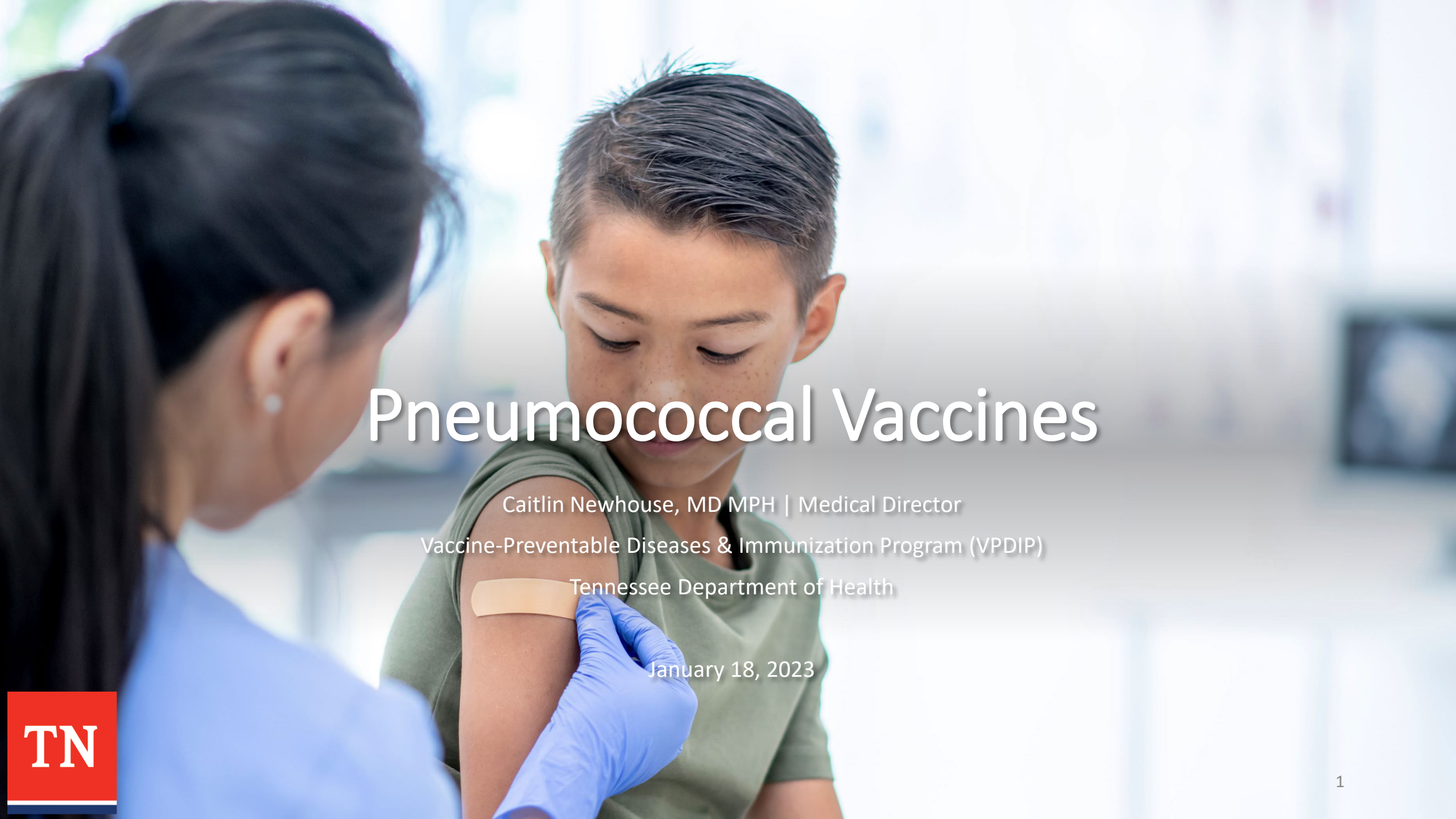

Pneumococcal Vaccines

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Tennessee Department of Health

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Disclosures

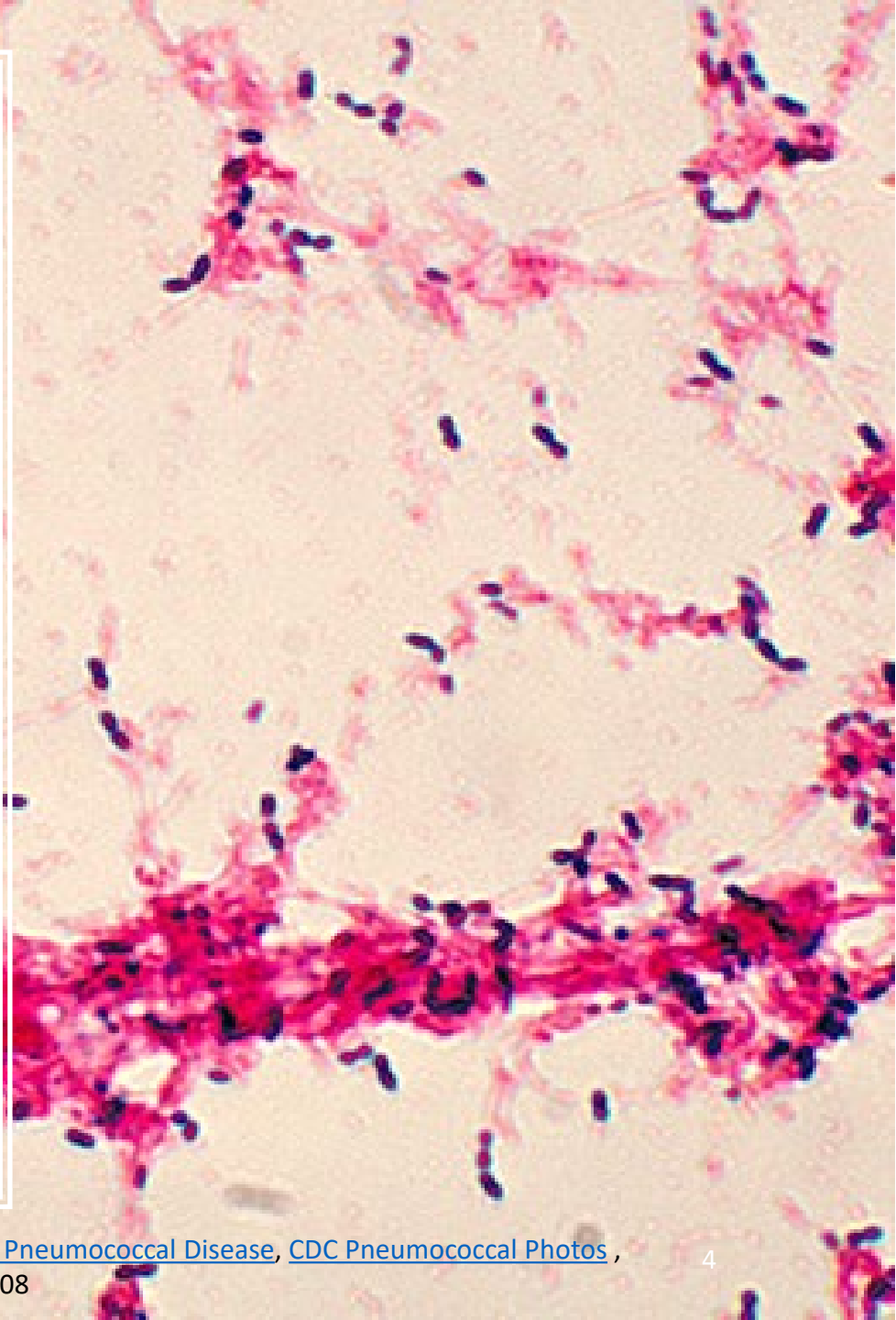
I do not have any financial relationships to disclose.

Objectives

- Describe the mechanism of clinical presentation and epidemiology of *Streptococcus pneumoniae.*
- List currently available pneumococcal vaccines and describe basic indications, storage and handling of each vaccine.
- Describe recent and upcoming changes to the ACIP Schedules related to pneumococcal vaccines.
- Answer frequently asked questions about the available pneumococcal vaccines.

Streptococcus pneumoniae

- Facultatively anerobic, lancet-shaped, gram-positive diplococci (bacteria)
- Commonly found in respiratory tract (nasopharynx)
- Encapsulated
  - 100 serotypes
  - Seroprevalence varies by geography & age
  - Most serotypes can cause serious disease
  - Fewer than 20 serotypes are responsible for majority of infections

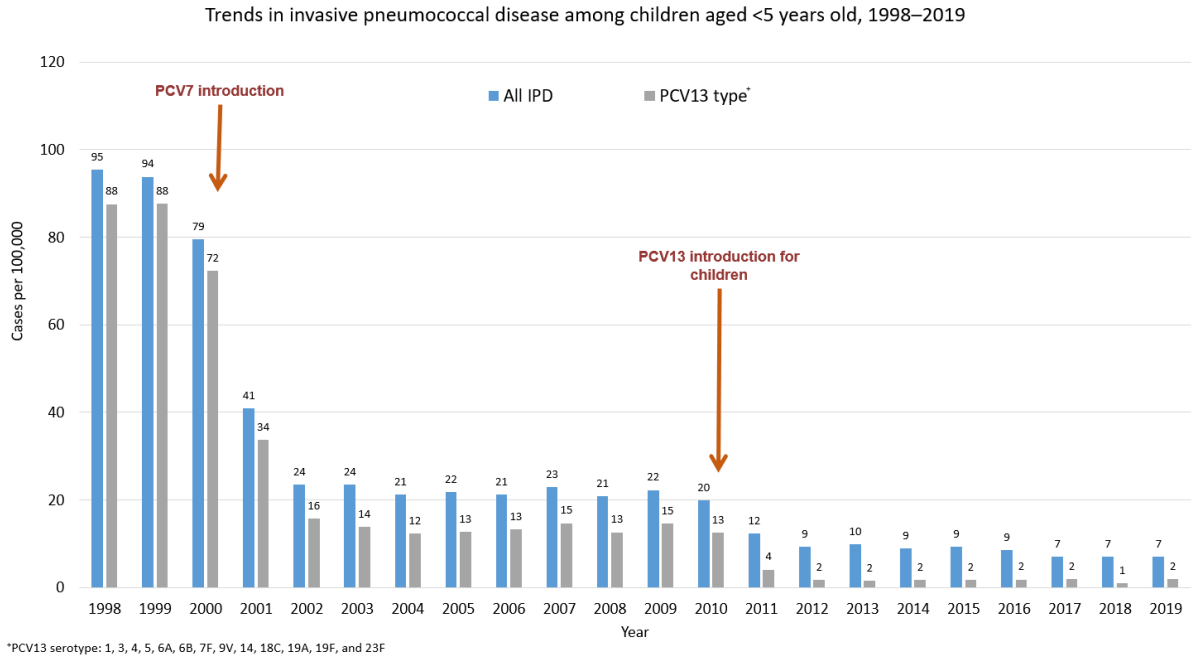


Source: CDC Pink Book Chapter 17: Pneumococcal Disease, CDC Pneumococcal Photos , Marshall The Vaccine Handbook 2008

Epidemiology

- Spreads person-to-person
- More common in winter and early spring
- Unknown timing of infectious period

- >90% decline in invasive pneumococcal disease among children < 5 years from 1998 to 2019
- 17,680 cases and 2,580 deaths from invasive pneumococcal disease (2020)



Source: Immuize.org, CDC Pneumococcal Disease Surveillance and Reporting, ABCs Report Streptococcus Pneumoniae, 2020

Clinical Disease

- Wide clinical spectrum of disease
  - Invasive: pneumonia with or without bacteremia, meningitis, septic arthritis
  - Non-invasive: otitis media, sinusitis
- Susceptibility to penicillin has improved since 1990s

- Adults:
  - 10-30% of community acquired pneumonia
- Children:
  - Bacteremia
  - Leading cause of meningitis in children in US

Source: CDC Pink Book Chapter 17: Pneumococcal Disease, Marshall The Vaccine Handbook 2008

100 years of Pneumococcal Vaccine History

1911

1940

1960

1977

1983

PNEUMOVAX 23
(Pneumococcal Vaccine Polyvalent)

2000

Prevnar 7

2010

Prevnar 13®
Pneumococcal 13-valent Conjugate Vaccine
(Diphtheria CRM_{197} Protein)

2021-2022

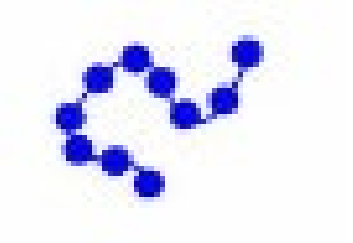
Prevnar 20®
Pneumococcal 20-valent
Conjugate Vaccine

Vaxneuvance™
Pneumococcal 15-valent
Conjugate Vaccine

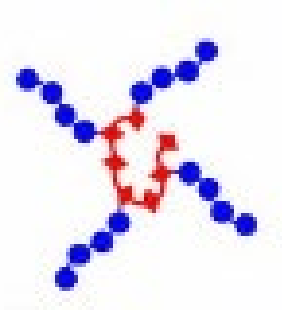
2022

Available Pneumococcal Vaccines

- Polysaccharide:
  - PPSV23 (Pneumovax 23, Merck)



- Conjugate:
  - PCV13 (Prevnar, Pfizer)
  - PCV15 (Vaxneuvance, Merck)
  - PCV20 (Prevnar 20, Pfizer)



Source: [Immuize.org Ask the Experts Pneumococcal Vaccines]
Images from: Rappuoli et al. On the mechanisms of conjugate vaccines. 2019.

Common Pneumococcal Serotypes by Vaccine

	1	2	3	4	5	6A	6B	7F	8	9N	9V	10A	11A	12F	14	15B	17F	18C	19A	19F	20	22F	23F	33F
PCV13	x		x	x	x	x	x	x			x				x			x	x	x			x	
PCV15	x		x	x	x	x	x	x			x				x			x	x	x		x	x	x
PCV20	x		x	x	x	x	x	x	x		x	x	x	x	x	x		x	x	x		x	x	x
PPSV23	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x

Source: [Immuize.org Ask the Experts Pneumococcal Vaccines](), Marshall The Vaccine Handbook 2008

PPSV23 (Pneumovax 23)

- Licensed for 2 years +
- 1983
- Indications:
  - Children ages 2 years + with risk factors for pneumococcal disease
  - With PCV15 for adults with increased risk for invasive pneumococcal disease
  - With PCV15 for adults 65 years + for prevention of pneumococcal pneumonia

PNEUMOVAX 23
(Pneumococcal Vaccine Polyvalent)

Source: Immuize.org Ask the Experts Pneumococcal Vaccines

PPSV23 Storage & Handling

- Clear, sterile solution supplied as either:
  - A box of 10-single dose vials, colored with purple cap and stripe on vial labels and cartons, or
  - A box of 10-single-dose, pre-filled syringes with tip caps, color coded with a violet plunger rod and purple stripe on the syringe labels and cartons
- Store refrigerated at 2°C–8°C (36°F–46°F)
- Single 0.5 mL dose administered IM or SC

Source: Merck Pneumovax23 How supplied/Storage and Handling for PNEUMOVAX23
Pneumovax Highlights of Prescribing Information

PCV 13 (Prevnar 13)

- Licensed for 6 weeks +
- 2010
- Indications:
  - All children < 5 years
  - Children 6-18 years without prior PCV13 with high-risk invasive pneumococcal disease
- ** No longer recommended for use in adults

Source: Immuize.org Ask the Experts Pneumococcal Vaccines
Prevnar 13 Information Pfizer

PCV 13 Storage & Handling

- White suspension supplied as:
  - Single-dose prefilled syringes, either 10 per package or 1 per package
- Store refrigerated at 2°C–8°C (36°F–46°F)
- Single 0.5 mL dose administered IM only
  - Shake vigorously prior to administration to obtain homogenous white suspension

Source: PREVNAR13 Dosage and Administration

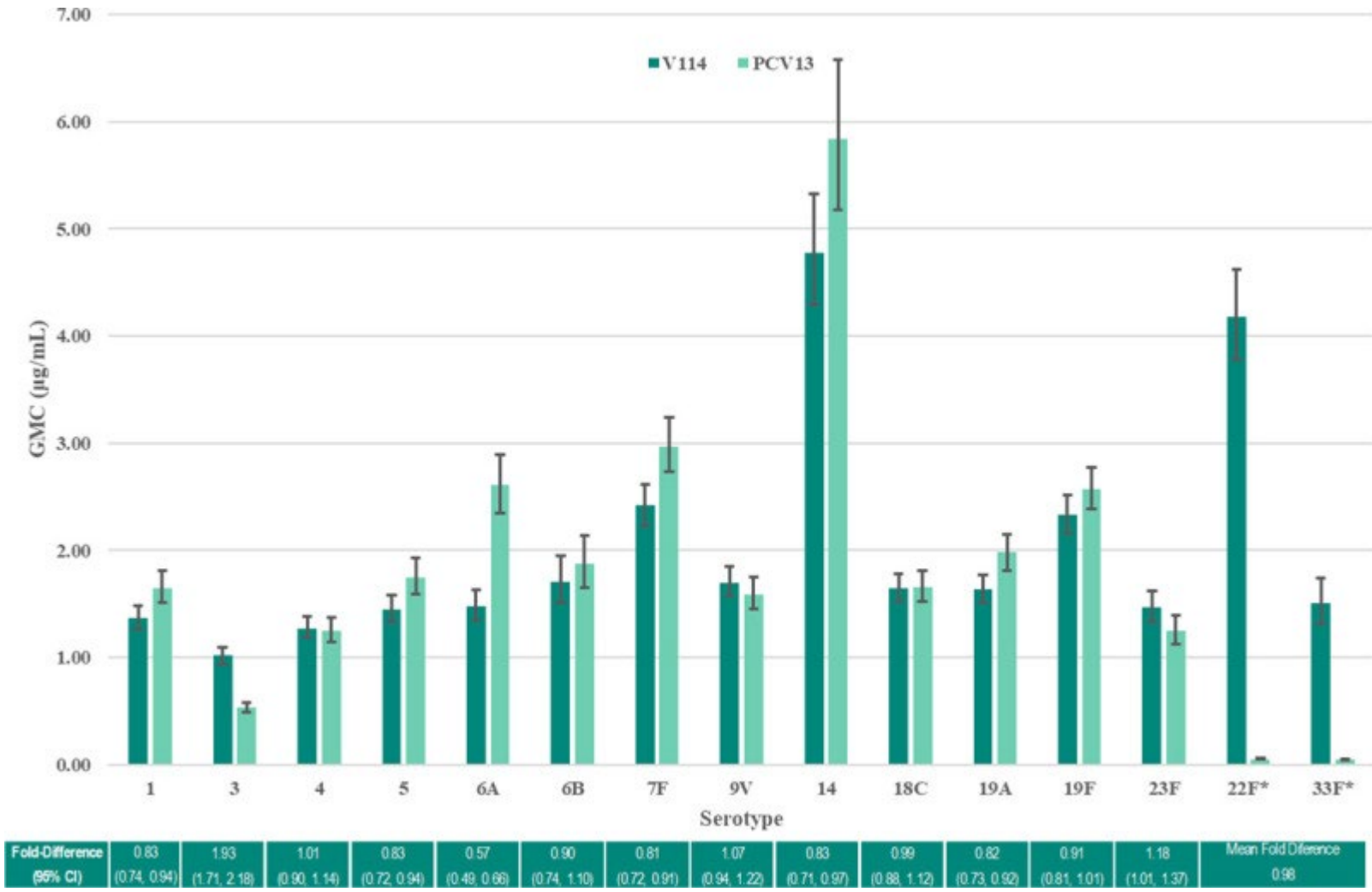
PCV 15 (Vaxneuvance)

- Licensed for adults 18 years+ (2021)
- Licensed for 6 weeks + (September 2022)
- Indications:
  - **All children < 5 years**
  - **Children 6-18 years without prior PCV13 with high-risk invasive pneumococcal disease**
  - Adults who have not previously received pneumococcal conjugate vaccine
  - Followed by PPSV23 for adults at increased risk of invasive pneumococcal disease and all adults 65 years+
- Similar safety and immunogenicity profile as PCV13

Source: Immuize.org Ask the Experts Pneumococcal Vaccines, Kobayashi MMWR Updated ACIP Recommendations 2022

A Phase II Trial of Safety, Tolerability and Immunogenicity of V114, a 15-Valent Pneumococcal Conjugate Vaccine, Compared with 13-Valent Pneumococcal Conjugate Vaccine in Healthy Infants

- Immune responses of both PCV 15 lots were noninferior to PCV13 for all 13 shared serotypes



IgG GMC antibody responses 1-month PD3 PCV15 versus PCV13

Platt HL, et al. A Phase II Trial of Safety, Tolerability and Immunogenicity of V114, a 15-Valent Pneumococcal Conjugate Vaccine, Compared With 13-Valent Pneumococcal Conjugate Vaccine in Healthy Infants. Pediatr Infect Dis J. 2020.

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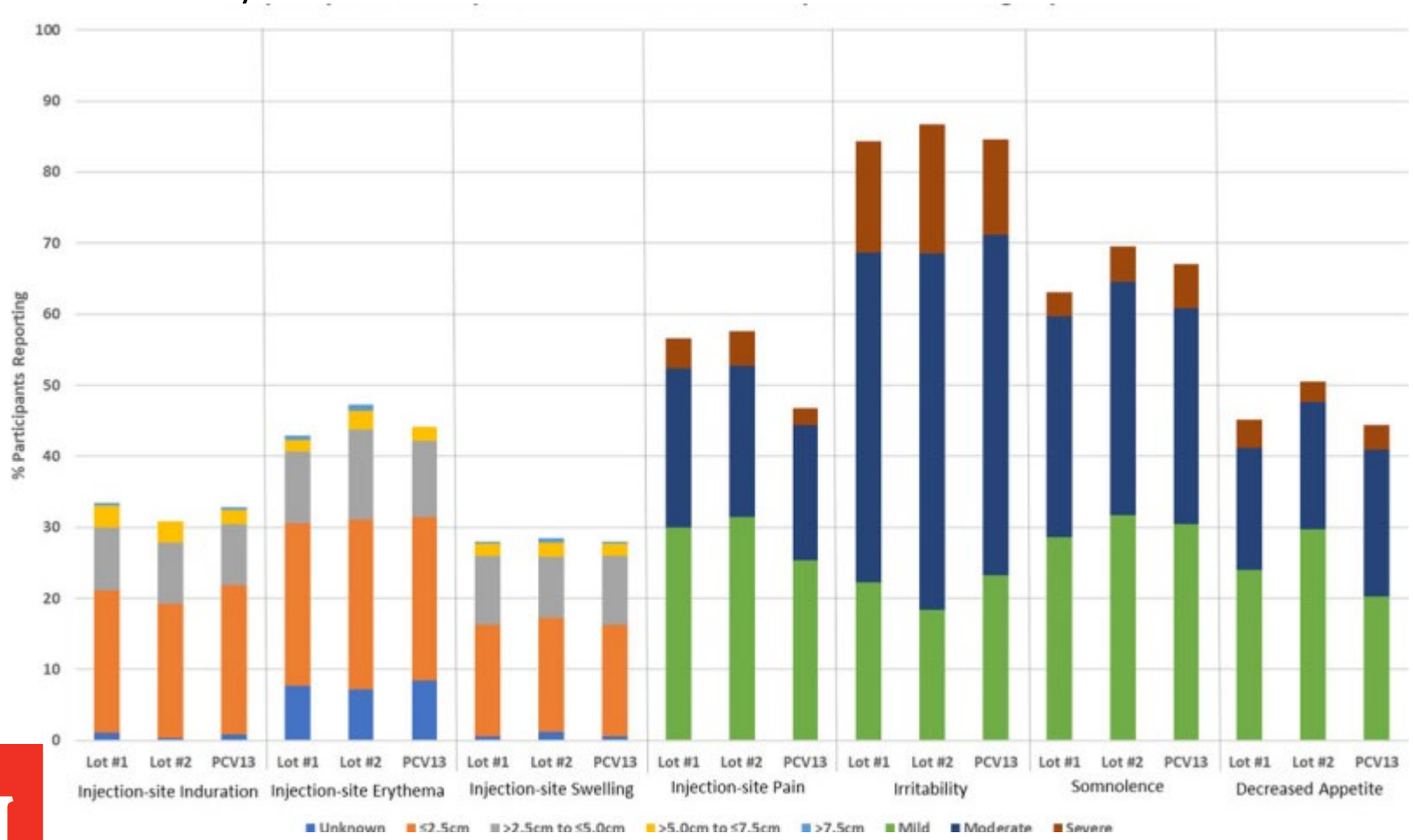


- The majority of injection-site and systemic AEs were mild-moderate
  - Irritability, somnolence, decreased appetite
  - Elevated temperatures

Frequency and intensity of injection-site and systemic adverse events days 1–14 following any vaccination

Platt HL, et al. A Phase II Trial of Safety, Tolerability and Immunogenicity of V114, a 15-Valent Pneumococcal Conjugate Vaccine, Compared With 13-Valent Pneumococcal Conjugate Vaccine in Healthy Infants. Pediatr Infect Dis J. 2020.

PCV 15 Storage & Handling

- Opalescent suspension supplied as:
  - Single-dose prefilled syringes, either 10 per carton or 1 per carton
- Store refrigerated at 2°C–8°C (36°F–46°F)
- Single 0.5 mL dose administered IM only
  - Shake vigorously prior to administration to obtain opalescent suspension

Source: Vaxneuvance Package Insert FDA
Vaxneuvance Storage and Handling

ACIP* recommends 15-valent pneumococcal conjugate vaccine (PCV15) as an option for pneumococcal conjugate vaccination of children**

- PCV13 and PCV15:
  - can be used interchangeably
  - are recommended for all children aged 2–59 months and some others based on risk factors
  - can be administered at the same time as other routine vaccines, including COVID-19, using different syringes and vaccine sites
- PCV15 can be used according to currently recommended PCV13 dosing and schedules

Make sure your patients are up to date with their pneumococcal vaccinations

* ACIP (Advisory Committee on Immunization Practices)

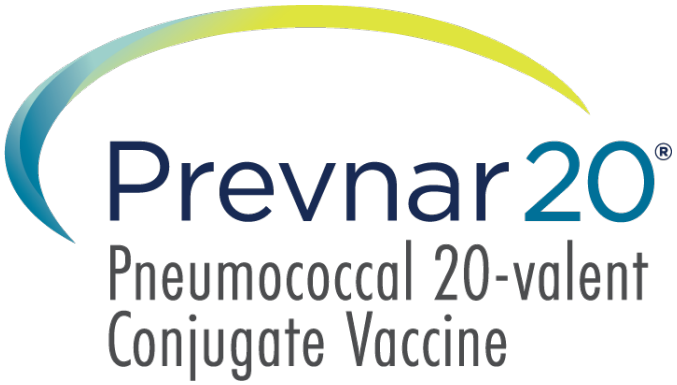
** Risk-based recommendations on use of PPSV23 for people aged 2–18 years with certain underlying medical conditions that increase the risk for pneumococcal disease have not changed.

bit.ly/mm7137a3

SEPTEMBER 22, 2022

MMWR

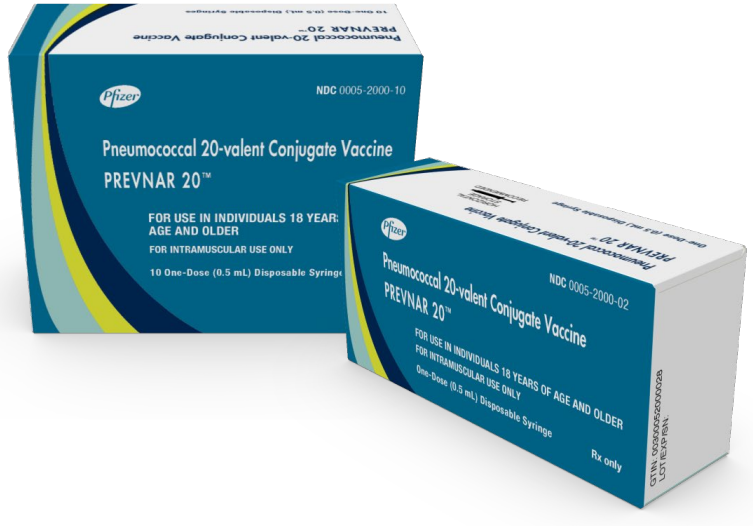
PCV20 (Prevnar 20)



- Licensed for adults 18 years +
- 2021
- Indications:
  - Any adults who have not previously received pneumococcal conjugate vaccine
  - Adults at increased risk of invasive pneumococcal disease
  - All adults 65 years+

Source: Immuize.org Ask the Experts Pneumococcal Vaccines Prevnar 20 Information

PCV 20 Storage & Handling



- White suspension supplied as:
  - Single-dose prefilled syringes
- Store refrigerated at 2°C–8°C (36°F–46°F)
- Single 0.5 mL dose administered IM only
  - Shake vigorously prior to administration to obtain homogenous white suspension

Source: Prevnar 20 Administration Info

Advisory Committee on Immunization Practices (ACIP)

2022* ACIP Schedule for Children

PCV 13 or PCV 15*: All children < 5 years for routine vaccination
Children 6-18 years without prior PCV13 with high-risk invasive pneumococcal disease

PPSV23: Children ages 2 years + with risk factors for pneumococcal disease

Source: ACIP 2022 Immunization Schedules

Childhood ACIP Immunization Schedule by Medical Indication, 2022*

VACCINE	INDICATION									
	Pregnancy	Immunocom-promised status (excluding HIV infection)	HIV infection CD4+ count		Kidney failure, end stage renal disease, or on dialysis	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 count of <200/mm3	>15% and total CD4 count of >200/mm3						
Pneumococcal Conjugate (PCV 13 or 15*)										
Pneumococcal Polysaccharide (PPSV23)										

Recommended and additional doses may be necessary based on medical condition or vaccine

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

No recommendation/not applicable

Source: ACIP 2022 Immunization Schedules

Adult ACIP Immunization Schedule by Medical Indication, 2022

VACCINE	INDICATION										
	Pregnancy	Immunocom-promised status (excluding HIV infection)	HIV infection CD4+ count		End-stage renal disease, or on hemodialysis	Heart or lung disease; alcoholism	Asplenia or persistent complement deficiencies	Chronic liver disease	Diabetes	Health care personnel	Men who have sex with men
			<15% or total CD4 count of <200/mm3	>15% and total CD4 count of >200/mm3							
Any Pneumococcal Vaccine PCV 13, 15, 20 or PPSV23											

Recommended and additional doses may be necessary based on medical condition or vaccine

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

No recommendation/not applicable

Source: ACIP 2022 Immunization Schedules

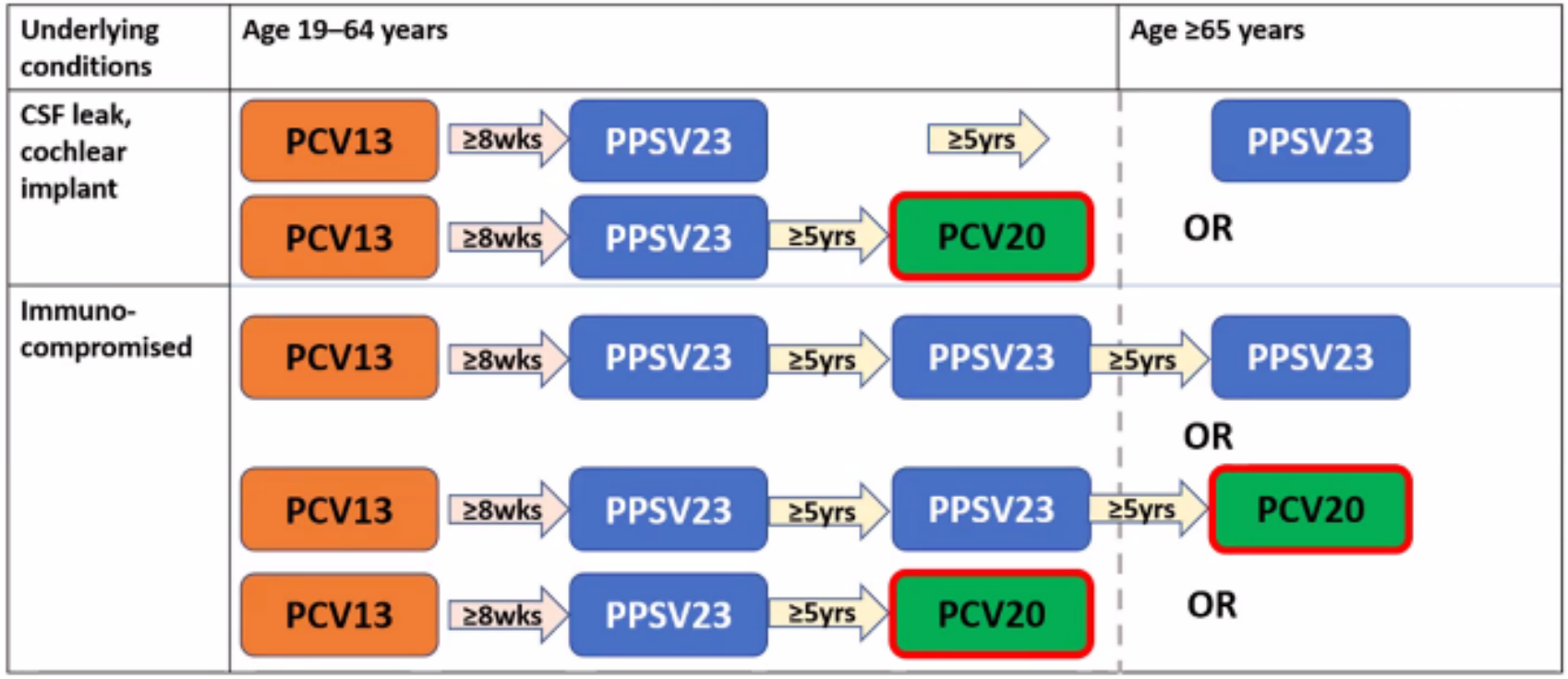
ACIP Recommendations: October 2022

- Adults with an **immunocompromising condition, cochlear implant, or cerebrospinal fluid leak** who have received both PCV13 and PPSV23 with incomplete vaccination status are recommended to complete their pneumococcal vaccine series by receiving either a dose of PCV20 at least 5 years after the last pneumococcal vaccine dose or PPSV23 as previously recommended.
- Shared clinical decision-making is recommended regarding administration of PCV20 for **adults aged ≥65 years** who completed their vaccine series with both PCV13 and PPSV23. If a decision to administer PCV20 is made, a dose of PCV20 is recommended at least 5 years after the last pneumococcal vaccine dose.
- **Adults** who have received PCV13 only are recommended to receive a dose of PCV20 at least 1 year after the PCV13 dose or PPSV23 as previously recommended to complete their pneumococcal vaccine series.

Source: Association of Immunization Managers Member ACIP Summary Email 10/20/2022

New in the 2023 ACIP Schedule for Adults

Group 1: Immunocompromised adults who received PCV13+PPSV23 but have not completed their series



Recommend either a dose PCV20 (at least 5 yrs after last pneumococcal vaccine dose) or PPSV23 as previously recommended

New in the 2023 ACIP Schedule for Adults

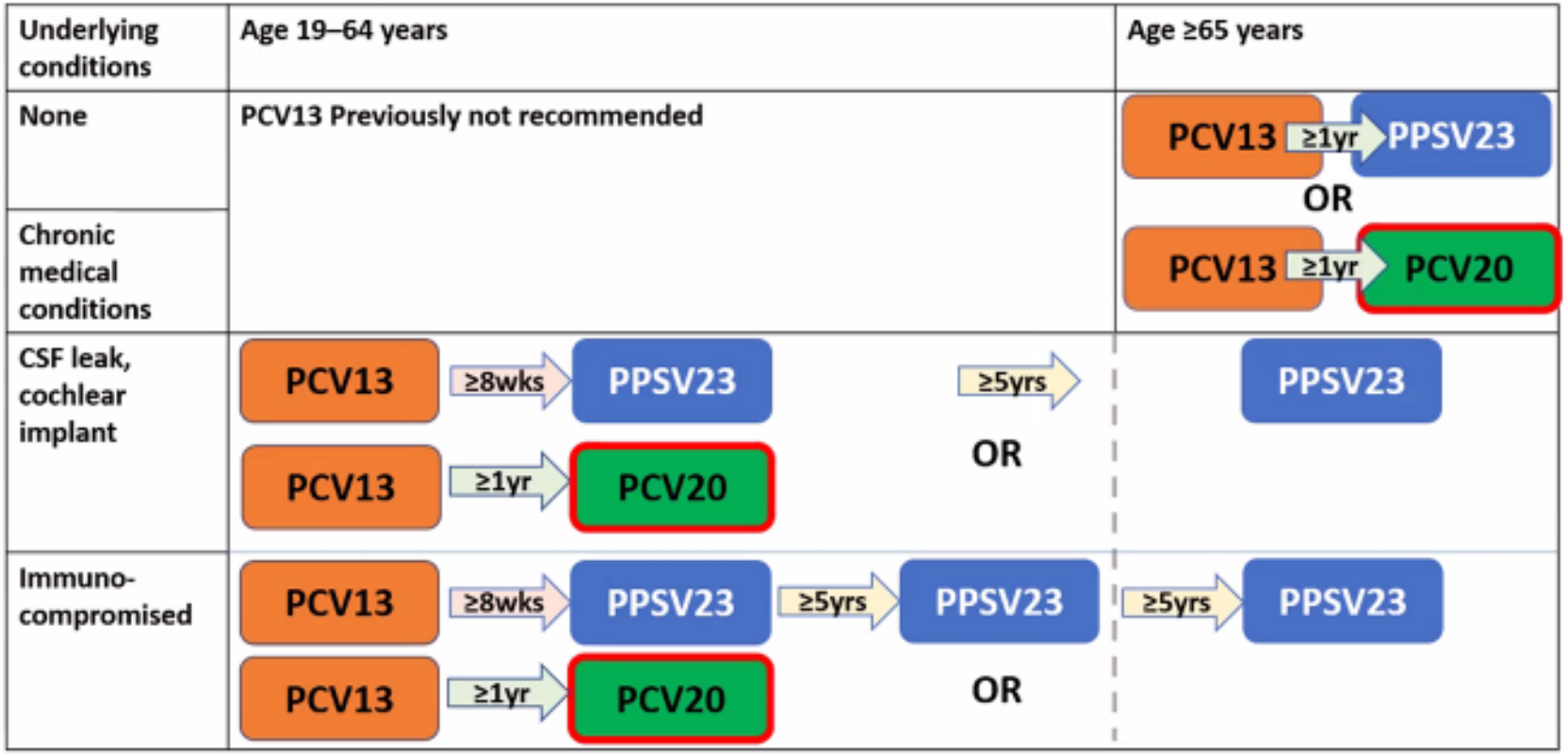
Group 2: Adults aged ≥65 yrs who completed the series with PCV13+PPSV23

Shared clinical decision making

If decision to administer PCV20 is made, a dose of PCV20 is recommended at least 5 years after last pneumococcal vaccine dose.

New in the 2023 ACIP Schedule for Adults

Group 3: Adults who started the series with PCV13 but have not received PPSV23



Recommend either a dose PCV20 (>1 yr after PCV13) or PPSV23 as previously recommended

Pneumococcal Vaccine FAQs

Why are conjugate vaccines recommended to be given first when a patient is getting both a PCV and PPSV23 vaccines? Wouldn't PPSV23 protect them against additional strains of the pneumococcal bacteria?

- Evaluation of immune response has shown that PCV then PPSV gives the best immune response to both vaccines.
  - PPSV23 → PCV → lower antibody responses 1 year later
  - PCV → PPSV → higher antibody responses 1 year later

- *Remember: Polysaccharide vaccines are not effective under age 2 years.*

Source: Immuize.org Ask the Experts Pneumococcal Vaccines

Why should we not give PCV vaccines to someone who has had a serious reaction to a diphtheria-containing vaccine in the past?

- PCV vaccines are conjugated to a type of diphtheria-toxoid. If someone has a past history of anaphylaxis following diphtheria-containing vaccine, it might be due to the diphtheria toxoid, and the cause of the anaphylactic allergy should be identified before the administration of a PCV vaccine.

Source: Immuize.org Ask the Experts Pneumococcal Vaccines

Can I give other vaccines at the same time I give either PCV13, PCV15, PCV20 or PPSV23 to a patient?

- Yes, with several exceptions. These are all inactivated vaccines, which means you can give other recommended vaccines at the same visit (using separate syringes) or at any later time with no waiting period following the vaccination.
- Here are the exceptions:
  - 1. You cannot give both PCV and PPSV23 vaccines at the same time.
  - 2. If the person has functional/anatomic asplenia or HIV infection, observe these rules:
    - If using Menveo (MenACWY-CRM) or MenQuadfi (MenACWY-TT) you may give PCV at the same visit or at any interval before or after each other.
    - If using Menactra (MenACWY-D) vaccine, you should give PCV first and wait 4 weeks after the final dose of PCV before giving Menactra.

Source: Immuize.org Ask the Experts Pneumococcal Vaccines

The pneumococcal conjugate vaccine (PCV20) package insert says that in adults, antibody responses to Prevnar 13 (Pfizer) were diminished when given with inactivated influenza vaccine. Does this mean we should not give PCV20 and influenza vaccine at the same visit?

- No. The available data have been interpreted that any changes in antibody response to either vaccine's components were clinically insignificant.
- If PCV20 and influenza vaccine are both indicated and recommended, they **should be administered** at the same visit.

Source: Immuize.org Ask the Experts Pneumococcal Vaccines

Our 5-year-old patient is planning a surgery for cochlear implant or splenectomy. When should they be vaccinated?

- Ideally, PCV, Hib vaccine, meningococcal ACWY conjugate vaccine, and meningococcal B vaccine should be given at least 14 days before splenectomy, if possible.
- Doses given during the 2 weeks (14 days) before surgery can be counted as valid.
- If the doses cannot be given prior to the surgery, they should be given as soon as the patient's condition has stabilized after surgery.

- ***This guidance is true for children and adults.***

Source: Immuize.org Ask the Experts Pneumococcal Vaccines

Our 65-year-old patient needs PCV15 or PCV20 today, but we only stock PPSV23. Should we give him PPSV23 today and tell him to return in a year for PCV15?

- In this case, refer the patient to a provider where the patient may receive either PCV20 alone or PCV15 with plans to receive PPSV23 one year later.
- *REMEMBER: ACIP recommends that PCV be administered before PPSV23 for optimal immune response to vaccination.*
- However, if there is a challenge in finding another provider who has PCV15 or PCV20 then administer PPSV23; it is better to give PPSV23 then nothing at all.

Source: Immuize.org Ask the Experts Pneumococcal Vaccines

We gave PPSV23 to a 66-year-old patient who is newly diagnosed with a medical condition that places him at increased risk for pneumococcal disease and its complications. Should we give him a second dose in 5 years because of his underlying medical condition?

- No. However, this person should receive PCV15 or PCV20 one year after PPSV23 if they have no history or an unknown history of receiving a pneumococcal conjugate vaccine in the past.

Source: Immuize.org Ask the Experts Pneumococcal Vaccines

One of our team administered PCV13 and PPSV23 at the same visit to a 5-year-old child who is immunocompromised. We know the PPSV23 was supposed to be administered at least 8 weeks later. We are looking for guidance for what to do now.

- *REMEMBER: PCV vaccines and PPSV23 should not be administered at the same visit or at an interval less than 8 weeks.*
- In children, if PCV and PPSV23 are administered at the same visit, the PCV dose **should be repeated** no earlier than 8 weeks after doses that were administered on the same day.
- However, in adults, if a PCV and PPSV23 are administered at the same visit or at an interval less than 8 weeks, CDC recommends that **neither dose needs to be repeated**.

Source: Immuize.org Ask the Experts Pneumococcal Vaccines

Questions?

Caitlin.Newhouse@tn.gov

Resources

- ACIP 2022 Immunization Schedules
- Active Bacterial Core Surveillance (ABCs) Report Emerging Infections Program Network Streptococcus Pneumoniae, 2020
- CDC Epidemiology and Prevention of Vaccine-Preventable Diseases Chapter 17: Pneumococcal Disease
- CDC Pneumococcal Disease Surveillance and Reporting
- Immuize.org Ask the Experts Pneumococcal Vaccines
- Kobayashi, et al. Use of PCV-15 Among US Children: Updated ACIP Recommendations -- US 2022 MMWR September 16, 2022
- Marshall, Gary. The Vaccine Handbook: A Practical Guide for Clinicians, Chapter 9: Routine Vaccines, pp 355-364. 2nd Ed. 2008.
- Platt HL, et al. A Phase II Trial of Safety, Tolerability and Immunogenicity of V114, a 15-Valent Pneumococcal Conjugate Vaccine, Compared With 13-Valent Pneumococcal Conjugate Vaccine in Healthy Infants. Pediatr Infect Dis J. 2020 Aug;39(8):763-770. doi: 10.1097/INF.0000000000002765. PMID: 32639460; PMCID: PMC7360095.
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