



Pneumococcal Disease and Pneumococcal Vaccines

September 2019

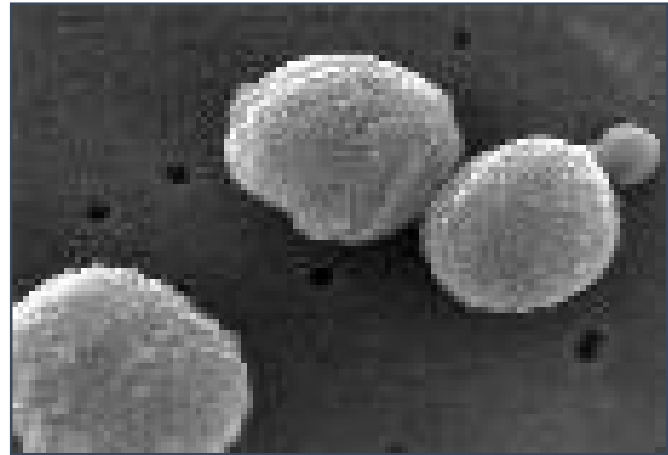
Chapter 17

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Disease

Streptococcus pneumoniae

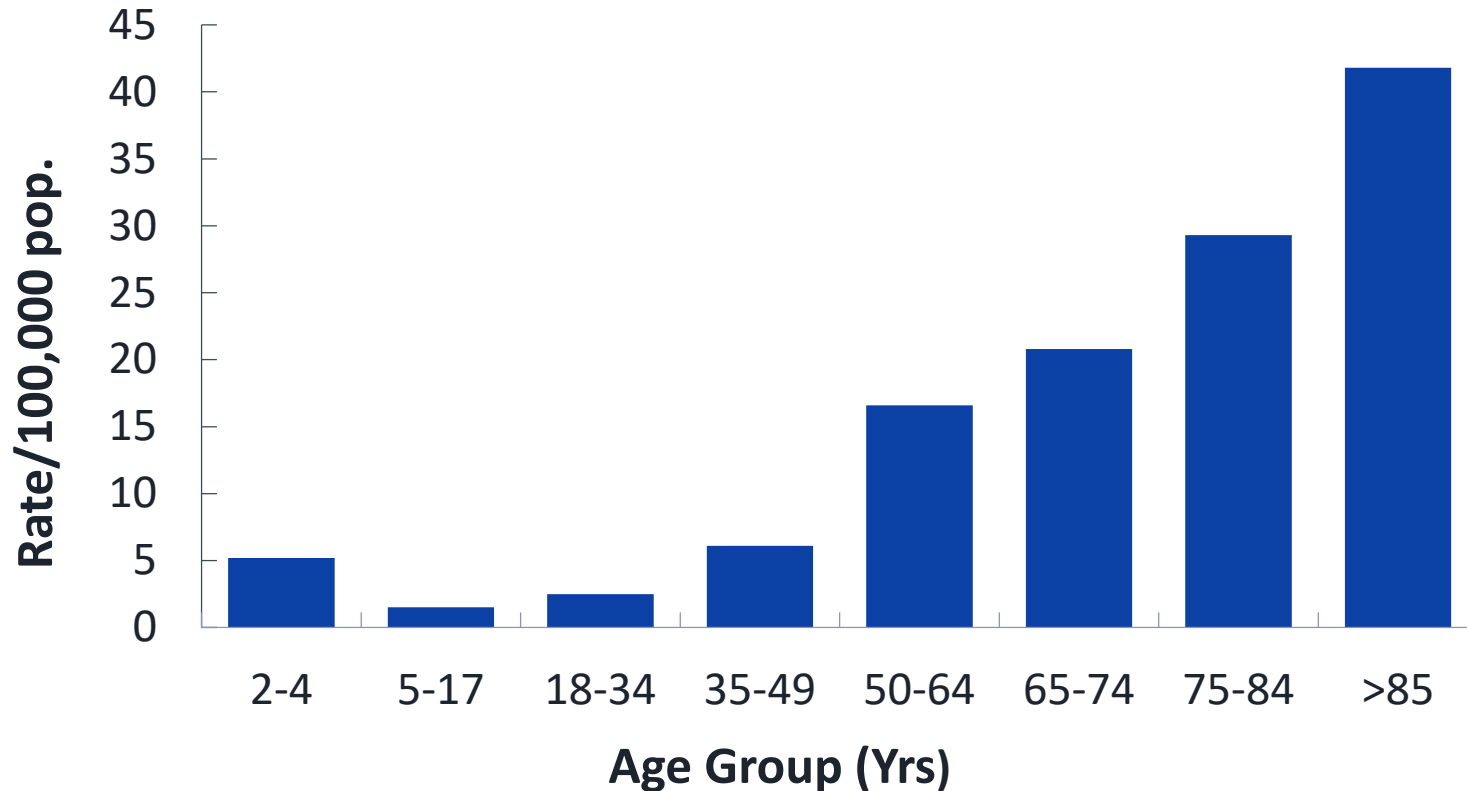
- Gram-positive bacteria
- 92 known serotypes
- Polysaccharide capsule important virulence factor
- Type-specific antibody is protective
- Limited cross-reactivity



Pneumococcal Disease

- **Second most common cause of vaccine-preventable disease in the U.S.**
- **Major clinical syndromes**
 - Pneumonia
 - Bacteremia
 - Meningitis

Invasive Pneumococcal Disease Incidence by Age Group–2017*

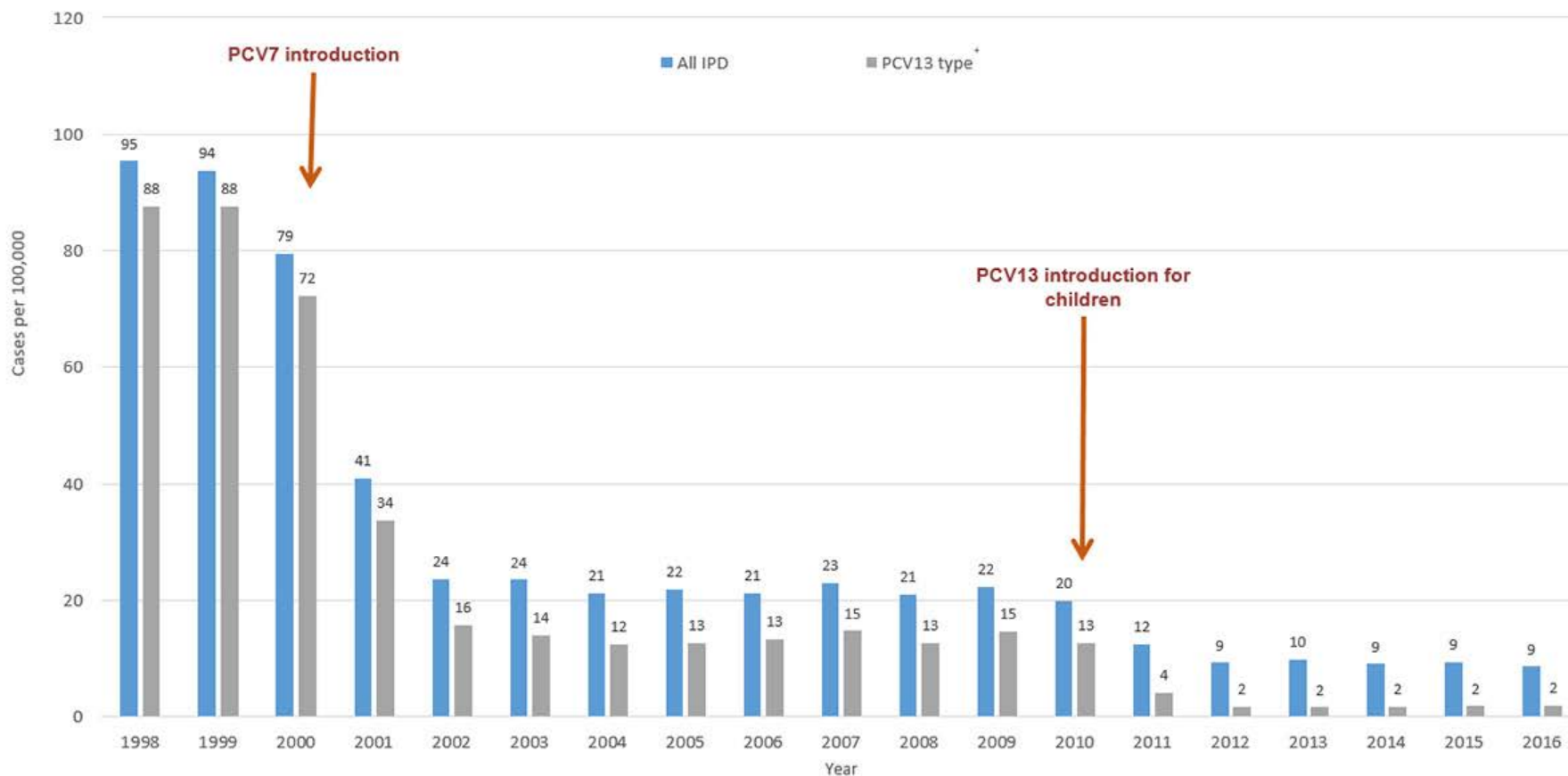


*CDC Active Bacterial Core surveillance 2017 report:

<http://www.cdc.gov/abcs/reports-findings/survreports/spneu17.html>

invasive pneumococcal disease (IPD) among children <5 years old, 1998--2016, United States

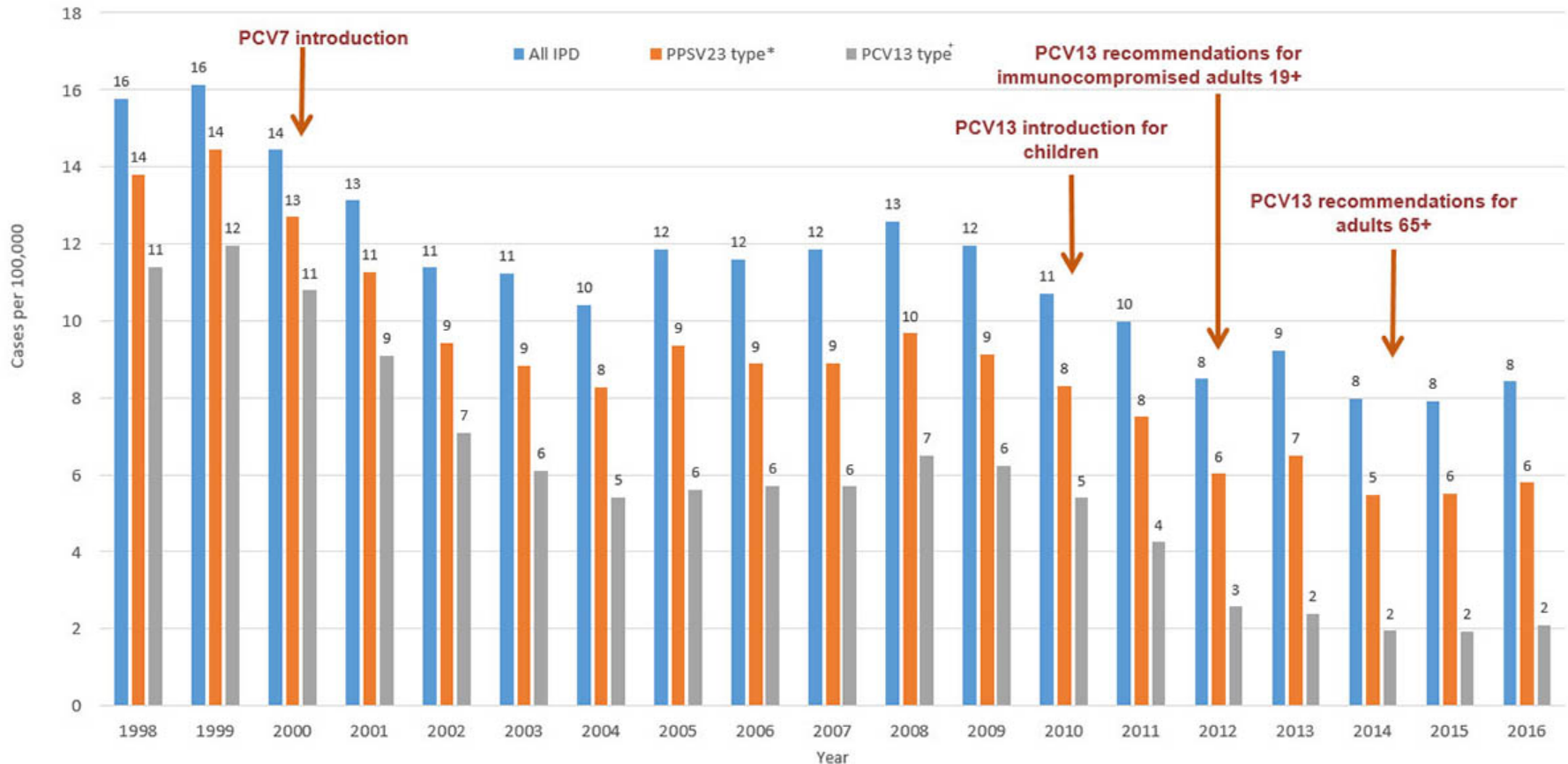
Trends in invasive pneumococcal disease among children aged <5 years old, 1998–2016



*PCV13 serotype: 1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F, and 23F

Trends in Invasive Pneumococcal Disease among Adults 19–64 Years of Age, 1998–2016

Trends in invasive pneumococcal disease among adults aged 19-64 years old, 1998–2016

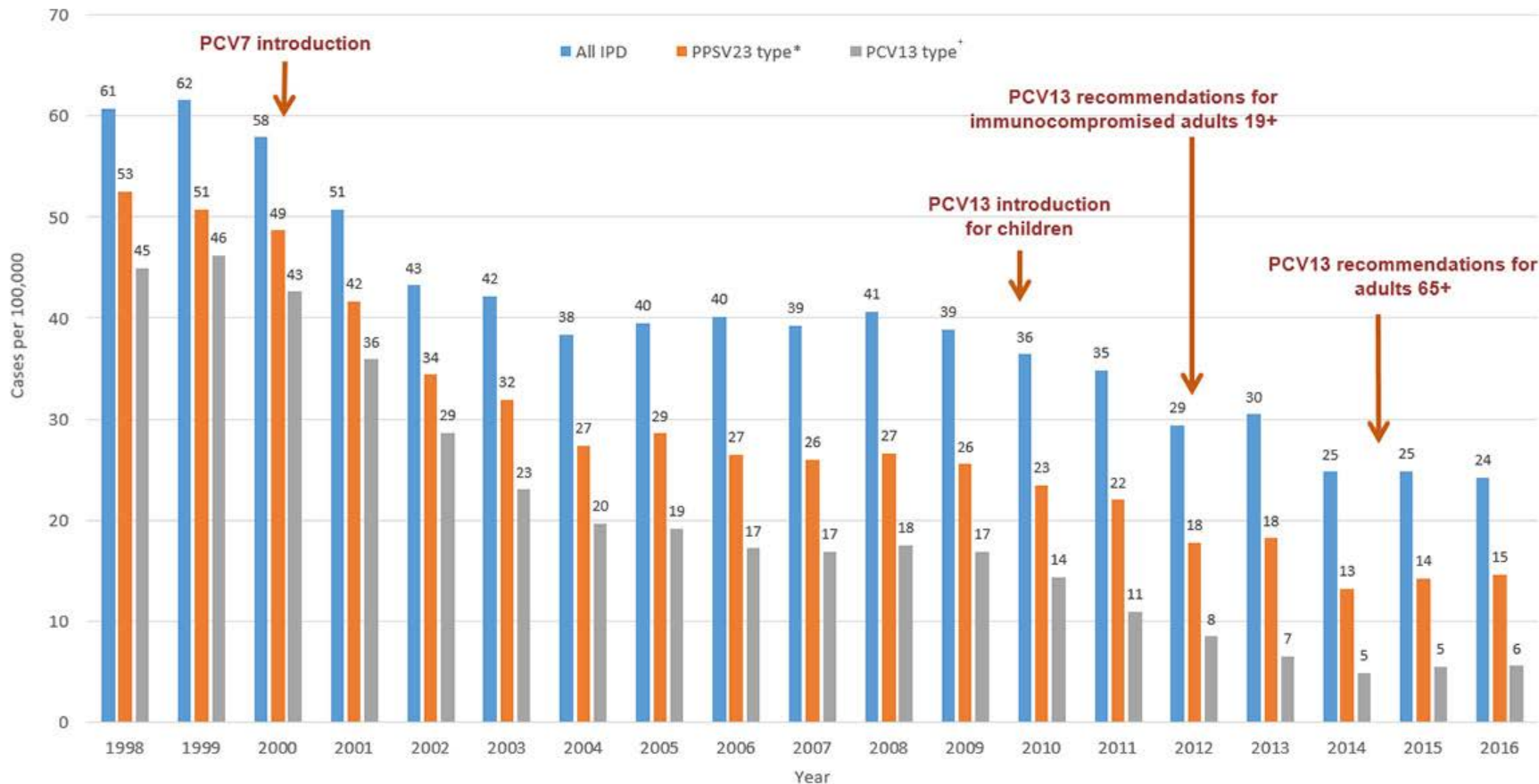


*PPSV23 serotypes: 1, 2, 3, 4, 5, 6B, 7F, 8, 9N, 9V, 10A, 11A, 12F, 14, 15B, 17F, 18C, 19A, 19F, 20, 22F, 23F, and 33F

†PCV13 serotype: 1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F, and 23F

Trends in Invasive Pneumococcal Disease among Adults 65 Years of Age and Older, 1998–2016

Trends in invasive pneumococcal disease among adults aged ≥ 65 years old, 1998–2016



*PPSV23 serotypes: 1, 2, 3, 4, 5, 6B, 7F, 8, 9N, 9V, 10A, 11A, 12F, 14, 15B, 17F, 18C, 19A, 19F, 20, 22F, 23F, and 33F

†PCV13 serotype: 1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F, and 23F

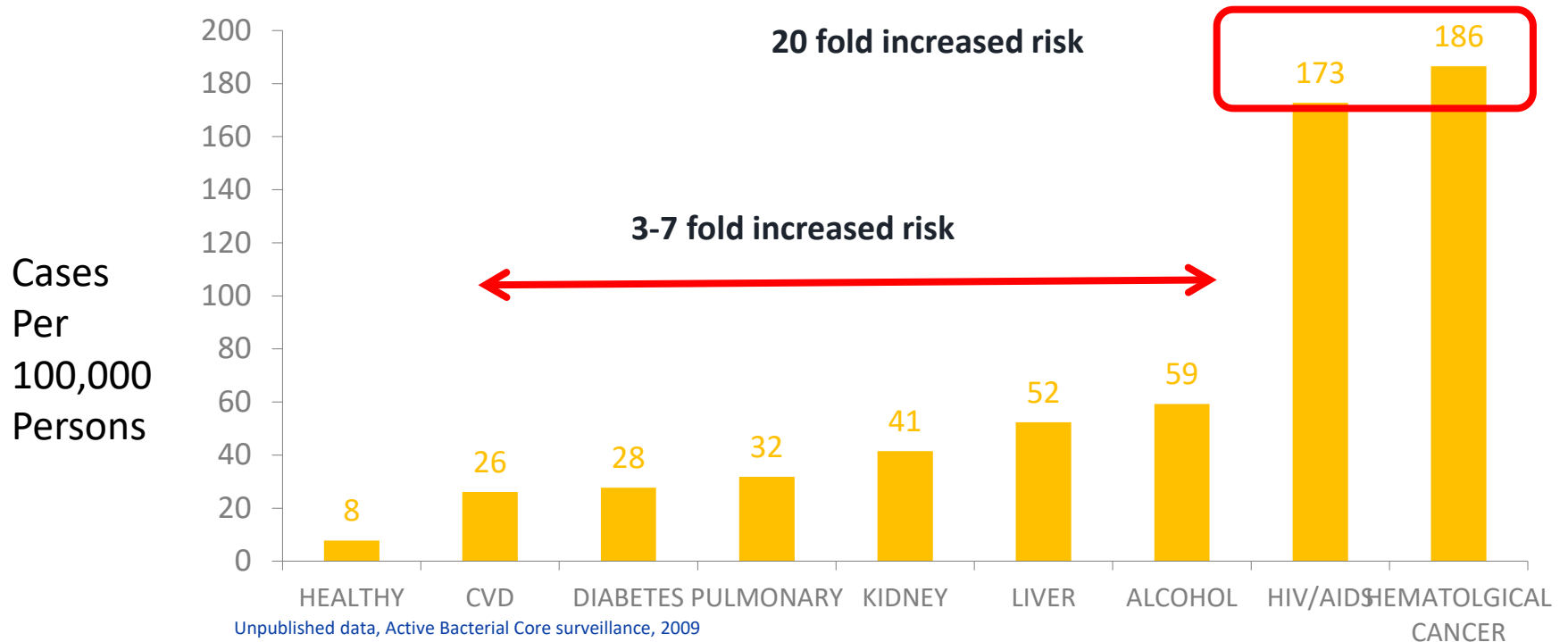
Risk Factors for Invasive Pneumococcal Disease

- **Functional or anatomic asplenia, including sickle-cell disease**
- **Altered immunocompetence**
- **Underlying medical conditions, including chronic renal disease, nephrotic syndrome, and CSF leak**
- **Cochlear implant**

Pneumococcal Disease Epidemiology

- **Reservoir** Human carriers
- **Transmission** Respiratory and autoinoculation
- **Temporal pattern** Winter and early spring
- **Communicability** Unknown; probably as long as organism in respiratory secretions

Incidence of IPD in Adults Age 18–64 Years with Selected Underlying Conditions, United States, 2009



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Vaccines

Pneumococcal Vaccines

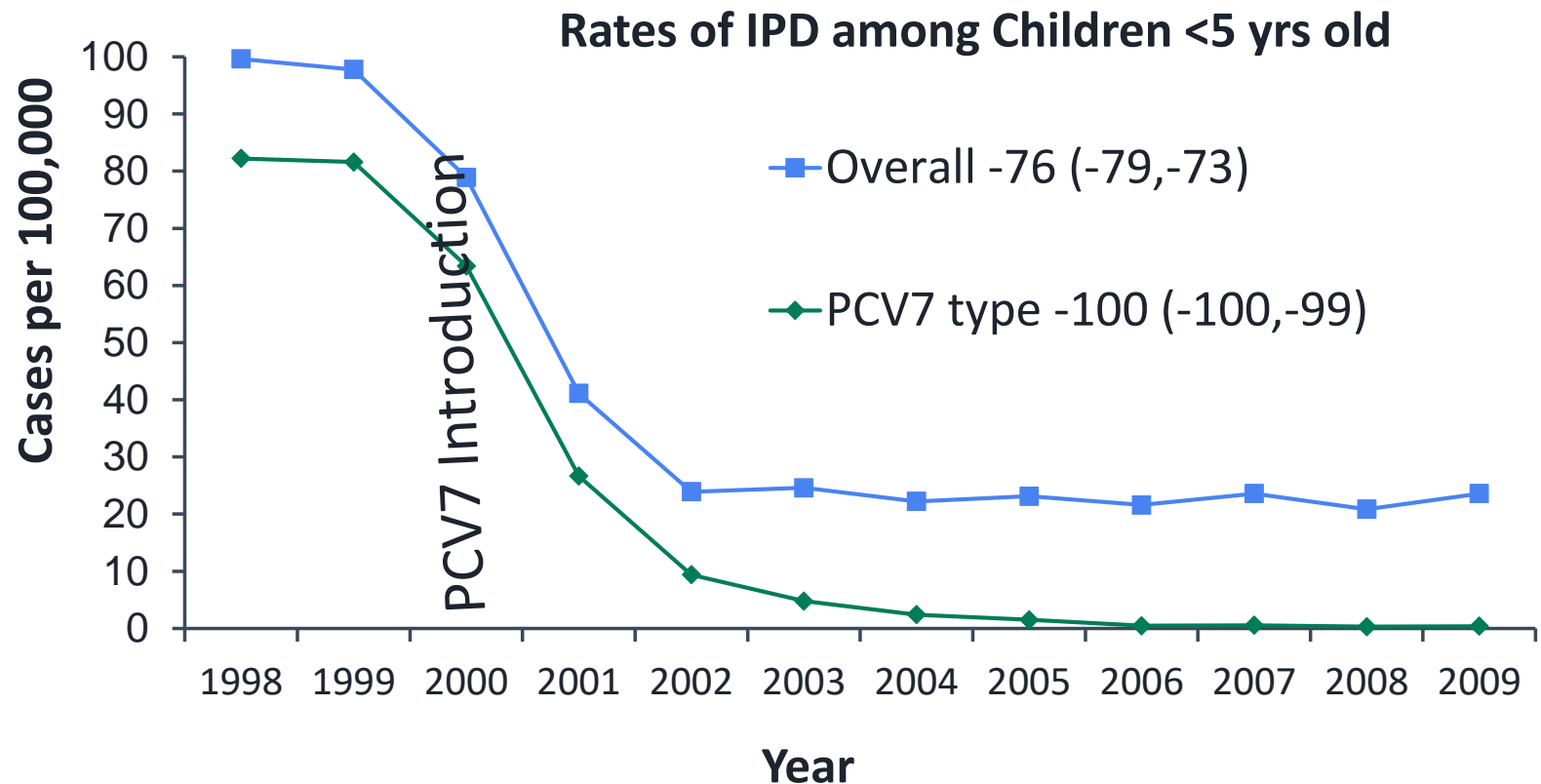
- **1977** ▪ 14-valent polysaccharide vaccine licensed
- **1983** ▪ 23-valent polysaccharide vaccine licensed (PPSV23)
- **2000** ▪ 7-valent polysaccharide conjugate vaccine licensed (PCV7)
- **2010** ▪ 13-valent polysaccharide conjugate vaccine licensed (PCV13)

Pneumococcal Vaccine Products

Vaccine product	Age indications
Pneumococcal Polysaccharide Vaccine	
Pneumovax 23 (PPSV23)	50 years of age or older and persons age ≥ 2 years who are at increased risk for pneumococcal disease
Pneumococcal Conjugate Vaccine	
Prevnar 13 (PCV13)	Children: 6 weeks–18 years Adults: 19 years and older

PCV7 Introduction among U.S. Children and Its Impact on Invasive Pneumococcal Disease

- PCV7 introduced into routine schedule 2000



Moore, IDSA, 2009, and CDC, unpublished data

Pneumococcal Conjugate Vaccine (PCV13) in Children

- **In 2008, 61% of invasive pneumococcal disease cases among children younger than 5 years were attributable to the serotypes included in PCV13**

Pneumococcal Conjugate Vaccine (PCV13) in Adults

- **In 2013, 20%–25% of invasive pneumococcal disease cases among adults 65 years old and older were attributable to PCV13 serotypes**
- **10% of community-acquired pneumonia in adults due to PCV13 serotypes**

Pneumococcal Polysaccharide Vaccine (PPSV23)

Immunogenicity/Effectiveness

- **Most estimates range between 60%–70% effective against invasive disease among immunocompetent older persons and adults with underlying illnesses**
- **Effectiveness among immunocompromised or very old persons not demonstrated**

Pneumococcal Conjugate Vaccine (PCV13) Immunogenicity/Efficacy

- **Highly immunogenic in infants and young children, including those with high-risk medical conditions**
- **PCV7 was 97% effective against invasive disease caused by vaccine serotypes (presumably PCV13 as well)**

New Evidence Supporting PCV13 Use among Adults, CAPiTA Results

Study/Population	Endpoint	Vaccine Efficacy (95% CI)
CAPiTA ~85,000 Adults 65+ Netherlands	PCV13-serotype IPD	75% (41%, 91%)
	PCV13-serotype nonbacteremic pneumonia	45% (14%, 65%)

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**Clinical
Considerations**



MMWRTM

Morbidity and Mortality Weekly Report

www.cdc.gov/mmwr

Recommendations and Reports

December 10, 2010 / Vol. 59 / No. RR-11

Prevention of Pneumococcal Disease Among Infants and Children – Use of 13-Valent Pneumococcal Conjugate Vaccine and 23-Valent Pneumococcal Polysaccharide Vaccine

Recommendations of the Advisory Committee on Immunization Practices (ACIP)

ACIP PCV13 Vaccine Recommendations: Pediatric

Vaccine	Birth	1 mo	2 mos	4 mos	6 mos	9 mos	12 mos	15 mos	18 mos	19-23 mos	2-3 yrs	4-6 yrs	7-10 yrs	11-12 yrs	13-15 yrs	16 yrs	17-18 yrs
Pneumococcal conjugate (PCV13)			1 st dose	2 nd dose	3 rd dose		← 4 th dose →										

- Routinely recommended for infants and children 2 through 59 months of age
 - 4 doses at 2, 4, 6, and 12 to 15 months
 - Fewer doses if series started at 7 months of age or older
- Children who have received 1 or more doses of PCV7 should complete the immunization series with PCV13

Pneumococcal Conjugate Vaccination Schedule for Unvaccinated Older Children: Primary Series

Age at First Dose	# of Doses	Booster
7–11 months	2 doses	Yes
12–23 months	2 doses*	No
24–59 months	1 dose	No
24–71 months, with medical conditions**	2 doses*	No

*Separated by at least 8 weeks; see *MMWR* 2010;59(RR-11):1–19, at <https://www.cdc.gov/mmwr/pdf/rr/rr5911.pdf>

**Chronic heart, lung disease, diabetes, CSF leak, cochlear implant, sickle cell disease, other hemoglobinopathies, functional or anatomic asplenia, HIV infection, immunocompromising conditions

PCV13

- **ACIP recommended use of PCV13 for immunocompromised persons 6 years and older (2012, 2013)**
- **ACIP recommended use of PCV13 for all adults 65 years or older in 2014**

ACIP Recommendations for PCV13 Dose

- **A dose of PCV13 should be administered to children 6 through 18 years of age who are at increased risk for invasive pneumococcal disease* (and no prior PCV13 doses)**
 - Functional or anatomic asplenia, including sickle cell disease
 - HIV infection and other immunocompromising conditions
 - Cochlear implant
 - CSF leak

- **Regardless of previous history of PCV7 or PPSV vaccine**

*Off-label recommendation, MMWR, June 28, 2013, Vol 62, #25

Pneumococcal Conjugate (PCV13)

Vaccine Administration

- **Administer PCV13 vaccine via intramuscular (IM) injection**
 - Needle gauge: 22–5 gauge
 - Needle length*: 5/8–1.5 inch, depending on the patient's age and/or weight
 - Site*:
 - Birth–11 months: Vastus lateralis muscle is preferred
 - 1–2 years: Vastus lateralis muscle is preferred; deltoid muscle may be used if the muscle mass is adequate
 - 3 years and older: Deltoid muscle is preferred; vastus lateralis muscle may be used
- **Administer at the same medical visit as other vaccines except MenACWY-D in asplenic persons (others, ok to administer)**

*Professional judgement should be used to determine the proper needle length and site. Factors influencing site include local reaction, number of vaccines to be administered, age, and muscle mass

ACIP PCV13 Vaccine Recommendations: Adults

Vaccine	19–21 years	22–26 years	27–49 years	50–64 years	≥65 years
Pneumococcal conjugate (PCV13)	1 dose				

- Recommended for adults 19–64 years at increased risk
- Routinely recommended for adults age 65 years or older, 2014 to 2019
- Now recommend shared clinical decision making before vaccination

ACIP PPSV23 Vaccine Recommendations: Pediatric

Vaccine	Birth	1 mo	2 mos	4 mos	6 mos	9 mos	12 mos	15 mos	18 mos	19-23 mos	2-3 yrs	4-6 yrs	7-10 yrs	11-12 yrs	13-15 yrs	16 yrs	17-18 yrs
Pneumococcal polysaccharide (PPSV23)											See Notes						

- Recommended for children 2–18 years at increased risk
- When both PCV13 and PPSV23 are indicated, administer PCV13 first
- PCV13 and PPSV23 should not be administered at the same visit

ACIP PPSV23 Vaccine Recommendations: Adults

Vaccine	19–21 years	22–26 years	27–49 years	50–64 years	≥65 years
Pneumococcal polysaccharide (PPSV23)	1 or 2 doses depending on indication				1 dose

- Routinely recommended for adults 65 years or older at least 1 year after receiving PCV13
- Recommended for adults 19–64 at increased risk
- When both PCV13 and PPSV23 are indicated, administer PCV13 first
- PCV13 and PPSV23 should not be administered at the same visit

Pneumococcal Polysaccharide Vaccine Revaccination

- **Routine revaccination of immunocompetent persons is not recommended**
- **Revaccination recommended for persons 2–64 years of age who are at highest risk of serious pneumococcal infection**

Pneumococcal Polysaccharide Vaccine Candidates for Revaccination

- **5-year interval (2–64 years) with additional dose after 65th birthday, 5 years after previous dose:**
 - Functional or anatomic asplenia (including sickle cell disease)
 - Immunosuppression (including HIV infection)
 - Transplant
 - Chronic renal failure
 - Nephrotic syndrome
 - Generalized malignancy
 - Hematologic malignancy

- **1 dose is recommended after the 65th birthday, but only 1 dose recommended after 65th birthday**

- **Maximum 3 doses of PPSV23 in a lifetime**

What Do You Think?

- A 6-year-old patient has sickle cell disease. Her immunization history includes a complete PCV13 series and PPSV23 at 4 years of age. Should PPSV23 be administered today?
 - Yes
 - No

Pneumococcal Polysaccharide (PPSV23) Vaccine Administration

- **Administer PPSV23 vaccine via intramuscular (IM) or subcutaneous injection**
 - Choose needle size based on route and patient age and/or size
 - IM Site*:
 - 2–3 years: Vastus lateralis muscle is preferred; deltoid muscle may be used if the muscle mass is adequate
 - 4 years and older: Deltoid muscle is preferred; vastus lateralis muscle may be used
 - Subcut site:
 - Subcutaneous tissue over the upper outer triceps of arm

- **Administer at the same medical visit as other vaccines**

*Professional judgement should be used to determine the proper needle length and site. Factors influencing site include local reaction, number of vaccines to be administered, age, and muscle mass

PCV13 for Immunocompromised Adults*

- **Adults 19 years of age or older with:**
 - Immunocompromising conditions
 - Functional or anatomic asplenia
 - CSF leaks
 - Cochlear implants

- **Those who have not previously received PCV13 or PPSV23 should receive a single dose of PCV13 followed by a dose of PPSV23 at least 8 weeks later, with a booster dose of PPSV23 5 or more years later for those with:**
 - Immunocompromising conditions
 - Functional or anatomic asplenia

**MMWR*. October 12, 2012;61(40):816–819

Pneumococcal Vaccination and Adults

- **PCV13 and PPSV23 adult vaccination recommendations are divided between 2 age groups. Persons who are:**
 - 19 through 64 years of age
 - 65 years of age and older
- **Immunization recommendations for persons 19 through 64 years of age are based on risk, including those at:**
 - High risk
 - Higher risk
 - Highest risk

High Risk for IPD

- **Administer 1 dose of PPSV23 to adults 19 through 64 years of age at high risk for IPD**
 - PCV13 is NOT indicated
- **This includes persons with:**
 - Pulmonary disease (including asthma)
 - Cardiac disease (excluding hypertension)
 - Liver disease (including cirrhosis)
 - Diabetes
 - Alcoholism
 - Smokers
 - Residents of a long-term care facility

**1 dose
PPSV23**



Higher Risk for IPD

- Administer PCV13 and PPSV23 to adults 19 through 64 years of age at higher risk for IPD, including those with:
 - CSF leak
 - Cochlear implant
- Administer PCV13 followed by PPSV23 vaccine



Highest Risk for IPD

- **Adults 19 through 64 years of age at highest risk for IPD, including those who:**
 - Are immunocompromised (including HIV infection)
 - Have chronic renal failure or nephrotic syndrome
 - Are asplenic
- **Administer PCV13 and 2 doses of PPSV23**



New PCV 13 Recommendations for Persons 65 Years and Older, June, 2019

- PCV13-type disease reduced to historically low levels among adults ≥ 65 years old through pediatric PCV13 use.
- 2014 PCV13 recommendation for all adults ≥ 65 years old: minimal impact on PCV13-type disease
- PCV13 is safe and effective
- Balancing this evidence ACIP recommends PCV13 based on shared clinical decision making for those ≥ 65 years old without
 - immunocompromising condition
 - CSF leak
 - cochlear implant.
- ACIP still recommends all adults ≥ 65 years old should receive one dose of PPSV23

Persons Age 65 Years and Older:

PCV13 – Shared clinical decision-making

PPSV23 – recommended for all persons

- No history of pneumococcal vaccine



- Immunization history of PPSV23 at age 65 or older

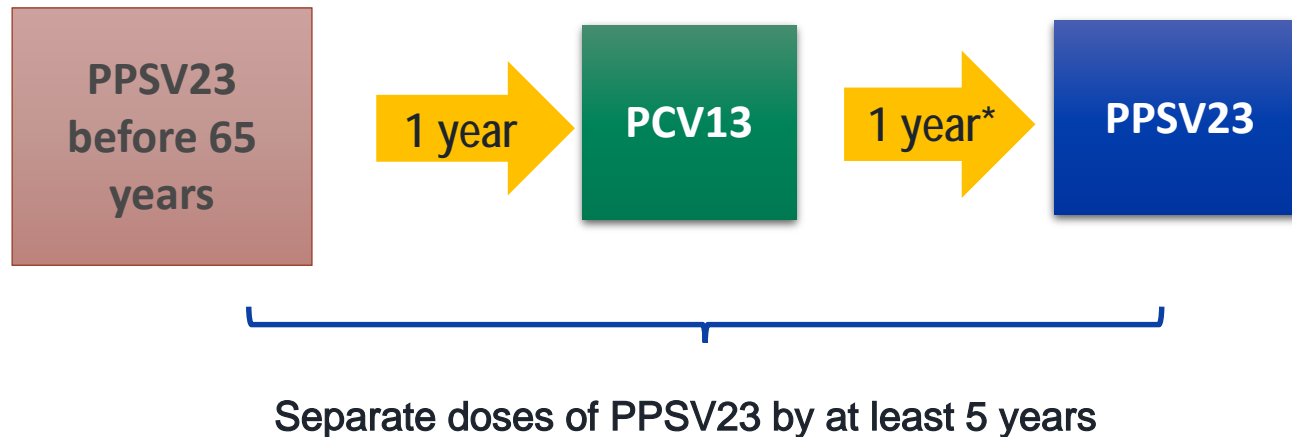


*8 weeks if at higher or highest risk

MMWR 2015;64(34):944–47

Persons Age 65 Years and Older: PCV13 – Shared clinical decision-making PPSV23 – recommended for all persons

- Received PPSV23 before age 65 years



*8 weeks if at higher or highest risk

MMWR 2015;64(34):944–47

Vaccine Administration Errors

Pneumococcal Vaccines

- **Frequent vaccine administration errors:**
 - Wrong vaccine
 - PPSV23 to an infant
 - Schedule error:
 - More than 1 PPSV23 revaccination dose to immunocompetent at-risk persons

Pneumococcal Vaccines

Adverse Reactions

	PPSV23	PCV13
▪ Local reactions	30%–50%	5%–49%
▪ Fever, myalgia	<1%	24–35%
▪ Febrile seizures	---	Rare: 1–14/100,000; with IIV 4–45/ 100,000
▪ Severe adverse reactions	Rare	8% (local)

Pneumococcal Vaccines

Contraindications and Precautions

- **Severe allergic reaction to vaccine component or following prior dose of vaccine**
- **Moderate or severe acute illness**

Vaccine Storage and Handling

- **Store PCV13 and PPSV23 vaccines in a refrigerator between 2°C–8°C (36°F–46°F)**
- **Store:**
 - In the original packaging with the lids closed
 - In a clearly labeled bin and/or area of the storage unit—not next to each other
- **Do not freeze the vaccine**

PCV13 (Prevnar 13)

Ages: All children 6 weeks through 5 years
Increased risk children 6 years through 18 years

Increased risk adults 19 years and older
Adults 65 years and older who have never received PCV13

Route: Intramuscular (IM) injection

PPSV23 (Pneumovax 23)

Ages: Healthy adults 65 years and older

Increased risk persons 2 years through 64 years

Route: Intramuscular (IM) injection OR
Subcutaneous (subcut) injection

No more than two doses of PPSV23 recommended before 65th birthday and one dose after 65.

Administering PCV13 and PPSV23 Vaccines

General Rules

- **PCV13 and PPSV23 should not be administered during the same clinic visit**
 - Either vaccine may be administered simultaneously with influenza vaccine
- **Administer PCV13 before PPSV23 whenever possible**

What Do You Think?

- **A 70-year-old patient is immunosuppressed. Her immunization history includes PCV13 and PPSV23 administered on the same day at 65 years of age. Should PPSV23 be administered today?**
 - Yes
 - No

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Resources

Resources are being updated

- See

<https://www.cdc.gov/vaccines/vpd/pneumo/hcp/recommendations.html> for updates soon