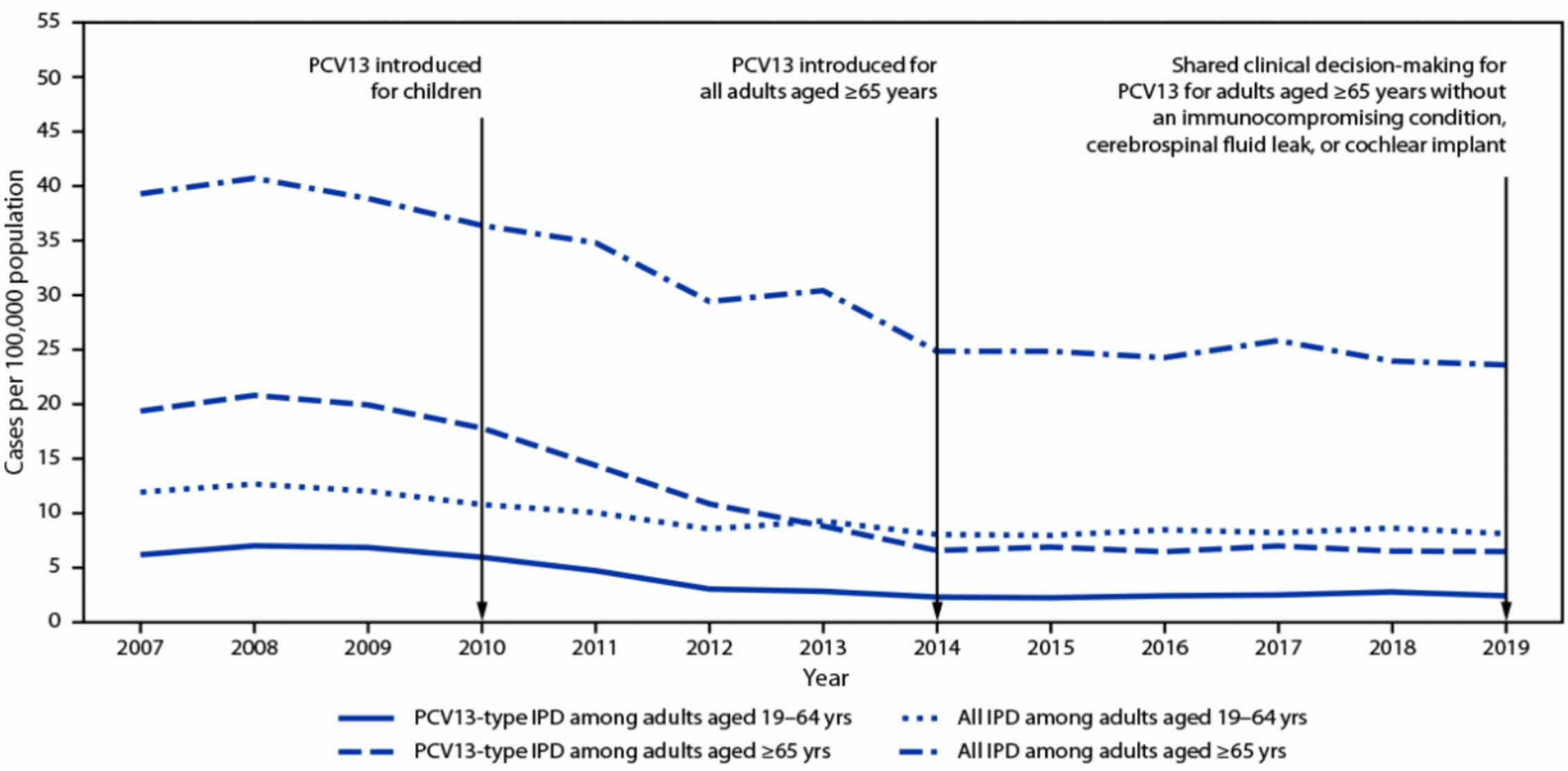
http://www.cdc.gov/vaccines/pubs/pinkbook/pneumo.html, accessed 2/20/22
https://www.cdc.gov/abcs/downloads/SPN_Surveillance_Report_2019.pdf, accessed 2/21/22

Pneumococcal Vaccine Coverage



https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2021-10-20-21/02-Pneumococcal-Kobayashi-508.pdf

FIGURE. Incidence of all invasive pneumococcal disease and 13-valent pneumococcal conjugate vaccine-type* invasive pneumococcal disease among adults aged ≥19 years, by invasive pneumococcal disease type and age group — United States, 2007–2019†



Kobayashi, et al. *MMWR* / January 28, 2022 / 71(4);109–117

Pneumococcal Disease Burden of disease

- IPD incidence for ages >65 years: 24 per 100,000
- Cases associated with IPD vaccine serotypes

	PCV13	PCV15	PCV20	PPSV23
Age≥65	27%	+15% (42%)	+27% (54%)	+35% (62%)
Ages 19-64	30%	+13% (43%)	+28% (55%)	+43% (73%)
CAP	4.6%	+1.4 (5.6%)	+3.3% (7.9%)	-

Kobayashi, et al. *MMWR* / January 28, 2022 / 71(4);109–117

Proportion of Medicare beneficiaries aged ≥65 years with claims submitted for pneumococcal vaccination

Category	Total enrolled beneficiaries	≥1 dose PPSV23† (%)	≥1 dose PCV13 § (%)	Both PPSV23 & PCV13¶ (%)	Any pneumococcal (%)**
White	21,911,116	47.8	51.2	33.9	65.0
Black	1,803,442	35.1	34.9	20.8	49.3
Asian	525,916	43.2	41.9	25.5	59.6
Hispanic	400,149	32.2	30.1	16.2	46.1
American Indian/Alaska Native	121,697	38.2	40.2	21.0	57.4
West Virginia	104,310	41.0	41.6	26.0	56.6

https://www.cdc.gov/vaccines/imz-managers/coverage/adultvaxview/pubs-resources/pcv13-medicare-beneficiaries-2010-2019.html, accessed 2/21/22

Proportion of Medicare beneficiaries aged ≥65 years with claims submitted for pneumococcal vaccination

Category	Total enrolled beneficiaries	≥1 dose PPSV23† (%)	≥1 dose PCV13 § (%)	Both PPSV23 & PCV13¶ (%)	Any pneumococcal (%)**
Age (years)					
65–69	7,957,095	29.7	40.4	20.5	49.6
70–74	6,796,985	44.8	51.2	33.2	62.8
75–79	4,743,679	55.0	55.4	39.4	71.0
80–84	3,150,261	62.1	55.4	42.5	75.1
>85	3,110,957	62.2	52.4	39.3	75.3

https://www.cdc.gov/vaccines/imz-managers/coverage/adultvaxview/pubs-resources/pcv13-medicare-beneficiaries-2010-2019.html, accessed 2/21/22

Proportion of Medicare beneficiaries aged ≥65 years with claims submitted for pneumococcal vaccination

Category	Total enrolled beneficiaries	≥1 dose PPSV23† (%)	≥1 dose PCV13 § (%)	Both PPSV23 & PCV13¶ (%)	Any pneumococcal (%)**
Immunocompromising Condition§§					
Yes	16,813,636	53.8	55.2	37.8	71.2
No	8,945,341	32.1	38.2	21.9	48.4
Underlying conditions ¶¶					
Yes	21,665,388	50.2	52.5	35.0	67.7
No	4,093,589	25.4	32.5	18.0	39.9

https://www.cdc.gov/vaccines/imz-managers/coverage/adultvaxview/pubs-resources/pcv13-medicare-beneficiaries-2010-2019.html, accessed 2/21/22

Pneumococcal Recommendations

Advantages of PCV20 Use Alone	Disadvantages of PCV20 Use Alone
• Acceptable and feasible to implement a single vaccine option • Cost-saving* in cost-effectiveness analyses • Expected to provide better protection for the serotypes covered by PPSV23 alone	• Clinical significance of lower immunogenicity vs. PCV13 unknown • No data in immunocompromised adults • Losing protection against PPSV23, non-PCV20 serotypes
Advantages of PCV15+PPSV23	**Disadvantages of PCV15+PPSV23**
• Provides broad serotype coverage • Age-based use at age 65 was cost-saving* according to CDC's cost-effectiveness analysis	• Logistically more challenging to administer PCV15-PPSV23 vaccine series • Need to know vaccination history to correctly complete series • Can result in lower serotype coverage if series not completed

*lower cost and better health outcome compared to current recommendations

https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2021-10-20-21/02-Pneumococcal-Kobayashi-508.pdf, accessed 2/18/22

Thank you for your attention!

dani.dolin.m@wvumedicine.org

"Prevent all the disease you can, then treat the rest"

- John Grabenstein, RPh, PhD, ScD

A special thanks to Tony, the Scout dad who helped me take my slides from n = 76 to where they are today