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Pneumococcal vaccination in children

- **A. Sanaei**
- **Professor of Pediatric Infectious Diseases**
- **Professor Alborzi clinical microbiology research center**

- Children <5 years of age, particularly those <2 years of age, are at increased risk for invasive pneumococcal disease (IPD), such as meningitis and bacteremia.

  Routine immunization with a pneumococcal conjugate vaccine (PCV) is effective in preventing IPD in vaccinated children and providing community ("herd") immunity for people who are not vaccinated.

Table 2. Categories of pneumococcal serotypes according to vaccine serotypes*

Category	Serotypes included
PCV7	4, 6B, 9V, 14, 18C, 19F, and 23F
PCV10 non-7 (in PCV10 and not PCV7)	1, 5, and 7F
PCV13 non-10 (in PCV13 and not PCV10)	3, 6A, and 19A
Non-PCV10	Any serotype not in PCV10
Non-PCV13	Any serotype not in PCV13
PPV23 non-PCV13 (in PPV23 and not PCV13)	2, 8, 9N, 10A, 11A, 12F, 15B, 17F, 20, 22F, and 33F
Nonvaccine (not in PCV13 or PPV23)	Any serotype not in PCV13 and not in PPV23
New vaccines	
PCV15 non-13 (in PCV15 and not PCV13)	22F and 33F
PCV20 non-13 (in PCV20 and not PCV13)	8, 10A, 11A, 12F, 15B, 22F and 33F

*PCV, pneumococcal conjugate vaccine; PCV7, 7-valent pneumococcal conjugate vaccine; PCV10, 10-valent pneumococcal conjugate vaccine; PCV13, 13-valent pneumococcal conjugate vaccine; PPV23, 23-valent pneumococcal polysaccharide vaccine.

Pneumococcal vaccine 13 vs 10

1. **Broader Serotype Coverage**

- PCV-13** protects against **13 pneumococcal serotypes** (including 1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F, and 23F), whereas **PCV-10** covers **10 serotypes** (excluding 3, 6A, and 19A) .

- Key additional serotypes in PCV-13**:

- Serotype 3**: A major cause of invasive pneumococcal disease (IPD) and pneumonia, though neither vaccine shows significant effectiveness against it .

- Serotype 6A**: Covered directly in PCV-13, while PCV-10 offers limited cross-protection through 6B .

- Serotype 19A**: A highly virulent and antibiotic-resistant strain. PCV-13 demonstrates **85.1% effectiveness** against 19A, whereas PCV-10 shows inconsistent cross-protection (32.5% to -14.4% in some studies) .

2. **Enhanced Protection Against Vaccine-Related Serotypes**

- **Cross-protection for 6C**: PCV-13 provides indirect protection against serotype 6C due to its inclusion of 6A, whereas PCV-10 lacks this effect. Studies in Sweden observed a rise in 6C cases in PCV-10 regions but not in PCV-13 areas .

- **Serotype 19A**: PCV-13's direct inclusion of 19A ensures robust protection, particularly in children under 12 months, while PCV-10's cross-protection remains unverified in younger age groups .

Pneumococcal vaccine 13 vs 10

3. **Superior Effectiveness Against Acute Otitis Media (AOM)**

- PCV-13 shows **86% effectiveness against AOM , significantly higher than PCV-10's **26.9% (clinically defined)** and 43.3% (bacteriologically confirmed)** effectiveness .**

4. **Impact on Invasive Pneumococcal Disease (IPD)**

- PCV-13 demonstrates **84.2% effectiveness** against its covered serotypes, with sustained protection against fatal IPD (84.7% effectiveness) .**

- **PCV-10 shows comparable effectiveness against its own serotypes (84.8%) but fails to address non-vaccine types (NVTs) like 19A and 6C, which dominate post-vaccination IPD cases in older populations .**

5. **Epidemiological Advantages**

- Post-vaccination surveillance in Sweden revealed that **PCV-13 counties experienced a slower rise in NVTs among the elderly compared to PCV-10 regions, suggesting better indirect herd protection .**

- Serotype replacement (e.g., increases in NVTs like 12F and 8) is less pronounced with PCV-13 due to its broader coverage

❑ **Limitations and Considerations**

- **Serotype 3: Neither vaccine effectively reduces serotype 3 infections, highlighting a gap in current formulations .**

- **Waning Immunity: PCV-13's effectiveness declines over time post-booster, particularly against serotypes 3 and 19A .**

- **Cost-effectiveness: The choice between vaccines may depend on local serotype prevalence and NVTs .**

Comparison of properties of the pneumococcal polysaccharide and conjugate vaccines

	Polysaccharide vaccine	Conjugate polysaccharide vaccine
Stimulates antibodies in infants and toddlers	No	Yes
Stimulates antibodies in healthy adults	Yes	Yes
Stimulates antibodies in immunocompromised adults	+/-	+/-
Antibodies are long-lasting	+/-	+/-
Primes immunologically for enhanced responses	No	Possibly
Stimulates mucosal immunity, resulting in decreased colonization	No	Yes
Exhibits herd effect (secondary protection of unvaccinated individuals)	No	Yes
Use is associated with replacement strains	No	Yes

In the United States

- **Routine schedule** – In the United States, the routine schedule for PCV (either 15-valent PCV [PCV15] or 20-valent PCV [PCV20]) for all children includes a three-dose primary series and a booster dose [21]. We prefer to administer PCV20 when available. The recommended schedule is as follows:

  - Age two months (the minimum age for this dose is 6 weeks)
  - Age four months and ≥4 weeks after the first dose
  - Age six months and ≥4 weeks after the second dose
  - Booster dose at age 12 through 15 months and ≥8 weeks after the third dose

  If the child has only received PCV13, the series may be completed with PCV15 or PCV20. Restarting the series is not necessary.

- In preterm infants, PCV is administered according to chronologic age

جدول یک

High-risk children include:

1 ■ Children with immune-compromising conditions, including:

- Functional or anatomic asplenia (eg, sickle cell disease, other hemoglobinopathies, congenital or acquired splenic dysfunction)
- Congenital or acquired immunodeficiency (eg, B- or T-lymphocyte deficiency, complement deficiency, phacyocyte disorders [except CGD])
- HIV infection
- Chronic renal failure
- Nephrotic syndrome
- Generalized malignancy (eg, metastatic disease, disease treated with chemotherapy)
- Hematologic malignancy (eg, leukemia, lymphoma, Hodgkin disease, multiple myeloma)

2 • Iatrogenic immunosuppression (eg, solid organ transplant, long-term systemic glucocorticoids, tumor necrosis alpha inhibitors [eg, etanercept, infliximab], radiation therapy)

3 ■ Immune-competent children with:

- CSF leak, cochlear implant
- Certain chronic conditions, including: chronic heart disease, chronic lung disease, diabetes mellitus, chronic liver disease

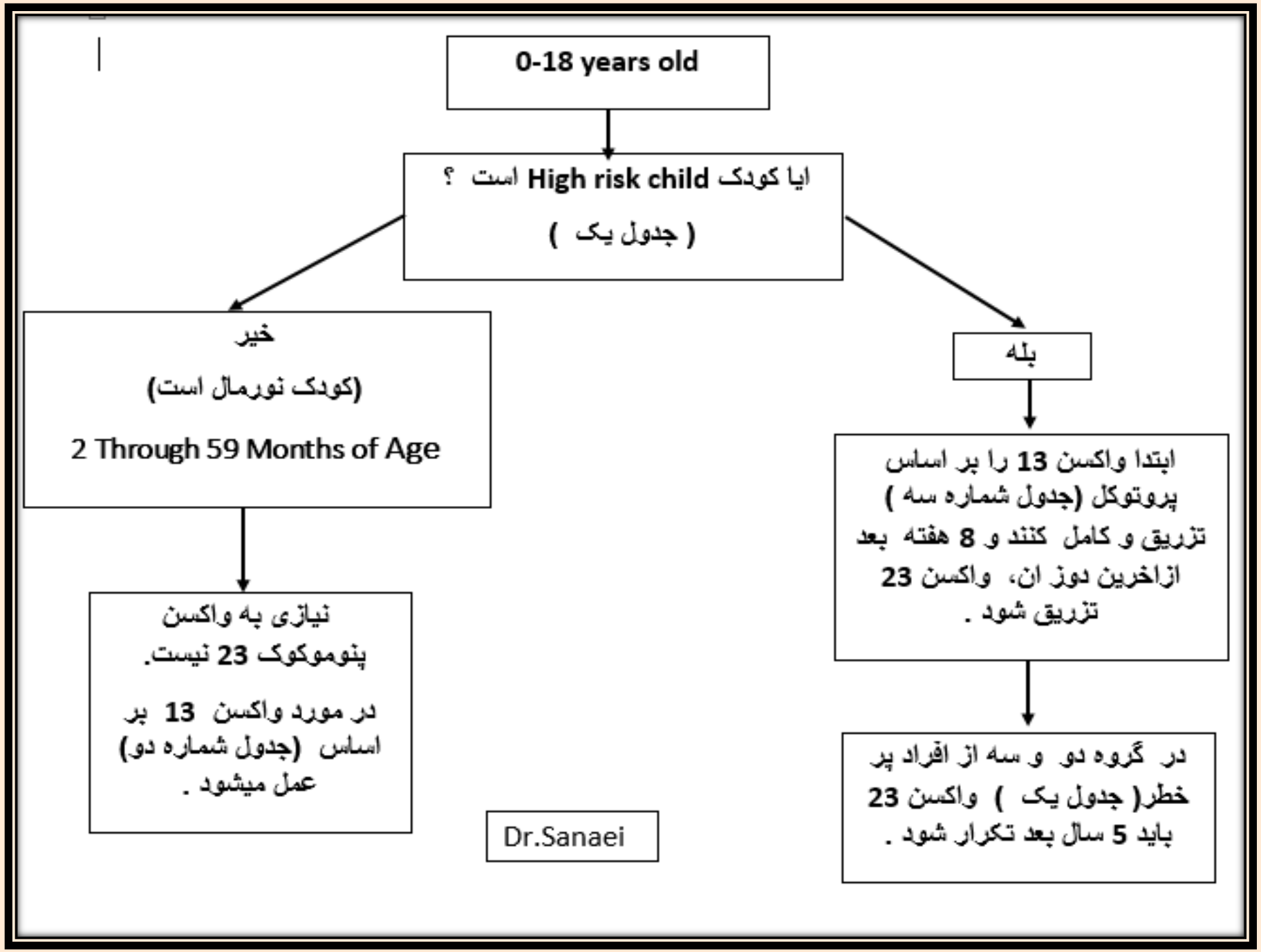
High-risk conditions in immune-competent children include:

- CSF leak
- Cochlear implant
- Chronic heart disease, particularly cyanotic congenital heart disease, cardiac failure, and cardiomyopathy
- Chronic lung disease, including asthma if treated with high-dose oral glucocorticoid therapy*
- Diabetes mellitus
- Chronic liver disease
- Alcoholism

Risk-based Recommendations

People with Underlying Medical Conditions or Other Risk Factors

		PCV13			PPSV23	
Risk Group	**Underlying medical condition or other risk factor**	Administer PCV13 doses needed to complete series to children through age 71 months	Administer 1 dose to PCV13-naïve children age 6 through 18 years	Administer 1 dose to PCV13-naïve adults age 19 years and older	Administer 1 dose of PPSV23 at age 2 through 64 years	Administer a second dose of PPSV23 5 years after first dose if age younger than 65 years
Immuno-competent	Chronic heart disease[3]	X			X	
	Chronic lung disease[4]	X			X	
	Diabetes mellitus	X			X	
	Cerebrospinal fluid leak	X	X	X	X	
	Cochlear implant	X	X	X	X	
	Alcoholism, chronic liver disease, cirrhosis (6 yrs and older)				X	
	Cigarette smoking (19 yrs and older)				X	
Functional or anatomic asplenia	Sickle cell disease/other hemoglobinopathy	X	X	X	X	X
	Congenital or acquired asplenia	X	X	X	X	X
Immuno-compromised	Congenital or acquired immunodeficiency[5]	X	X	X	X	X
	HIV	X	X	X	X	X
	Chronic renal failure	X	X	X	X	X
	Nephrotic syndrome	X	X	X	X	X
	Leukemia	X	X	X	X	X
	Lymphoma	X	X	X	X	X
	Hodgkin disease	X	X	X	X	X
	Generalized malignancy	X	X	X	X	X
	Iatrogenic immunosuppression[6]	X	X	X	X	X
	Solid organ transplant	X	X	X	X	X
	Multiple myeloma	X	X	X	X	X


0-18 years old
ایا کودک High risk child است ؟
(جدول یک)
خیر
(کودک نورمال است)
2 Through 59 Months of Age
نیازی به واکسن
پنوموکوک 23 نیست.
در مورد واکسن 13 بر
اساس (جدول شماره دو)
عمل میشود .
بله
ابتدا واکسن 13 را بر اساس
پروتوکل (جدول شماره سه)
تزریق و کامل کنند و 8 هفته بعد
ازاخرین دوز ان، واکسن 23
تزریق شود .
در گروه دو و سه از افراد پر
خطر(جدول یک) واکسن 23
باید 5 سال بعد تکرار شود .
Dr.Sanaei

جدول شماره دو

Recommended Schedule for Doses of PCV13, Including Catch-up Immunizations in Previously Unimmunized and Partially Immunized Children 2 Through 59 Months of Age

Age at Examination	Immunization History	Recommended Regimen[a,b]
2 through 6 mo	0 doses	3 doses, 8 wk apart; fourth dose at 12 through 15 mo of age
	1 dose	2 doses, 8 wk apart; fourth dose at 12 through 15 mo of age
	2 doses	1 dose, 8 wk after the most recent dose; fourth dose at 12 through 15 mo of age
7 through 11 mo	0 doses	2 doses, 4 wk apart; third dose at 12 mo of age
	1 or 2 doses before age 7 mo	1 dose at age 7 through 11 mo, with another dose at 12 through 15 mo of age (≥2 mo later)
12 through 23 mo	0 doses	2 doses, ≥8 wk apart
	1 dose at <12 mo	2 doses, ≥8 wk apart
	1 dose at ≥12 mo	1 dose, ≥8 wk after the most recent dose
	2 or 3 doses at <12 mo	1 dose, ≥8 wk after the most recent dose
24 through 59 mo[c] Healthy children	Any incomplete schedule	1 dose, ≥8 wk after the most recent dose[c]

- **Catch-up schedule**

  - Healthy children between 2 and <5 years of age who are incompletely immunized with PCV should receive a single dose of either PCV15 or PCV20. We prefer PCV20 when available. The dose should be administered at least eight weeks after the most recent PCV dose (if applicable) [21].

Recommendations for Pneumococcal Immunization with PCV13 and/or PPSV23 Vaccine for Children at High Risk or Presumed High Risk of Pneumococcal Disease

جدول شماره سه

Age	Previous Dose(s) of Any Pneumococcal Vaccine	Recommendations
23 mo or younger	None	PCV13, as in Table 3.62 (p 718).
24 through 71 mo	4 doses of PCV13	1 dose of PPSV23 vaccine at 24 mo of age, ≥8 wk after last dose of PCV13.
24 through 71 mo	3 previous doses of PCV13 before 24 mo of age	1 dose of PCV13.
		1 dose of PPSV23, ≥8 wk after the last dose of PCV13.
24 through 71 mo	<3 doses of PCV13 before 24 mo of age	2 doses of PCV13, ≥8 wk after last dose of PCV13 (if applicable).
		1 dose of PPSV23 vaccine, ≥8 wk after the last dose of PCV13.
24 through 71 mo	1 dose of PPSV23	2 doses of PCV13, 8 wk apart, beginning at 8 wk after last dose of PPSV23.
6 years through 18 years with immunocompromising conditions[a,b]	No previous doses of PCV13 or PPSV23	1 dose of PCV13 followed by 1 dose of PPSV23 at least 8 weeks later and a second dose of PPSV23 5 years after the first.[c]
	1 dose of PCV13	1 dose of PPSV23 and a second dose of PPSV23 5 years after the first
	≥1 dose of PPSV23 and no previous dose of PCV13	1 dose of PCV13 (even if PCV7 previously administered) ≥8 weeks after the last PPSV23 dose; if a second PPSV23 dose is indicated, it should be administered ≥5 years after the first PPSV23 dose

Age	Previous Dose(s) of Any Pneumococcal Vaccine	Recommendations
23 mo or younger	None	PCV13, as in Table 3.62 (p 718).
24 through 71 mo	4 doses of PCV13	1 dose of PPSV23 vaccine at 24 mo of age, ≥8 wk after last dose of PCV13.
24 through 71 mo	3 previous doses of PCV13 before 24 mo of age	1 dose of PCV13.
		1 dose of PPSV23, ≥8 wk after the last dose of PCV13.
24 through 71 mo	<3 doses of PCV13 before 24 mo of age	2 doses of PCV13, ≥8 wk after last dose of PCV13 (if applicable).
		1 dose of PPSV23 vaccine, ≥8 wk after the last dose of PCV13.
24 through 71 mo	1 dose of PPSV23	2 doses of PCV13, 8 wk apart, beginning at 8 wk after last dose of PPSV23.

6 years through 18 years with immunocompromising conditions[a,b]	No previous doses of PCV13 or PPSV23	1 dose of PCV13 followed by 1 dose of PPSV23 at least 8 weeks later and a second dose of PPSV23 5 years after the first.[c]
	1 dose of PCV13	1 dose of PPSV23 and a second dose of PPSV23 5 years after the first
	≥1 dose of PPSV23 and no previous dose of PCV13	1 dose of PCV13 (even if PCV7 previously administered) ≥8 weeks after the last PPSV23 dose; if a second PPSV23 dose is indicated, it should be administered ≥5 years after the first PPSV23 dose

Recommendations for Pneumococcal Immunization With PCV15, PCV20, and/or PPSV23 Vaccine for Children at High Risk or Presumed High Risk of Pneumococcal Disease

6 years through 18 years with immunocompromising conditions[a,b,c,d]	No previous doses of PCV13, PCV15, PCV20, or PPSV23	1 dose of PCV15 followed by 1 dose of PPSV23 at least 8 weeks later and a second dose of PPSV23 5 years after the first*; OR 1 dose of PCV20 with no additional doses of any pneumococcal vaccine indicated thereafter
	1 dose of PCV13, PCV15, or PCV20	If prior dose was with PCV13 or PCV15: 1 dose of PPSV23 and a second dose of PPSV23 5 years after the first.* If prior dose was with PCV20: no additional doses of any pneumococcal vaccine are indicated.
	≥1 dose of PPSV23 and no previous dose of PCV13, PCV15, or PCV20	1 dose of PCV15 or PCV20 (even if PCV7 previously administered) ≥8 weeks after the last PPSV23 dose; if a second PPSV23 dose is indicated,* it should be administered ≥5 years after the first PPSV23 dose

•ACIP Guidelines, Aged 2-5 Years With High Risk

- **Dosage for high risk 2-5 years olds**
- **1. if 3 doses of PCV (7- or 13-valent) were received previously …..Administer 1 dose of PCV13**
- **2. if fewer than 3 doses of PCV13 were received previously….Administer 2 doses of PCV at least 8 weeks apart**
- **3. The minimum interval between doses of PCV is 8 wk**
- **4. For children with no history of PPSV23 vaccination, administer PPSV23 at least 8 wk after the most recent dose of PCV13**

ACIP Guidelines, Aged 6-17 Years With High Risk

- 1. If neither PCV13 nor PPSV23 has been received previously, administer 1 dose of PCV13 now and 1 dose of PPSV23 at least 8 wk later
- 2. If PCV13 has been received previously but PPSV23 has not, administer 1 dose of PPSV23 at least 8 wk after the most recent dose of PCV13
- 3. If PPSV23 has been received but PCV13 has not, administer 1 dose of PCV13 at least 8 wk after the most recent dose of PPSV23

Recommendations for immunization with PCV13/PCV15 and PPSV23 for children at high risk* of pneumococcal disease who are 2 through 5 years of age

Pneumococcal vaccine history before age 2 years	Pneumococcal vaccines needed for completion through age 5 years¶
No doses of PPSV23 and:	
▪ 4 doses of PCV13/PCV15	▪ 1 dose of PPSV23 ≥8 weeks after last dose of PCV13/PCV15
▪ 3 doses of PCV13/PCV15	▪ 1 dose of PCV13/PCV15 ≥8 weeks after last dose of PCV13/PCV15 ▪ 1 dose of PPSV23 ≥8 weeks later
▪ <3 doses of PCV13/PCV15	▪ 2 doses of PCV13/PCV15 ≥8 weeks apart, beginning ≥8 weeks after last dose of PCV13/PV15 ▪ 1 dose of PPSV23 ≥8 weeks later
One dose of PPSV23 after age 2 years and:	
▪ 4 doses of PCV13/PCV15	▪ Pneumococcal immunization through age 5 is complete
▪ 3 doses of PCV13/PCV15	▪ 1 dose of PCV13/PCV15 ≥8 weeks after last pneumococcal vaccine (PCV13/PSV15 or PPSV23)
▪ <3 doses of PCV13/PCV15	▪ 2 doses of PCV13/PCV15 ≥8 weeks apart, beginning ≥8 weeks after last pneumococcal vaccine (PCV13/PCV15 or PPSV23)

This table is intended for use in conjunction with the UpToDate topic on pneumococcal vaccination in children. PCV13 and PCV15 are interchangeable. When obtaining the pneumococcal vaccination history, doses that are unknown or uncertain should not be counted. Refer to UpToDate content on pneumococcal vaccination in children for details.

Recommendations for immunization with PCV13/PCV15 and PPSV23 for children at high risk of pneumococcal disease who are 6 through 18 years of age

High-risk condition	Pneumococcal vaccine history*	Pneumococcal vaccines needed for completion
Immune compromised:¶ ▪ Congenital or acquired asplenia or splenic dysfunction, including sickle cell disease or other hemoglobinopathies ▪ Congenital or acquired immunodeficiency ▪ HIV infection ▪ Chronic kidney failure ▪ Nephrotic syndrome ▪ Generalized malignancy ▪ Hematologic malignancy ▪ Iatrogenic immunosuppression (eg, immunosuppressive drugs or radiation therapy, solid organ transplant)	▪ No doses of PCV13/PCV15 ▪ No doses of PPSV23	▪ 1 dose of PCV13/PCV15 ▪ First dose of PPSV23 ≥8 weeks after PCV13/PCV15 ▪ Second dose of PPSV23 ≥5 years¶ after the first
	▪ No doses of PCV13/PCV15 ▪ 1 dose of PPSV23	▪ 1 dose of PCV13/PCV15 ≥8 weeks after PPSV23 ▪ Second dose of PPSV23 ≥5 years¶ after the first
	▪ No doses of PCV13/PCV15 ▪ 2 doses of PPSV23	▪ 1 dose of PCV13/CPV15 ≥8 weeks after last dose of PPSV23
	▪ ≥1 dose of PCV13/PCV15 ▪ No doses of PPSV23	▪ First dose of PPSV23 ≥8 weeks after PCV13/PCV15 ▪ Second dose of PPSV23 ≥5 years¶ after the first
	▪ ≥1 dose of PCV13/PCV15 ▪ 1 dose of PPSV23	▪ Second dose of PPSV23 ≥5 years after the first
	▪ ≥1 dose of PCV13/PCV15 ▪ 2 doses of PPSV23	▪ No additional immunization necessary
Immune competent with CSF leak or cochlear implant	▪ No doses of PCV13/PCV15 ▪ No doses of PPSV23	▪ 1 dose of PCV13/PCV15 ▪ 1 dose of PPSV23 ≥8 weeks after PCV13/PCV15
	▪ 1 dose of PCV13/PCV15 ▪ No doses of PPSV23	▪ 1 dose of PPSV23 ≥8 weeks after PCV13/PCV15
	▪ No doses of PCV13/PCV15 ▪ ≥1 dose of PPSV23	▪ 1 dose of PCV13/PCV15 ≥8 weeks after the last PPSV23
Immune competent with chronic conditions including: ▪ Chronic heart disease ▪ Chronic lung disease ▪ Diabetes mellitus ▪ Chronic liver disease ▪ Alcoholism	▪ No doses of PCV13/PCV15 ▪ No doses of PPSV23	▪ 1 dose of PPSV23
	▪ No dose of PCV13/PCV15 ▪ ≥1 dose of PPSV23	▪ No additional immunization necessary

- The most commonly reported serious adverse events
- ;bronchiolitis (0.9%), gastroenteritis, (0.9%,)-and pneumonia (0.9%) for Prevnar 13

App available to interpret recommendations

CDC offers **PneumoRecs VaxAdvisor** as a free app to quickly and easily provide patient-specific pneumococcal vaccine guidance. It's available for **download for iOS and Android** mobile devices. There's also a **web-based version** that doesn't require a download.

PneumoRecs VaxAdvisor

Age Group	Interval Recommendation (PCV15 then PPSV23, preferred)	Interval Recommendation (PPSV23 then PCV15)
Children 2 through 18 years old with certain risk conditions*	8 weeks or longer	8 weeks or longer
19 years or older with certain risk conditions* or other risk factors**	1 year or longer†	1 year or longer
50 years or older	1 year or longer†	1 year or longer

TABLE. Summary of recommended intervals, by risk and age groups, for persons with indications to receive PCV13 and PPSV23 sequence — Advisory Committee on Immunization Practices, United States, September 2015

Risk group/Underlying medical condition	Intervals for PCV13–PPSV23 sequence, by age group				Intervals for PPSV23–PCV13 sequence, by age group			
	24–71 months	6–18 years	19–64 years	≥65 years	24–71 months	6–18 years	19–64 years	≥65 years
No underlying chronic conditions	**NA**	**NA**	**NA**	**≥1 year**	**NA**	**NA**	**NA**	**≥1 year**
Immunocompetent persons Chronic heart disease Chronic lung disease Diabetes mellitus Alcoholism* Chronic liver disease, cirrhosis* Cigarette smoking*	≥8 weeks	NA	NA	≥1 year	≥8 weeks	NA	NA	≥1 year
Immunocompetent persons Cerebrospinal fluid leak Cochlear implant	≥8 weeks	≥8 weeks	≥8 weeks	≥8 weeks	≥8 weeks	≥8 weeks	≥1 year	≥1 year
Persons with functional or anatomic asplenia Sickle cell disease/other hemaglobinopathy Congenital or acquired asplenia	≥8 weeks	≥8 weeks	≥8 weeks	≥8 weeks	≥8 weeks	≥8 weeks	≥1 year	≥1 year

Pneumococcal Vaccination Recommendations for Children and Adults by Age and/or Risk Factor[1]

Routine Recommendations

for Pneumococcal Conjugate Vaccine (PCV13) and Pneumococcal Polysaccharide Vaccine (PPSV23)

For children age 2 months and older	Administer PCV13 series to all children beginning at age 2 months, followed by doses at 4 months, 6 months, and 12–15 months (booster dose).
For adults age 65 years and older	Administer 1 dose of PPSV23 at age 65. However, if PCV13 is given at age 65 years based on shared clinical decision-making between the healthcare provider and the patient, delay PPSV23 until 1 year after PCV13.[2]

ACIP Guidelines, Aged 6-17 Years With High Risk

- 1. If neither PCV13 nor PPSV23 has been received previously, administer 1 dose of PCV13 now and 1 dose of PPSV23 at least 8 wk later
- 2. If PCV13 has been received previously but PPSV23 has not, administer 1 dose of PPSV23 at least 8 wk after the most recent dose of PCV13
- 3. If PPSV23 has been received but PCV13 has not, administer 1 dose of PCV13 at least 8 wk after the most recent dose of PPSV23

		PCV13			PPSV23	
		Administer PCV13 doses needed to complete series to children through age 71 months	Administer 1 dose to PCV13-naïve children age 6 through 18 years	Administer 1 dose to PCV13-naïve adults age 19 years and older	Administer 1 dose of PPSV23 at age 2 through 64 years	Administer a second dose of PPSV23 5 years after first dose if age younger than 65 years
Functional or anatomic asplenia	Sickle cell disease/other hemoglobinopathy	X	X	X	X	X
	Congenital or acquired asplenia	X	X	X	X	X
Immuno-compromised	Congenital or acquired immunodeficiency[3]	X	X	X	X	X
	HIV	X	X	X	X	X
	Chronic renal failure	X	X	X	X	X
	Nephrotic syndrome	X	X	X	X	X
	Leukemia	X	X	X	X	X
	Lymphoma	X	X	X	X	X
	Hodgkin disease	X	X	X	X	X
	Generalized malignancy	X	X	X	X	X
	Iatrogenic immunosuppression[4]	X	X	X	X	X
	Solid organ transplant	X	X	X	X	X
	Multiple myeloma	X	X	X	X	X

		PCV13			PPSV23	
		Administer PCV13 doses needed to complete series to children through age 71 months	Administer 1 dose to PCV13-naïve children age 6 through 18 years	Administer 1 dose to PCV13-naïve adults age 19 years and older	Administer 1 dose of PPSV23 at age 2 through 64 years	Administer a second dose of PPSV23 5 years after first dose if age younger than 65 years
Functional or anatomic asplenia	Sickle cell disease/other hemoglobinopathy	X	X	X	X	X
	Congenital or acquired asplenia	X	X	X	X	X
Immuno-compromised	Congenital or acquired immunodeficiency[3]	X	X	X	X	X
	HIV	X	X	X	X	X
	Chronic renal failure	X	X	X	X	X
	Nephrotic syndrome	X	X	X	X	X
	Leukemia	X	X	X	X	X
	Lymphoma	X	X	X	X	X
	Hodgkin disease	X	X	X	X	X
	Generalized malignancy	X	X	X	X	X
	Iatrogenic immunosuppression[6]	X	X	X	X	X
	Solid organ transplant	X	X	X	X	X
	Multiple myeloma	X	X	X	X	X

Risk-based Recommendations

People with Underlying Medical Conditions or Other Risk Factors

		PCV13			PPSV23	
Risk Group	**Underlying medical condition or other risk factor**	Administer PCV13 doses needed to complete series to children through age 71 months	Administer 1 dose to PCV13-naïve children age 6 through 18 years	Administer 1 dose to PCV13-naïve adults age 19 years and older	Administer 1 dose of PPSV23 at age 2 through 64 years	Administer a second dose of PPSV23 5 years after first dose if age younger than 65 years
Immuno-competent	Chronic heart disease[3]	X			X	
	Chronic lung disease[4]	X			X	
	Diabetes mellitus	X			X	
	Cerebrospinal fluid leak	X	X	X	X	
	Cochlear implant	X	X	X	X	
	Alcoholism, chronic liver disease, cirrhosis (6 yrs and older)				X	
	Cigarette smoking (19 yrs and older)				X	

Pneumococcal vaccination for children age 2 through 5 years at high risk for invasive pneumococcal disease

Children 6 through 18 Years Old with Certain Medical Conditions

CDC recommends pneumococcal vaccination for children 6 through 18 years old who have certain medical conditions that increase their risk of pneumococcal disease. The tables below provide detailed information by medical condition. See table 3 for additional details.

For a child with any of these conditions:

- Cerebrospinal fluid leak
- Cochlear implant

CDC recommends you:

- Give 1 dose of a pneumococcal conjugate vaccine (either PCV13 or PCV15) if they have not received any doses of a pneumococcal conjugate vaccine. Administer PCV13 or PCV15 before giving any recommended doses of PPSV23.
- Give 1 dose of PPSV23 (if not already given earlier in childhood) at least 8 weeks after PCV13 or PCV15.

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

| 03/15/23

Pneumococcal Vaccine Timing for Adults

Make sure your patients are up to date with pneumococcal vaccination.

Adults ≥65 years old
Complete pneumococcal vaccine schedules

Prior vaccines	Option A	Option B
None*	**PCV20**	**PCV15** → ≥1 year† → **PPSV23**
PPSV23 only at any age	≥1 year → **PCV20**	≥1 year → **PCV15**
PCV13 only at any age	≥1 year → **PCV20**	≥1 year† → **PPSV23**
PCV13 at any age & **PPSV23** at <65 yrs	≥5 years → **PCV20**	≥5 years§ → **PPSV23**

* Also applies to people who received PCV7 at any age and no other pneumococcal vaccines
† Consider minimum interval (8 weeks) for adults with an immunocompromising condition, cochlear implant, or cerebrospinal fluid leak (CSF) leak
§ For adults with an immunocompromising condition, cochlear implant, or CSF leak, the minimum interval for PPSV23 is ≥8 weeks since last PCV13 dose and ≥5 years since last PPSV23 dose; for others, the minimum interval for PPSV23 is ≥1 year since last PCV13 dose and ≥5 years since last PPSV23 dose

Shared clinical decision-making for those who already completed the series with PCV13 and PPSV23

Adults 19–64 years old with specified immunocompromising conditions
Complete pneumococcal vaccine schedules

Prior vaccines	Option A	Option B
None*	**PCV20**	**PCV15** → ≥8 weeks → **PPSV23**
PPSV23 only	≥1 year → **PCV20**	≥1 year → **PCV15**
PCV13 only	≥1 year → **PCV20**	≥8 weeks → **PPSV23** → ≥5 years → **PPSV23** Review pneumococcal vaccine recommendations again when your patient turns 65 years old.
PCV13 and 1 dose of PPSV23	≥5 years → **PCV20**	≥5 years† → **PPSV23** Review pneumococcal vaccine recommendations again when your patient turns 65 years old.
PCV13 and 2 doses of PPSV23	≥5 years → **PCV20**	**No vaccines** recommended at this time. Review pneumococcal vaccine recommendations again when your patient turns 65 years old.
Immunocompromising conditions	• Chronic renal failure • Congenital or acquired asplenia • Congenital or acquired immunodeficiency§ • Generalized malignancy • HIV infection • Hodgkin disease • Iatrogenic immunosuppression¶ • Leukemia • Lymphoma • Multiple myeloma • Nephrotic syndrome • Sickle cell disease/other hemoglobinopathies • Solid organ transplant	

* Also applies to people who received PCV7 at any age and no other pneumococcal vaccines
† The minimum interval for PPSV23 is ≥8 weeks since last PCV13 dose and ≥5 years since last PPSV23 dose
§ Includes B- (humoral) or T-lymphocyte deficiency, complement deficiencies (particularly C1, C2, C3, and C4 deficiencies), and phagocytic disorders (excluding chronic granulomatous disease)
¶ Includes diseases requiring treatment with immunosuppressive drugs, including long-term systemic corticosteroids and radiation therapy

Adults 19–64 years old with a cochlear implant or cerebrospinal fluid leak

Complete pneumococcal vaccine schedules

Prior vaccines	Option A	Option B
None*	PCV20	PCV15 → ≥8 weeks → PPSV23
PPSV23 only	≥1 year → PCV20	≥1 year → PCV15
PCV13 only	≥1 year → PCV20	≥8 weeks → PPSV23 Review pneumococcal vaccine recommendations again when your patient turns 65 years old.
PCV13 and 1 dose of PPSV23	≥5 years → PCV20	**No vaccines** recommended at this time. Review pneumococcal vaccine recommendations again when your patient turns 65 years old.

* Also applies to people who received PCV7 at any age and no other pneumococcal vaccines

Adults 19–64 years old with a cochlear implant or cerebrospinal fluid leak
Complete pneumococcal vaccine schedules

PCV13 and **1 dose of PPSV23**	≥5 years → **PCV20**	**No vaccines** recommended at this time. Review pneumococcal vaccine recommendations again when your patient turns 65 years old.

Adults 19–64 years old with chronic health conditions
Complete pneumococcal vaccine schedules

Prior vaccines	Option A	Option B
None*	**PCV20**	**PCV15** → ≥1 year → **PPSV23**
PPSV23 only	≥1 year → **PCV20**	≥1 year → **PCV15**
PCV13† only	≥1 year → **PCV20**	≥1 year → **PPSV23** Review pneumococcal vaccine recommendations again when your patient turns 65 years old.
PCV13† and PPSV23	**No vaccines** are recommended at this time. Review pneumococcal vaccine recommendations again when your patient turns 65 years old.	
Chronic health conditions	• Alcoholism • Chronic heart disease, including congestive heart failure and cardiomyopathies • Chronic liver disease	• Chronic lung disease, including chronic obstructive pulmonary disease, emphysema, and asthma • Cigarette smoking • Diabetes mellitus

* Also applies to people who received PCV7 at any age and no other pneumococcal vaccines
† Adults with chronic medical conditions were previously not recommended to receive PCV13

Clinical Infectious Diseases

MAJOR ARTICLE

Comparison of the Impact of Pneumococcal Conjugate Vaccine 10 or Pneumococcal Conjugate Vaccine 13 on Invasive Pneumococcal Disease in Equivalent Populations

Pontus Naucler,[1,2] Ilias Galanis,[3] Eva Morfeldt,[3] Jessica Darenberg,[3] Åke Örtqvist,[1,4] and Birgitta Henriques-Normark[3,5,6,7]

[1]Unit of Infectious Diseases, Department of Medicine Solna, Karolinska Institutet, [2]Department of Infectious Diseases, Karolinska University Hospital, Stockholm, Sweden; [3]Public Health Agency of

CID 2017:65 (1 December) • Naucler et al

- Invasive pneumococcal disease incidences decreased between 2005 and 2016 in vaccinated children (by 68.5%), and in the whole population (by 13.5%), but not among the elderly (increased by 2%), due to a substantial increase of non-vaccine types.(NVTs).
- In 2016, NVTs constituted 72% of IPD cases in the elderly.
- Serotype 6A declined in PCV10 and PCV13 counties, whereas serotype 19A increased in PCV10 counties.
- There was no effect against serotype 3.
- Cross-protection was found between 6B and 6A,but not between 19F and 19A. Serotype 6C increased in PCV10 counties, but not in PCV13 counties, suggesting cross-protection with 6A, which is included in PCV13

- we found a significant decline in the incidence of serotype 6A following vaccine introduction in both PCV10 and PCV13 counties in the whole population .
- In contrast, the incidence of serotype 19A in older age groups increased significantly in PCV10 counties as compared to PCV13 counties. Although the results in children aged <5 years need to be interpreted cautiously due to few events, there was a significant reduction of serotypes 3, 6A and 19A combined in PCV13 counties, primarily due to a reduction of serotype 19A In PCV13 counties, there were no cases of 19A among children aged <5 years in 2013–16 compared with an incidence of 1.1 per 100 000 population in PCV10 counties
- The results were similar for children aged 0–2 years.

Global impact of ten-valent and 13-valent pneumococcal conjugate vaccines on invasive pneumococcal disease in all ages (the PSERENADE project): a global surveillance analysis

Julia C Bennett, Maria Deloria Knoll*, Eunice W Kagucia, Maria Garcia Quesada, Scott L Zeger, Marissa K Hetrich, Yangyupei Yang, Carly Herbert, Anju Ogyu, Adam L Cohen, Inci Yildirim, Brita A Winje, Anne von Gottberg, Delphine Viriot, Mark van der Linden, Palle Valentiner-Branth, Shigeru Suga, Anneke Steens, Anna Skoczynska, Nadja Sinkovec Zorko, J Anthony Scott, Camelia Savulescu, Larisa Savrasova, Juan Carlos Sanz,*

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- **Summary**
- **We evaluated their global impact on invasive pneumococcal disease (IPD) incidence in all ages.**
- **Findings Analyses included 32 PCV13 sites (488 758 cases) and 15 PCV10 sites (46 386 cases) in 30 countries, primarily high income (39 sites), using booster dose schedules (41 sites).**
- **By 6 years after PCV10 or PCV13 introduction, IPD due to PCV10-type serotypes and PCV10-related serotype 6A declined substantially for both products (age <5 years: 83–99% decline; ≥65 years: 54–96% decline). PCV7-related serotype 19A increases before PCV10 or PCV13 introduction were reversed at PCV13 sites (age <5 years: 61–79% decline relative to before any PCV; age ≥65 years: 7–26% decline) but increased at PCV10 sites (age <5 years: 1·6–2·3-fold; age ≥65 years: 3·6–4·9-fold).**
- **Non-PCV13-type IPD increased similarly for both products (age <5 years: 2·3–3·3-fold; age ≥65 years: 1·7–2·3-fold). Despite different serotype 19A trends, all-serotype IPD declined similarly between products among children younger than 5 years (58–74%); among adults aged 65 years or older, declines were greater at PCV13 (25–29%) than PCV10 (4–14%) sites, but other differences between sites precluded attribution to product.**
- **Interpretation Long-term use of PCV10 or PCV13 reduced IPD substantially in young children and more moderately in older ages. Non-vaccine-type serotypes increased approximately two-fold to three-fold by 6 years after introduction of PCV10 or PCV13. Continuing serotype 19A increases at PCV10 sites and declines at PCV13 sites suggest that PCV13 use would further reduce IPD at PCV10 sites**

Immunogenicity and reactogenicity of ten-valent versus 13-valent pneumococcal conjugate vaccines among infants in Ho Chi Minh City, Vietnam: a randomised controlled trial

Beth Temple, Nguyen Trong Toan, Vo Thi Trang Dai, Kathryn Bright, Paul Vincent Licciardi, Rachel Ann Marimla, Cattram Duong Nguyen, Doan Y Uyen, Anne Balloch, Tran Ngoc Huu, Edward Kim Mulholland**

- the immunogenicity and reactogenicity of PCV10 and PCV13.
- Methods In this parallel, open-label, randomised controlled trial, healthy infants from two districts in Ho Chi Minh
- City, Vietnam, were randomly allocated (in a 3:3:5:4:5:4 ratio), with use of a computer-generated list, to one of
- six infant PCV schedules: PCV10 in a 3 + 1 (group A), 3 + 0 (group B), 2 + 1 (group C), or two-dose schedule (group D);
- PCV13 in a 2 + 1 schedule (group E); or no infant PCV (control; group F). Blood samples were collected from infants
- between 2 months and 18 months of age at various timepoints before and after PCV doses and analysed (in a blinded
- manner) by ELISA and opsonophagocytic assay. The trial had two independent aims: to compare vaccination
- responses between PCV10 and PCV13, and to evaluate different schedules of PCV10. In this Article, we present
- results pertaining to the first aim. The primary outcome was the proportion of infants with an IgG concentration of
- at least 0·35 µg/mL for the ten serotypes common to the two vaccines at age 5 months, 4 weeks after the two-dose
- primary vaccination series (group C vs group E, per protocol population). An overall difference among the schedules
- was defined as at least seven of ten serotypes differing in the same direction at the 10% level. We also assessed

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Immunogenicity and seroefficacy of 10-valent and 13-valent pneumococcal conjugate vaccines: a systematic review and network meta-analysis of individual participant data

Shuo Feng,[a,*] Julie McLellan,[b] Nicola Pidduck,[b] Nia Roberts,[c] Julian P. T. Higgins,[d] Yoon Choi,[e] Alane Izu,[f] Mark Jit,[g] Shabir A. Madhi,[f,h] Kim Mulholland,[g,i,j] Andrew J. Pollard,[a,k] Beth Temple,[g,i,j] and Merryn Voysey[a,k,*]

- Research in context
- Evidence before this study
- The World Health Organization (WHO) recommends
- vaccination of all children worldwide with at least 3 doses of a
- licensed pneumococcal conjugate vaccine (PCV) in infancy and
- does not recommend one product over another. A 2017
- systematic review of pneumococcal vaccines which reviewed
- all data on different pneumococcal vaccine products, included
- five head-to-head studies comparing PCV13 vs PCV10. This
- review identified differences in immunogenicity between
- PCV10 and PCV13 after the primary series and after the
- booster dose, showing that PCV13 induced higher antibody
- than PCV10 in some common serotypes at both time points,
- e.g. serotypes 1, 5, 7F and 23F, while evidence was mixed for
- other serotypes. The review did not contain a meta-analysis,
- or head-to-head comparisons of the protection provided by
- different PCVs.
- Added value of this study
- We estimated serotype-specific difference in antibody
- responses and seroinfection between PCV13 and PCV10 and
- showed that for some serotypes, PCV13 induces higher
- antibody responses. Higher antibody responses corresponded
- with higher levels of protection against seroinfection (a proxy
- for carriage) such that in our models comparing two vaccines,
- a two-fold higher antibody response with one vaccine
- resulted in a 54% reduction in seroinfection (Relative Risk
- (RR) 0.46, 95% CI 0.23–0.96). Additionally, we found that
- PCVs from different manufacturers that produce equivalent
- levels of antibody provide comparable levels of protection
- against subclinical infections.
- Implications of all the available evidence
- Our findings suggest that PCV13 provides better protection
- against subclinical infection for some, but not all serotypes.

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Comparison of PCV-10 and PCV-13 vaccine coverage for invasive pneumococcal isolates obtained across Canadian geographic regions, SAVE 2011 to 2017

Rachel K. Hink [a], Heather J. Adam [a b], Alyssa R. Golden [a], Melanie Baxter [a],

Highlights

- 9166 invasive pneumococcal isolates from Canadian patients (2011–2017) were studied.
- PCV-10 serotypes decreased significantly (from 27% to 11%) from 2011 to 2017.
- PCV-13 serotypes decreased significantly (from 48% to 26%) from 2011 to 2017.
- PCV-13 (23%–36%) had significantly greater regional coverage than PCV-10 (10%–16%).
- PCV-13 (53%) had significantly greater MDR isolate coverage than PCV-10 (15%).

- To assess the coverage of invasive *Streptococcus pneumoniae* by pneumococcal conjugate vaccines (PCV)-10 and PCV-13 across Canada. In total, 9166 invasive *S. pneumoniae* isolates were collected as part of the SAVE 2011 to 2017 study. Serotyping was performed by the Quellung reaction and antimicrobial susceptibility testing was performed using CLSI methods. The proportion of both PCV-10 and PCV-13 serotypes decreased significantly ($P < 0.0001$) from 2011 (26.7% and 48.0%, respectively) to 2017 (11.2% and 26.2%). For central, western, and eastern regions of Canada, PCV-13 provided significantly greater ($P < 0.0001$) coverage at 33.7% (2060/6110), 23.0% (456/1985), and 36.3% (389/1071), respectively, compared to PCV-10 at 15.4% (939/6110), 10.1% (201/1985), and 15.8% (169/1071) coverage. PCV-13 provided significantly greater coverage (53.3%, 282/529) of multidrug-resistant (MDR) isolates (resistant to ≥3 antimicrobial classes) than PCV-10 (14.6%, 77/529, $P < 0.0001$). PCV-13 provided significantly greater coverage of invasive *S. pneumoniae* serotypes, as well as coverage of MDR isolates, than PCV-10

- We present 7 years of surveillance data on the coverage of invasive S. pneumoniae serotypes by PCV-10 and PCV-13 following the introduction of PCV-13 in Canada in 2011. Overall, the rate of coverage of invasive S. pneumoniae serotypes was approximately 2-fold greater for PCV-13 than PCV-10 (31.7% and 14.3%, respectively; Table 1 and Fig. 1). The coverage provided by both vaccines decreased significantly over the course of the study. Studies from other countries who have sequentially used PCV-7

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Research

Serotype Replacement after Introduction of 10-Valent and 13-Valent Pneumococcal Conjugate Vaccines in 10 Countries, Europe

Germaine Hanquet✉, Pavla Krizova, Tina Dalby, Shamez N. Ladhani, J. Pekka Nuorti, Kostas Danis, Jolita Mereckiene, Mirjam J. Knol, Brita A. Winje, Pilar Ciruela, Sara de Miguel, Maria Eugenia Portillo, Laura MacDonald, Eva Morfeldt, Jana Kozakova, Palle Valentiner-Branth, Norman K. Fry, Hanna Rinta-Kokko, Emmanuelle Varon, Mary Corcoran, Arie van der Ende, Didrik F. Vestrheim, Carmen Munoz-

- **Abstract**
- We evaluated invasive pneumococcal disease (IPD) during 8 years of infant pneumococcal conjugate vaccine (PCV) programs using 10-valent (PCV10) and 13-valent (PCV13) vaccines in 10 countries in Europe. IPD incidence declined during 2011–2014 but increased during 2015–2018 in all age groups. From the 7-valent PCV period to 2018, IPD incidence declined by 42% in children <5 years of age, 32% in persons 5–64 years of age, and 7% in persons >65 years of age; non-PCV13 serotype incidence increased by 111%, 63%, and 84%, respectively, for these groups. Trends were similar in countries using PCV13 or PCV10, despite different serotype distribution. Serotypes included in the 15-valent PCV represented one third of cases and those in the 20-valent PCVs two thirds of cases in children <5 years of age and in persons >65 years of age in 2018. Non-PCV13 serotype increases reduced the overall effect of childhood PCV10/PCV13 programs on IPD. New vaccines providing broader serotype protection are needed.

- By 2019, 9 years after the introduction of PCV13, the incidence of PCV13-type invasive pneumococcal infections decreased by 98% compared with incidence before introduction of PCV7, and the incidence of all IPD decreased by 95% in children younger than 5 years. In adults 65 years and older, IPD caused by PCV13 serotypes decreased 86% compared with pre-PCV7 baseline, and all IPD decreased by 61%. Most of the reduction in cases in this latter group occurred before routine PCV13 use was recommended in 2014 for older adults, indicating the significant indirect (ie, herd effect) benefits of PCV13 immunization achieved by interruption of transmission of pneumococci from vaccinated children to adults. Although *S pneumoniae* strains that are nonsusceptible to penicillin G, ceftriaxone, and other antimicrobial agents have been identified throughout the United States and worldwide, a reduction in the proportion of isolates that are penicillin-nonsusceptible (intermediate or resistant) and ceftriaxoneresistant has been observed since introduction of PCV7 and PCV13.

- Underlying Medical Conditions That Are Indications for Immunization With 23-Valent Pneumococcal Polysaccharide Vaccine (PPSV23)a or PCV20 Among Children, by Risk Group

- In contrast
  to immunization with PCV13, PCV15, and PCV20, immunization with PPSV23 does
  not induce immunologic memory or boosting with subsequent doses, has no effects on
  nasopharyngeal carriage, and therefore, does not interrupt transmission and indirectly
  protect unimmunized people.

- . PCV15 or PCV20 is recommended for all infants and children 2 through 59 months of age. There is no preference for one of these vaccines over the other. For infants, the vaccine should be
  administered at 2, 4, 6, and 12 through 15 months of age; catch-up immunization is recommended for all children 59 months of age or younger (Table 3.70). Infants should begin the PCV15 or PCV20 immunization series in conjunction with other recommended vaccines at the time of the first regularly scheduled health maintenance visit after 6 weeks of age. Infants of very low birth weight (1500 g or less) should be immunized when they attain a chronologic age of 6 to 8 weeks, regardless of their gestational age at birth. PCV15 or PCV20 can be administered concurrently with all other age-appropriate childhood immunizations (except PPSV23 and MenACWY-D [Menactra], see General Recommendations for Use of Pneumococcal Vaccines, below) using a separate syringe and a separate injection site.

- ***Immunization of Children Under 6 Years of Age Who Are Unimmunized or Incompletely Immunized With PCV13, PCV15, or PCV20.*** For healthy children 2 through 59 months of age with an incomplete PCV vaccination status, use of either PCV15 or PCV20 according to the currently recommended dosing and schedules is recommended (see Table 3.70). For all children 2 through 71 months who are at high risk or presumed high risk of acquiring invasive pneumococcal infection, as defined in Table 3.67 (p 812), the recommended use of PCV15, PCV20, and PPSV23 is outlined in Table 3.71 (p 819).
  Immunization of Children 6 Through 18 Years of Age With High-Risk Conditions Who Have Not
  Received Any Dose of PCV.**1–23**
  For children 6 through 18 years of age who previously have not received PCV13, PCV15, or PCV20 and who are at increased risk of IPD because of a high-risk condition (defined in Table 3.67, p 812), administration of a single PCV15 or PCV20 dose is recommended. When PCV15 is used, it should be followed by either a dose of PCV20 or a dose of PPSV23 at least 8 weeks later.

. Recommended Schedule for Doses of PCV15 or PCV20, Including Catch-up Immunizations, for Previously Unimmunized and Partially Immunized Children 2 Through 59 Months of Age

Age at Examination	Immunization History	Recommended Regimen[a,b,c,d]
2 through 6 mo	0 doses	4 doses: 3 doses, 8 wk apart; fourth dose at age 12–15 mo
	1 dose	3 additional doses: 2 doses, 8 wk apart; last dose at age 12–15 mo
	2 doses	2 additional doses: 1 dose 8 wk after most recent dose; last dose ≥8 wk later at age 12–15 mo
	3 doses	1 additional dose at age 12–15 mo
7 through 11 mo	0 doses	3 doses: 2 doses, ≥4 wk apart; third dose ≥8 wk later at age 12–15 mo
	1 or 2 doses (at age <7 mo)	2 additional doses: 1 dose 8 wk after most recent dose; last dose ≥8 wk later at age 12–15 mo
	3 doses (at age <7 mo)	1 additional dose at age 12–15 mo
	1 dose (at age ≥7 mo)	2 additional doses: 1 dose 8 wk after most recent dose; last dose ≥8 wk later at age 12–15 mo
	2 doses (at age ≥7 mo)	1 additional dose at age 12–15 mo
12 through 23 mo	0 doses	2 doses, ≥8 wk apart
	1 dose (at age <12 mo)	2 additional doses: 1 dose ≥8 wk after most recent dose; last dose ≥8 wk later
	1 dose (at ≥12 mo)	1 additional dose, ≥8 wk after most recent dose
	2 or 3 doses (at <12 mo)	1 additional dose, ≥8 wk after most recent dose
24 through 59 mo[e] Healthy children	Any incomplete schedule	1 dose, ≥8 wk after the most recent dose[e]

- PCV15 indicates 15-valent pneumococcal conjugate vaccine. PCV20 indicates 20-valent pneumococcal conjugate vaccine.
  aFor children immunized at younger than 12 months, the minimum interval between doses is 4 weeks. Doses administered at 12 months or older should be at least 8 weeks apart.
  bCenters for Disease Control and Prevention. Licensure of a 13-valent pneumococcal conjugate vaccine (PCV13) and recommendations for use among children. Advisory Committee on Immunization Practices (ACIP).

- PCV13 indicates 13-valent pneumococcal conjugate vaccine; PCV15 indicates 15-valent pneumococcal conjugate vaccine; PCV20 indicates 20-valent pneumococcal conjugate vaccine; PPSV23, 23-valent pneumococcal polysaccharide vaccine.
  aIncludes anatomic or functional asplenia, human immunodeficiency virus (HIV) infection, cochlear implant, cerebrospinal fluid (CSF) leak, nephrotic syndrome, chronic renal failure, or other immunocompromising conditions.
  bAmerican Academy of Pediatrics, Committee on Infectious Diseases. Policy statement: Immunization for *Streptococcus pneumoniae* infections in high-risk children. *Pediatrics.* 2014;134(6):1230–1233
  cKobayashi M, Farrar JI, Gierke R, et al. Use of 15-valent pneumococcal conjugate vaccine among US children: updated recommendations of the Advisory Committee on Immunization Practices—United States, 2022. *MMWR Morb Mortal Wkly Rep*. 2022;71(4):1174-1181.
  dACIP Updates: Recommendations for use of 20-valent pneumococcal conjugate vaccine in children—United States, 2023. *MMWR Morb Mortal Wkly Rep*. 2023;72(39):1072.
  eA second dose of PPSV23 5 years after the first dose is recommended only for children who have functional or anatomic asplenia, HIV infection, or other immunocompromising conditions (Table 3.67, p 812). No more than 2 doses of PPSV23 are recommended

- A second dose of PPSV23 or a first dose of PCV20 (if no prior PCV20 has been
administered) is recommended 5 years after the first dose of PPSV23 in children with
sickle cell disease or functional or anatomic asplenia, HIV infection, or other immunocompromising conditions, but no more than a total of 2 PPSV23 doses should be
administered before 65 years of age.
Immunization of Children 2 Through 18 Years of Age Who Are at Increased Risk of IPD With
PPSV23 After PCV13, PCV15, or PCV20.**1–23** Children 2 years or older with an underlying
medical condition increasing the risk of IPD should receive a dose of PPSV23 at leas

- 8 weeks after completing all recommended doses of PCV13 or PCV15. However, if they have received one or more doses of PCV20, no additional doses of any pneumococcal vaccine, including PPSV23, are indicated. In children who are candidates for solid organ transplantation and in cases when a splenectomy is planned for a patient older than 2 years, a dose of PPSV23 (if they previously had received only PCV13 or PCV15) or one dose of PCV20 should be administered at least 2 weeks before transplant or splenectomy. In candidates for solid organ transplantation not previously vaccinated with PCV13 or PCV15, a dose of PCV15 or PCV20 should be administered, even for those older than 6 years.
  A second dose of PPSV23 or a first dose of PCV20 (if no prior PCV20 has been administered) is recommended 5 years after the first dose of PPSV23 in children with sickle cell disease or functional or anatomic asplenia, HIV infection, or other immunocompromising conditions, but no more than a total of 2 PPSV23 doses should be administered before 65 years of age.
  General Recommendations for Use of Pneumococcal Vaccines.
  • PPSV23 should not be given together with a conjugate pneumococcal vaccines (PCV15 or PCV20) but can be administered concurrently with other childhood vaccines, with 1 exception. For children for whom quadrivalent meningococcal conjugate vaccine is indicated, MenACWY-D (Menactra) should not be administered concomitantly OR within 4 weeks of administration of PCV15 or PCV20 immunization to avoid potential interference with the immune response to PCV15 or PCV20. Because of their high risk for IPD, children with functional or anatomic asplenia should not be immunized with MenACWY-D (Menactra) before 2 years of age so that they can complete their PCV15 or PCV20 series; only MenACWYCRM (Menveo]) should be used in this age group because it has been shown to not interfere with the immune response to PCV15 or PCV20 and because the only other alternative, MenACWY-TT (MenQuadfi), is only approved in children ≥2 years of age (see Table 3.40, p 594).
  • When elective splenectomy is performed for any reason, immunization with PCV15 or PCV20 should be completed at least 2 weeks before splenectomy. Immunization also should precede initiation of immune-compromising therapy or placement of a cochlear implant by at least 2 weeks. PPSV23 should be administered 8 or more weeks after PCV15, but should not be administered if one or more doses of PCV20 has already been given (see Immunization and Other Considerations in Immunocompromised Children, p 93).
  • Generally, pneumococcal vaccines should be deferred during pregnancy. However, pregnant people with underlying conditions that warrant pneumococcal immunization may be vaccinated when the benefit of the vaccination is considered to outweigh any potential risks.
  Adverse Reactions to Pneumococcal Vaccines. Adverse reactions after administration of polysaccharide or conjugate vaccines generally are mild to moderate. The most commonly reported adverse reactions are local reactions of injection site, pain, redness, or swelling in addition to irritability, decreased appetite, or impaired sleep. Fever may occur within the first 1 to 2 days after injections, particularly after use of conjugate vaccine. Other systemic reactions include fatigue, headache, generalized muscle pain, decreased appetite, and chills

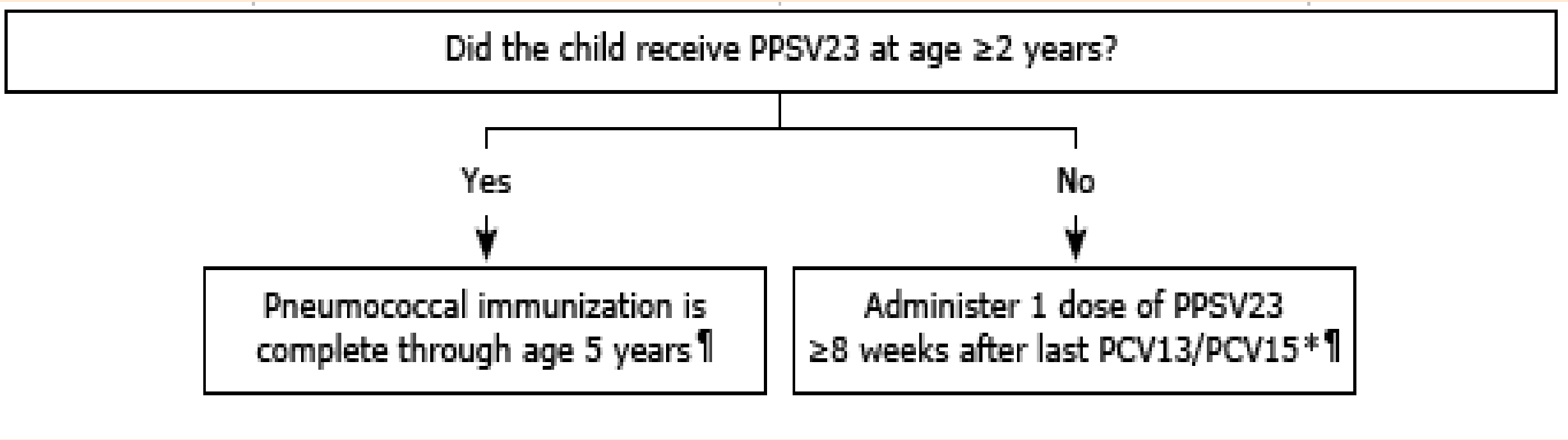
- ***hemoprophylaxis.*** Daily antimicrobial prophylaxis is recommended for certain children with functional or anatomic asplenia, regardless of their immunization status,
for prevention of pneumococcal disease on the basis of results of a large, multicenter
study (see Asplenia and Functional Asplenia, p 108). Oral penicillin V (125 mg, twice
a day, for children younger than 3 years; 250 mg, twice a day, for children 3 years and
older) is recommended. The study, performed before routine use of any of the conjugate pneumococcal vaccines in the United States, demonstrated that oral penicillin V
administered to infants and young children with sickle cell disease decreased the incidence of pneumococcal bacteremia by 84% compared with the placebo control group.
Although overall incidence of IPD is decreased after penicillin prophylaxis, cases of
penicillin-nonsusceptible IPD and nasopharyngeal carriage of penicillin-nonsusceptible strains in patients with sickle cell disease have increased since these studies were
conducted. Parents should be informed that penicillin prophylaxis may not be effective
in preventing all cases of IPD. In children with suspected or proven penicillin allergy,
erythromycin is an alternative agent for prophylaxis.1
The age at which prophylaxis is discontinued is an empiric decision. Most children
with sickle cell disease who have received all recommended pneumococcal vaccines for
age and who had received penicillin prophylaxis for prolonged periods, who are receiving
regular medical attention, and who have not had a previous severe pneumococcal infection or a surgical splenectomy may discontinue prophylactic penicillin safely at 5 years of
age. However, they must be counseled to seek medical attention promptly for all febrile
events. The duration of prophylaxis for children with asplenia attributable to other
causes is unknown. Some experts continue prophylaxis throughout childhood or longer.

- 2023 UpToDate recommendations for pneumococcal vaccination in recipients of previous pneumococcal vaccines

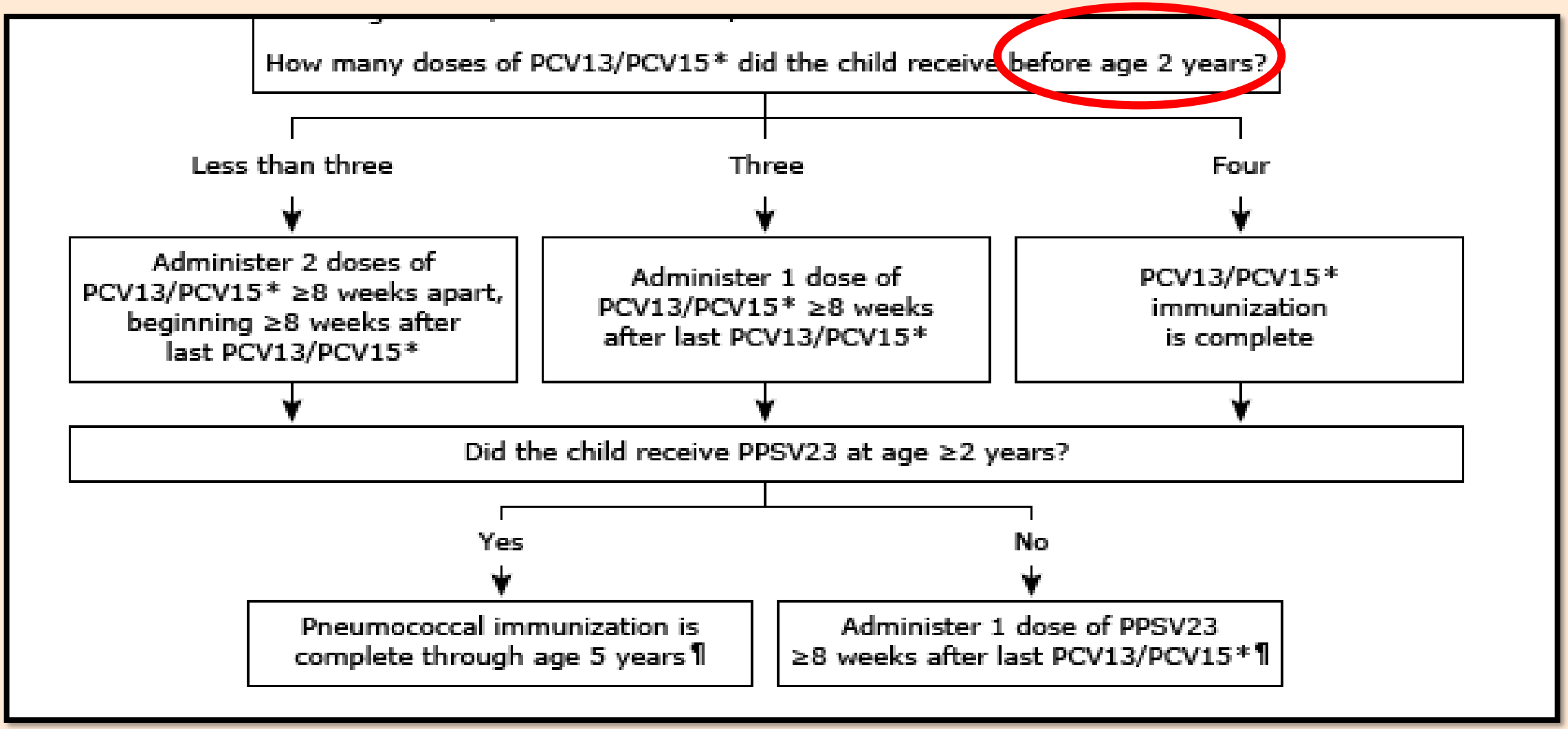
ACIP updated pneumococcal vaccine recommendations in 2022

- If PCV20 is not available, PPSV23 is a reasonable alternative.
- If PPSV23 is administered instead of PCV20, a shorter interval of ≥8 weeks may be used to maximize protection more quickly in high-risk individuals (eg, immunocompromising conditions, cochlear implant, or cerebrospinal fluid leak).
- Δ If PCV20 is not available, PPSV23 is a reasonable alternative. Notably, the ACIP advises shared decision-making regarding the benefit of administering PCV20 to patients who received their last PPSV23 dose at ≥65 years of age and also does not recommend a second dose of PPSV23 to patients at increased risk of meningitis (eg, cochlear implant, cerebrospinal fluid leak). Refer to the UpToDate text on pneumococcal vaccination in adults for additional information on the ACIP and authors' recommendations.

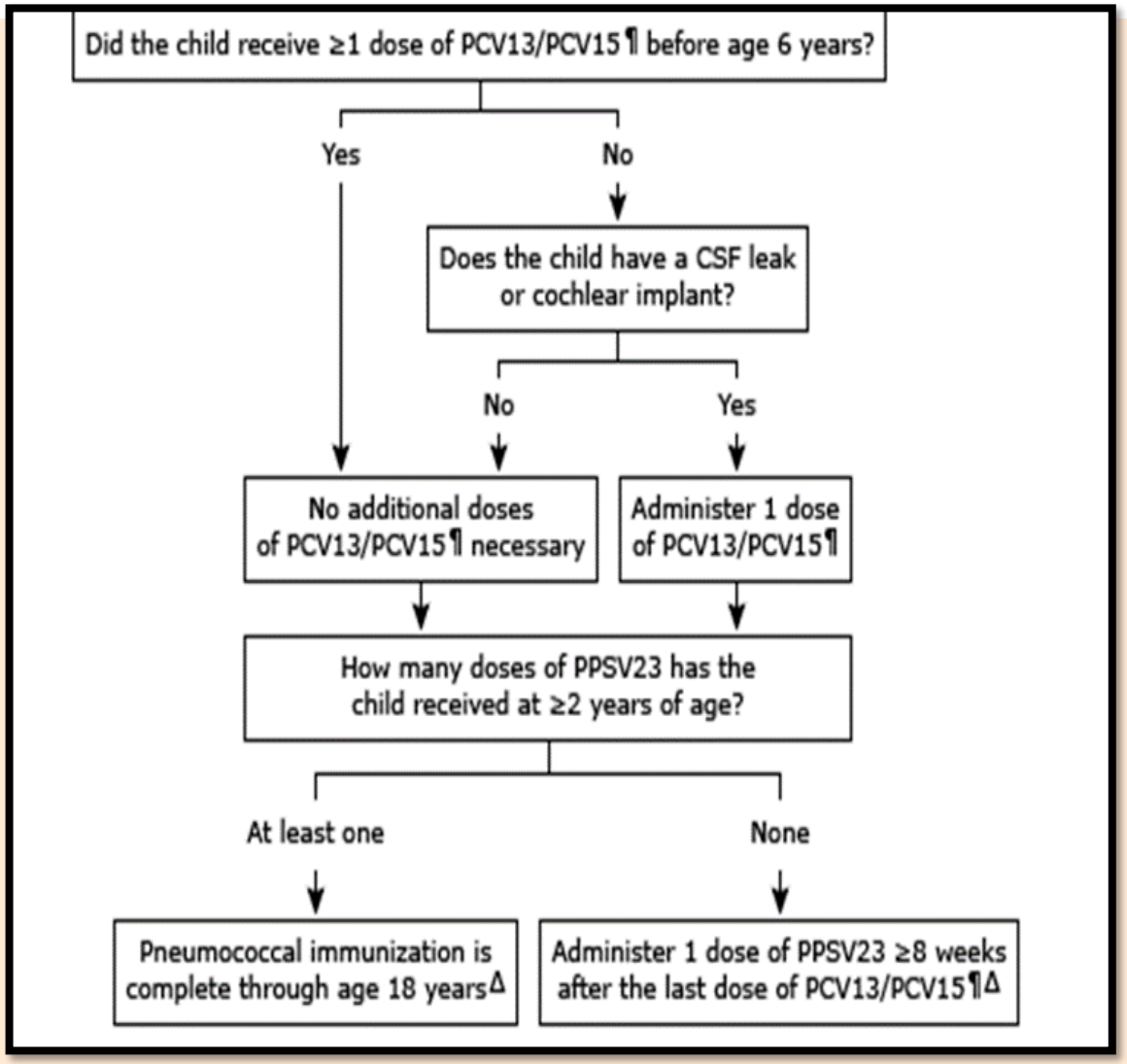
- CGD: chronic granulomatous disease; CSF: cerebrospinal fluid; PCV13: 13-valent pneumococcal conjugate vaccine; PCV15: 15-valent pneumococcal conjugate vaccine; PPSV23: 23-valent pneumococcal polysaccharide vaccine; IPD: invasive pneumococcal disease.
- * PCV13 and PCV15 can be used interchangeably.
- ¶ Refer to UpToDate content on pneumococcal vaccination in children for additional information about pneumococcal immunization in high-risk children older than 6 years. Immune-compromised children at high risk for IPD should receive a second dose of PPSV23, which is usually given ≥5 years after the first. However, for children with sickle cell disease, some experts recommend an interval of 3 years between the first and second PPSV23. Refer to UpToDate content on management of sickle cell disease for details.


Did the child receive PPSV23 at age ≥2 years?
Yes
No
Pneumococcal immunization is complete through age 5 years¶
Administer 1 dose of PPSV23 ≥8 weeks after last PCV13/PCV15*¶

Pneumococcal vaccination for children age 2 through 5 years at high risk for invasive pneumococcal disease



Pneumococcal vaccination for immune-competent children age 6 through 18 years who are at high risk for invasive pneumococcal disease



High-risk conditions in immune-competent children include:

- CSF leak
- Cochlear implant
- Chronic heart disease, particularly cyanotic congenital heart disease, cardiac failure, and cardiomyopathy
- Chronic lung disease, including asthma if treated with high-dose oral glucocorticoid therapy*
- Diabetes mellitus
- Chronic liver disease
- Alcoholism

Did the child receive ≥1 dose of PCV13/PCV15¶ before age 6 years?

- Particularly cyanotic congenital heart disease and cardiac failure in children; including congestive heart failure and cardiomyopathy in all ages; excluding hypertension in adults.
- Including asthma in children if treated with high-dose oral corticosteroid therapy, as well as chronic obstructive pulmonary disease (COPD), emphysema, and asthma in adults
- Includes B- (humoral) or T-lymphocyte deficiency, complement deficiencies (particularly C1, C2, C3, and C4 deficiencies), and phagocytic disorders (excluding chronic granulomatous disease).
- Diseases requiring treatment with immunosuppressive drugs, including long-term systemic corticosteroids and radiation therapy

CDC

- CDC recommends routine administration of pneumococcal conjugate vaccine (PCV13 or PCV15) for all children younger than 2 years of age.
- Give PCV13 or PCV15 to infants as a series of 4 doses, one dose at each of these ages: 2 months, 4 months, 6 months, and 12 through 15 months.
- Children who miss their shots or start the series later should still get vaccinated. The number of doses recommended and the intervals between doses will depend on the child's age when vaccination begins
- In certain situations, children 2 years or older and adults younger than age 65 should also receive pneumococcal vaccines.

- DC recommends routine administration of pneumococcal conjugate vaccine (PCV15 or PCV20) for all adults 65 years or older who have never received any pneumococcal conjugate vaccine or whose previous vaccination history is unknown:
- If PCV15 is used, this should be followed by a dose of PPSV23 one year later.
- The minimum interval is 8 weeks and can be considered in adults with an immunocompromising condition , cochlear implant, or cerebrospinal fluid leak.

If PCV20 is used, a dose of PPSV23 is NOT indicated

For a child with any of these conditions:

- Cerebrospinal fluid leak
- Chronic heart disease, particularly cyanotic congenital heart disease and cardiac failure
- Chronic lung disease, including asthma if treated with prolonged high-dose oral corticosteroid therapy
- Cochlear implant
- Diabetes mellitus

CDC recommends you:

- Give 2 doses of a pneumococcal conjugate vaccine (either PCV13 or PCV15) if they are unvaccinated or received an incomplete pneumococcal conjugate vaccine series with <3 doses before 24 months of age. Give the second dose at least 8 weeks after the first.
- Give 1 dose of PCV13 or PCV15 if they received 3 doses of a pneumococcal conjugate vaccine before 12 months but have not received their fourth booster dose.
- Give 1 dose of PPSV23 at least 8 weeks after the pneumococcal conjugate vaccine series is complete.

➢ CDC recommends :

Give 2 doses of a pneumococcal conjugate vaccine (either PCV13 or PCV15) if they are unvaccinated or received an incomplete pneumococcal conjugate vaccine series with <3 doses before 24 months of age. Give the second dose at least 8 weeks after the first.

Give 1 dose of PCV13 or PCV15 if they received 3 doses of a pneumococcal conjugate vaccine before 12 months but have not received their fourth booster dose.

Give 2 doses of PPSV23 after the pneumococcal conjugate vaccine series is complete. Give the first dose at least 8 weeks after any prior pneumococcal conjugate vaccine dose, then give the second dose of PPSV23 at least 5 years after the first PPSV23 dose.

For a child with any of these conditions:

- Chronic renal failure or nephrotic syndrome
- Congenital immunodeficiency
  - B- (humoral) or T-lymphocyte deficiency
  - Complement deficiency, particularly C1, C2, C3, or C4 deficiency
  - Phagocytic disorder, excluding chronic granulomatous disease
- Congenital or acquired asplenia, or splenic dysfunction
- Diseases associated with treatment of immunosuppressive drugs or radiation therapy
  - Hodgkin disease
  - Leukemia
  - Lymphoma
  - Malignant neoplasm
  - Solid organ transplant
- HIV infection
- Sickle cell disease or other hemoglobinopathies

Children 6 through 18 Years Old with Certain Medical Conditions

CDC recommends pneumococcal vaccination for children 6 through 18 years old who have certain medical conditions that increase their risk of pneumococcal disease. The tables below provide detailed information by medical condition. See table 3 for additional details.

For a child with any of these conditions:

- Cerebrospinal fluid leak
- Cochlear implant

CDC recommends you:

- Give 1 dose of a pneumococcal conjugate vaccine (either PCV13 or PCV15) if they have not received any doses of a pneumococcal conjugate vaccine. Administer PCV13 or PCV15 before giving any recommended doses of PPSV23.
- Give 1 dose of PPSV23 (if not already given earlier in childhood) at least 8 weeks after PCV13 or PCV15.

Adults 19 through 64 Years Old

CDC recommends pneumococcal vaccination for adults 19 through 64 years old who have certain chronic medical conditions or other risk factors. The tables below provide detailed information

For adults with any of the conditions or risk factors listed below:

- Alcoholism
- Cerebrospinal fluid leak
- Chronic heart disease, including congestive heart failure and cardiomyopathies
- Chronic liver disease
- Chronic lung disease, including chronic obstructive pulmonary disease, emphysema, and asthma
- Chronic renal failure*
- Cigarette smoking
- Cochlear implant
- Congenital or acquired asplenia*
- Congenital or acquired immunodeficiency*
    - B- (humoral) or T-lymphocyte deficiency
    - Complement deficiency, particularly C1, C2, C3, or C4 deficiency
    - Phagocytic disorder, excluding chronic granulomatous disease
- Diabetes mellitus
- Generalized malignancy*
- HIV infection*
- Hodgkin disease*
- Iatrogenic immunosuppression, including long-term systemic corticosteroids and radiation therapy*
- Leukemia*
- Lymphoma*
- Multiple myeloma*
- Nephrotic syndrome*
- Sickle cell disease or other hemoglobinopathies*
- Solid organ transplant*

* An immunocompromising condition

- **For those who have not previously received any pneumococcal vaccine†, CDC recommends you:**
- Give 1 dose of PCV15 or PCV20.
  - If PCV15 is used, this should be followed by a dose of PPSV23 at least one year later. The minimum interval is 8 weeks and can be considered in adults with an **immunocompromising condition, cochlear implant, or cerebrospinal fluid leak**.
  - If PCV20 is used, a dose of PPSV23 is NOT indicated.
- † Also applies to people who received PCV7 at any age and no other pneumococcal vaccines.
- **For those who have only received PPSV23, CDC recommends you:**
- Give 1 dose of PCV15 or PCV20.
  - The PCV15 or PCV20 dose should be administered at least 1 year after the most recent PPSV23 vaccination.
  - Regardless of if PCV15 or PCV20 is given, an additional dose of PPSV23 is not recommended since they already received it.
- **For those who have only received PCV13, CDC recommends you either:**
- Give 1 dose of PCV20 at least 1 year after PCV13.
- or
- Give 1 dose of PPSV23; the minimum interval between the PCV13 and PPSV23 doses will vary based on their specific risk factor.
  - **Immunocompromising condition**: At least 8 weeks after PCV13 These patients could receive up to two additional doses of PPSV23 in their lifetime. The second dose of PPSV23 should be administered at least 5 years after the first dose of PPSV23. If a patient is aged 65 years or older when the second dose is given, then a third dose is not indicated.
  - If a patient is younger than 65 years when the second PPSV23 dose is given, then review pneumococcal vaccine recommendations again when the patient turns 65 years old.
  - **Cochlear implant or cerebrospinal fluid leak**: At least 8 weeks after PCV13 Review pneumococcal vaccine recommendations again when the patient turns 65 years old.
  - **Other chronic health condition**: Adults with a chronic medical condition (other than an immunocompromising condition, cochlear implant, or cerebrospinal fluid leak) were previously not recommended to receive PCV13; however, if they received it then they should wait at least 1 year before receiving PPSV23 Review pneumococcal vaccine recommendations again when the patient turns 65 years old.
- **For those who have received PCV13 and 1 dose of PPSV23, CDC recommends you either:**
- Give 1 dose of PCV20 at least 5 years after the last pneumococcal vaccine.
- or
- Give a second dose of PPSV23 at least 8 weeks after PCV13 and 5 years after PPSV23 if they have an **immunocompromising condition**. Otherwise, no vaccines are recommended at this time for patients with any of the other conditions or risk factors listed above.
  - Review pneumococcal vaccine recommendations again when these patients turn 65 years old.

- **1- For those who have not previously received any pneumococcal vaccine†, CDC recommends you:**
- Give 1 dose of PCV15 or PCV20.
  - If PCV15 is used, this should be followed by a dose of PPSV23 at least one year later. The minimum interval is 8 weeks and can be considered in adults with an **immunocompromising condition, cochlear implant, or cerebrospinal fluid leak**.
  - If PCV20 is used, a dose of PPSV23 is NOT indicated.
- † Also applies to people who received PCV7 at any age and no other pneumococcal vaccines.
- **2- For those who have only received PPSV23, CDC recommends you:**
- Give 1 dose of PCV15 or PCV20.
  - The PCV15 or PCV20 dose should be administered at least 1 year after the most recent PPSV23 vaccination.
  - Regardless of if PCV15 or PCV20 is given, an additional dose of PPSV23 is not recommended since they already received it.

- **3- For adults 65 years or older who have only received PCV13, CDC recommends you either:**
- Give 1 dose of PCV20 at least 1 year after PCV13.
- or
- Give 1 dose of PPSV23 at least 1 year after PCV13.
  - The minimum interval is 8 weeks and can be considered in adults with an **immunocompromising condition, cochlear implant, or cerebrospinal fluid leak**.
- **4- For adults 65 years or older who have received PCV13 at any age and PPSV23 before age 65 years, CDC recommends you either:**
- Give 1 dose of PCV20 at least 5 years after the last pneumococcal vaccine.
- or
- Give 1 dose of PPSV23 at least 1 year after PCV13 dose and at least 5 years after the last PPSV23 dose.
  - The minimum interval (8 weeks since last PCV13 dose and 5 years since last PPSV23 dose) is recommended in adults with an **immunocompromising condition, cochlear implant, or cerebrospinal fluid leak**.

- **6-For adults 65 years or older who have received PCV13 at any age and PPSV23 at or after age 65 years, CDC recommends:**
- Shared clinical decision-making on whether to administer PCV20.
  - If the vaccine provider and patient decide PCV20 is appropriate, the dose of PCV20 should be administered at least 5 years after the last pneumococcal vaccine.

Up to date

- In agreement with the ACIP , we recommend pneumococcal vaccination for
- ●All adults ≥65 years of age
- ●Adults aged 19 to 64 years with:
- •Predisposing chronic medical conditions (eg, chronic lung disease, chronic liver disease, diabetes mellitus)
- •Increased risk of meningitis (eg, cochlear implant, cerebrospinal fluid [CSF] leak)
- •Immunocompromising conditions (eg, human immunodeficiency virus [HIV] infection, hematologic malignancies) and other conditions associated with altered immunocompetence (functional or anatomic asplenia, chronic renal disease, and nephrotic syndrome)
- •Functional or anatomic asplenia
- In addition to the indications outlined by the ACIP, we also recommend pneumococcal vaccination for those with prior history of IPD.

- Vaccination is not recommended for healthy adults less than 65 years of age

- Vaccine selection
- Approach to healthy older adults and those with predisposing medical conditions — The ACIP recommends the 20-valent PCV (PCV20) alone or the 15-valent PCV (PCV15) followed by the 23-valent PPSV (PPSV23) for all adults with indications for vaccination (table 3). For most adults, including healthy older adults, those with predisposing medical conditions, and those with a history of IPD, we prefer to administer PCV20, when available, due to the simplicity and lower cost of a single-dose vaccine. Comparative efficacy of these two approaches is unknown.
- If PCV20 is not available, PCV15 followed by PPSV23 is a recommended alternative. If PCV15 is administered, PPSV23 should be administered one year after PCV15 to provide immunity against an increased number of pneumococcal serotypes. When the series PCV15 followed by PPSV23 is completed, protection is offered to an additional three serotypes compared with the single PCV20 approach. Although it is hypothesized that the immunogenicity of PPSV is boosted by prior administration of PCV, this booster effect has not been convincingly demonstrated [6,7].
- Some experts may prefer PCV15 followed by PPSV23 to PCV20 alone based on indirect preliminary data suggesting PCV15 may be more immunogenic than PCV20 [8] (but the data only demonstrate immunogenicity for the first 30 days post-vaccination) and because PCV15 has been studied in immunocompromised individuals (eg, patients with HIV) [8,9]. No study to date has directly compared PCV15 and PCV20, and the clinical significance of higher antibody levels 30 days after vaccination is unknown.
- Approach to individuals at highest risk of pneumococcal disease — For immunocompromised individuals (eg, transplant recipients, persons with HIV) and those at increased risk for meningitis (eg, cochlear implant, CSF leak), the authors prefer to administer PCV20 followed by PPSV23 ≥8 weeks later. This recommendation differs from the ACIP and other experts' recommendations to administer PCV20 alone (or PCV15 followed by PPSV23) in these populations. The authors administer the PPSV23 in addition to PCV20 in these individuals to provide protection against serotypes present in PPSV23 that are absent from PCV20. Although PCV20 covers the majority of the serotypes implicated in IPD, there are three relatively common serotypes (9N, 20, 17F) included in PPSV23 that are not included in PCV20
- ●**PPSV23 only** – Adults who have only received the PPSV23 vaccine should receive PCV20 (or PCV15 if PCV20 is not available) at least a year after PPSV23 [11].
- ●**PCV13 only** – Adults who have only received PCV13 should receive PCV20 (or PPSV23 if PCV20 is not available) at least one year after receipt of PCV13 [11]. A shorter interval for PPSV23 of ≥8 weeks is recommended for those at highest risk for pneumococcal disease
- ●**Both PCV13 and PPSV23**
- •Adults ≥65 years of age:
- -Those who received both the PCV13 and PPSV23 prior to age 65 years should receive PCV20 or PPSV23 (if PCV20 is not available) ≥5 years after their last pneumococcal vaccine dose.
- -Those who received PCV13 at any age and PPSV23 at ≥65 years of age, the ACIP advises shared decision-making between clinician and patient regarding whether to administer PCV20 ≥5 years after their last pneumococcal vaccine [11]. The authors of this topic prefer to administer PCV20 (or PPSV23 if PCV20 is not available) ≥5 years after the patient's last pneumococcal vaccine since the benefits generally outweigh the minimal risks of an adverse vaccine reaction.
- •Adults aged 19 to 64 who have already received both PCV13 and PPSV23 should receive PCV20 (or PPSV23 if PCV20 is not available) five years after their last pneumococcal vaccination. Although the ACIP does not recommend a second dose of PPSV23 to those with increased risk for meningitis (eg, cochlear implants, CSF leak) [11], the authors of this topic believe the benefits of a second PPSV23 dose (when PCV20 is not available) outweigh the minimal risks of an adverse vaccine reaction. Those who have received PCV13 and two doses of PPSV23 should receive PCV20 five years after their last pneumococcal vaccination, if available.

Recommendations for immunization with PCV13/PCV15 and PPSV23 for children at high risk* of pneumococcal disease who are 2 through 5 years of age

Pneumococcal vaccine history before age 2 years	Pneumococcal vaccines needed for completion through age 5 years¶
No doses of PPSV23 and:	
▪ 4 doses of PCV13/PCV15	▪ 1 dose of PPSV23 ≥8 weeks after last dose of PCV13/PCV15
▪ 3 doses of PCV13/PCV15	▪ 1 dose of PCV13/PCV15 ≥8 weeks after last dose of PCV13/PCV15 ▪ 1 dose of PPSV23 ≥8 weeks later
▪ <3 doses of PCV13/PCV15	▪ 2 doses of PCV13/PCV15 ≥8 weeks apart, beginning ≥8 weeks after last dose of PCV13/PV15 ▪ 1 dose of PPSV23 ≥8 weeks later
One dose of PPSV23 after age 2 years and:	
▪ 4 doses of PCV13/PCV15	▪ Pneumococcal immunization through age 5 is complete
▪ 3 doses of PCV13/PCV15	▪ 1 dose of PCV13/PCV15 ≥8 weeks after last pneumococcal vaccine (PCV13/PSV15 or PPSV23)
▪ <3 doses of PCV13/PCV15	▪ 2 doses of PCV13/PCV15 ≥8 weeks apart, beginning ≥8 weeks after last pneumococcal vaccine (PCV13/PCV15 or PPSV23)

This table is intended for use in conjunction with the UpToDate topic on pneumococcal vaccination in children. PCV13 and PCV15 are interchangeable. When obtaining the pneumococcal vaccination history, doses that are unknown or uncertain should not be counted. Refer to UpToDate content on pneumococcal vaccination in children for details.

- High-risk conditions include: Immune-compromising conditions (eg, functional or anatomic asplenia [including sickle cell disease, other hemoglobinopathies, and congenital or acquired asplenia or splenic dysfunction], congenital or acquired immunodeficiency, HIV infection, chronic kidney failure, nephrotic syndrome, generalized malignancy, hematologic malignancy [eg, leukemia, lymphoma], iatrogenic immunosuppression)
- CSF leak or cochlear implant in immune-competent children
- Certain chronic conditions in immune-competent children (eg, chronic heart disease, chronic lung disease, diabetes mellitus, chronic liver disease, alcoholism)
- ¶ High-risk children with immune-compromising conditions require a second dose of PPSV23, usually ≥5 years after the first. For patients with sickle cell disease, some experts recommend an interval of three years between the first and second dose of PPSV23[1], whereas others recommend an interval of five years[2-5]. A second dose of PPSV23 is **not** recommended for immunocompetent children with anatomic barrier defects or chronic condition

IMPORTANT SAFETY INFORMATION AND INDICATION FOR PREVNAR 13®

IMPORTANT SAFETY INFORMATION

- Prevnar 13® should not be given to anyone with a history of severe allergic reaction to any component of Prevnar 13® or any diphtheria toxoid–containing vaccine
- Children with weakened immune systems (eg, HIV infection, leukemia) may have a reduced immune response
- A temporary pause of breathing following vaccination has been observed in some infants born prematurely
- The most commonly reported serious adverse events in infants and toddlers were bronchiolitis (an infection of the lungs) (0.9%), gastroenteritis (inflammation of the stomach and small intestine) (0.9%), and pneumonia (0.9%)
- In children 6 weeks through 17 years, the most common side effects were tenderness, redness, or swelling at the injection site, irritability, decreased appetite, decreased or increased sleep, and fever
- Ask your healthcare provider about the risks and benefits of Prevnar 13®. Only a healthcare provider can decide if Prevnar 13® is right for your child

Patients should always ask their doctors for medical advice about adverse events. You are encouraged to report negative side effects of vaccines to the US Food and Drug Administration (FDA) and the Centers for Disease Control and Prevention (CDC). Visit www.vaers.hhs.gov or call 1-800-822-7967.

INDICATION FOR PREVNAR 13®

- Prevnar 13® is a vaccine approved for children 6 weeks through 17 years of age for the prevention of invasive disease caused by 13 *Streptococcus pneumoniae* strains (1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F, and 23F), and for children 6 weeks through 5 years for the prevention of otitis media caused by 7 of the 13 strains
- Prevnar 13® is not 100% effective and will only help protect against the 13 strains included in the vaccine

Adults

- **Streptococcus pneumoniae Immunization**
- Pneumococcal vaccine 13-valent (PCV13) is indicated for active immunization for the prevention of pneumonia and invasive disease caused by Streptococcus pneumoniae serotypes 1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F and 23F
- Adults aged 19-64 years: ACIP guidelines recommend use for adults with certain medical conditions
- Immunocompetent adults aged ≥65 years: Need for vaccination based on shared decision making between patient and clinician (ie, no longer routinely recommended for all adults aged ≥65 yr)

- Adults aged 19-64 years with certain medical conditions
- 1 dose PCV13 followed by 1 dose PPSV23 at least 1 year later; repeat regimen when aged ≥65 years
- **Immunocompetent adults aged ≥65 years**
- Based on shared clinical decision making
- If both PCV13 and PPSV23 administered, PCV13 should be administered first
- PCV13 and PPSV23 should be administered at least 1 year apart
- Do not administer during the same visit
- **Dosing Considerations**

Adults

- **Specific medical conditions for aged 19-64 years**
- Alcoholism
- Chronic heart, liver, or lung disease
- Cigarette smoking hgf/
- Diabetes mellitus
- Cochlear implant
- CSF leak
- Congenital or acquired asplenia
- Sickle cell disease or other hemoglobinopathies
- Chronic renal failure
- Congenital or acquired immunodeficiencies
- Generalized malignancy
- HIV infection
- Hodgkin disease, leukemia, lymphoma, multiple myeloma
- Iatrogenic immunosuppression
- Nephrotic syndrome
- Solid organ transplant

- **ACIP Guidelines, Aged 2-5 Years With High Risk**
- Any of the following conditions:
- Chronic heart disease (particularly cyanotic congenital heart disease and cardiac failure)
- Chronic lung disease (including asthma if treated with high-dose oral corticosteroid therapy)
- Diabetes mellitus
- Cerebrospinal fluid leak
- Cochlear implant
- Sickle cell disease and other hemoglobinopathies
- Anatomic or functional asplenia
- HIV infection
- Chronic renal failure
- Nephrotic syndrome
- Diseases associated with immunosuppressive drugs or radiation therapy, including malignant neoplasms, leukemias, lymphomas, and Hodgkin disease; solid organ transplantation; or congenital immunodeficiency
- **Dosage for high risk 2-5 years olds**
- 1. Administer 1 dose of PCV13 if 3 doses of PCV (7- or 13-valent) were received previously
- 2. Administer 2 doses of PCV at least 8 weeks apart if fewer than 3 doses of PCV13 were received previously
- 3. Administer 1 supplemental dose of PCV13 if 4 doses of PCV7 or other age-appropriate complete PCV7 series was received previously
- 4. The minimum interval between doses of PCV is 8 wk
- 5. For children with no history of PPSV23 vaccination, administer PPSV23 at least 8 wk after the most recent dose of PCV13

- PCV13 is no longer routinely recommended for adults age 65 years and older. However, PCV13 may be given at this age based on shared clinical decision-making between the provider and patient.
- Particularly cyanotic congenital heart disease and cardiac failure in children; including congestive heart failure and cardiomyopathy in all ages; excluding hypertension in adults.
- Including asthma in children if treated with high-dose oral corticosteroid therapy, as well as chronic obstructive pulmonary disease (COPD), emphysema, and asthma in adults
- Includes B- (humoral) or T-lymphocyte deficiency, complement deficiencies (particularly C1, C2, C3, and C4 deficiencies), and phagocytic disorders (excluding chronic granulomatous disease).
- Diseases requiring treatment with immunosuppressive drugs, including long-term systemic corticosteroids and radiation therapy

cdc

- **Routine Vaccination of Infants, Children, and Adults 65 Years or Older**
- **Infants and children**
- CDC recommends routine administration of pneumococcal conjugate vaccine (PCV13 or PCV15) for all children younger than 2 years of age.
- Give PCV13 or PCV15 to infants as a series of 4 doses, one dose at each of these ages: 2 months, 4 months, 6 months, and 12 through 15 months.
- Children who miss their shots or start the series later should still get vaccinated. The number of doses recommended and the intervals between doses will depend on the child's age when vaccination begins

- DC recommends routine administration of pneumococcal conjugate vaccine (PCV15 or PCV20) for all adults 65 years or older who have never received any pneumococcal conjugate vaccine or whose previous vaccination history is unknown:
- If PCV15 is used, this should be followed by a dose of PPSV23 one year later. The minimum interval is 8 weeks and can be considered in adults with an immunocompromising condition†, cochlear implant, or cerebrospinal fluid leak.
- If PCV20 is used, a dose of PPSV23 is NOT indicated

- **Vaccination of Older Children and Adults with Certain Indications**
- In certain situations, children 2 years or older and adults younger than age 65 should also receive pneumococcal vaccines. See Pneumococcal Vaccination: Summary of Who and When to Vaccinate for all pneumococcal vaccine recommendations by vaccine and age.

For a child with any of these conditions:

- Cerebrospinal fluid leak
- Chronic heart disease, particularly cyanotic congenital heart disease and cardiac failure
- Chronic lung disease, including asthma if treated with prolonged high-dose oral corticosteroid therapy
- Cochlear implant
- Diabetes mellitus

CDC recommends you:

- Give 2 doses of a pneumococcal conjugate vaccine (either PCV13 or PCV15) if they are unvaccinated or received an incomplete pneumococcal conjugate vaccine series with <3 doses before 24 months of age. Give the second dose at least 8 weeks after the first.
- Give 1 dose of PCV13 or PCV15 if they received 3 doses of a pneumococcal conjugate vaccine before 12 months but have not received their fourth booster dose.
- Give 1 dose of PPSV23 at least 8 weeks after the pneumococcal conjugate vaccine series is complete.

CDC recommends you:

Give 2 doses of a pneumococcal conjugate vaccine (either PCV13 or PCV15) if they are unvaccinated or received an incomplete pneumococcal conjugate vaccine series with <3 doses before 24 months of age. Give the second dose at least 8 weeks after the first.

Give 1 dose of PCV13 or PCV15 if they received 3 doses of a pneumococcal conjugate vaccine before 12 months but have not received their fourth booster dose.

Give 2 doses of PPSV23 after the pneumococcal conjugate vaccine series is complete. Give the first dose at least 8 weeks after any prior pneumococcal conjugate vaccine dose, then give the second dose of PPSV23 at least 5 years after the first PPSV23 dose.

For a child with any of these conditions:

- Chronic renal failure or nephrotic syndrome
- Congenital immunodeficiency
  - B- (humoral) or T-lymphocyte deficiency
  - Complement deficiency, particularly C1, C2, C3, or C4 deficiency
  - Phagocytic disorder, excluding chronic granulomatous disease
- Congenital or acquired asplenia, or splenic dysfunction
- Diseases associated with treatment of immunosuppressive drugs or radiation therapy
  - Hodgkin disease
  - Leukemia
  - Lymphoma
  - Malignant neoplasm
  - Solid organ transplant
- HIV infection
- Sickle cell disease or other hemoglobinopathies

CDC recommends you:

Give 1 dose of a pneumococcal conjugate vaccine (either PCV13 or PCV15) if they have not received any doses of a pneumococcal conjugate vaccine. Administer PCV13 or PCV15 before giving any recommended doses of PPSV23.

Ensure the child receives 2 doses of PPSV23. The first dose of PPSV23 should be given at least 8 weeks after any prior pneumococcal conjugate vaccine dose, then the second dose of PPSV23 should be given at least 5 years after the first dose of PPSV23.

For a child with any of these conditions:

- Chronic renal failure or nephrotic syndrome
- Congenital immunodeficiency
  - B- (humoral) or T-lymphocyte deficiency
  - Complement deficiency, particularly C1, C2, C3, or C4 deficiency
  - Phagocytic disorder, excluding chronic granulomatous disease
- Congenital or acquired asplenia, or splenic dysfunction
- Diseases associated with treatment of immunosuppressive drugs or radiation therapy
  - Hodgkin disease
  - Leukemia
  - Lymphoma
  - Malignant neoplasm
  - Solid organ transplant
- HIV infection
- Sickle cell disease or other hemoglobinopathies

For a child with any of these conditions:

- Chronic heart disease, particularly cyanotic congenital heart disease and cardiac failure
- Chronic lung disease, including asthma if treated with prolonged high-dose oral corticosteroid therapy
- Diabetes mellitus

CDC recommends you:

- Give 1 dose of PPSV23 (if not already given earlier in childhood).

Adults 19 through 64 Years Old

CDC recommends pneumococcal vaccination for adults 19 through 64 years old who have certain chronic medical conditions or other risk factors. The tables below provide detailed information

For adults with any of the conditions or risk factors listed below:

- Alcoholism
- Cerebrospinal fluid leak
- Chronic heart disease, including congestive heart failure and cardiomyopathies
- Chronic liver disease
- Chronic lung disease, including chronic obstructive pulmonary disease, emphysema, and asthma
- Chronic renal failure*
- Cigarette smoking
- Cochlear implant
- Congenital or acquired asplenia*
- Congenital or acquired immunodeficiency*
    - B- (humoral) or T-lymphocyte deficiency
    - Complement deficiency, particularly C1, C2, C3, or C4 deficiency
    - Phagocytic disorder, excluding chronic granulomatous disease
- Diabetes mellitus
- Generalized malignancy*
- HIV infection*
- Hodgkin disease*
- Iatrogenic immunosuppression, including long-term systemic corticosteroids and radiation therapy*
- Leukemia*
- Lymphoma*
- Multiple myeloma*
- Nephrotic syndrome*
- Sickle cell disease or other hemoglobinopathies*
- Solid organ transplant*

* An immunocompromising condition

- **For those who have not previously received any pneumococcal vaccine†, CDC recommends you:**
- Give 1 dose of PCV15 or PCV20.
  - If PCV15 is used, this should be followed by a dose of PPSV23 at least one year later. The minimum interval is 8 weeks and can be considered in adults with an **immunocompromising condition, cochlear implant, or cerebrospinal fluid leak**.
  - If PCV20 is used, a dose of PPSV23 is NOT indicated.
- † Also applies to people who received PCV7 at any age and no other pneumococcal vaccines.
- **For those who have only received PPSV23, CDC recommends you:**
- Give 1 dose of PCV15 or PCV20.
  - The PCV15 or PCV20 dose should be administered at least 1 year after the most recent PPSV23 vaccination.
  - Regardless of if PCV15 or PCV20 is given, an additional dose of PPSV23 is not recommended since they already received it.
- **For those who have only received PCV13, CDC recommends you either:**
- Give 1 dose of PCV20 at least 1 year after PCV13.
- or
- Give 1 dose of PPSV23; the minimum interval between the PCV13 and PPSV23 doses will vary based on their specific risk factor.
  - **Immunocompromising condition**: At least 8 weeks after PCV13 These patients could receive up to two additional doses of PPSV23 in their lifetime. The second dose of PPSV23 should be administered at least 5 years after the first dose of PPSV23. If a patient is aged 65 years or older when the second dose is given, then a third dose is not indicated.
  - If a patient is younger than 65 years when the second PPSV23 dose is given, then review pneumococcal vaccine recommendations again when the patient turns 65 years old.
  - **Cochlear implant or cerebrospinal fluid leak**: At least 8 weeks after PCV13 Review pneumococcal vaccine recommendations again when the patient turns 65 years old.
  - **Other chronic health condition**: Adults with a chronic medical condition (other than an immunocompromising condition, cochlear implant, or cerebrospinal fluid leak) were previously not recommended to receive PCV13; however, if they received it then they should wait at least 1 year before receiving PPSV23 Review pneumococcal vaccine recommendations again when the patient turns 65 years old.
- **For those who have received PCV13 and 1 dose of PPSV23, CDC recommends you either:**
- Give 1 dose of PCV20 at least 5 years after the last pneumococcal vaccine.
- or
- Give a second dose of PPSV23 at least 8 weeks after PCV13 and 5 years after PPSV23 if they have an **immunocompromising condition**. Otherwise, no vaccines are

- **Adults 65 Years or Older**
- CDC recommends pneumococcal vaccination for all adults 65 years or older. The tables below provide detailed information.
- **For adults 65 years or older who have not previously received any pneumococcal vaccine†, CDC recommends you:**
- Give 1 dose of PCV15 or PCV20.
    - If PCV15 is used, this should be followed by a dose of PPSV23 at least 1 year later. The minimum interval is 8 weeks and can be considered in adults with an **immunocompromising condition, cochlear implant, or cerebrospinal fluid leak**.
    - If PCV20 is used, a dose of PPSV23 is NOT indicated.
- †Also applies to people who received PCV7 at any age and no other pneumococcal vaccines.
- **For adults 65 years or older who have only received PPSV23, CDC recommends you:**
- Give 1 dose of PCV15 or PCV20.
    - The PCV15 or PCV20 dose should be administered at least 1 year after the most recent PPSV23 vaccination.
    - Regardless of if PCV15 or PCV20 is given, an additional dose of PPSV23 is not recommended since they already received it.
- **For adults 65 years or older who have only received PCV13, CDC recommends you either:**
- Give 1 dose of PCV20 at least 1 year after PCV13.
- or
- Give 1 dose of PPSV23 at least 1 year after PCV13.
    - The minimum interval is 8 weeks and can be considered in adults with an **immunocompromising condition, cochlear implant, or cerebrospinal fluid leak**.
- **For adults 65 years or older who have received PCV13 at any age and PPSV23 before age 65 years, CDC recommends you either:**
- Give 1 dose of PCV20 at least 5 years after the last pneumococcal vaccine.
- or
- Give 1 dose of PPSV23 at least 1 year after PCV13 dose and at least 5 years after the last PPSV23 dose.
    - The minimum interval (8 weeks since last PCV13 dose and 5 years since last PPSV23 dose) is recommended in adults with an **immunocompromising condition, cochlear implant, or cerebrospinal fluid leak**.
- See Examples: Complete pneumococcal vaccine schedules for adults for a visual illustration of these vaccine options.
- **For adults 65 years or older who have received PCV13 at any age and PPSV23 at or after age 65 years, CDC recommends:**
- Shared clinical decision-making on whether to administer PCV20.
    - If the vaccine provider and patient decide PCV20 is appropriate, the dose of PCV20 should be administered at least 5 years after the last pneumococcal vaccine.

Up to date

- APPROACH TO VACCINATIONThe United States Centers for Disease Control and Prevention's Advisory Committee on Immunization Practices (ACIP) updated its recommendation in 2022 [1]. The approach of the authors of this topic is largely consistent with the ACIP although varies for certain patient populations. These recommendations are discussed in the sections that follow.
- Indications for vaccination — The goal of vaccination in adults is to prevent invasive pneumococcal disease (IPD; eg, bacteremic pneumonia, meningitis) and nonbacteremic pneumonia. In agreement with the ACIP [1], we recommend pneumococcal vaccination for (table 3):
- ●All adults ≥65 years of age
- ●Adults aged 19 to 64 years with:
- •Predisposing chronic medical conditions (eg, chronic lung disease, chronic liver disease, diabetes mellitus)
- •Increased risk of meningitis (eg, cochlear implant, cerebrospinal fluid [CSF] leak)
- •Immunocompromising conditions (eg, human immunodeficiency virus [HIV] infection, hematologic malignancies) and other conditions associated with altered immunocompetence (functional or anatomic asplenia, chronic renal disease, and nephrotic syndrome)
- •Functional or anatomic asplenia
- In addition to the indications outlined by the ACIP, we also recommend pneumococcal vaccination for those with prior history of IPD.
- In situations where it is unclear whether pneumococcal vaccination is indicated or not, we choose to vaccinate because the benefits of the vaccine outweigh the minimal risks.
- These populations are at increased risk of developing IPD and/or are at higher risk of morbidity and mortality from IPD. In 2018, approximately 43 percent of IPD occurred in those over the age of 65 and another 48 percent in adults <65 years of age with predisposing conditions (figure 2) [2]. While there is evidence that many patients with immunocompromising conditions such as lymphoma or multiple myeloma are unlikely to develop antibody following vaccination with pneumococcal conjugate vaccines (PCV) or pneumococcal polysaccharide vaccine (PPSV), the potential benefits of even suboptimal responses greatly outweigh the risks and the cost is regarded as appropriate for the benefit received [3,4]. (See 'Rationale for vaccination' below.)
- Vaccination is not recommended for healthy adults less than 65 years of age. Although the risk for pneumococcal disease starts to increase at age 50 (figure 2), analyses have suggested initiating vaccination at that age would not be cost-effective; thus, the ACIP did not lower the recommended age for vaccination in healthy adults [5].

- Vaccine selection
- Approach to healthy older adults and those with predisposing medical conditions — The ACIP recommends the 20-valent PCV (PCV20) alone or the 15-valent PCV (PCV15) followed by the 23-valent PPSV (PPSV23) for all adults with indications for vaccination (table 3). For most adults, including healthy older adults, those with predisposing medical conditions, and those with a history of IPD, we prefer to administer PCV20, when available, due to the simplicity and lower cost of a single-dose vaccine. Comparative efficacy of these two approaches is unknown.
- If PCV20 is not available, PCV15 followed by PPSV23 is a recommended alternative. If PCV15 is administered, PPSV23 should be administered one year after PCV15 to provide immunity against an increased number of pneumococcal serotypes. When the series PCV15 followed by PPSV23 is completed, protection is offered to an additional three serotypes compared with the single PCV20 approach. Although it is hypothesized that the immunogenicity of PPSV is boosted by prior administration of PCV, this booster effect has not been convincingly demonstrated [6,7].
- Some experts may prefer PCV15 followed by PPSV23 to PCV20 alone based on indirect preliminary data suggesting PCV15 may be more immunogenic than PCV20 [8] (but the data only demonstrate immunogenicity for the first 30 days post-vaccination) and because PCV15 has been studied in immunocompromised individuals (eg, patients with HIV) [8,9]. No study to date has directly compared PCV15 and PCV20, and the clinical significance of higher antibody levels 30 days after vaccination is unknown.
- Approach to individuals at highest risk of pneumococcal disease — For immunocompromised individuals (eg, transplant recipients, persons with HIV) and those at increased risk for meningitis (eg, cochlear implant, CSF leak), the authors prefer to administer PCV20 followed by PPSV23 ≥8 weeks later. This recommendation differs from the ACIP and other experts' recommendations to administer PCV20 alone (or PCV15 followed by PPSV23) in these populations. The authors administer the PPSV23 in addition to PCV20 in these individuals to provide protection against serotypes present in PPSV23 that are absent from PCV20. Although PCV20 covers the majority of the serotypes implicated in IPD, there are three relatively common serotypes (9N, 20, 17F) included in PPSV23 that are not included in PCV20 (figure 3) [10].
- Additional detail on vaccine efficacy and timing in specific immunocompromised patients is provided separately. (See 'Rationale for vaccination' below and "Pneumococcal immunization in adults with HIV" and "Immunizations in autoimmune inflammatory rheumatic disease in adults" and "Immunizations in adults with cancer" and "Immunizations in solid organ transplant candidates and recipients" and "Immunizations in hematopoietic cell transplant candidates and recipients".)
- Approach to recipients of prior pneumococcal vaccines — The approach to complete the pneumococcal vaccination series for individuals who have already received pneumococcal vaccination depends on the specific vaccine they received (algorithm 1).
- ●**PPSV23 only** – Adults who have only received the PPSV23 vaccine should receive PCV20 (or PCV15 if PCV20 is not available) at least a year after PPSV23 [11].
- ●**PCV13 only** – Adults who have only received PCV13 should receive PCV20 (or PPSV23 if PCV20 is not available) at least one year after receipt of PCV13 [11]. A shorter interval for PPSV23 of ≥8 weeks is recommended for those at highest risk for pneumococcal disease. (See 'Approach to individuals at highest risk of pneumococcal disease' above.)
- ●**Both PCV13 and PPSV23**
- •Adults ≥65 years of age:
- -Those who received both the PCV13 and PPSV23 prior to age 65 years should receive PCV20 or PPSV23 (if PCV20 is not available) ≥5 years after their last pneumococcal vaccine dose.
- -Those who received PCV13 at any age and PPSV23 at ≥65 years of age, the ACIP advises shared decision-making between clinician and patient regarding whether to administer PCV20 ≥5 years after their last pneumococcal vaccine [11]. The authors of this topic prefer to administer PCV20 (or PPSV23 if PCV20 is not available) ≥5 years after the patient's last pneumococcal vaccine since the benefits generally outweigh the minimal risks of an adverse vaccine reaction. (See 'General approach to revaccination' below.)
- •Adults aged 19 to 64 who have already received both PCV13 and PPSV23 should receive PCV20 (or PPSV23 if PCV20 is not available) five years after their last pneumococcal vaccination. Although the ACIP does not recommend a second dose of PPSV23 to those with increased risk for meningitis (eg, cochlear implants, CSF leak) [11], the authors of this topic believe the benefits of a second PPSV23 dose (when PCV20 is not available) outweigh the minimal risks of an adverse vaccine reaction. Those who have received PCV13 and two doses of PPSV23 should receive PCV20 five years after their last pneumococcal vaccination, if available.
- General approach to revaccination — The approach to revaccination varies among experts and clinical practice guidelines. The ACIP does not recommend additional doses of pneumococcal vaccines beyond those discussed above. (See 'Vaccine selection' above.) In contrast, the authors offer repeat vaccination with PPSV23 every 5 to 10 years to all adults who received an older formulation of PCV (eg, PCV13) and PPSV23. For patients who have received PCV20 alone, PCV20 in series with PPSV23, or PCV15 in series with PPSV23, no revaccinations are necessary [12].
- The authors' recommendation for revaccination every 5 to 10 years is based on in vitro studies that show waning of antibody and field studies that show waning effectiveness after vaccination with PPSV23 [13-15]. Although data on duration of antibody and effectiveness after receipt of PCV are not available beyond five years, any difference in opsonophagocytic effect between PPSV23 and PCV13 is no longer detectable after 12 months [16]. The authors suspect that no pneumococcal vaccine will provide lifetime protection and believe the potential benefits of repeat revaccination with PPSV23 every 5 to 10 years greatly outweigh the risks. Since there are no data on revaccination with PCV, the authors only revaccinate with PPSV23.

Morbidity and Mortality Weekly Report (*MMWR*)

•*MMWR*

Intervals Between PCV13 and PPSV23 Vaccines: Recommendations of the Advisory Committee on Immunization Practices (ACIP)

Please note: *An erratum has been published for this article. To view the erratum, please click here.*

Weekly

September 4, 2015 /

- **ummary**
- What is currently recommended?
- The Advisory Committee on Immunization Practices (ACIP) currently recommends that both 13-valent pneumococcal conjugate vaccine (PCV13) and 23-valent pneumococcal polysaccharide vaccine (PPSV23) be given to all immunocompetent adults aged ≥65 years. ACIP recommends that PCV13 be given first followed by PPSV23 6–12 months later. ACIP also recommends that adults aged ≥65 years who already received a dose of PPSV23, should also receive a dose of PCV13 ≥1 year after the dose of PPSV23. Among persons aged ≥2 years with medical indications to receive both PCV13 and PPSV23 in a series, including adults aged ≥65 years with immunocompromising conditions, functional or anatomic asplenia, cochlear implants, or cerebrospinal fluid leaks, a dose of PPSV23 should be given ≥8 weeks after a dose of PCV13.
- Why are the recommendations being modified now?
- To simplify the recommendations for PCV13 and PPSV23 use among immunocompetent adults aged ≥65 years, ACIP recommended harmonization of recommended intervals between PCV13 and PPSV23 regardless of the order in which the two vaccines are given.
- What are the new recommendations?
- ACIP recommends that both PCV13 and PPSV23 be given in series to adults aged ≥65 years. A dose of PCV13 should be given first followed by a dose of PPSV23 at least 1 year later to immunocompetent adults aged ≥65 years. The two vaccines should not be co-administered. If a dose of PPSV23 is inadvertently given earlier than the recommended interval, the dose need not be repeated.

Who should receive the pneumonia vaccine?

Group	PPSV23	PCV13
Children	✔ only for children 2 years and older with selected high risk conditions	✔ all children—typically started early infancy < 2 years of age
Adults 65 years and older	✔	Only in selected cases
Adults 18 years and older who smoke	✔	
Adults who have chronic conditions including heart or lung conditions, diabetes mellitus, alcoholism or liver disease.	✔	
Adults with high risk conditions for serious infection such as chronic kidney failure, leukemia, poor function of the spleen, HIV infection, a history of organ transplantation, or an immune system that is weaker than normal.	✔	✔
Pregnant Women—both are safe to give during pregnancy	✔ if needed	✔ if needed

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- **Heart, lung, diabetes, liver diseases in 6-17 year olds**
- Any of the following conditions:
- Chronic heart disease (particularly cyanotic congenital heart disease and cardiac failure)
- Chronic lung disease (including asthma if treated with high-dose oral corticosteroid therapy)
- Diabetes mellitus
- Alcoholism
- Chronic liver disease
- If the patient has not received PPSV23, administer 1 dose of PPSV23
- If PCV13 has been received previously, then PPSV23 should be administered at least 8 wk after any prior PCV13 dose

Recommended Schedule for Doses of PCV15 or PCV20, Including Catch-up Immunizations, for Previously Unimmunized and Partially Immunized Children 2 Through 59 Months of Age

Table 3.70. Recommended Schedule for Doses of PCV15 or PCV20, Including Catch-up Immunizations, for Previously Unimmunized and Partially Immunized Children 2 Through 59 Months of Age

Age at Examination	Immunization History	Recommended Regimen[a,b,c,d]
2 through 6 mo	0 doses	4 doses: 3 doses, 8 wk apart; fourth dose at age 12–15 mo
	1 dose	3 additional doses: 2 doses, 8 wk apart; last dose at age 12–15 mo
	2 doses	2 additional doses: 1 dose 8 wk after most recent dose; last dose ≥8 wk later at age 12–15 mo
	3 doses	1 additional dose at age 12–15 mo
7 through 11 mo	0 doses	3 doses: 2 doses, ≥4 wk apart; third dose ≥8 wk later at age 12–15 mo
	1 or 2 doses (at age <7 mo)	2 additional doses: 1 dose 8 wk after most recent dose; last dose ≥8 wk later at age 12–15 mo
	3 doses (at age <7 mo)	1 additional dose at age 12–15 mo
	1 dose (at age ≥7 mo)	2 additional doses: 1 dose 8 wk after most recent dose; last dose ≥8 wk later at age 12–15 mo
	2 doses (at age ≥7 mo)	1 additional dose at age 12–15 mo
12 through 23 mo	0 doses	2 doses, ≥8 wk apart
	1 dose (at age <12 mo)	2 additional doses: 1 dose ≥8 wk after most recent dose; last dose ≥8 wk later
	1 dose (at ≥12 mo)	1 additional dose, ≥8 wk after most recent dose
	2 or 3 doses (at <12 mo)	1 additional dose, ≥8 wk after most recent dose

Recommended Schedule for Doses of PCV15 or PCV20, Including Catch-up Immunizations, for Previously Unimmunized and Partially Immunized Children 2 Through 59 Months of Age

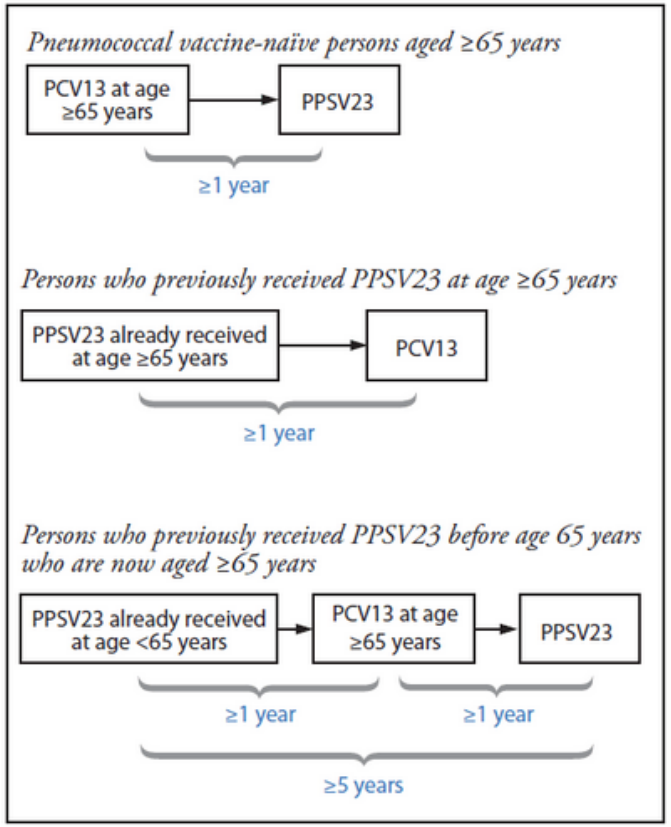
24 through 59 mo[a] Healthy children	Any incomplete schedule	1 dose, ≥8 wk after the most recent dose[a]

TABLE. Summary of recommended intervals, by risk and age groups, for persons with indications to receive PCV13 and PPSV23 sequence — Advisory Committee on Immunization Practices, United States, September 2015

Risk group/Underlying medical condition	Intervals for PCV13–PPSV23 sequence, by age group				Intervals for PPSV23–PCV13 sequence, by age group			
	24–71 months	**6–18 years**	**19–64 years**	**≥65 years**	**24–71 months**	**6–18 years**	**19–64 years**	**≥65 years**
No underlying chronic conditions	**NA**	**NA**	**NA**	**≥1 year**	**NA**	**NA**	**NA**	**≥1 year**
Immunocompetent persons Chronic heart disease Chronic lung disease Diabetes mellitus Alcoholism* Chronic liver disease, cirrhosis* Cigarette smoking*	≥8 weeks	NA	NA	≥1 year	≥8 weeks	NA	NA	≥1 year
Immunocompetent persons Cerebrospinal fluid leak Cochlear implant	≥8 weeks	≥8 weeks	≥8 weeks	≥8 weeks	≥8 weeks	≥8 weeks	≥1 year	≥1 year
Persons with functional or anatomic asplenia Sickle cell disease/other hemaglobinopathy Congenital or acquired asplenia	≥8 weeks	≥8 weeks	≥8 weeks	≥8 weeks	≥8 weeks	≥8 weeks	≥1 year	≥1 year

Persons with functional or anatomic asplenia Sickle cell disease/other hemaglobinopathy Congenital or acquired asplenia	≥8 weeks	≥8 weeks	≥8 weeks	≥8 weeks	≥8 weeks	≥8 weeks	≥1 year	≥1 year
Immunocompromised persons Congenital or acquired immunodeficiency Human immunodeficiency virus infection Chronic renal failure Nephrotic syndrome Leukemia Lymphoma Hodgkin disease Generalized malignancy Iatrogenic immunosuppression Solid organ transplant Multiple myeloma*	≥8 weeks	≥8 weeks	≥8 weeks	≥8 weeks	≥8 weeks	≥8 weeks	≥1 year	≥1 year
Abbreviation: NA = not applicable, sequential use of PCV13 and PPSV23 is not recommended for these age and risk groups. * Underlying medical conditions that are not included in the recommendations for children aged <6 years.								

BOX. Recommended intervals for sequential use of PCV13 and PPSV23 for immunocompetent adults aged ≥65 years — Advisory Committee on Immunization Practices, United States



Recommendations for Pneumococcal Immunization With PCV15, PCV20, and/or PPSV23 Vaccine for Children at High Risk or Presumed High Risk of Pneumococcal Disease

Age	Previous Dose(s) of Any Pneumococcal Vaccine	Recommendations
23 mo or younger	None	PCV15 or PCV20, as in Table 3.70.
24 through 71 mo	4 doses of PCV13, PCV15, or PCV20	If none of the prior 4 doses were PCV20: 1 dose of PPSV23 or PCV20, ≥8 wk after last dose of PCV13 or PCV15.
		If ≥1 of the prior 4 doses was PCV20: no additional doses of any pneumococcal vaccine are indicated.
24 through 71 mo	Incomplete series of 3 previous doses of PCV13, PCV15, or PCV20 before 24 mo of age	1 dose of PCV15 or PCV20.
		If PCV15 is used for this dose and there are no prior doses of PCV20, 1 dose of PPSV23 ≥8 wk after the last dose of PCV15.
		If PCV20 is used for this or any prior dose, no additional doses of any pneumococcal vaccine are indicated.
24 through 71 mo	Incomplete series of <3 doses of PCV13, PCV15, or PCV20 before 24 mo of age	2 doses of PCV15 or PCV20, ≥8 wk after last dose of PCV13, PCV15, or PCV20 (if applicable).
		If PCV15 is used for this dose, 1 dose of PPSV23 vaccine, ≥8 wk after the last dose of PCV13 or PCV15.
		If PCV20 is used for this dose, no additional doses of any pneumococcal vaccine are indicated.
24 through 71 mo	1 dose of PPSV23	2 doses of PCV15 or PCV20, 8 wk apart, beginning at 8 wk after last dose of PPSV23.