Current Epidemiology of Pediatric Pneumococcal Disease, United States

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Advisory Committee on Immunization Practices
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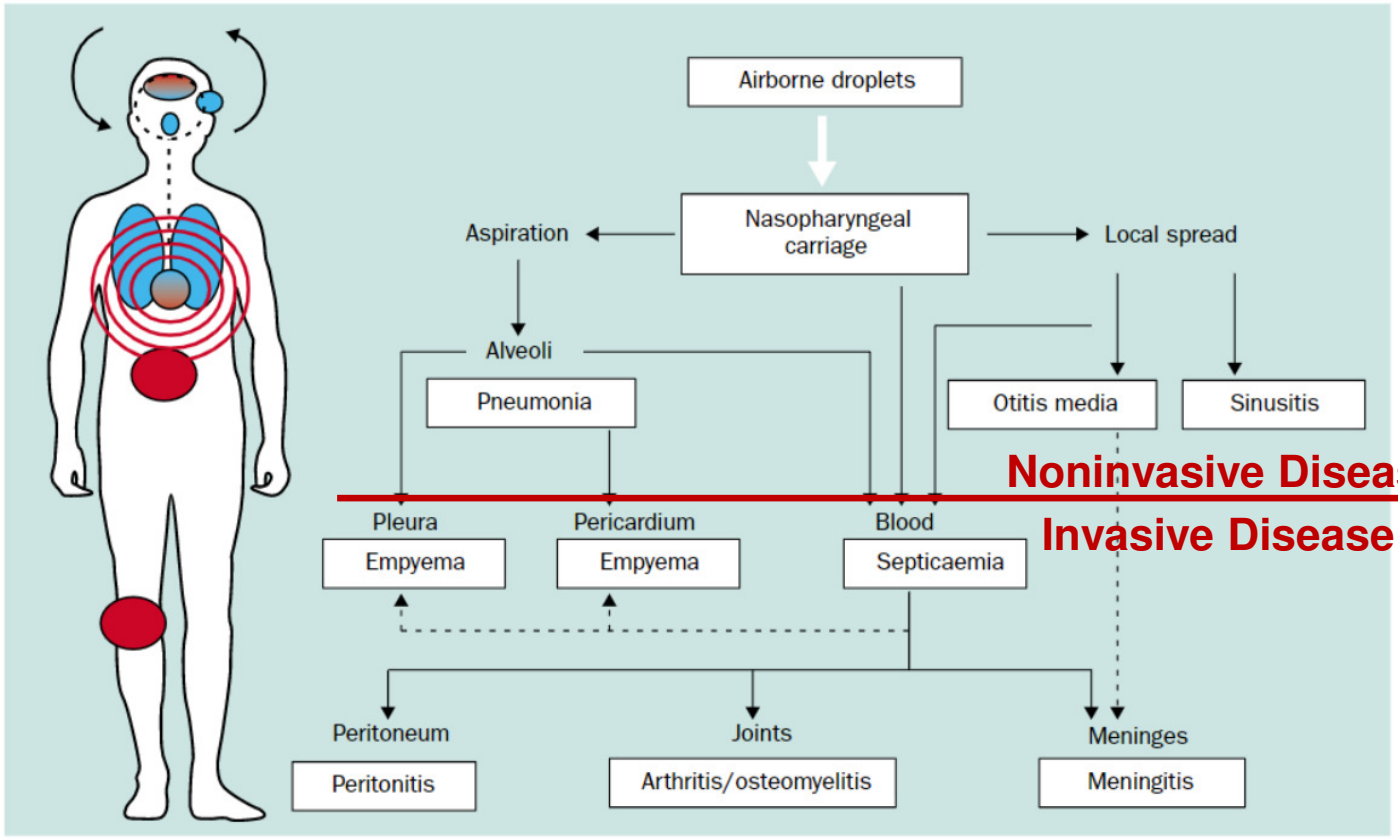
Pneumococcal carriage is precursor to pneumococcal disease



More frequent

Less frequent

Figure 1. Pathogenic route for S pneumoniae infection. Redrawn from reference 2. Organs infected through the airborne and haematogenic routes are depicted in blue and red, respectively.

Bogaert, Lancet Infect Dis 2004;4:144-54

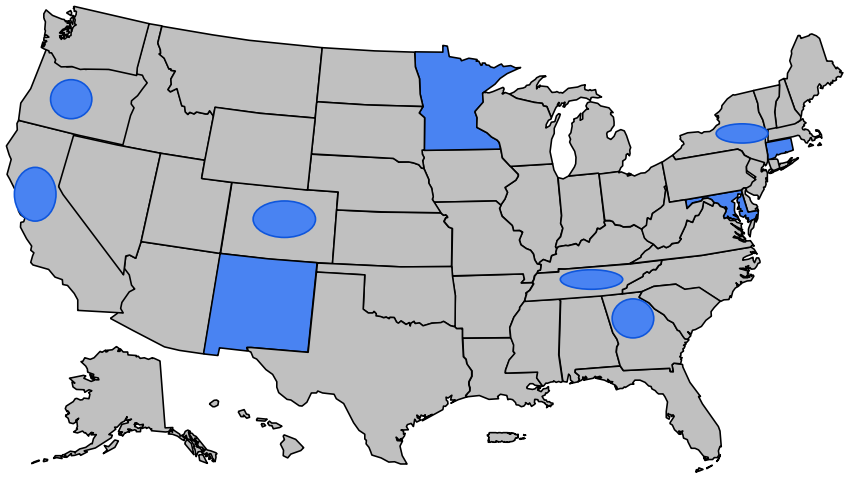
Outline

- Invasive Pneumococcal Disease (IPD) in children
  - Impact of Pneumococcal Conjugate Vaccines (PCVs) on IPD incidence and serotype distribution
  - IPD incidence caused by serotypes in PCV15 and PCV20
  - Changes in IPD incidence and serotype distribution post-COVID19
- Acute Otitis Media (AOM)
  - Impact of PCV13
  - Incidence Estimates
- Pneumonia in children
  - Impact of PCV13 on all-cause and pneumococcal pneumonia
  - Incidence Estimates

Impact of PCVs on Invasive Pneumococcal Disease (IPD) Incidence and Serotype Distribution among Children in the U.S.

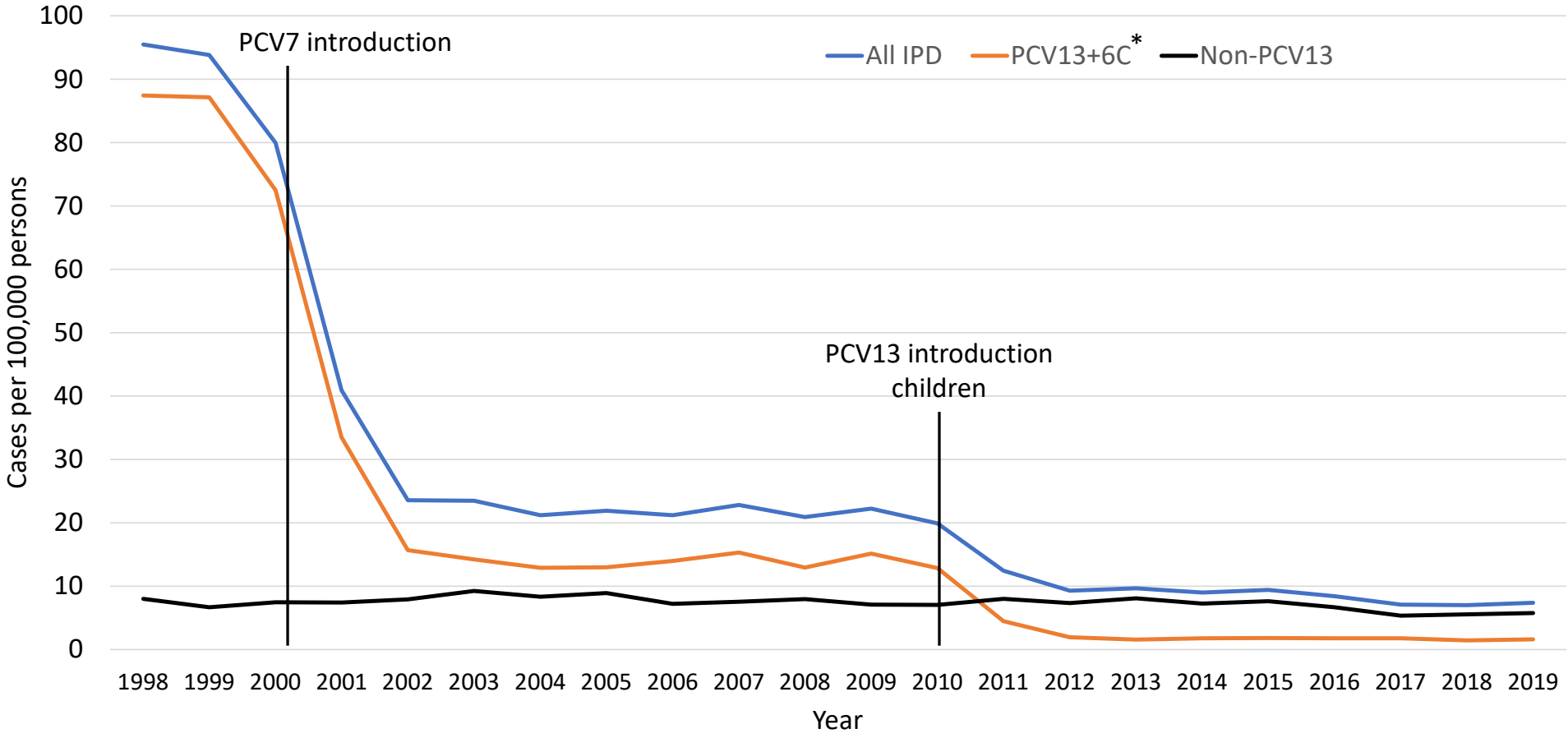
Methods

- **Active Bacterial Core surveillance (ABCs):**
  - Active laboratory and population-based surveillance, 10 sites
  - Pneumococcus isolation from sterile site



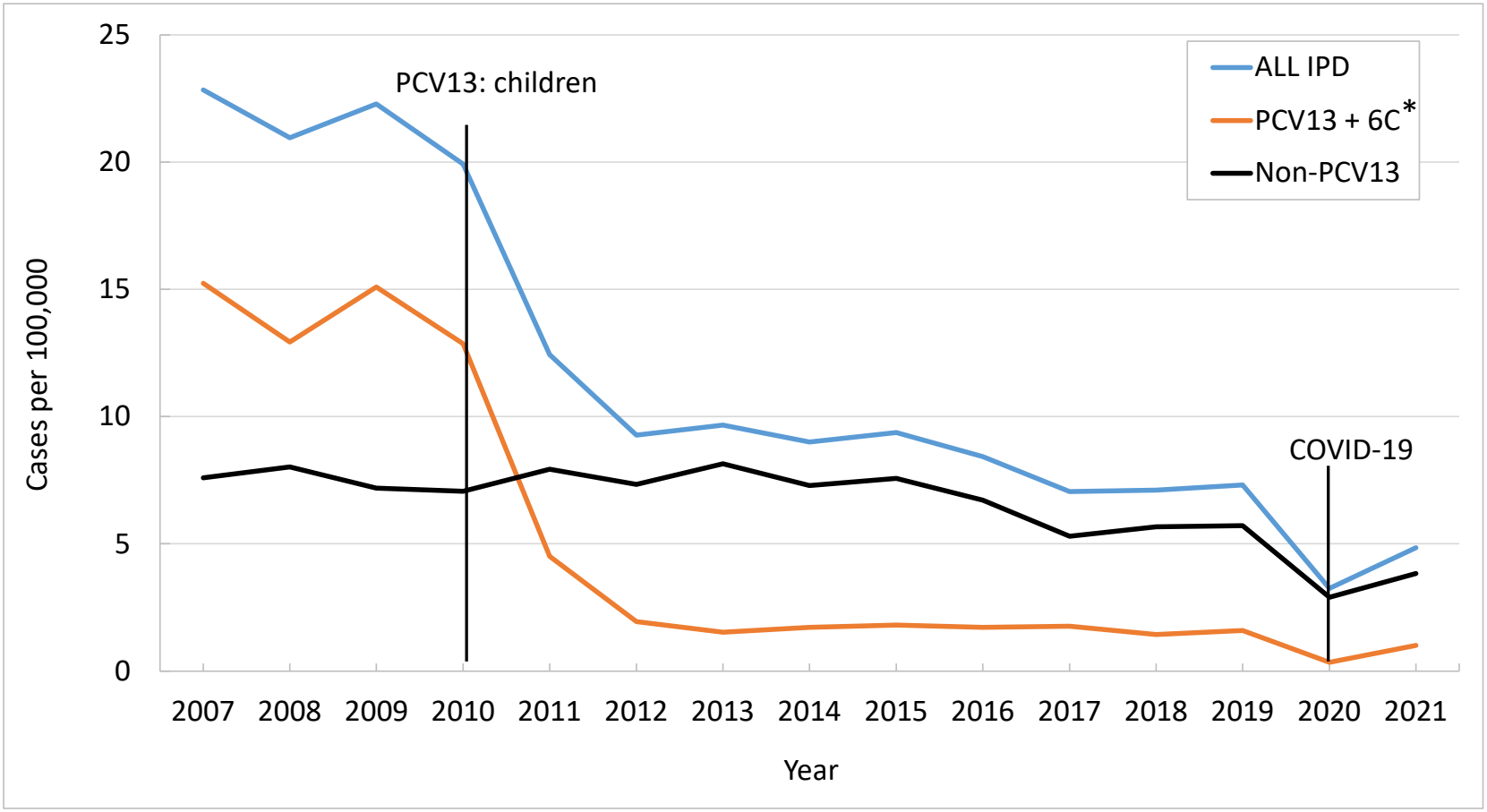
- **Isolates serotyped by whole genome sequencing, Quellung, or PCR at reference labs and grouped for analysis by vaccine type**
- **US Census Bureau race-bridged post-census population estimates used as denominators**
- **Overall and serotype-specific IPD incidence rates (cases per 100,000 people)**

Incidence rates of invasive pneumococcal disease (IPD) among children < 5 years old, 1998–2019



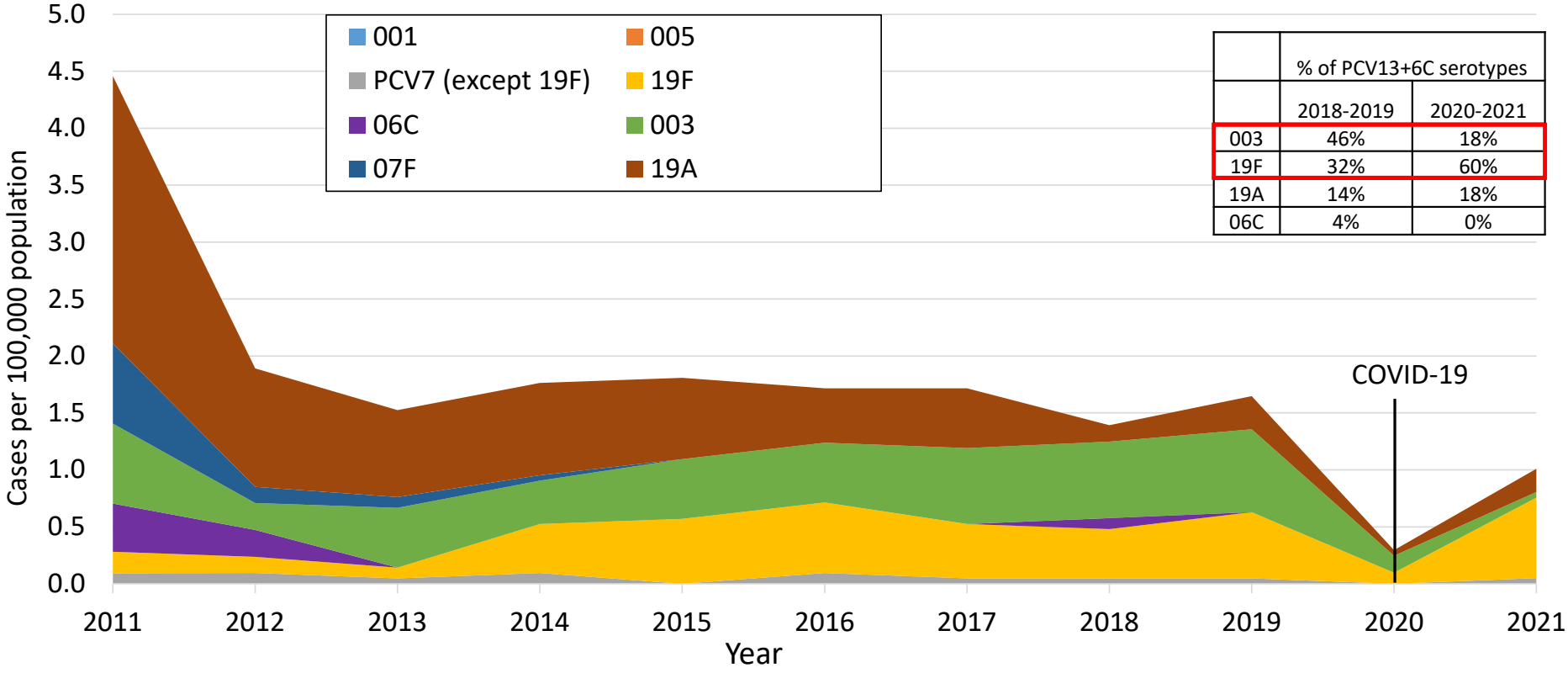
*Serotype 6C was grouped with PCV13 serotypes due to cross protection from 6A antigen in the vaccine

Incidence rates of invasive pneumococcal disease (IPD) among children < 5 years old, 2007 – 2021



*Serotype 6C was grouped with PCV13 serotypes due to cross protection from 6A antigen in the vaccine

Incidence rates of IPD among children < 5 years old, 2011 – 2021, by PCV13+6C* serotypes



	% of PCV13+6C serotypes	
	2018-2019	2020-2021
003	46%	18%
19F	32%	60%
19A	14%	18%
06C	4%	0%

*Serotype 6C was grouped with PCV13 serotypes due to cross protection from 6A antigen in the vaccine

Current Pediatric Pneumococcal Disease Incidence Caused by Serotypes in PCV15 and PCV20

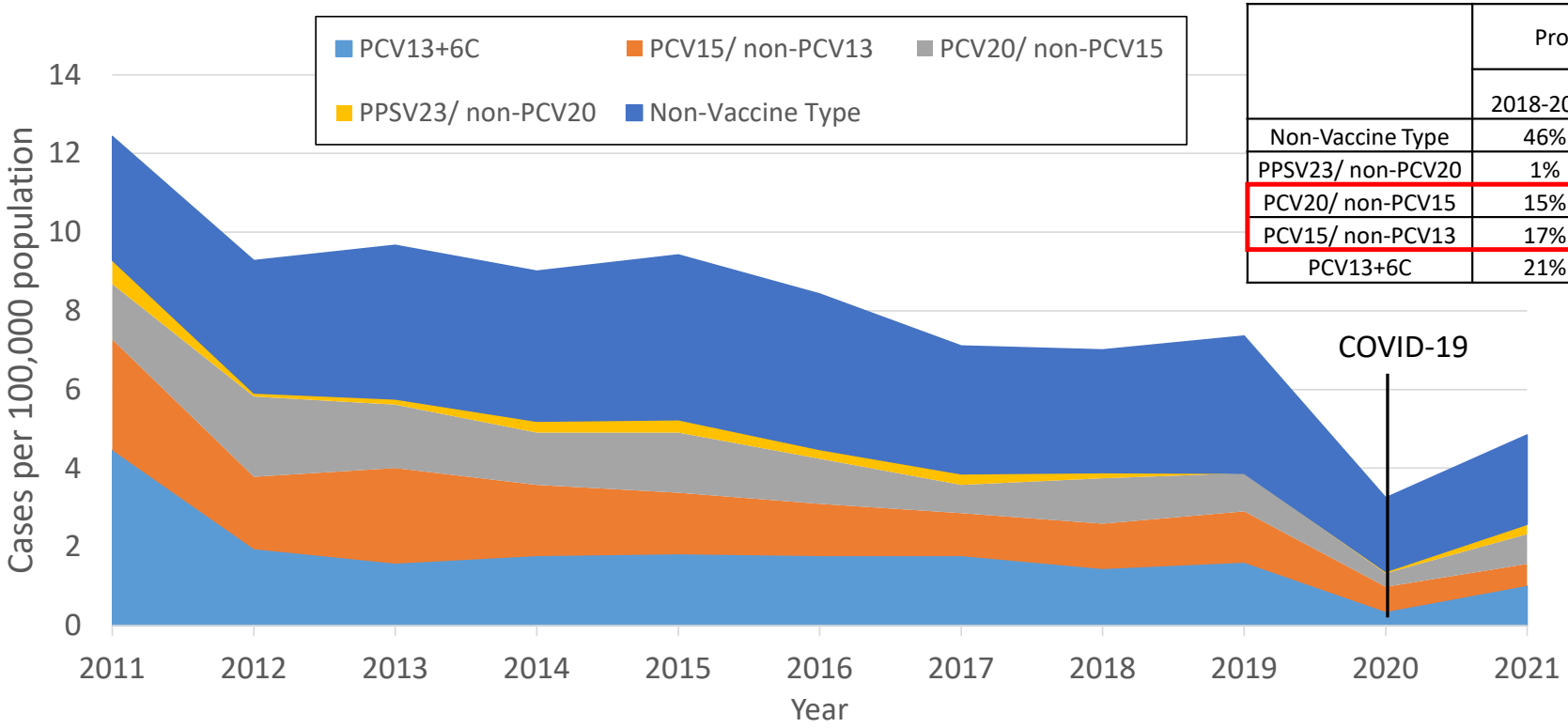
Serotypes contained in current and new pneumococcal vaccines

	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																								

For analysis purposes:

- **PCV13+6C**: includes serotype **6C** with PCV13 types due to cross protection from 6A antigen
- **PCV15 non-PCV13**: includes serotypes **22F and 33F**
- **PCV20 non-PCV15**: includes serotypes **8, 10A, 11A, 12F, and 15B**
- **PPSV23 non-PCV20**: includes serotypes **2, 9N, 17F, and 20**

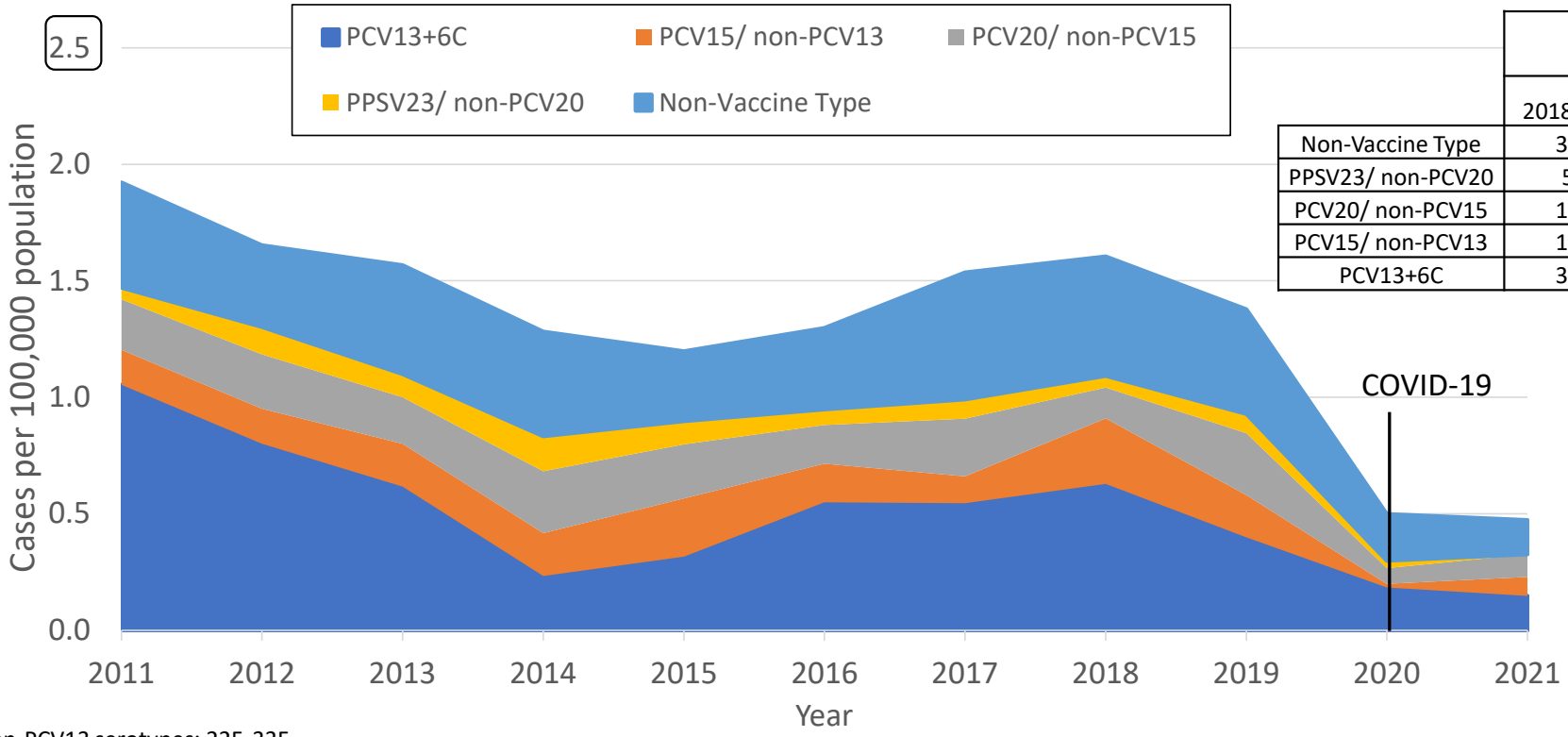
Incidence rates of IPD among children <5 years old, 2011 – 2021, by vaccine type



	Proportion of IPD	
	2018-2019	2020-2021
Non-Vaccine Type	46%	52%
PPSV23/ non-PCV20	1%	4%
PCV20/ non-PCV15	15%	13%
PCV15/ non-PCV13	17%	15%
PCV13+6C	21%	16%

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

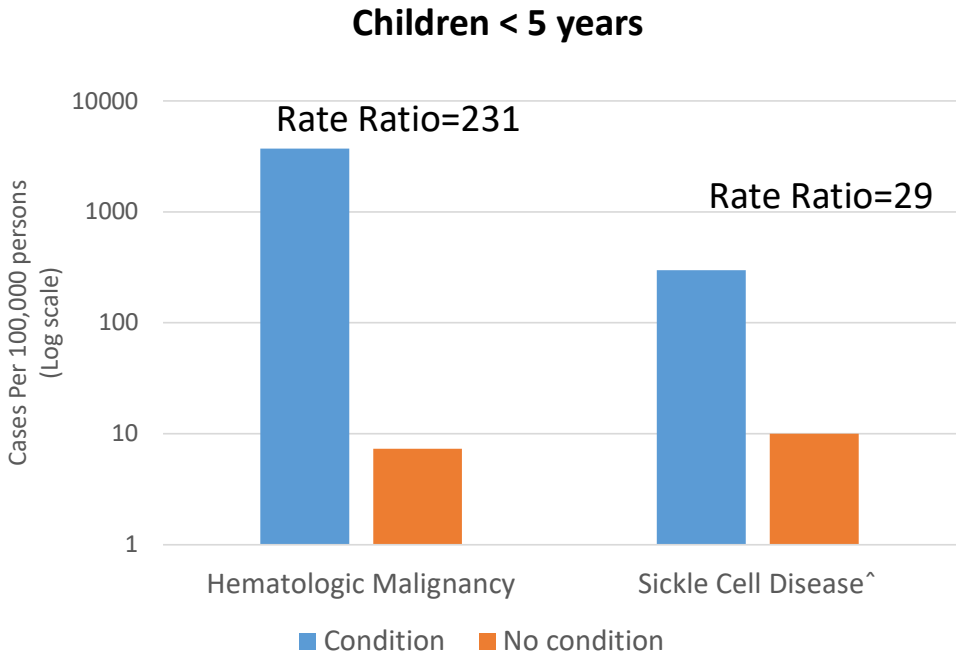
Incidence rates of IPD among children 5 -18 years old, 2011 – 2021, by vaccine type

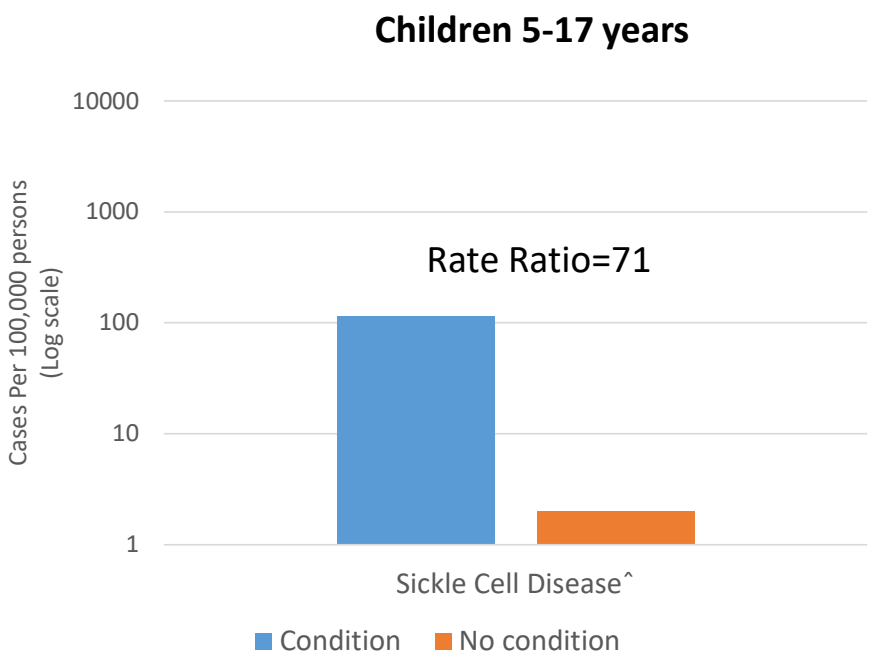


	% of IPD	
	2018-2019	2020-2021
Non-Vaccine Type	32%	36%
PPSV23/ non-PCV20	5%	5%
PCV20/ non-PCV15	13%	16%
PCV15/ non-PCV13	16%	9%
PCV13+6C	34%	34%

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

IPD incidence among children with immunocompromising conditions, 2015-2019*





CDC unpublished data, IPD cases identified from ABCs

*Hematologic Malignancy Data only available from 2015-2018 for children age <5 years

^ IPD rates for those with and without sickle cell disease are among African American children

Acute Otitis Media (AOM) in Children

PCV13 impact on acute otitis media in children

- AOM is a major cause of childhood morbidity[1,2,3]
  - Pneuococcus is a common bacterial cause of AOM
    - *S. pneumoniae* accounted for an estimated **24%**[4]

- AOM incidence decreased after PCV13 introduction
  - 11%-14% decrease, depending on age group and study years[1,2]

[1] Tong et al. *BMC* 2018
[2] King et al. *ASHE* 2021
[3]Casey et al *Clin Pediatr 2014;*
[4]Kaur et al. *EJCMID* 2022

Incidence of acute otitis media among children

AOM visits per 100,000 Person Years

	2014[1]	2014-2018[2]	2016-2018[3]
<1	43,180	--	--
1 year	47,860	--	--
<2 years	--	76,880	49,050
2-4 years	29,980	41,030	31,970
5-17 years	9,060	9,180	5,680

AOM incidence highest among children age <5 years

[1] Tong et al. *BMC* 2018
[2] Hu et al. *BMC* 2022
[3] Unpublished analysis courtesy of Laura King, UC Berkeley

Pneumonia in Children

Evidence of PCV13 impact on pneumonia in children

- Reduction in incidence of all-cause and pneumococcal pneumonia among in children following PCV13 introduction[1,2,3]
  - **17-35%** reduction in all cause-pneumonia[1]
  - **40**% and **51**% reduction in inpatient pneumococcal pneumonia among ages <1 and 5-17 years, respectively; no reductions in ages 2-4 years[2]

[1]Tong et al. *BMC* 2018
[2] Simonsen et al. *Lancet* 2014
[3]King et al. *ASHE* 2021

Pneumonia incidence among children

Age (years)	All-cause pneumonia (frequency per 100,000 person years)[1], 2014	All-cause inpatient pneumonia (cases per 100,000 population)[2], 2018–19
< 1	2,250	680
1	3,990	480
2–4	3,390	290
5–17	1,280	87

[1] Tong et al. BMC 2018
[2] National Inpatient Sample, 2018-2019

Conclusions

- Use of PCVs (PCV7, PCV13) significantly decreased the incidence of pneumococcal disease in U.S. children
- Risk of disease remains higher in children with immunocompromising conditions compared to children without
- In 2018–2019, the proportion of IPD caused by vaccine serotypes was:
  - PCV20, non-PCV13: ~30% of IPD
  - PCV15, non-PCV13: ~15% of IPD

Questions

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov