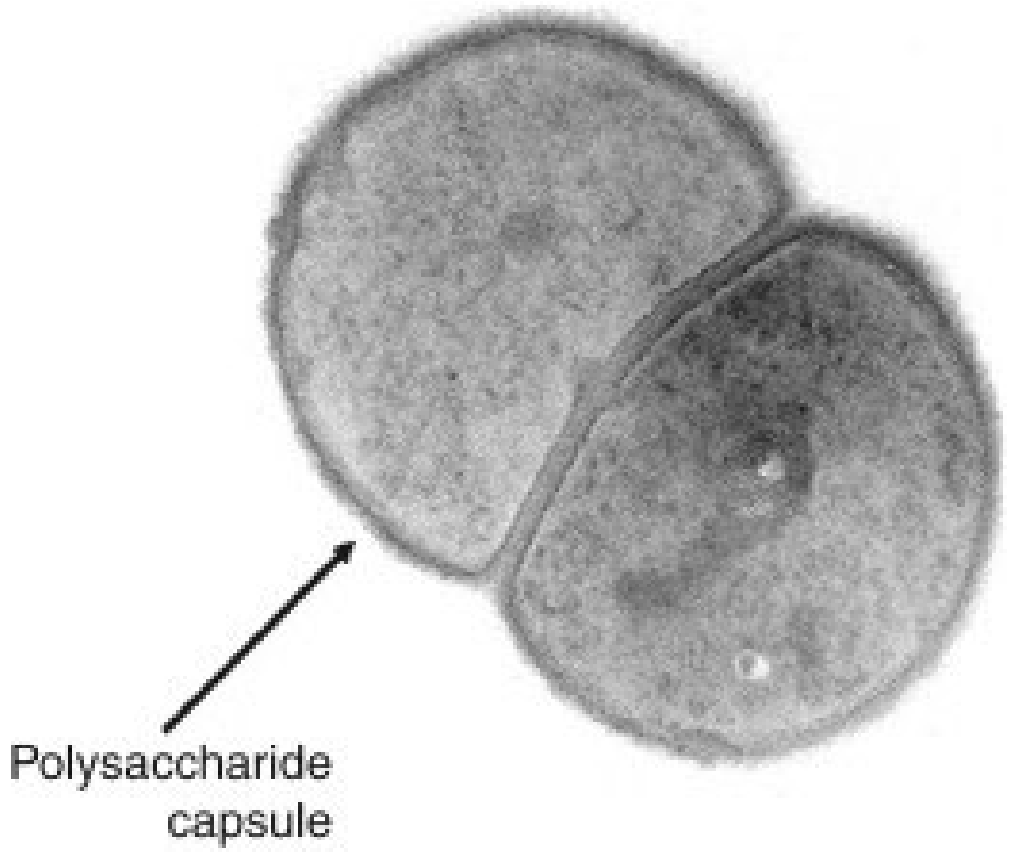
# Recommendations for Use of Pneumococcal Vaccines in Children and Adults in the United States

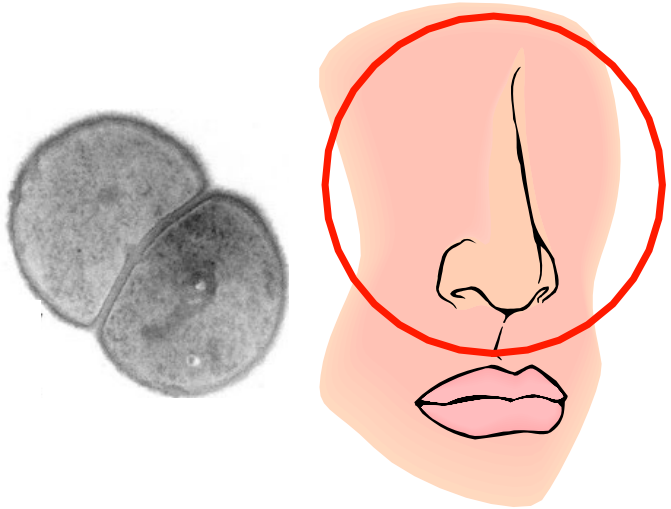
**Miwako Kobayashi, MD, MPH**

Current Issues in Immunization Webinar
August 23, 2023

# *Streptococcus pneumoniae* (capsular) serotypes

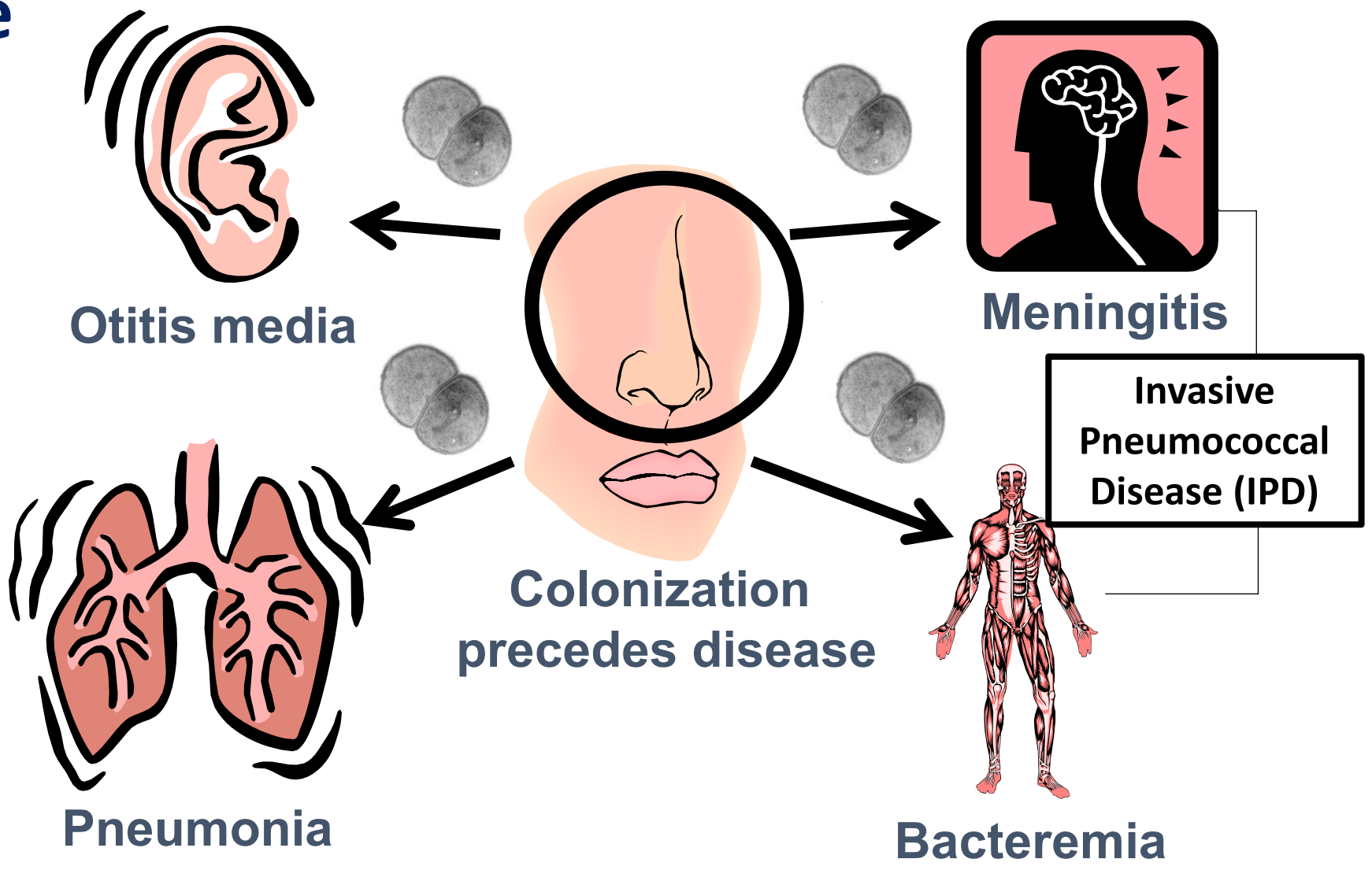


# Carriage of *Streptococcus pneumoniae* is common in healthy populations (especially children)



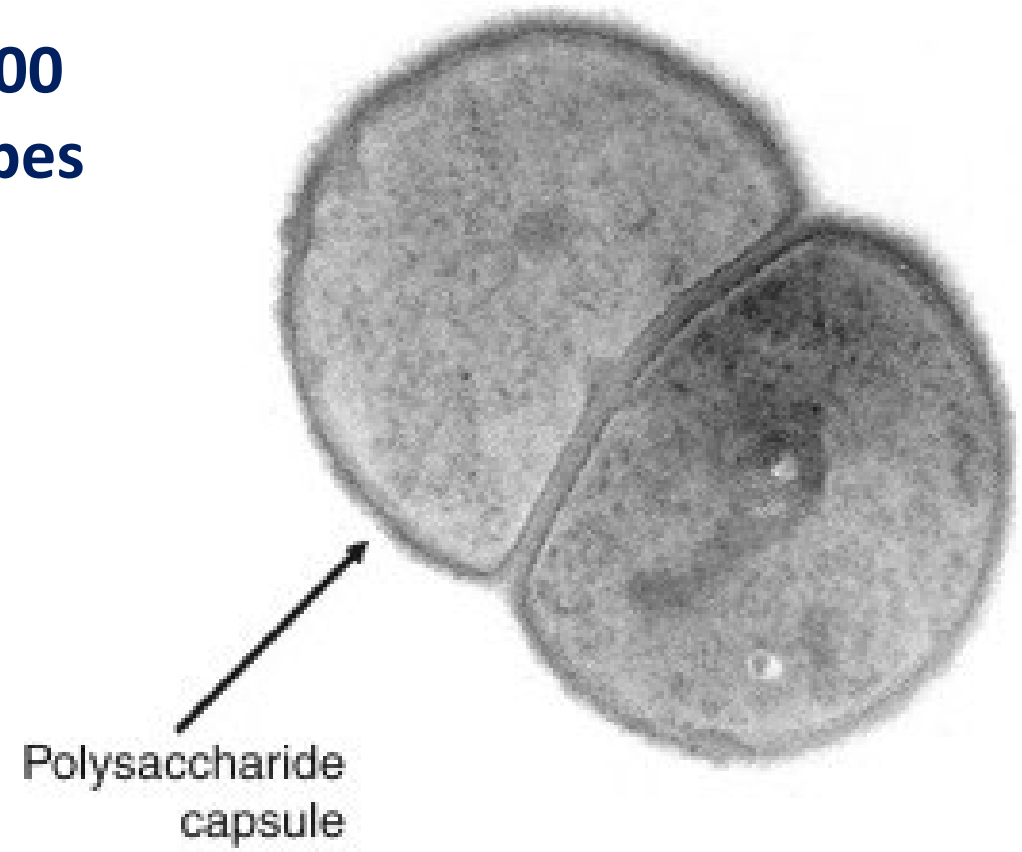
Colonization (carriage) precedes disease

# Pneumococcus can cause non-invasive or invasive disease



# *Streptococcus pneumoniae* (capsular) serotypes

**Over 100 serotypes**



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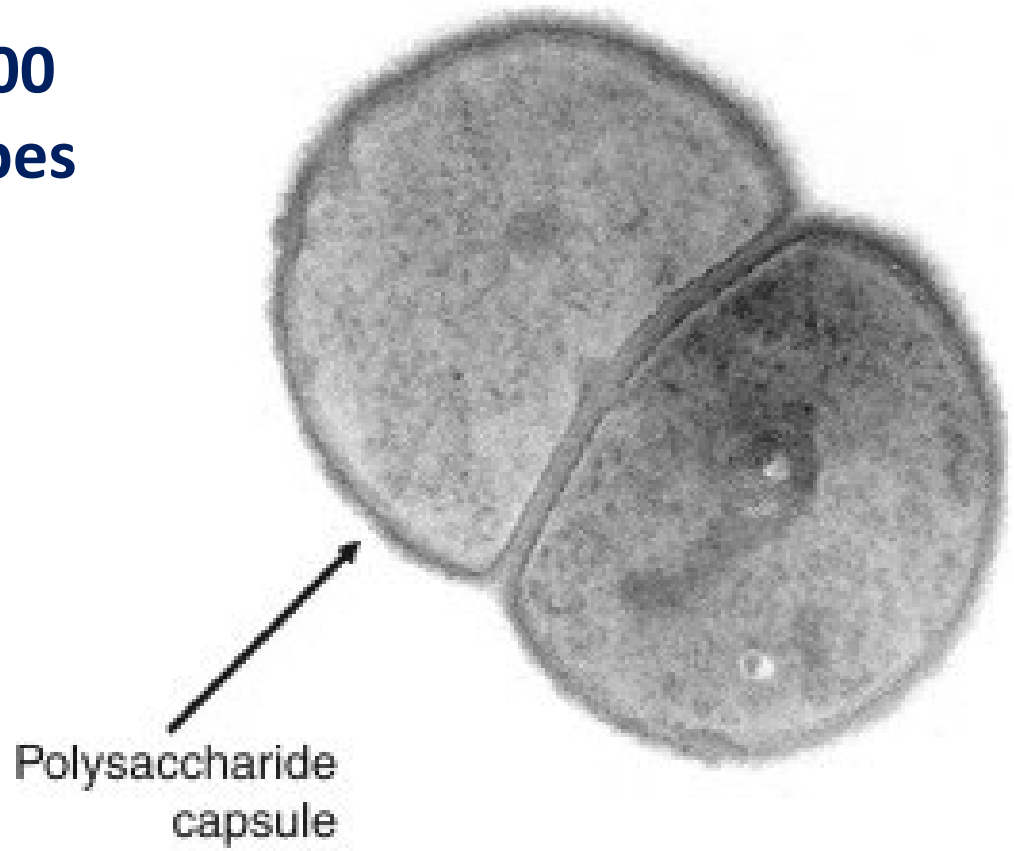
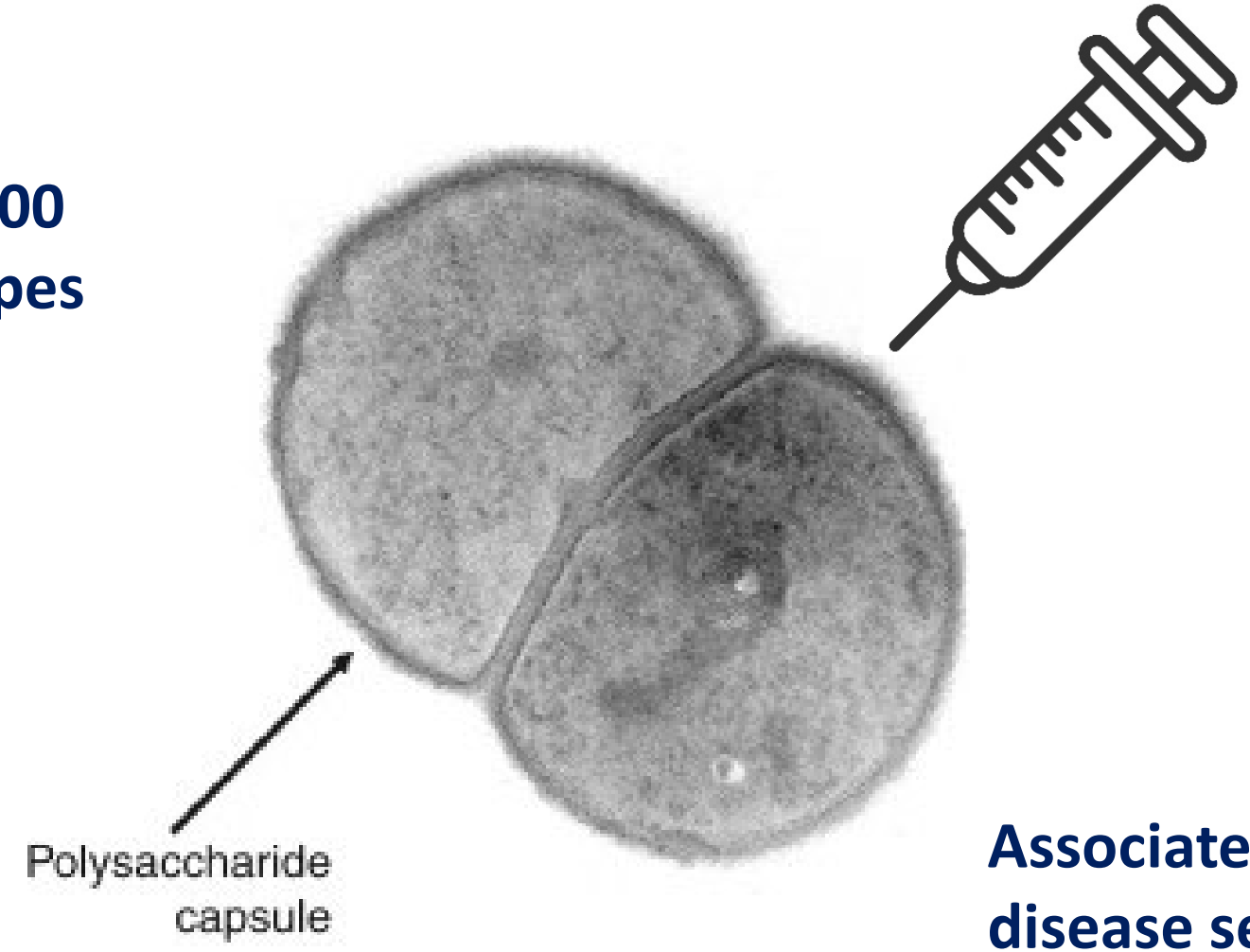



**Associated with disease severity**

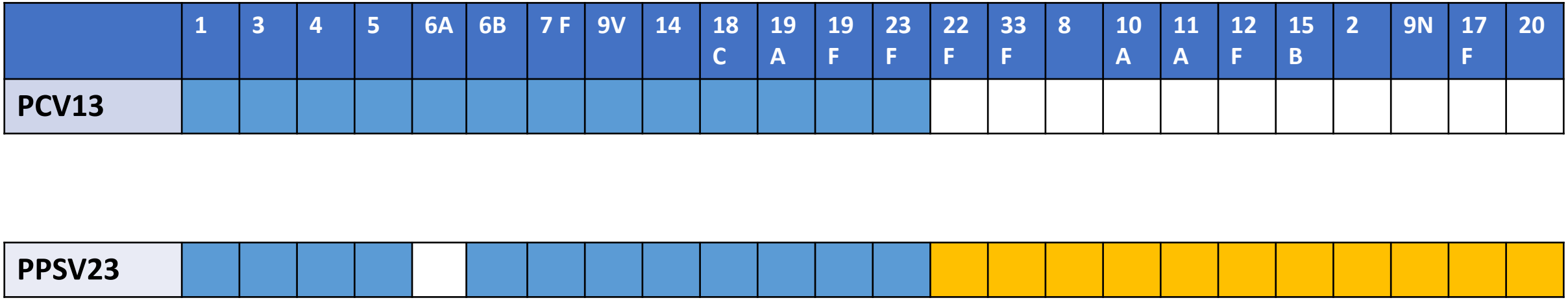
# *Streptococcus pneumoniae* (capsular) serotypes

**Over 100 serotypes**




**Associated with disease severity**

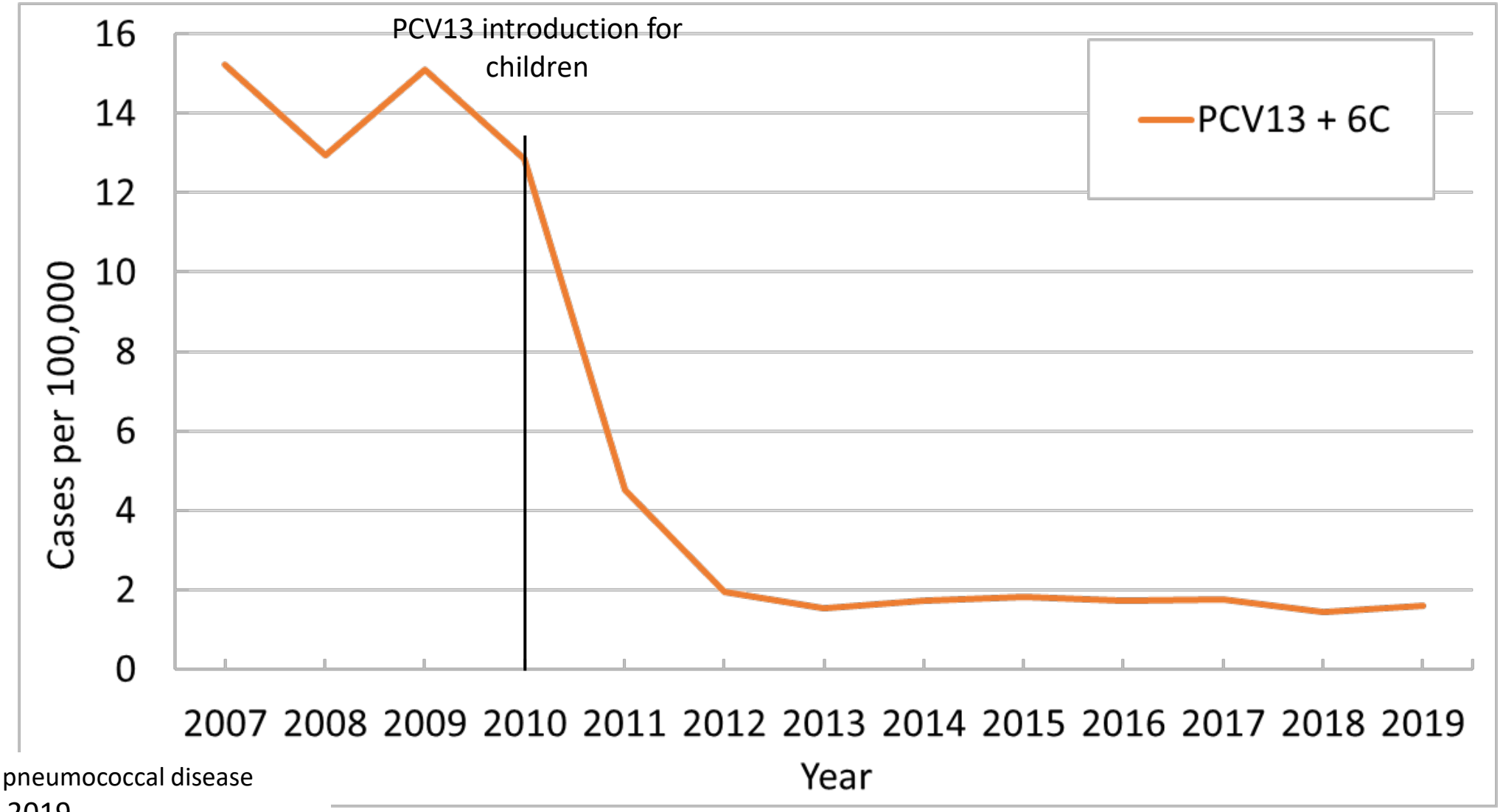
# Two pneumococcal vaccines were available for use in the United States before 2021




23-valent pneumococcal polysaccharide vaccine (PPSV23) Pneumovax23®

13-valent pneumococcal conjugate vaccine (PCV13) Prevnar13®

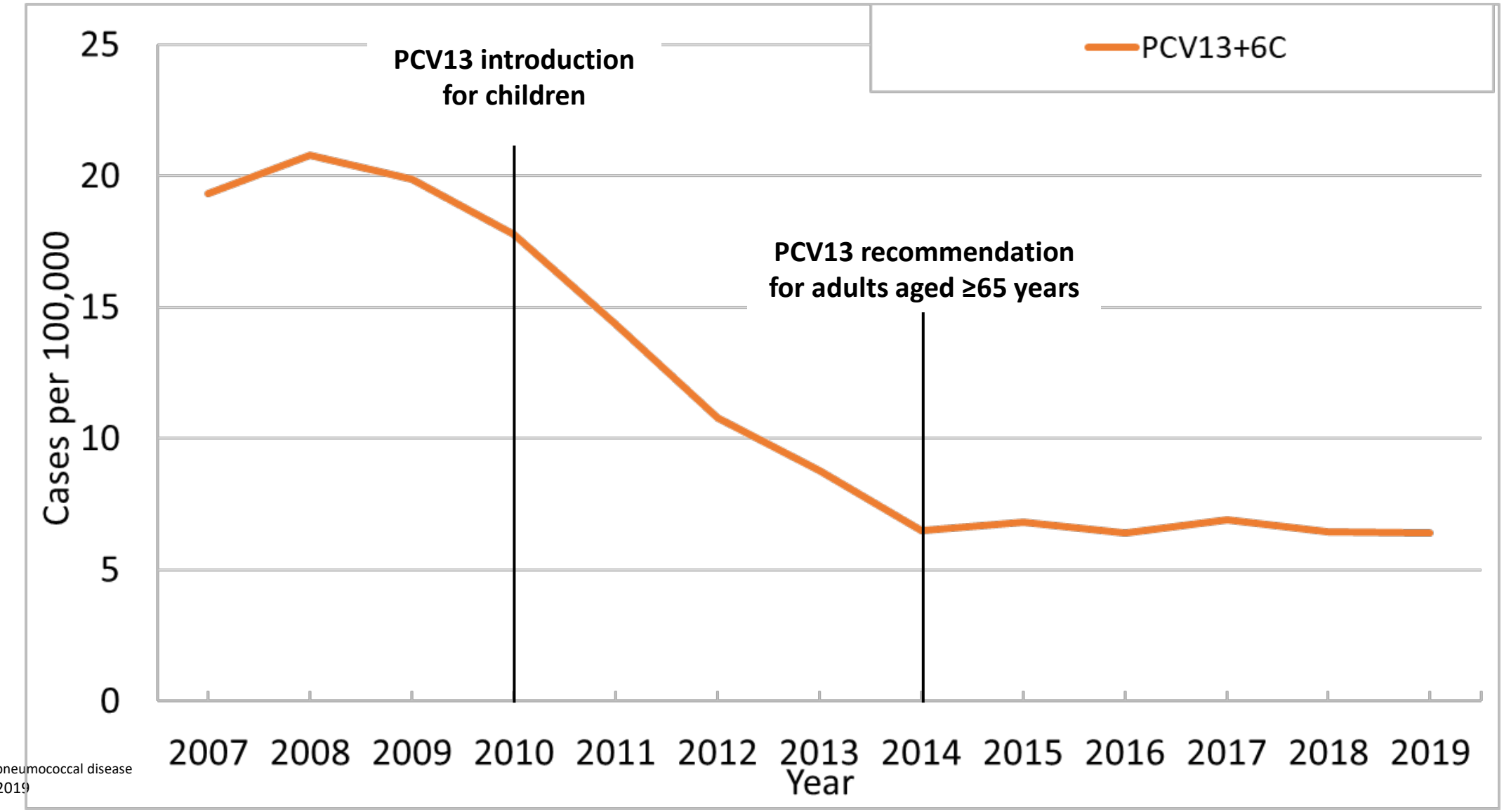
# PCV13 use in children not only reduced vaccine-type IPD incidence in children who received the vaccine….




IPD=invasive pneumococcal disease

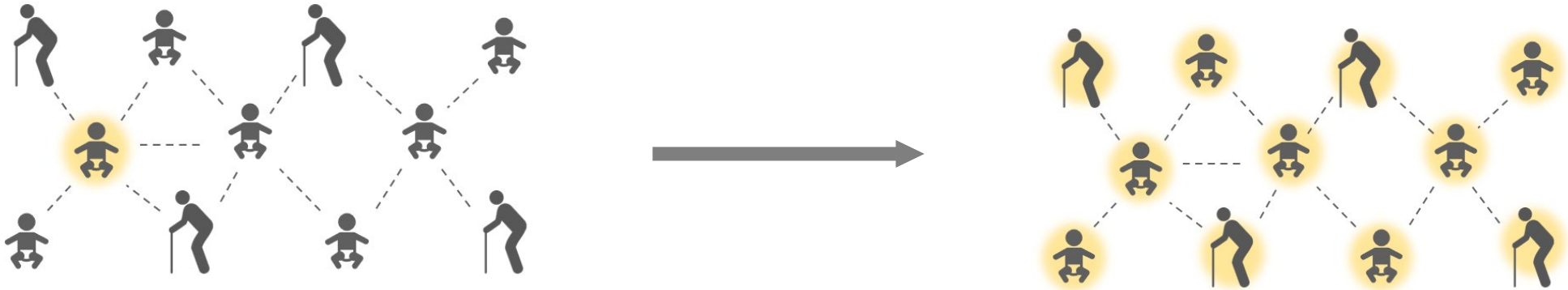
ABCs 2007–2019

# But also in adults, including adults aged ≥65 years, likely due to pediatric indirect effects

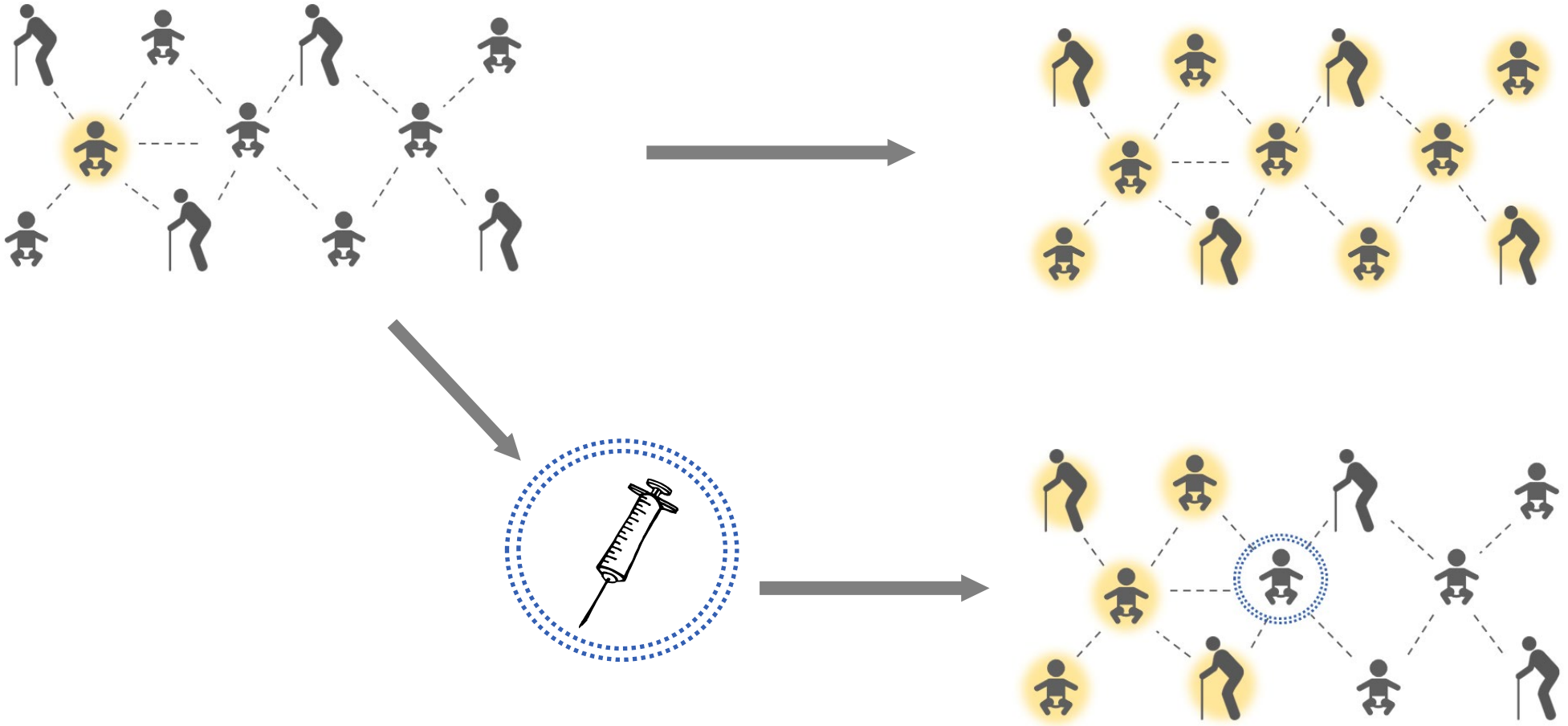



IPD=invasive pneumococcal disease
ABCs 2007–2019

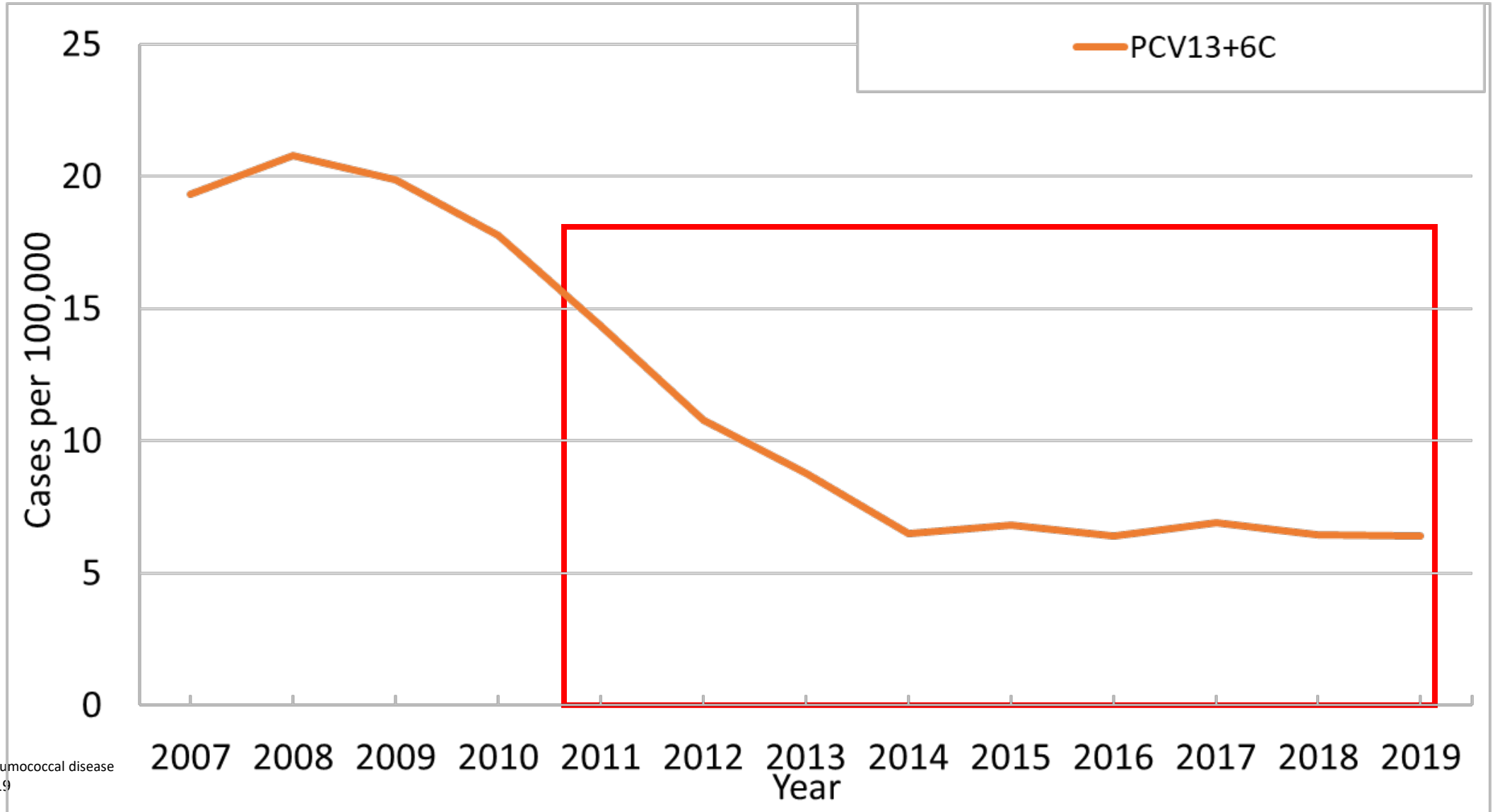
# Pneumococcal conjugate vaccines (PCVs) provide direct and indirect protection



# Pneumococcal conjugate vaccines (PCVs) provide direct and indirect protection

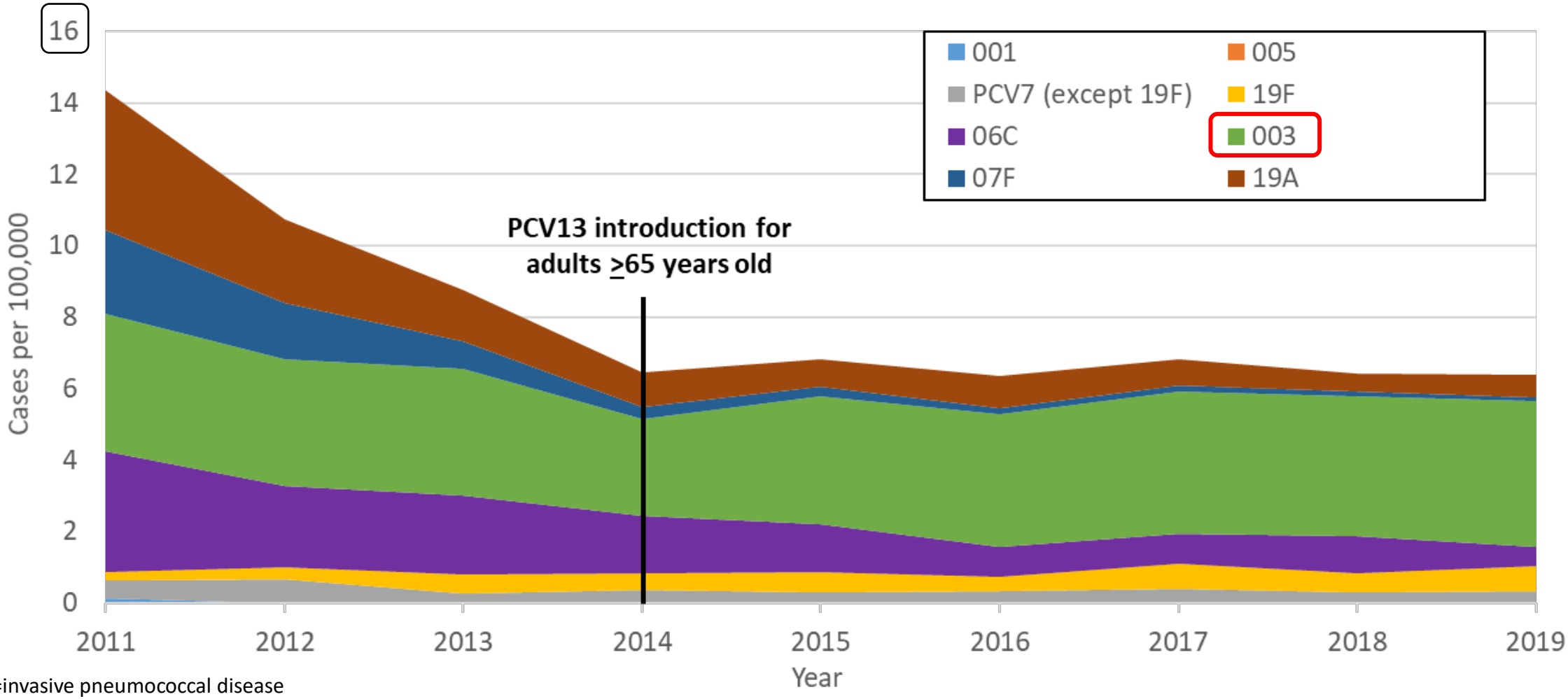


# Changes in IPD incidence were different by PCV13 serotypes




IPD=invasive pneumococcal disease
ABCs 2007–2019

# Serotype 3 is the most common serotype among remaining PCV13-type IPD in adults aged ≥65 years.



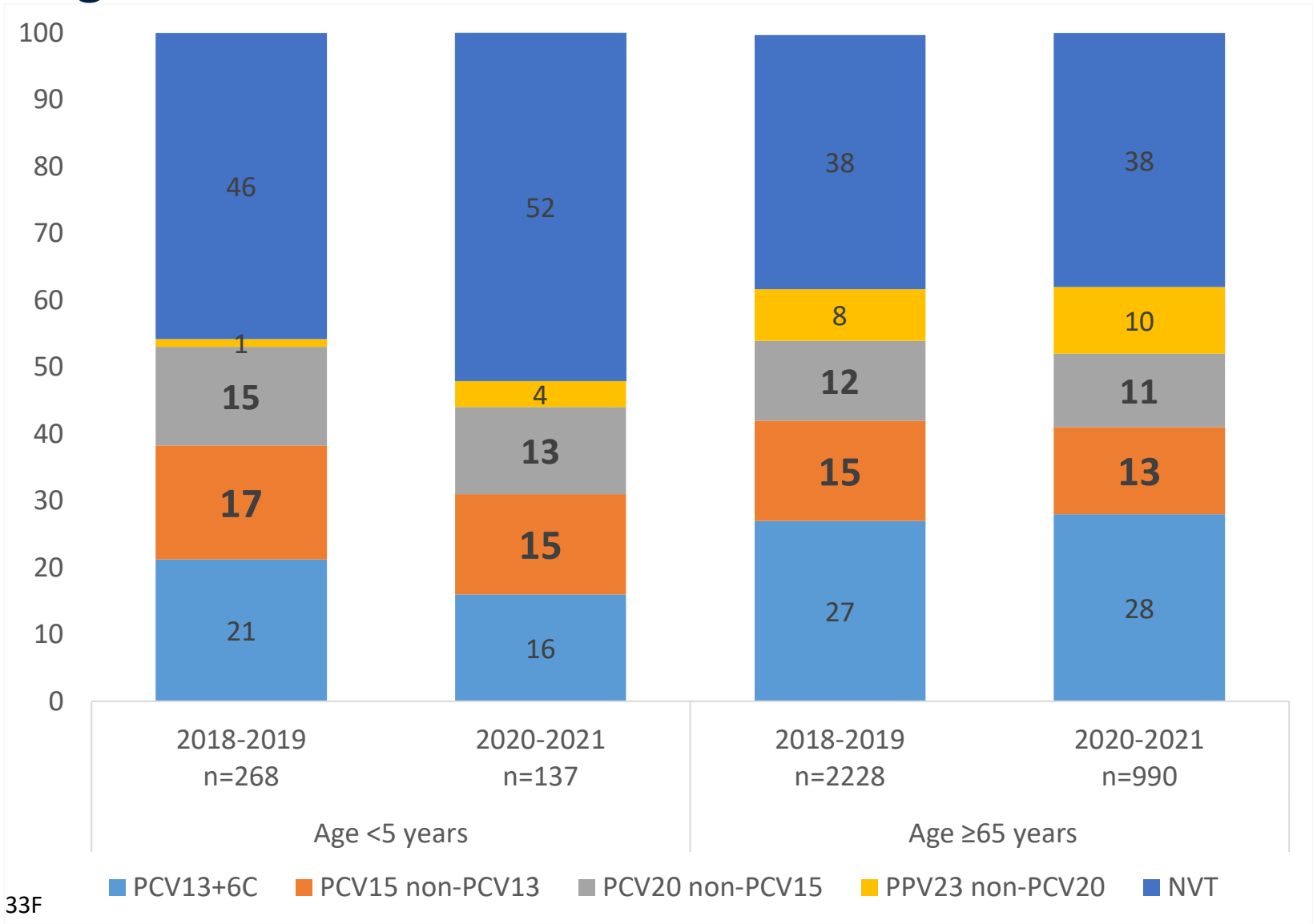

IPD=invasive pneumococcal disease
ABCs 2011–2019

# In 2021, 2 new pneumococcal conjugate vaccines were licensed for use among U.S. adults.

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

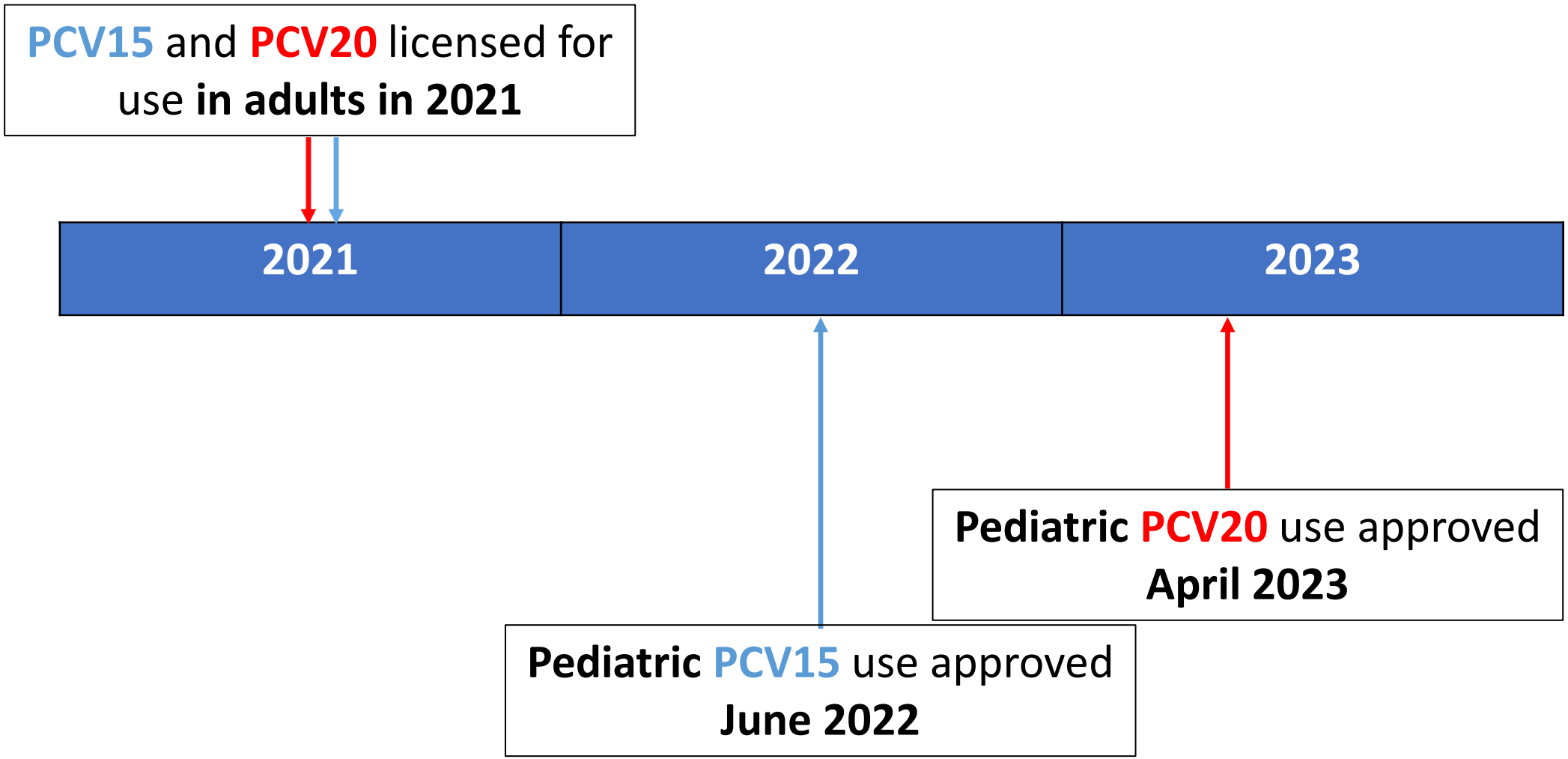
| | |
|---|---|
| 23-valent pneumococcal polysaccharide vaccine (PPSV23) | Pneumovax23® |
| 13-valent pneumococcal conjugate vaccine (PCV13) | Prevnar13® |
| **15-valent pneumococcal conjugate vaccine (PCV15)** | **Vaxneuvance™** |
| **20-valent pneumococcal conjugate vaccine (PCV20)** | **Prevnar20®** |

# Non-PCV13, PCV15 cases and non-PCV15, PCV20 cases cause 11–17% of remaining IPD cases.



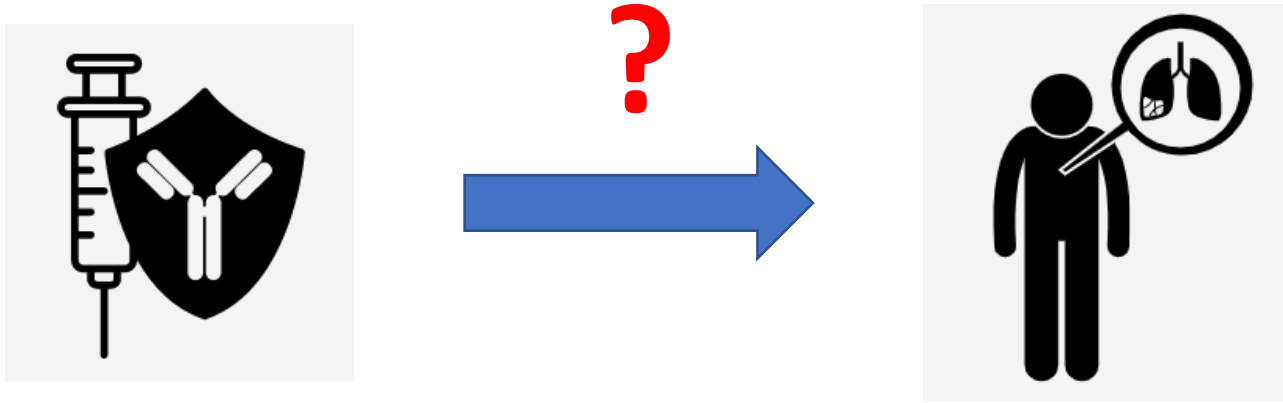

PCV15 non-PCV13 serotypes: 22F, 33F
PCV20 non-PCV15 serotypes: 8, 10A, 11A, 12F, 15B
PPSV23 non-PCV20 serotype: 2, 9N, 17F ,20
CDC Active Bacterial Core surveillance

# Challenge 1: Unlike PCV13, PCV15 and PCV20 were approved for use in adults, first.



# Challenge 2: Both PCV15 and PCV20 were approved based on safety and immunogenicity data compared with existing vaccines.

- **We don’t know how some of the immunogenicity study findings will translate to real-world clinical effectiveness.**




- **Unknown clinical implications:**
  - Numerically lower antibody responses vs PCV13
  - Numerically higher antibody response against serotype 3 in PCV15 vs PCV13
- **No direct PCV15 vs PCV20 comparison**

# Challenge 3: Existing pneumococcal vaccine recommendations were complicated.

## U.S. adult pneumococcal vaccine recommendations before 2021

| | Adults aged 19–64 years | Adults aged ≥65 years |
|---|---|---|
| **None of the conditions listed below** | No recommendation | PCV13* based on shared clinical decision making, PPSV23 for all |
| **Chronic medical conditions† (CMC)** | PPSV23 | |
| **Cochlear implant, CSF leak** | Both PCV13* and PPSV23 | Both PCV13* and PPSV23 |
| **Immunocompromising conditions** | Both PCV13* and PPSV23, repeat PPSV23 after 5 years | |

CSF: cerebrospinal fluid leak, PCV13: 13-valent pneumococcal conjugate vaccine, PCV15: 15-valent pneumococcal conjugate vaccine, PCV20: 20-valent pneumococcal conjugate vaccine, PPSV23: 23-valent pneumococcal polysaccharide vaccine

*If not previously given; †Examples include alcoholism, chronic heart/liver/lung disease, diabetes, cigarette smoking
https://www.cdc.gov/vaccines/vpd/pneumo/downloads/pneumo-vaccine-timing.pdf

# Timeline of ACIP votes on new pneumococcal vaccine use for U.S. adults

| ACIP meeting | Recommendation |
|---|---|
| October 2021 | PCV15/PCV20 use for adults **who have not previously received PCV** or whose previous pneumococcal vaccination history is unknown |
| October 2022 | PCV20 use for adults who have **previously received PCV13** |

# October 2021 ACIP recommendations simplified the previous recommendations for adults aged ≥65 years

| | Previous Recommendation | New Recommendation |
|---|---|---|
| **None of the conditions listed below** | PCV13* based on shared clinical decision making, PPSV23 for all | **PCV20 OR PCV15 and PPSV23** |
| **Chronic medical conditions† (CMC)** | | |
| **Cochlear implant, CSF leak** | Both PCV13* and PPSV23 | |
| **Immunocompromising conditions** | | |

PCV13: 13-valent pneumococcal conjugate vaccine, PCV15: 15-valent pneumococcal conjugate vaccine, PCV20: 20-valent pneumococcal conjugate vaccine, PPSV23: 23-valent pneumococcal polysaccharide vaccine

*If not previously given; †Examples include alcoholism, chronic heart/liver/lung disease, diabetes, cigarette smoking
https://www.cdc.gov/vaccines/vpd/pneumo/downloads/pneumo-vaccine-timing.pdf

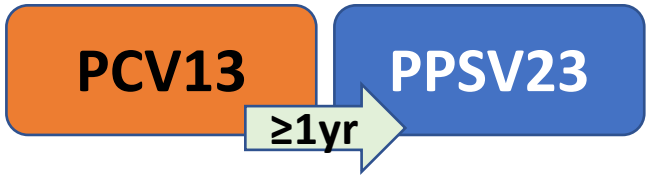
# October 2021 ACIP recommendations simplified the previous recommendations for adults aged 19–64 years with risk factors

| | Previous Recommendations | New Recommendations |
|---|---|---|
| **None of the conditions listed below** | No recommendation | No recommendation |
| **Chronic medical conditions† (CMC)** | PPSV23 | **PCV20 OR PCV15 and PPSV23** |
| **Cochlear implant, CSF leak** | Both PCV13* and PPSV23 | |
| **Immunocompromising conditions** | Both PCV13* and PPSV23, repeat PPSV23 after 5 years | |

PCV13: 13-valent pneumococcal conjugate vaccine, PCV15: 15-valent pneumococcal conjugate vaccine, PCV20: 20-valent pneumococcal conjugate vaccine, PPSV23: 23-valent pneumococcal polysaccharide vaccine

*If not previously given; †Examples include alcoholism, chronic heart/liver/lung disease, diabetes, cigarette smoking
https://www.cdc.gov/vaccines/vpd/pneumo/downloads/pneumo-vaccine-timing.pdf

# Adults who started the series with PCV13 were recommended to complete with PPSV23

| Underlying conditions | Age 19–64 years | Age ≥65 years |
|---|---|---|
| None | PCV13 Previously not recommended |  |
| Chronic medical conditions | | |
| CSF leak, cochlear implant |  |  |
| Immuno-compromised |  |  |











Use of 15-Valent Pneumococcal Conjugate Vaccine and 20-Valent Pneumococcal Conjugate Vaccine Among U.S. Adults: Updated Recommendations of the Advisory Committee on Immunization Practices — United States, 2022 | MMWR (cdc.gov)

# Pneumococcal Vaccines: PCVs vs. PPSV23

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

| | **PCV** | **PPSV23** |
|---|---|---|
| Basic Vaccine Composition | Capsular polysaccharides conjugated to **CRM197 Carrier Protein** | Capsular polysaccharide antigens |
| Mechanism of action | T-cell **dependent** | T-cell **independent** |
| Memory B cell production | **Yes** | **No** |

PCV: pneumococcal conjugate vaccine, PPSV23: 23-valent pneumococcal polysaccharide vaccine

# Pneumococcal Vaccines: PCVs vs. PPSV23

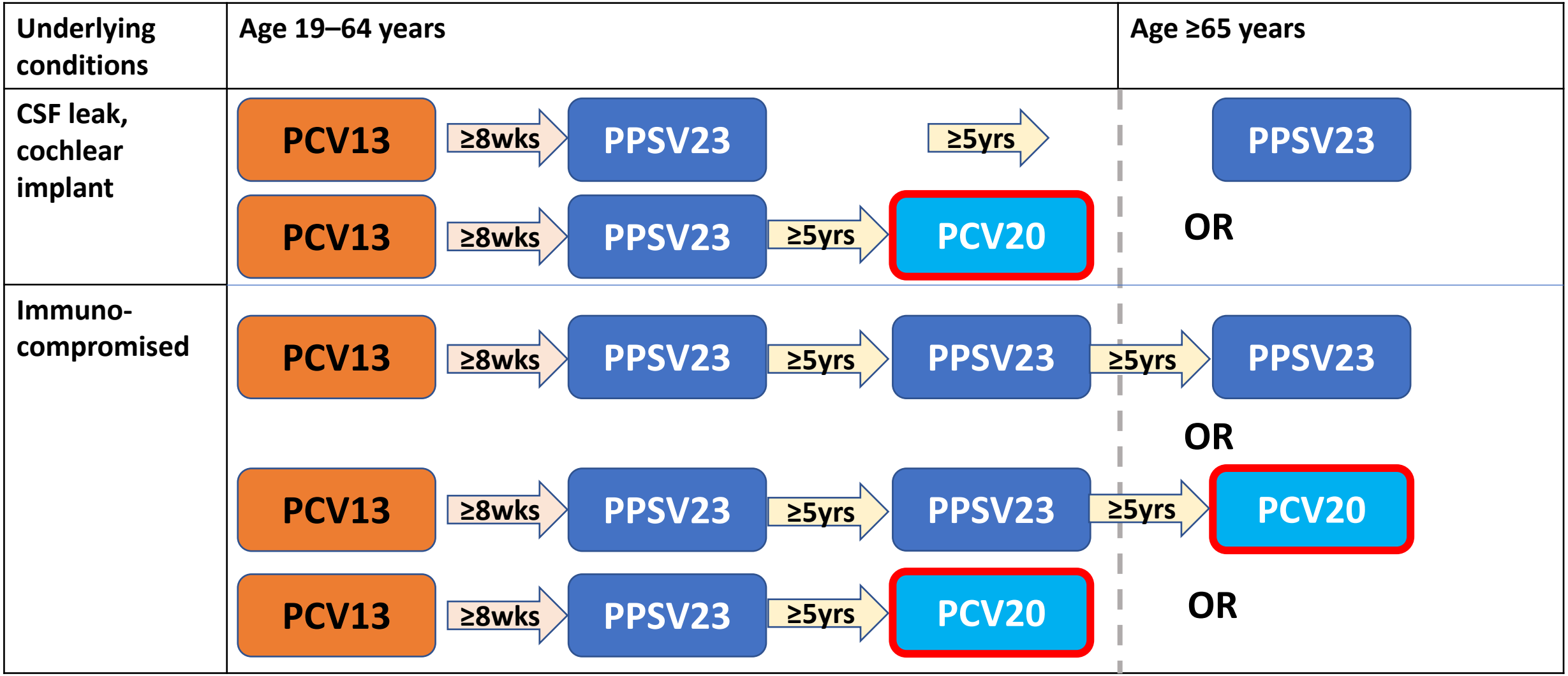
| | PCV | PPSV23 |
|---|---|---|
| **Duration of protection** | **No decline for 5 yrs**[1] | Variable findings, waning reported as early as **2 years** since vaccination[2] |
| **Vaccine Effectiveness** vs. Vaccine-type IPD | Supported by clinical efficacy/effectiveness data | Supported by clinical efficacy/effectiveness data; limited effectiveness reported in immunocompromised adults[3] |
| **Vaccine Effectiveness** vs. Vaccine-type non-invasive/non-bacteremic pneumonia | Supported by clinical efficacy data<br>• **Moderate** protection (45%: 95% CI 14 to 63)[4] | **Variable** clinical effectiveness data<br>• Modest protection (18%: 95% CI -4 to 35%) from a meta-analysis[5] |


1. Patterson et al. Trials in Vaccinology 2016.
2. World Health Organization. Strategic Advisory Group of Experts on Immunization 5-7 October 2020. https://terrance.who.int/mediacentre/data/sage/SAGE_eYB_October_2020.pdf?ua=1
3. French et al. NEJM 2000; Andrews et al. Vaccine 2012; Rudnick et al. Vaccine 2013; Djennad et al. EClinicalMedicine 2018
4. Bonten et al. NEJM 2015
5. Farrar et al. https://www.medrxiv.org/content/10.1101/2022.10.06.22280772v1.full

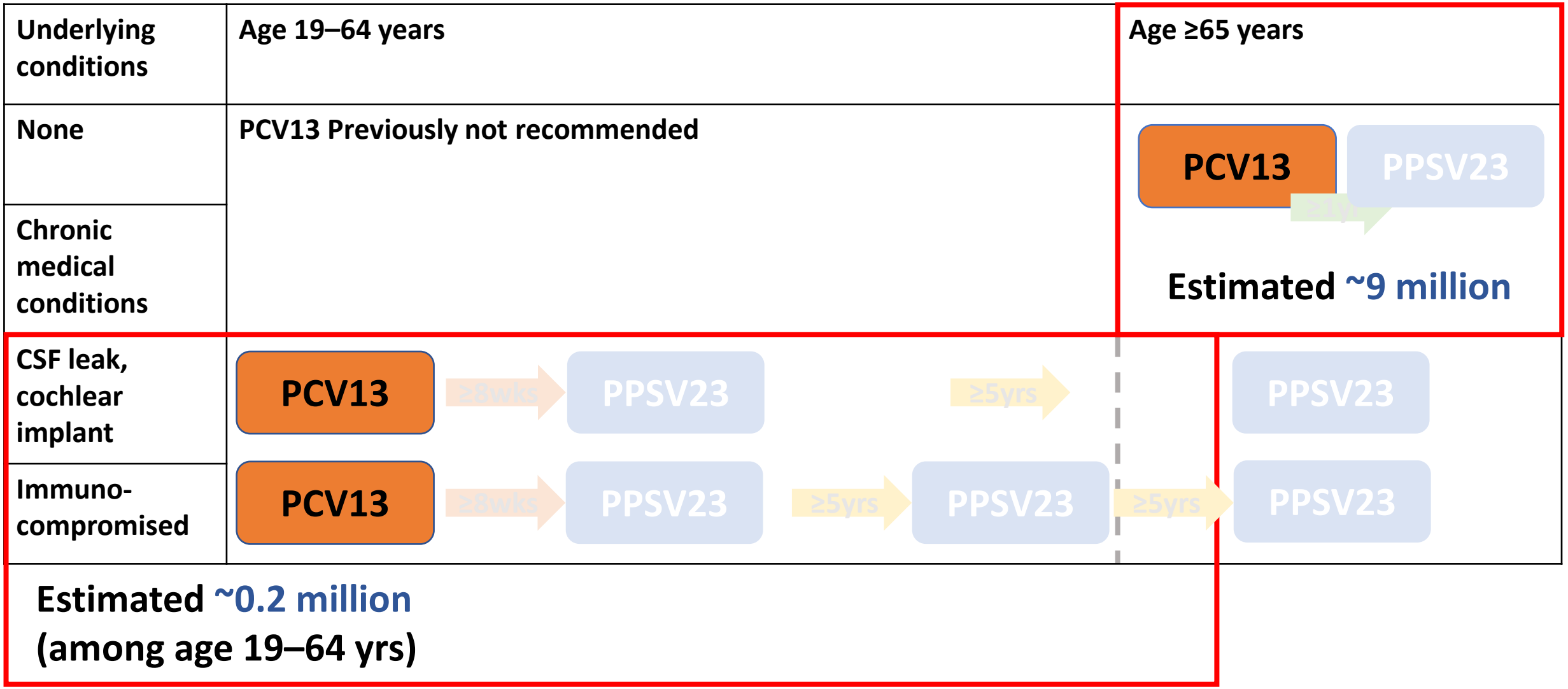
# Group 1: Immunocompromised adults who received PCV13+PPSV23 but have not completed their series

| Underlying conditions | Age 19–64 years | Age ≥65 years |
|---|---|---|
| None | PCV13 Previously not recommended | PCV13 ≥1yr PPSV23 |
| Chronic medical conditions | Estimated ~0.2 million (among age 19–64 yrs) | |
| CSF leak, cochlear implant | PCV13 ≥8wks PPSV23 ≥5yrs | PPSV23 |
| Immuno-compromised | PCV13 ≥8wks PPSV23 ≥5yrs PPSV23 | ≥5yrs PPSV23 |
| | PCV13 ≥8wks PPSV23 ≥5yrs PPSV23 | ≥5yrs PPSV23 |

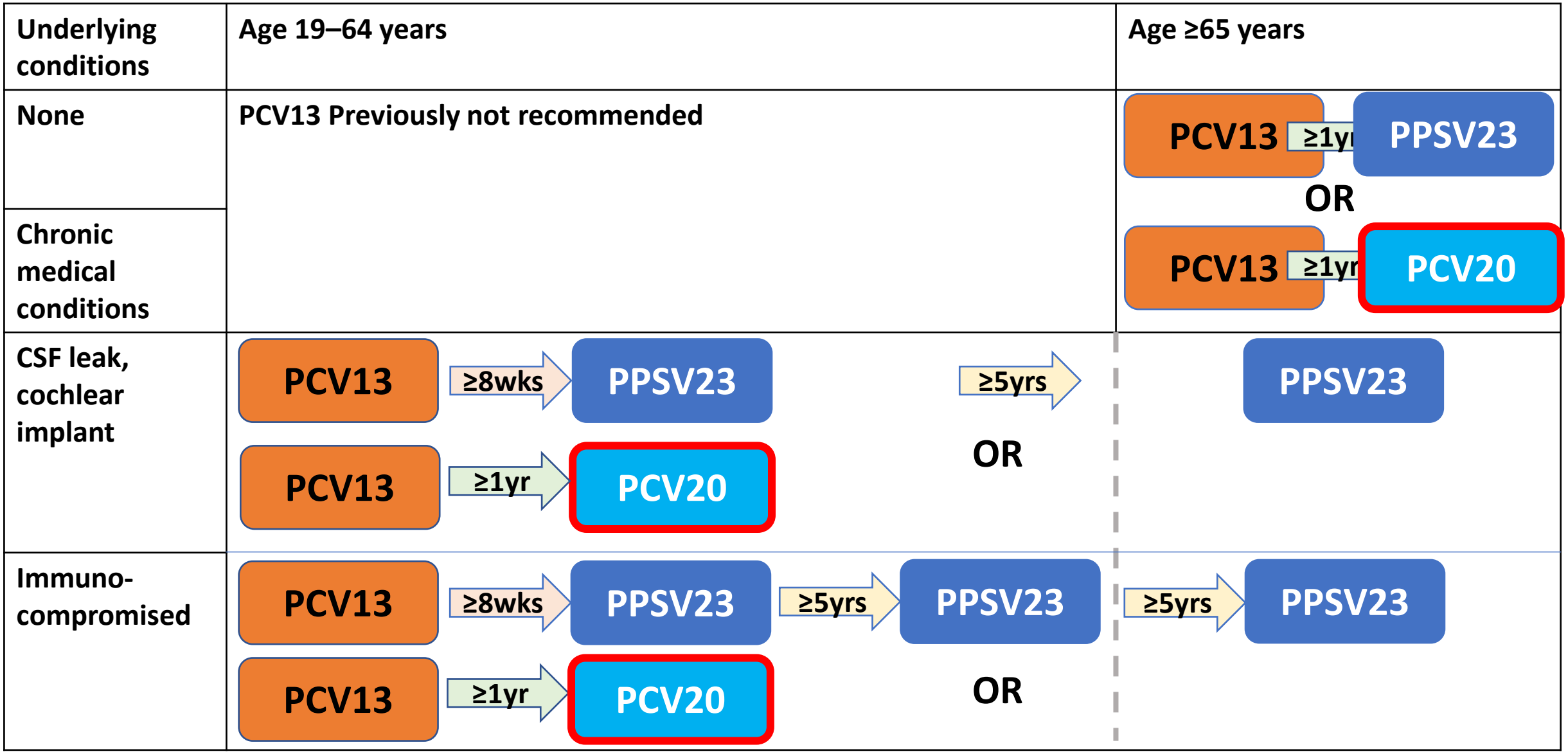
# Group 1: Immunocompromised adults who received PCV13+PPSV23 but have not completed their series



# Group 2: Adults who started the series with PCV13 but have not received PPSV23



# Group 2: Adults who started the series with PCV13 but have not received PPSV23



# Group 3: Adults aged ≥65 yrs who completed the series with PCV13+PPSV23

| Underlying conditions | Age 19–64 years | Age ≥65 years |
|---|---|---|
| None | PCV13 Previously not recommended | PCV13 → ≥1yr → PPSV23<br>Estimated ~17 million |
| Chronic medical conditions | | |
| CSF leak, cochlear implant | PCV13 → ≥8wks → PPSV23 → ≥5yrs | PPSV23 |
| Immuno-compromised | PCV13 → ≥8wks → PPSV23 → ≥5yrs → PPSV23 → ≥5yrs | PPSV23 |

# Group 3: Adults aged ≥65 yrs who completed the series with PCV13+PPSV23

| Underlying conditions | Age 19–64 years | Age ≥65 years |
|---|---|---|
| None | PCV13 Previously not recommended | PCV13 → ≥1yr → PPSV23<br>AND ≥5yrs → PCV20 |
| Chronic medical conditions | | |
| CSF leak, cochlear implant | PCV13 → ≥8wks → PPSV23 → ≥5yrs | Shared clinical decision-making |
| Immuno-compromised | PCV13 → ≥8wks → PPSV23 → ≥5yrs → PPSV23 → ≥5yrs → PPSV23 | |

# PneumoRecs VaxAdvisor Mobile App for Vaccine Providers

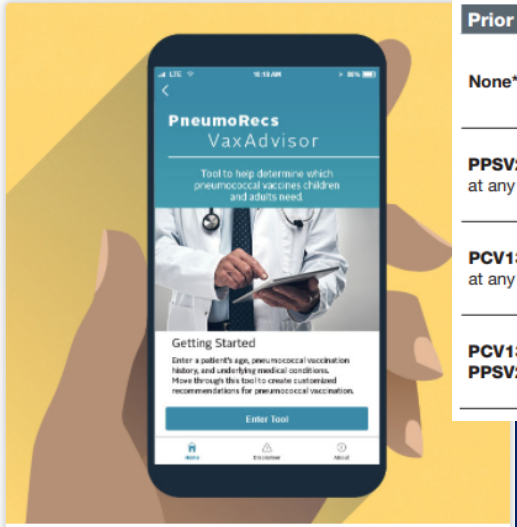
The PneumoRecs VaxAdvisor Mobile App was updated on February 9, 2022, to reflect CDC's new adult pneumococcal vaccination recommendations.

The ***PneumoRecs VaxAdvisor*** mobile app helps vaccination providers quickly and easily determine which pneumococcal vaccines a patient needs and when. The app incorporates recommendations for all ages so internists, family physicians, pediatricians, and pharmacists alike will find the tool beneficial.

Users simply:

- Enter a patient's age.
- Note if the patient has specific underlying medical conditions.
- Answer questions about the patient's pneumococcal vaccination history.

Then the app provides patient-specific guidance consistent with the immunization schedule recommended by the U.S. Advisory Committee on Immunization Practices (ACIP).




PneumoRecs VaxAdvisor is available for download on iOS and Android mobile devices.

## Download the App Today

*Download PneumoRecs VaxAdvisor for free:*

# 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 |

- ***MMWR Recommendations and Reports*** **summarizing the adult pneumococcal vaccine recommendations will be published soon**

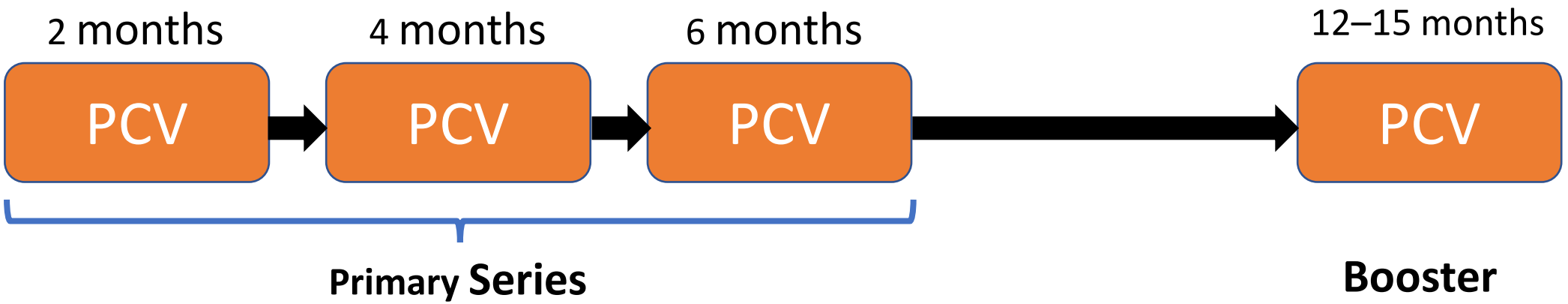
[PneumoRecs VaxAdvisor: Vaccine Provider App | CDC]
[Pneumococcal Vaccination: Who and When to Vaccinate | CDC]
[Pneumococcal Vaccine Timing for Adults greater than or equal to 65 years (cdc.gov)]
[Shared Clinical Decision-Making: PCV20 Vaccination for Adults 65 Years or Older-February 2, 2023 (cdc.gov)]

# Timeline of ACIP votes on new pneumococcal vaccine use for U.S. children

| ACIP meeting | Recommendation |
|---|---|
| June 2022 | PCV15 use for children as an option for pneumococcal conjugate vaccination |
| June 2023 | PCV20 for children |

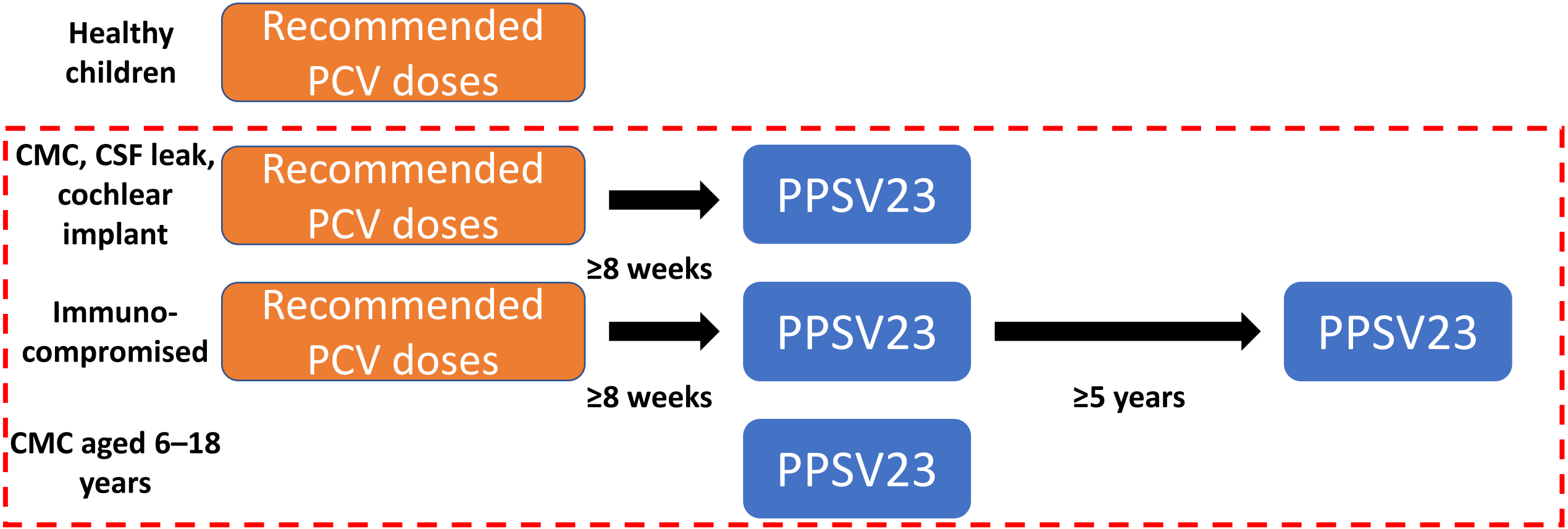
# All children under age 2 years have the same pneumococcal vaccine recommendations

- **3 primary series and a booster=“3+1” schedule**




Either **PCV13** or **PCV15** were recommended prior to June 2023 ACIP meeting.

# Children with certain underlying conditions were recommended* to receive PPSV23 in addition to the recommended PCV doses




**Note:** Excludes catch-up vaccination schedules.
*Recommendation before June 2023 ACIP meeting
CMC=chronic medical conditions, including chronic heart disease, chronic lung disease, diabetes mellitus
CSF=cerebrospinal fluid
Use of 15-Valent Pneumococcal Conjugate Vaccine Among U.S. Children: Updated Recommendations of the Advisory Committee on Immunization Practices — United States, 2022 | MMWR (cdc.gov)

# Policy questions considered by the ACIP

- Should **PCV20** be recommended as an option for pneumococcal conjugate vaccination **according to currently recommended dosing and schedules, for U.S. children aged <2 years**?

- Should **PCV20 without PPSV23** be recommended as an option for pneumococcal vaccination **for U.S. children aged 2–18 years with underlying medical conditions that increase the risk of pneumococcal disease?**

# 1. Routine PCV use for all children aged <24 months

**Use of either PCV15 or PCV20 is recommended for all children aged 2–23 months according to currently recommended PCV dosing and schedules.**

# 2. Catch-up PCV doses for children aged 24–71 months with an incomplete PCV vaccination status

**For children with an incomplete PCV vaccination status, use of either PCV15 or PCV20 according to currently recommended PCV dosing and schedules is recommended for:**

- **Healthy children aged 24–59 months**
- **Children with specified risk conditions* aged 24–71 months**

*Risk conditions include: cerebrospinal fluid leak; chronic heart disease; chronic kidney disease (excluding maintenance dialysis and nephrotic syndrome, which are included in immunocompromising conditions); chronic liver disease; chronic lung disease (including moderate persistent or severe persistent asthma); cochlear implant; diabetes mellitus; immunocompromising conditions (on maintenance dialysis or with nephrotic syndrome; congenital or acquired asplenia or splenic dysfunction; congenital or acquired immunodeficiencies; diseases and conditions treated with immunosuppressive drugs or radiation therapy, including malignant neoplasms, leukemias, lymphomas, Hodgkin disease, and solid organ transplant; HIV infection; and sickle cell disease and other hemoglobinopathies).

# 3. Children aged 2–18 years with any risk condition who have completed their recommended PCV doses before age 6 years

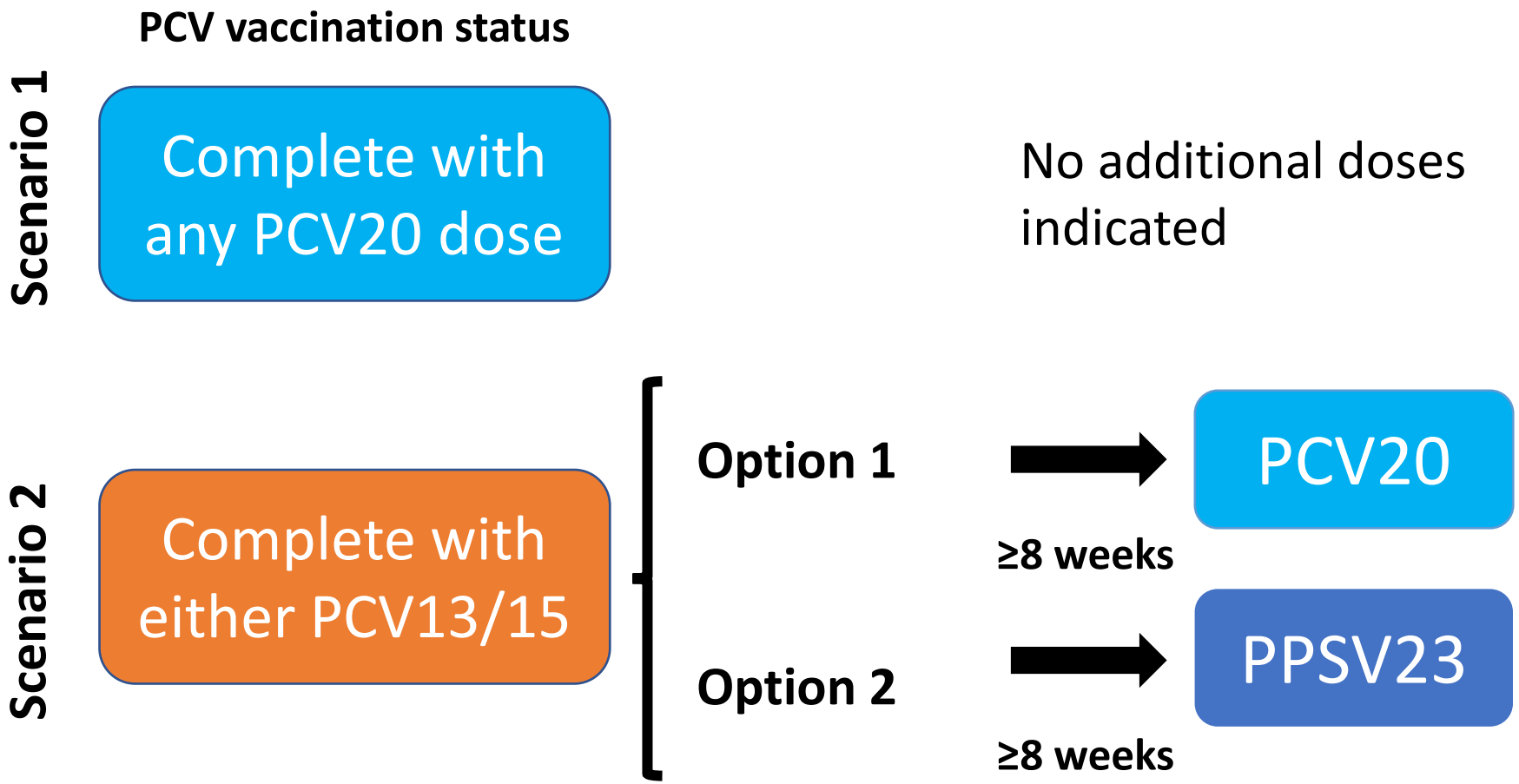
**For children aged 2–18 years with any risk condition who have received all recommended doses before age 6 years**

- **Using ≥1 dose of PCV20: No additional doses of any pneumococcal vaccine are indicated. This recommendation may be updated as additional data become available.**
- **Using PCV13 or PCV15 (no PCV20): A dose of PCV20 or PPSV23 using previously recommended doses and schedule is recommended.**

# Children aged 2–18 years with CMC, CSF leak, or cochlear implant who have received all recommended PCV doses before age 6 years, previous recommendation


CMC=chronic medical conditions, including chronic kidney disease (excluding maintenance dialysis and nephrotic syndrome, which are included in immunocompromising conditions), chronic heart disease, chronic liver disease, chronic lung disease (including moderate persistent or severe persistent asthma), diabetes mellitus; CSF=cerebrospinal fluid

# Children aged 2–18 years with CMC, CSF leak, or cochlear implant who have received all recommended PCV doses before age 6 years, updated recommendations

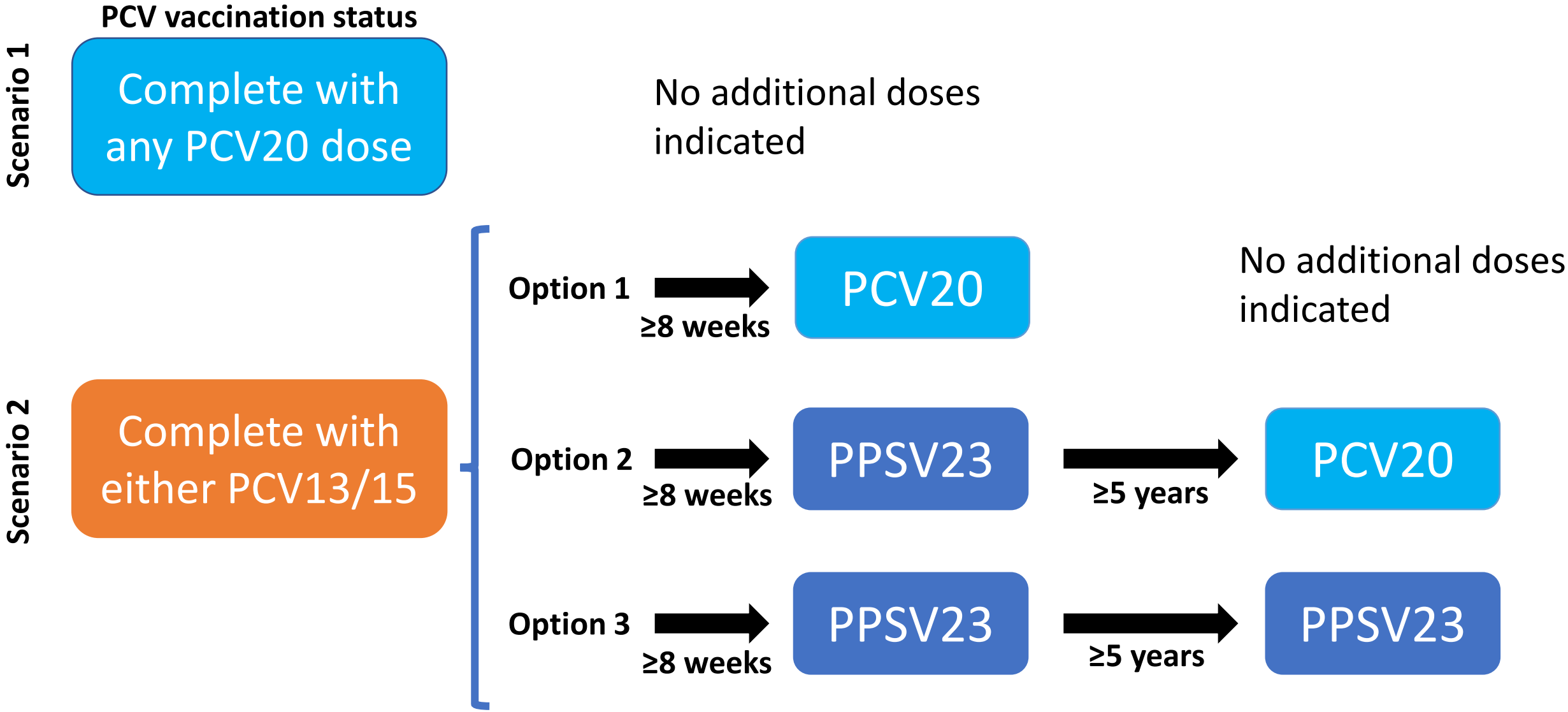



CMC=chronic medical conditions, including chronic kidney disease (excluding maintenance dialysis and nephrotic syndrome, which are included in immunocompromising conditions), chronic heart disease, chronic liver disease, chronic lung disease (including moderate persistent or severe persistent asthma), diabetes mellitus; CSF=cerebrospinal fluid

# Children with an immunocompromising condition aged 2–18 years who have completed PCV doses before age 6 years, previous recommendation


IC= immunocompromising condition

# Children with an immunocompromising condition aged 2–18 years who have completed PCV doses before age 6 years, updated recommendations




IC= immunocompromising condition

| Risk group/Condition |
| --- |
| **Children without immunocompromising conditions** |
| Chronic heart disease[†] |
| Chronic kidney disease (excluding maintenance dialysis and nephrotic syndrome, which are included in immunocompromising conditions) |
| Chronic liver disease |
| Chronic lung disease (including moderate persistent or severe persistent asthma) |
| Diabetes mellitus |
| Cerebrospinal fluid leak |
| Cochlear implant |
| **Children with immunocompromising conditions** |
| On maintenance dialysis or nephrotic syndrome |
| Congenital or acquired asplenia, or splenic dysfunction |
| Congenital or acquired immunodeficiency[¶] |
| Diseases and conditions treated with immunosuppressive drugs or radiation therapy** |
| HIV infection |
| Sickle cell disease or other hemoglobinopathies |
| Solid organ transplant |

[†] Recommendations are of particular importance for children with cyanotic congenital heart disease and cardiac failure.

[¶] Includes B-(humoral) or T-lymphocyte deficiency; complement deficiencies, particularly C1, C2, C3, and C4 deficiency; and phagocytic disorders (excluding chronic granulomatous disease).

** Including malignant neoplasms, leukemias, lymphomas, and Hodgkin disease.

# 4. Children aged 6–18 years with any risk condition who have not received any dose of PCV

**For children aged 6–18 years with any risk condition who have not received any dose of PCV13, PCV15, or PCV20, a single dose of PCV15 or PCV20 is recommended. When PCV15 is used, it should be followed by a dose of PPSV23 at least 8 weeks later if not previously given.**

# Previous risk-based pneumococcal vaccine recommendations for PCV unvaccinated children aged 6–18 years with risk conditions

| | PCV13/15 recommended | PPSV23 Recommended | Single PPSV23 revaccination 5 yrs after first dose |
|---|---|---|---|
| Chronic heart disease | | Y | |
| Chronic lung disease | | Y | |
| Diabetes mellitus | | Y | |
| Cerebrospinal fluid leak | Y | Y | |
| Cochlear implant | Y | Y | |
| Chronic renal failure or nephrotic syndrome | Y | Y | Y |
| Congenital or acquired asplenia, or splenic dysfunction | Y | Y | Y |
| Congenital or acquired immunodeficiency | Y | Y | Y |
| Diseases and conditions treated with immunosuppressive drugs or radiation therapy | Y | Y | Y |
| HIV infection | Y | Y | Y |
| Sickle cell disease or other hemoglobinopathies | Y | Y | Y |
| Solid organ transplant | Y | Y | Y |

# Updated risk-based pneumococcal vaccine recommendations for PCV unvaccinated children aged 6–18 years with risk conditions

| | PCV15/20 recommended | PPSV23 Recommended |
|---|---|---|
| Chronic heart disease | Y | Only if PCV15 used |
| Chronic kidney disease | Y | Only if PCV15 used |
| Chronic liver disease | Y | Only if PCV15 used |
| Chronic lung disease* | Y | Only if PCV15 used |
| Diabetes mellitus | Y | Only if PCV15 used |
| Cerebrospinal fluid leak | Y | Only if PCV15 used |
| Cochlear implant | Y | Only if PCV15 used |
| Maintenance dialysis or nephrotic syndrome | Y | Only if PCV15 used |
| Congenital or acquired asplenia, or splenic dysfunction | Y | Only if PCV15 used |
| Congenital or acquired immunodeficiency | Y | Only if PCV15 used |
| Diseases and conditions treated with immunosuppressive drugs or radiation therapy | Y | Only if PCV15 used |
| HIV infection | Y | Only if PCV15 used |
| Sickle cell disease or other hemoglobinopathies | Y | Only if PCV15 used |
| Solid organ transplant | Y | Only if PCV15 used |

*including moderate persistent or severe persistent asthma

# Publication of updated pediatric pneumococcal vaccine recommendations

- A report summarizing the pediatric pneumococcal vaccine recommendations and clinical guidance will be published in the coming months

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