



Current Epidemiology of Pneumococcal Disease and Pneumococcal Vaccine Coverage among Adults, United States

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Advisory Committee on Immunization Practices

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Outline

- Invasive Pneumococcal Disease (IPD)
 - Impact of PCV13 on IPD burden and the serotype distribution
 - IPD burden caused by serotypes in PCV15 and PCV20
- Pneumonia in Adults
 - Impact of PCV13 on all-cause, pneumococcal, and vaccine type pneumonia
 - Pneumonia burden estimates and % caused by PCV15 and PCV20 serotypes
- Pneumococcal Vaccine Coverage in Adults

Impact of PCV13 on Invasive Pneumococcal Disease (IPD) Incidence and Serotype Distribution in the U.S.

Serotypes contained in current pneumococcal vaccines

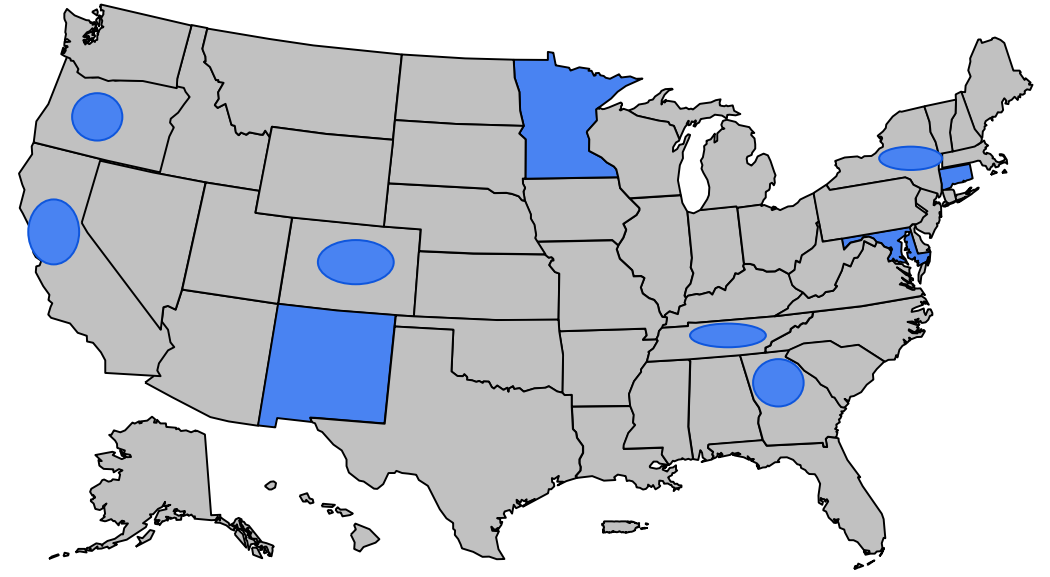
	1	3	4	5	6 A	6 B	7 F	9 V	14	18 C	19 A	19 F	23 F	2	8	9 N	10 A	11 A	12 F	15 B	17 F	20	22 F	33 F	
PCV13	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	White	White	White	White	White	White	White	White	White	White	White	White
PPSV23	Yellow	Yellow	Yellow	Yellow	White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

For analysis purposes:

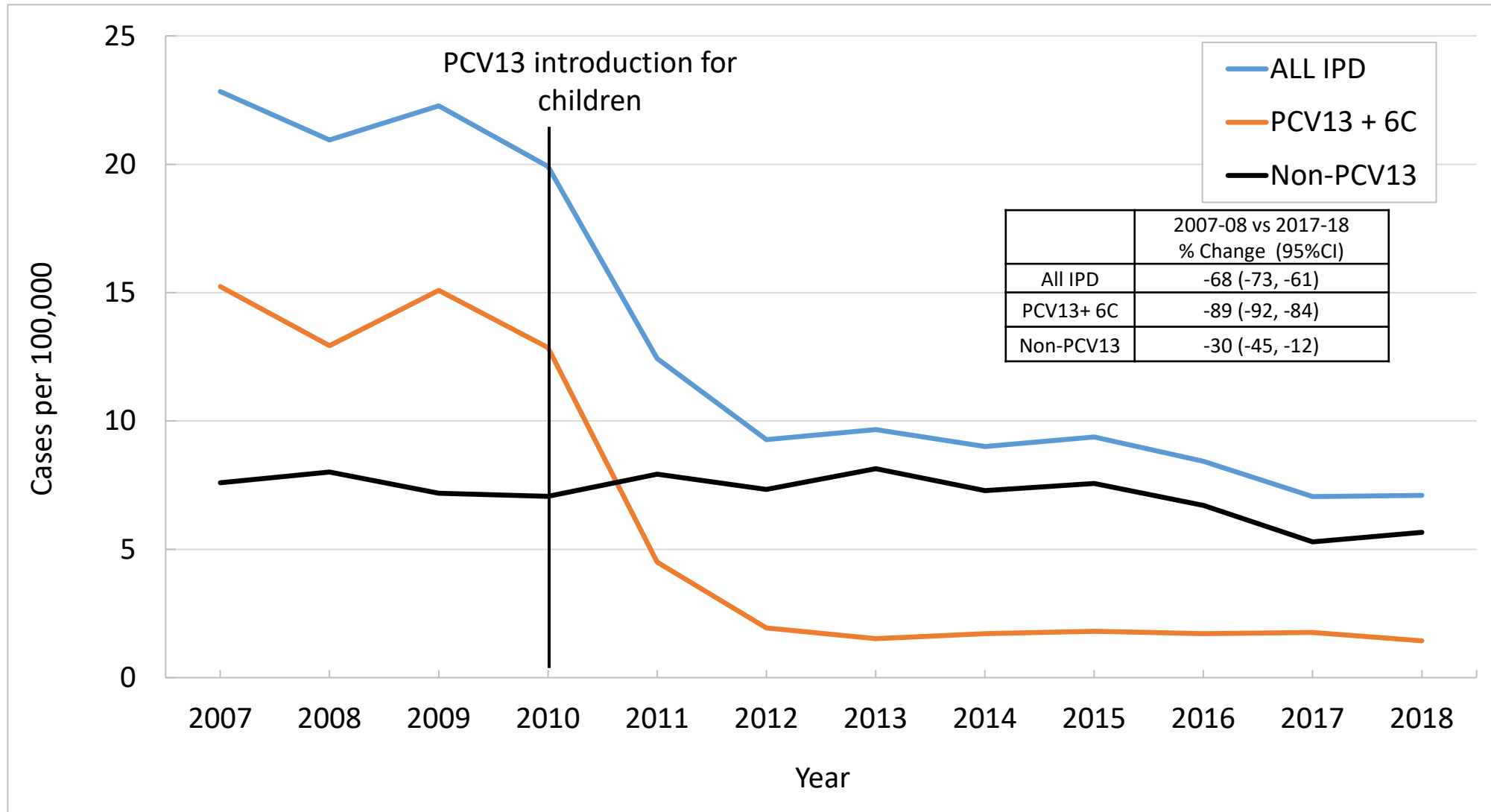
- **PCV13+6C:** Included serotype **6C** with PCV13 types due to cross protection from 6A antigen
- **PPSV23 non-PCV13:** 11 unique serotypes not in PCV13

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 vaccine-type IPD incidence rates (cases per 100,000)

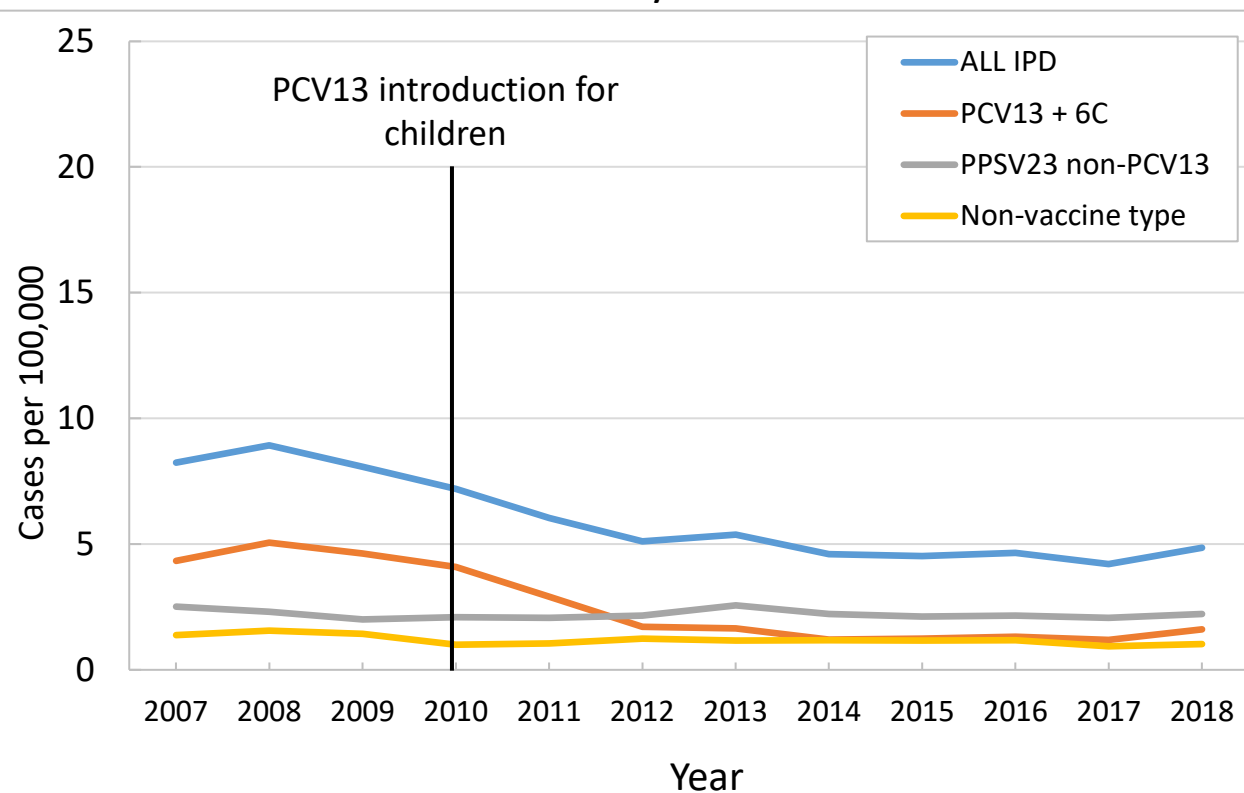


Incidence rates of invasive pneumococcal disease (IPD) among children < 5 years old, 2007 - 2018



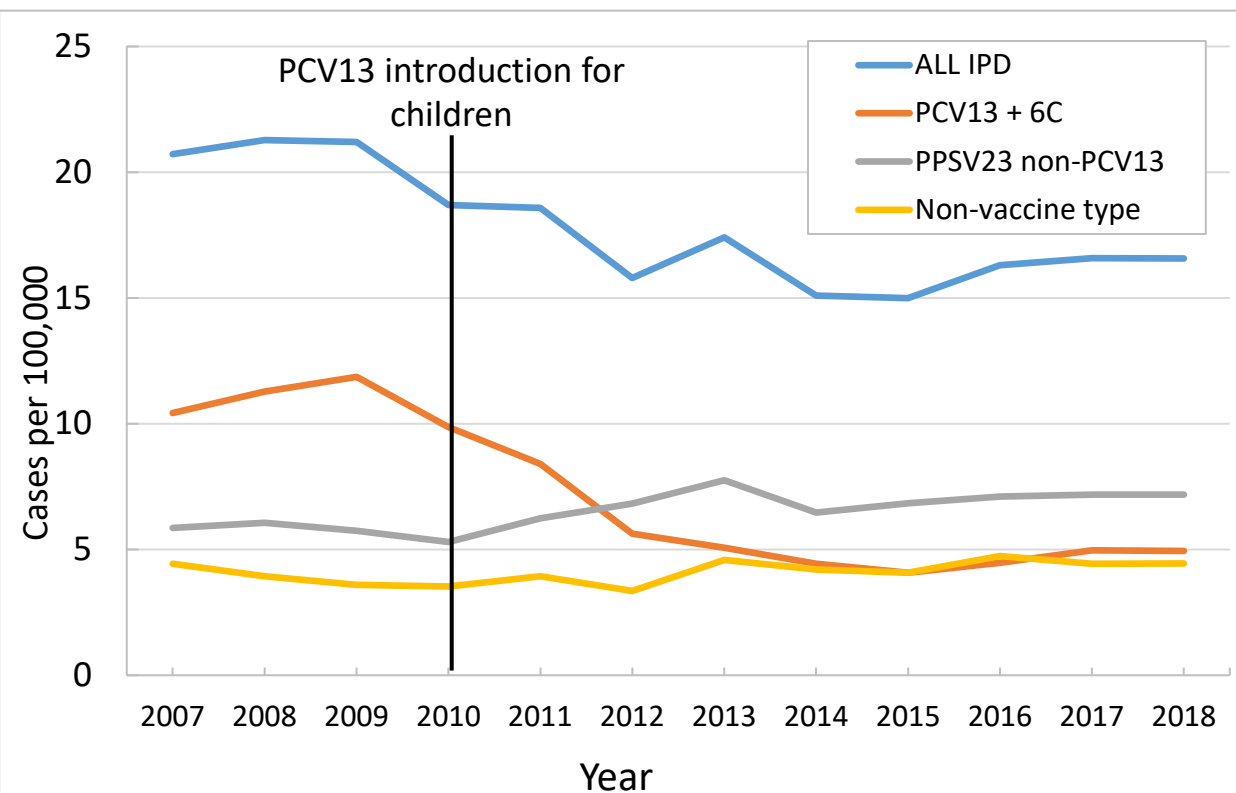
Incidence rates of IPD among adults 19-64 years old, 2007-2018

19-49 years old



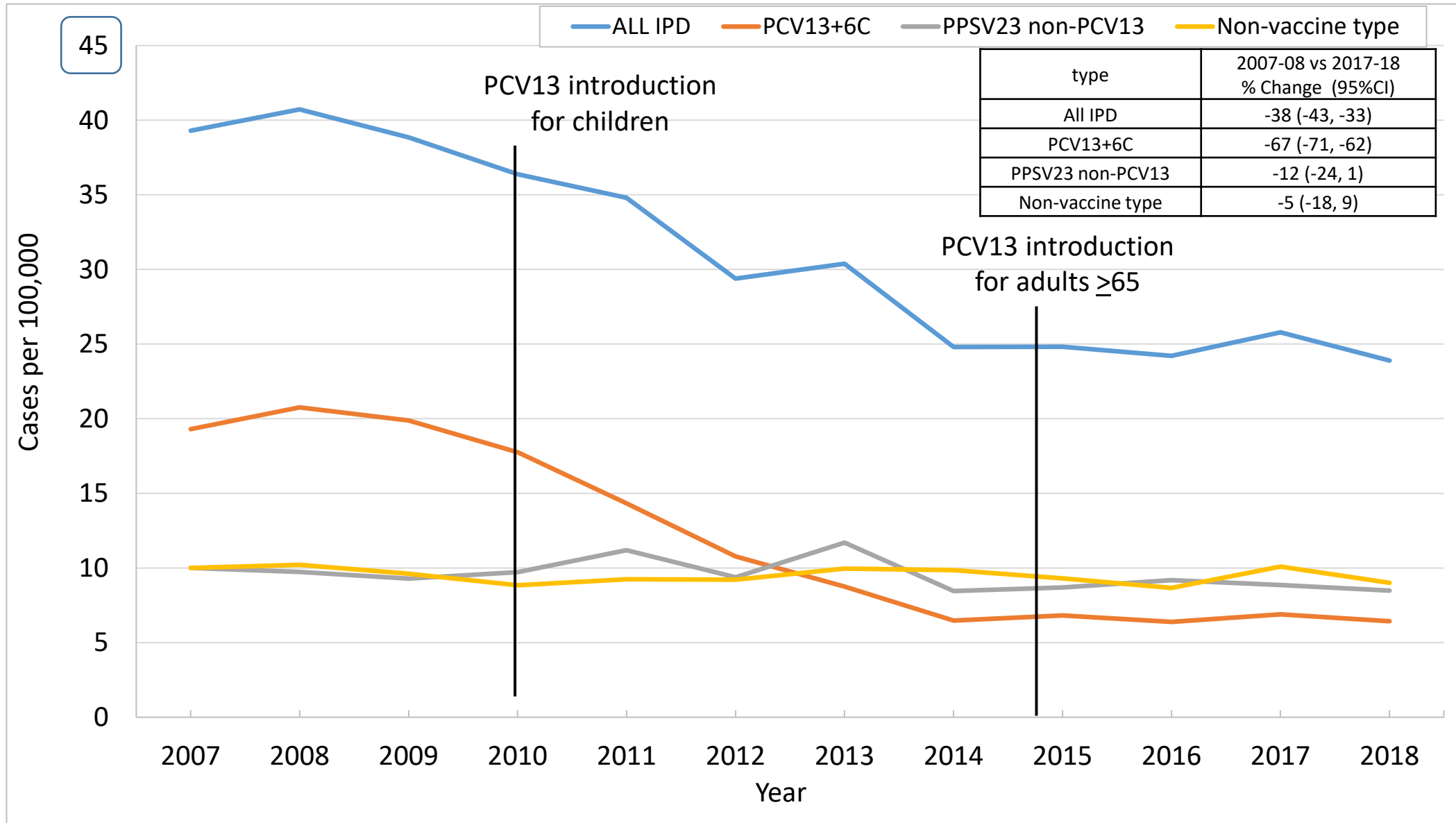
	2007-08 vs 2017-18 % Change (95%CI)
All IPD	-47 (-52, -42)
PCV13+6C	-70 (-75, -65)
PPSV23 non-PCV13	-11 (-24, 4)
Non-vaccine type	-33 (-47, -17)

50-64 years old

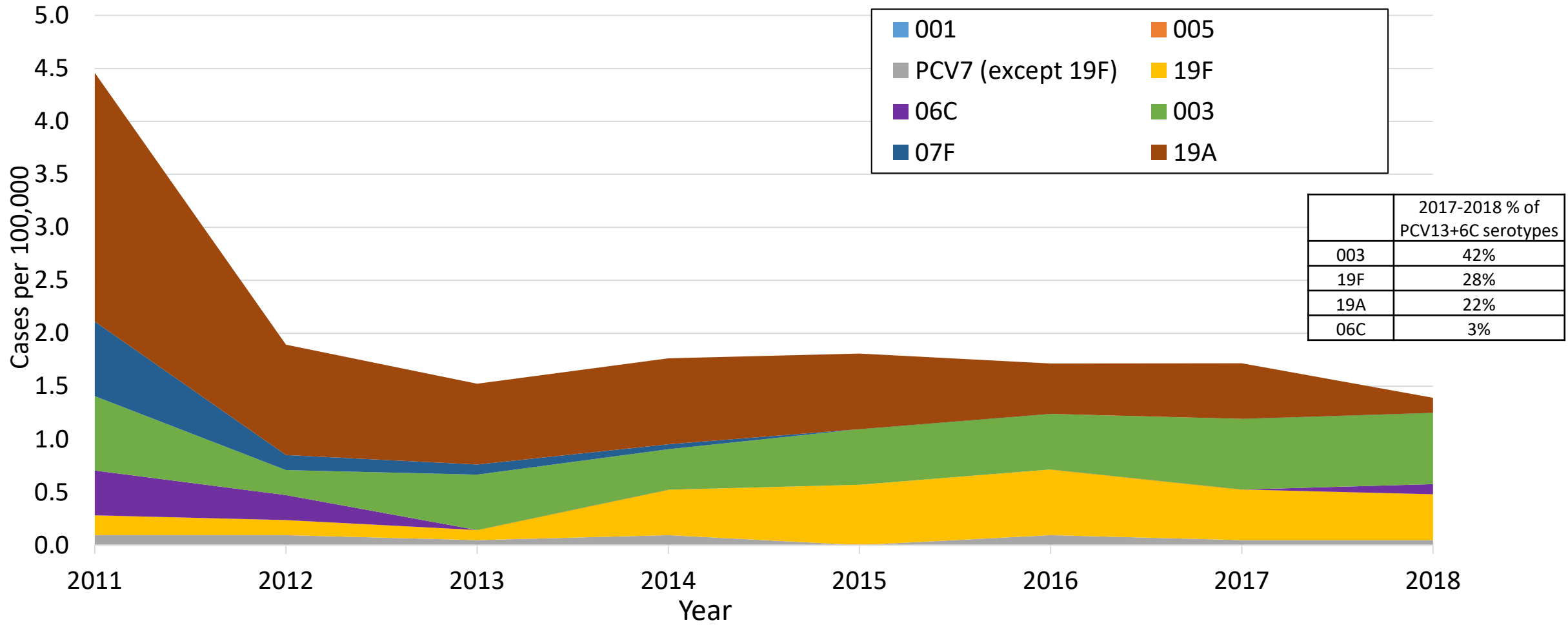


	2007-08 vs 2017-18 % Change (95%CI)
All IPD	-21 (-27, -14)
PCV13+6C	-55 (-60, -48)
PPSV23 non-PCV13	20 (4, 39)
Non-vaccine type	5 (-11, 26)

Incidence rates of IPD among adults >65 years old, 2007 - 2018

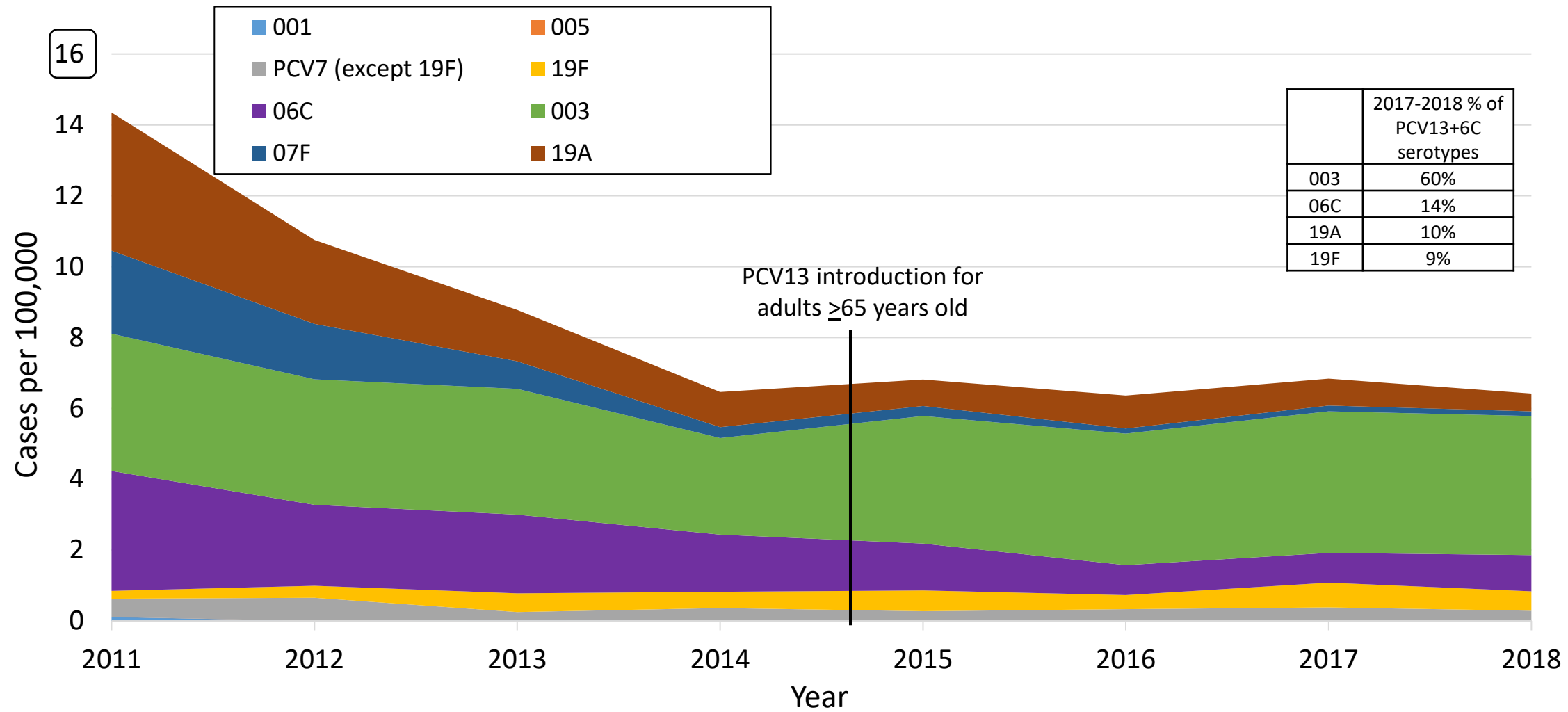


Incidence rates of IPD among children < 5 years old, 2011 – 2018, by PCV13+6C serotypes



	2017-2018 % of PCV13+6C serotypes
003	42%
19F	28%
19A	22%
06C	3%

Incidence rates of IPD among adults >65 years old, 2011 – 2018, by PCV13+6C serotypes



16

Cases per 100,000

PCV13 introduction for adults ≥ 65 years old

2011 2012 2013 2014 2015 2016 2017 2018

Year

Remaining PCV13-type* disease among adults age 19-64 years old

- Similar trends in PCV13+6C serotypes observed in adults aged 19-64 years old
- Top PCV13+6C serotypes 2017-2018 (% of PCV13+6 serotypes)
 - 19-49 years old:
 - 003 (35%), 004 (26%), 19A (11%), 19F (11%)
 - 50-64 years old:
 - 003 (53%), 19A (11%), 004 (10%), 19F (9%)
- Serotype 4 increasing in recent years in adults age 19-64 years old
 - Primarily among adults experiencing homelessness¹

*Includes serotype 6C

¹Beall, et al (2020). Upsurge of Conjugate Vaccine Serotype 4 Invasive Pneumococcal Disease Clusters Among Adults Experiencing Homelessness in California, Colorado, and New Mexico, *The Journal of Infectious Diseases*

Current IPD Burden Caused by Serotypes in PCV15 and PCV20

Serotypes contained in current and new pneumococcal vaccines

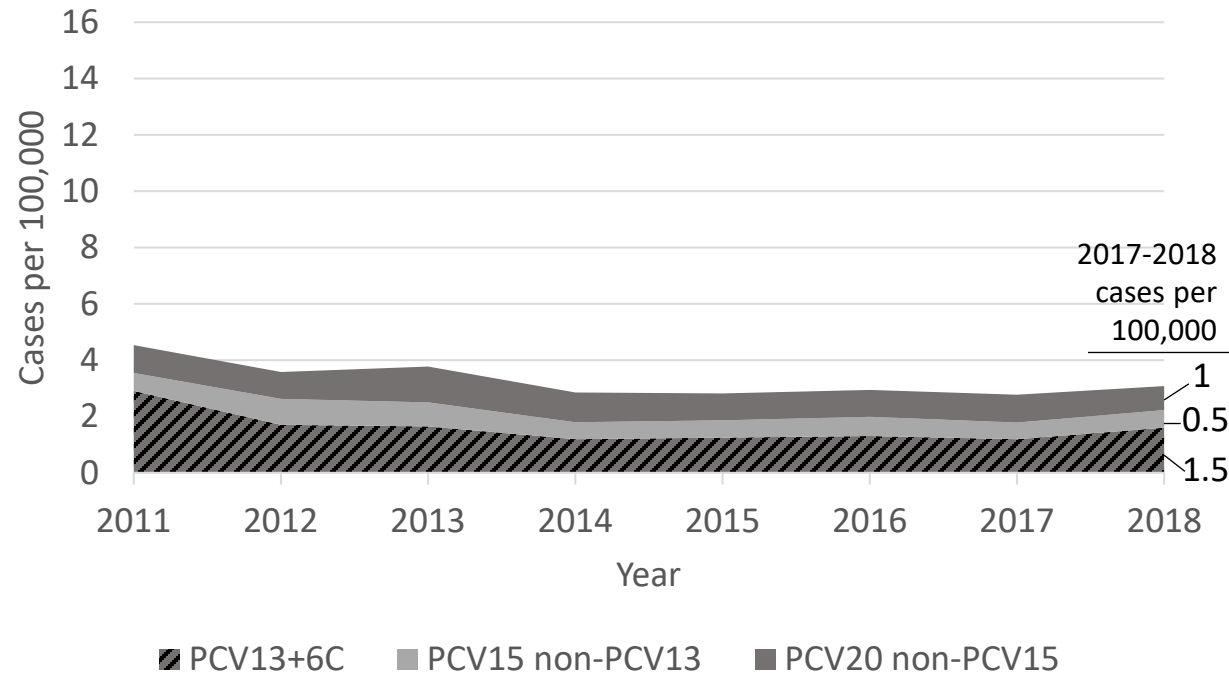
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PCV13	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow												
PPSV23	Yellow	Yellow	Yellow	Yellow	White	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
PCV15	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green										Light Green	Light Green	
PCV20	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green		Light Green		Light Green	Light Green	Light Green	Light Green				Light Green	Light Green

For analysis purposes:

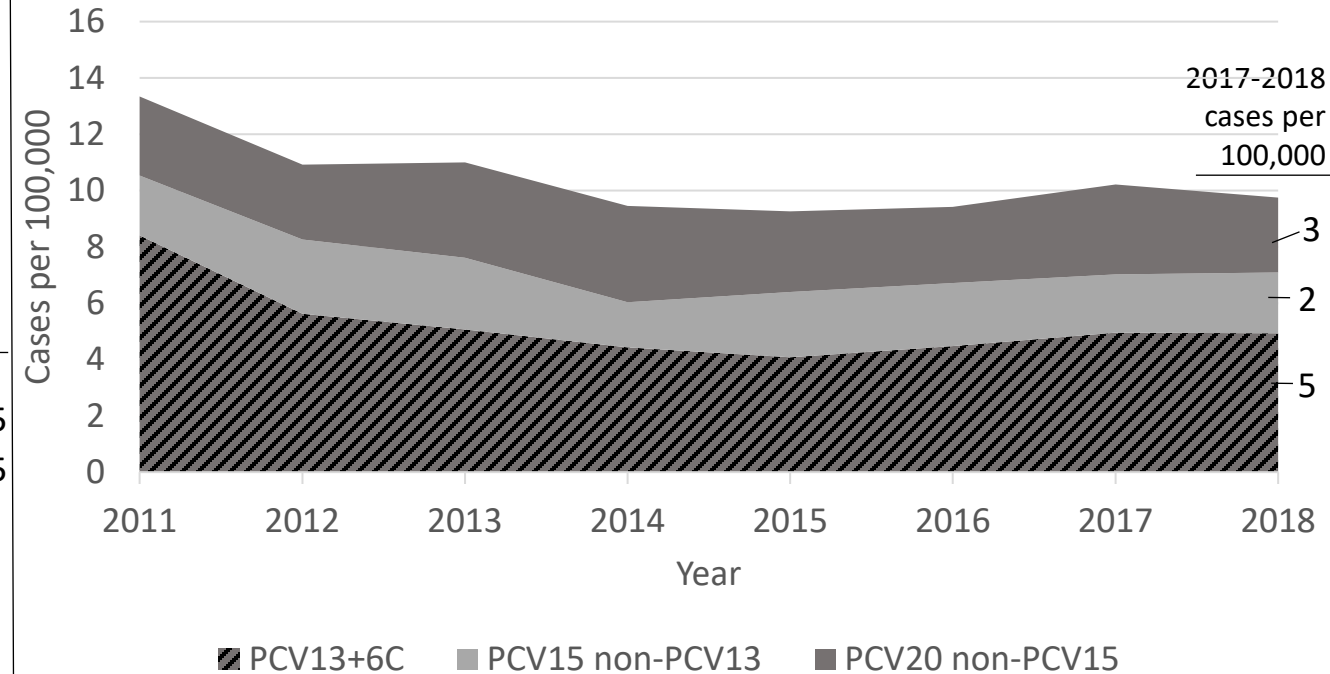
- PCV15 non-PCV13: includes serotypes **22F** and **33F**
- PCV20 non-PCV15: includes serotypes **8**, **10A**, **11A**, **12F**, and **15B/C**
- PPSV23 non-PCV20: includes serotypes **2**, **9N**, **17F**, and **20**

Incidence rates of IPD among adults 19-64 years old, 2011 – 2018, by conjugate vaccine type

19-49 years old



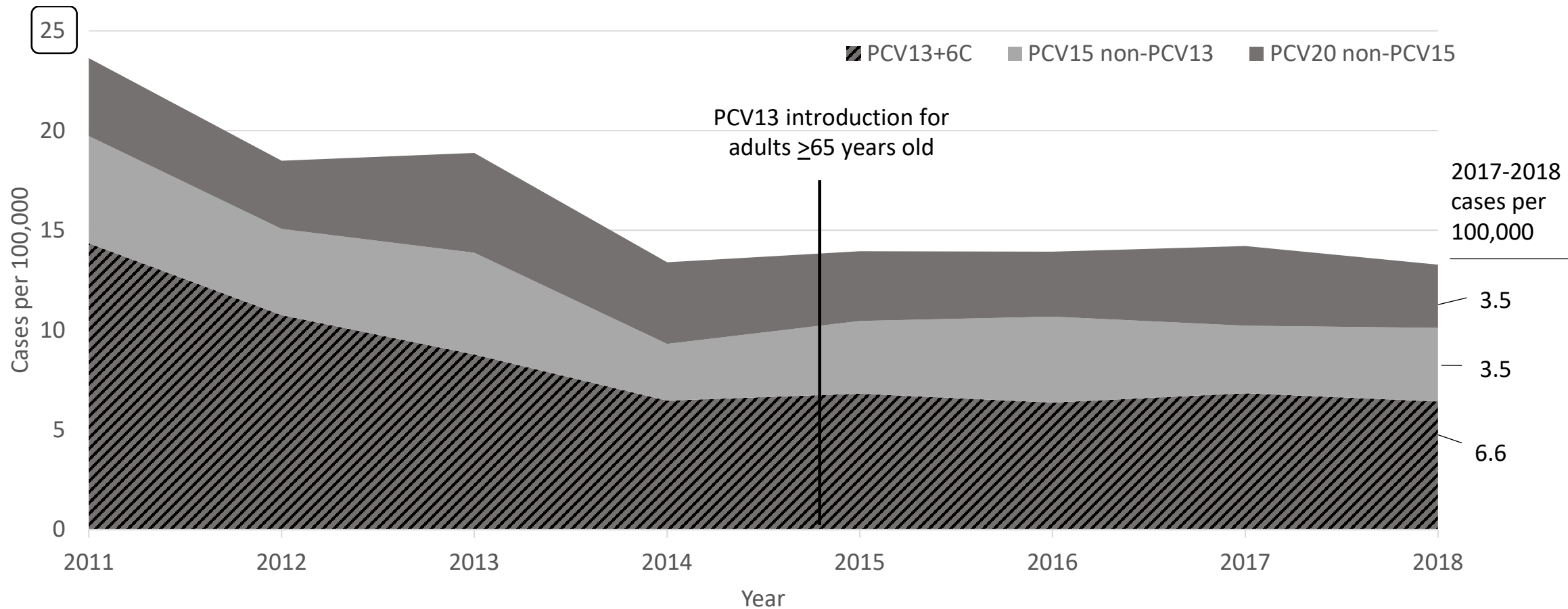
50-64 years old



PCV15 non-PCV13 serotypes: 22F, 33F

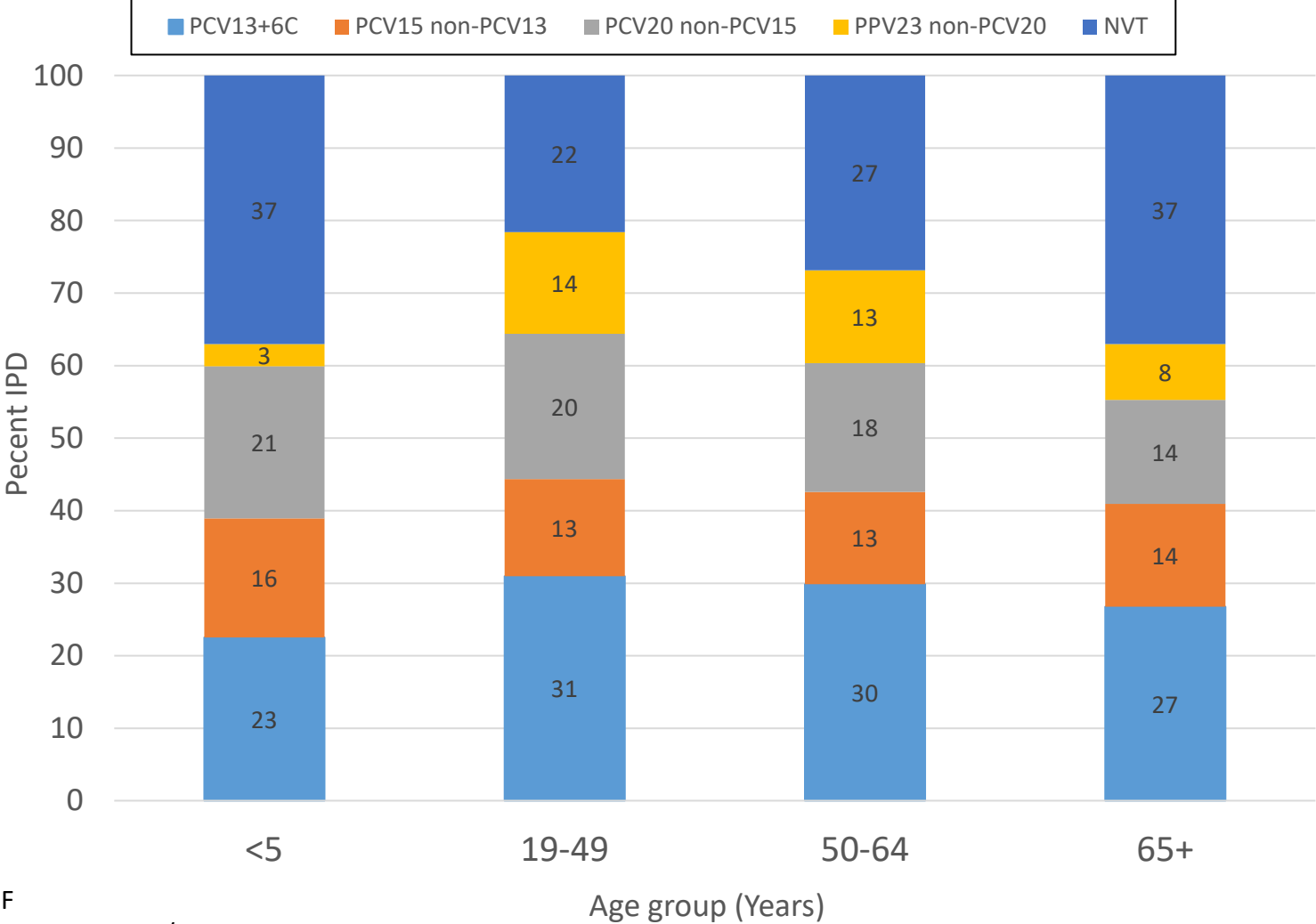
PCV20 non-PCV15 serotypes: 8, 10A, 11A, 12F, 15B/C

Incidence rates of IPD among adults >65 years old, 2011 – 2018, by conjugate vaccine type



PCV15 non-PCV13 serotypes: 22F, 33F
 PCV20 non-PCV15 serotypes: 8, 10A, 11A, 12F, 15B/C

Proportion of IPD by vaccine-type and age group in 2017-2018



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

Pneumonia in Adults

PCV13 impact on all-cause pneumonia in adults

Indirect effects: pre-PCV13 introduction in adults ≥ 65 (before 2015)

- Analysis of Healthcare Cost and Utilization Project (HCUP) data, 2010-2014¹
 - No reductions in all-cause pneumonia
- Analysis of US adult healthcare claims data 2007-10 vs 2013-15^{2*}
 - 4%-19% reduction depending on risk groups and age group
 - No reductions among adults age ≥ 75 years

Direct and indirect effects: post-PCV13 introduction in adults ≥ 65 (after 2015)

- Louisville cohort study, 2014-2016^{3*}
 - 13.8 % reduction (95%CI: 8.5, 18.7) among adults age ≥ 65 years

¹Lessa ACIP October 2018

²Pelton CID 2019*

³Swerdlow Jun 2018 ACIP*

PCV13 impact on pneumococcal pneumonia in adults

Indirect effects: pre-PCV13 introduction in adults ≥ 65 (before 2015)

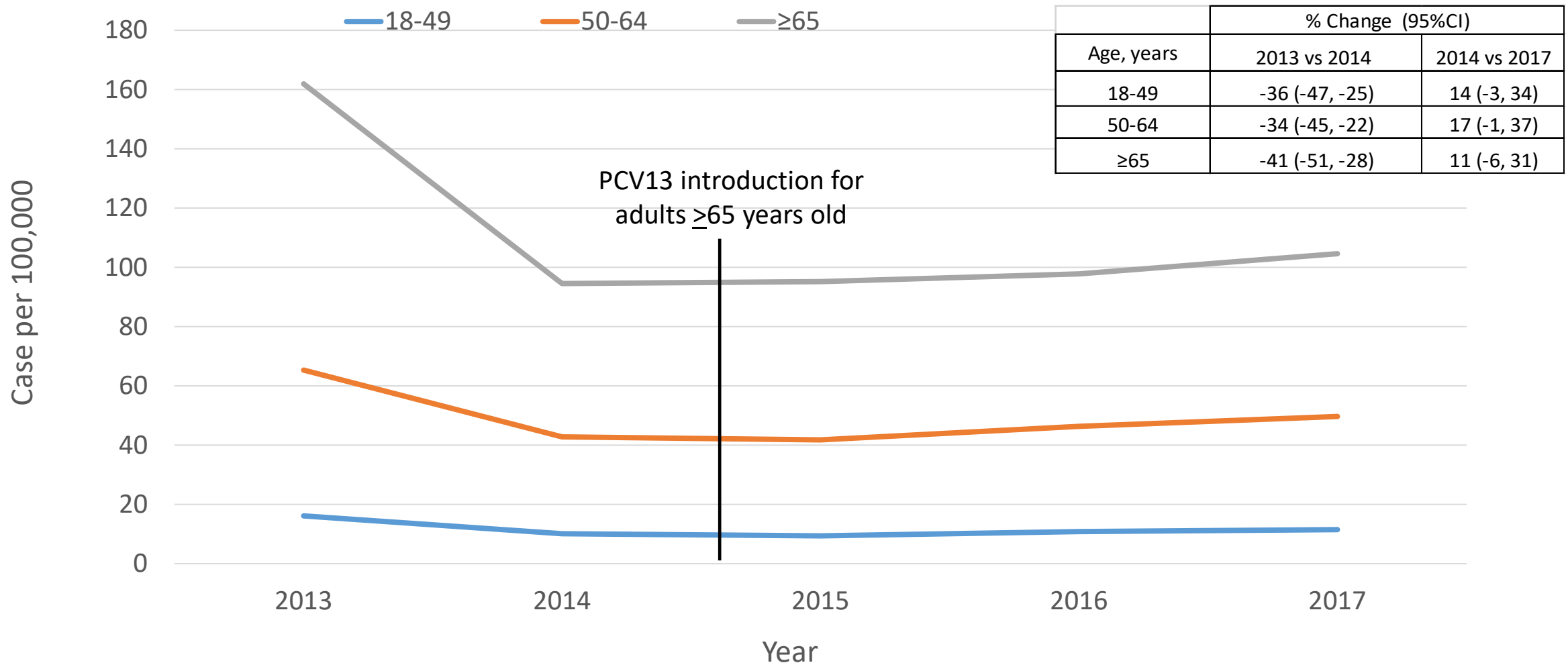
- Analysis of Healthcare Cost and Utilization Project (HCUP) data between 2010-2014 found declines in pneumococcal pneumonia¹
 - 35% reduction (-40% to -17%) for adults 65-74 years
 - No reductions among adults age ≥ 75 years
- Analysis of US adult healthcare claims 2007-10 vs 2013-15^{2*}
 - 22%-51% reduction depending on risk groups and age
 - No reductions among adults age ≥ 75 years

¹Lessa ACIP October 2018

² Pelton CID 2019*

*Pfizer funded study

Estimated annual non-bacteremic pneumococcal pneumonia incidence by age group, 2013-2017



PCV13 impact on vaccine-type pneumococcal pneumonia in adults

Indirect effects: (UK data: no age-based adult PCV13 use)

- United Kingdom cohort study: Patients aged ≥ 16 years, 2013-2018
 - Increase in PCV13(non-PCV7) IRR 1.12 (95%CI 1.04-1.21)¹
 - Predominantly serotype 3 (57% of PCV13(non-PCV7) cases)

Direct and indirect effects: post-PCV13 introduction in adults ≥ 65 years (after 2015)

- Louisville cohort study: among ≥ 65 years old, 2014-2016
 - 31.5% reduction (95%CI: 8.3, 48.9) in PCV13-type pneumococcal pneumonia^{2*}
- Serotype 3 (37% of PCV13 serotypes) 2015-2016^{3*}

¹ Pick Thorax 2020

² Swerdlow Jun 2018 ACIP*

³ Istruiz Vaccine 2020*

*Pfizer funded study

Pneumonia burden among adults

- All-cause pneumonia among adults age ≥ 65 years (2007-2016)
 - 630–2,300 per 100,000¹
- Recent systematic review of all-cause pneumonia (2010-2016)^{2*}
 - 847–3,365 per 100,000 among adults age ≥ 65 years
 - 126–422 per 100,000 among adults age < 65 years
- Approximately 11% (95% CI: 9 to 12) all-cause pneumonia are pneumococcal pneumonia³

¹Jain et. al. lowest, Ramirez et. al. highest, also includes Griffin et. al., Hayes et. al., and Simonsen et. al.

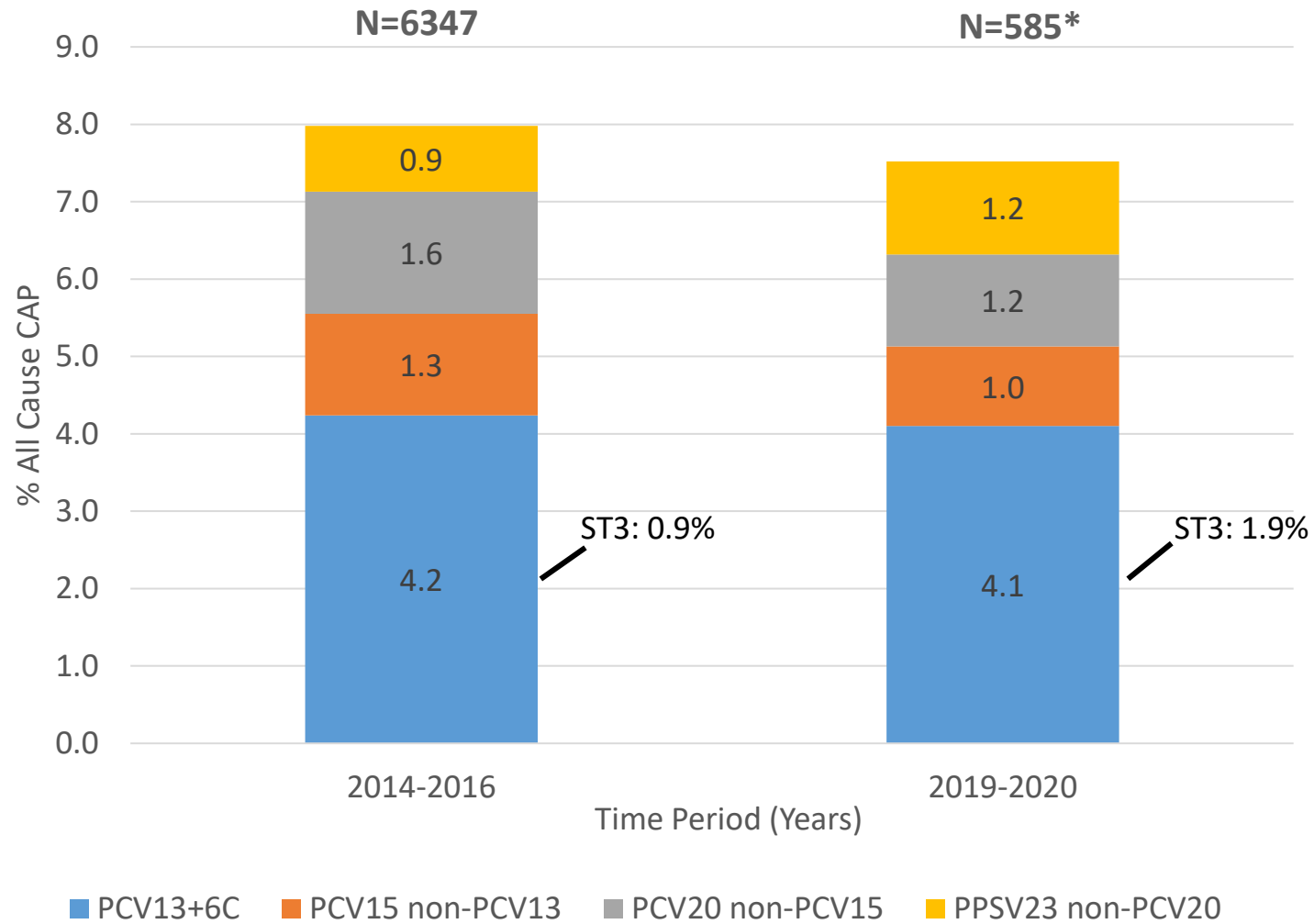
²McLaughlin et al. Vaccine 2020*

³Strategic Advisory Group of Experts on Immunization, October 2020

https://www.who.int/immunization/sage/meetings/2020/october/SAGE_eYB_Oct2020final.pdf?ua=1

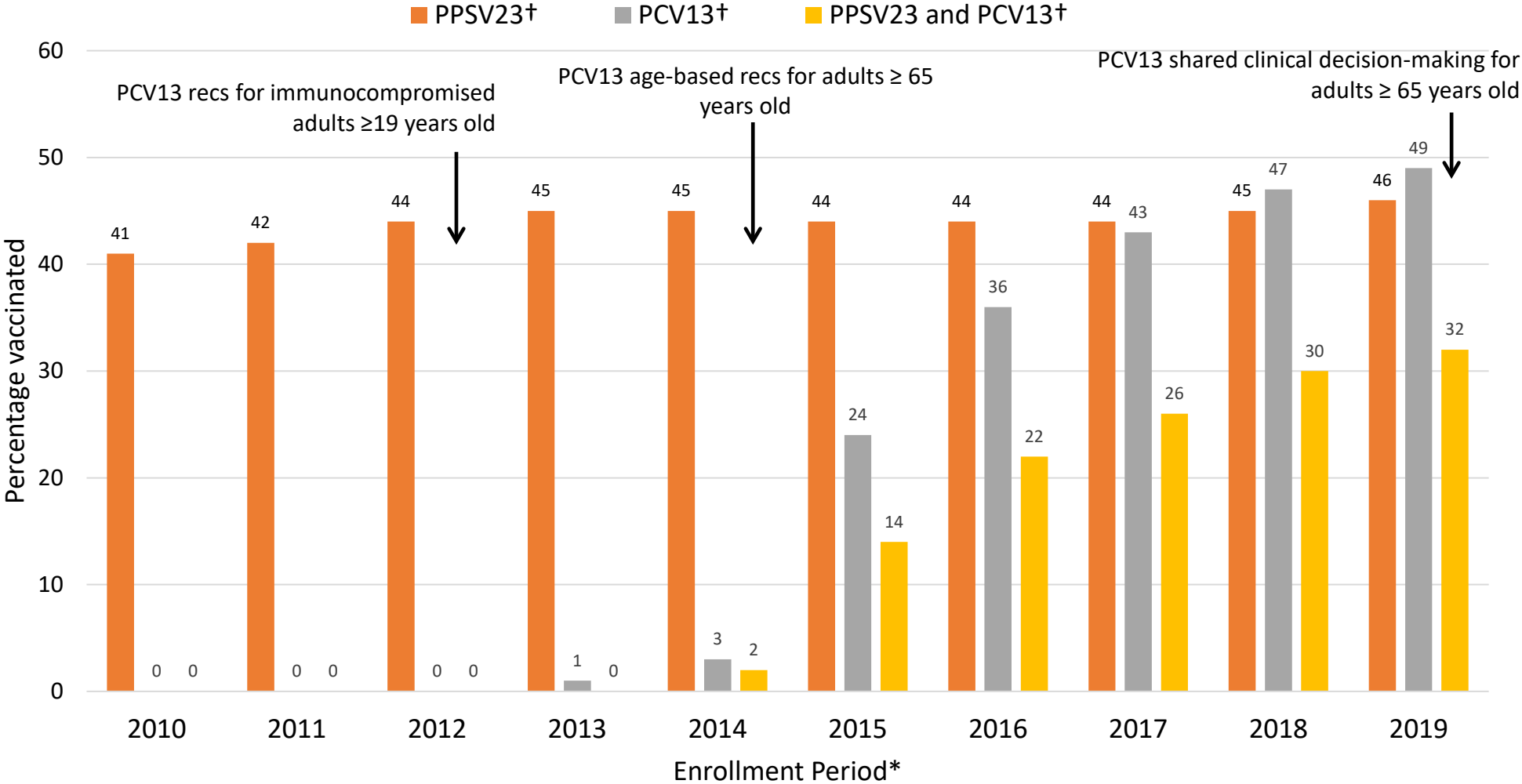
*Pfizer funded study

Pneumonia vaccine-type burden among adults >65 years old



Pneumococcal Vaccine Coverage in Adults

Proportion of Medicare beneficiaries aged ≥ 65 years with claims submitted for pneumococcal vaccination, regardless of prior vaccination – United States, 2010–2019*



* Each enrollment period is from January 1 through December 31 of the year. Denominators in each subgroup include all beneficiaries continuously enrolled in Medicare Parts A and B at least one year prior to December 31 of the respective year.

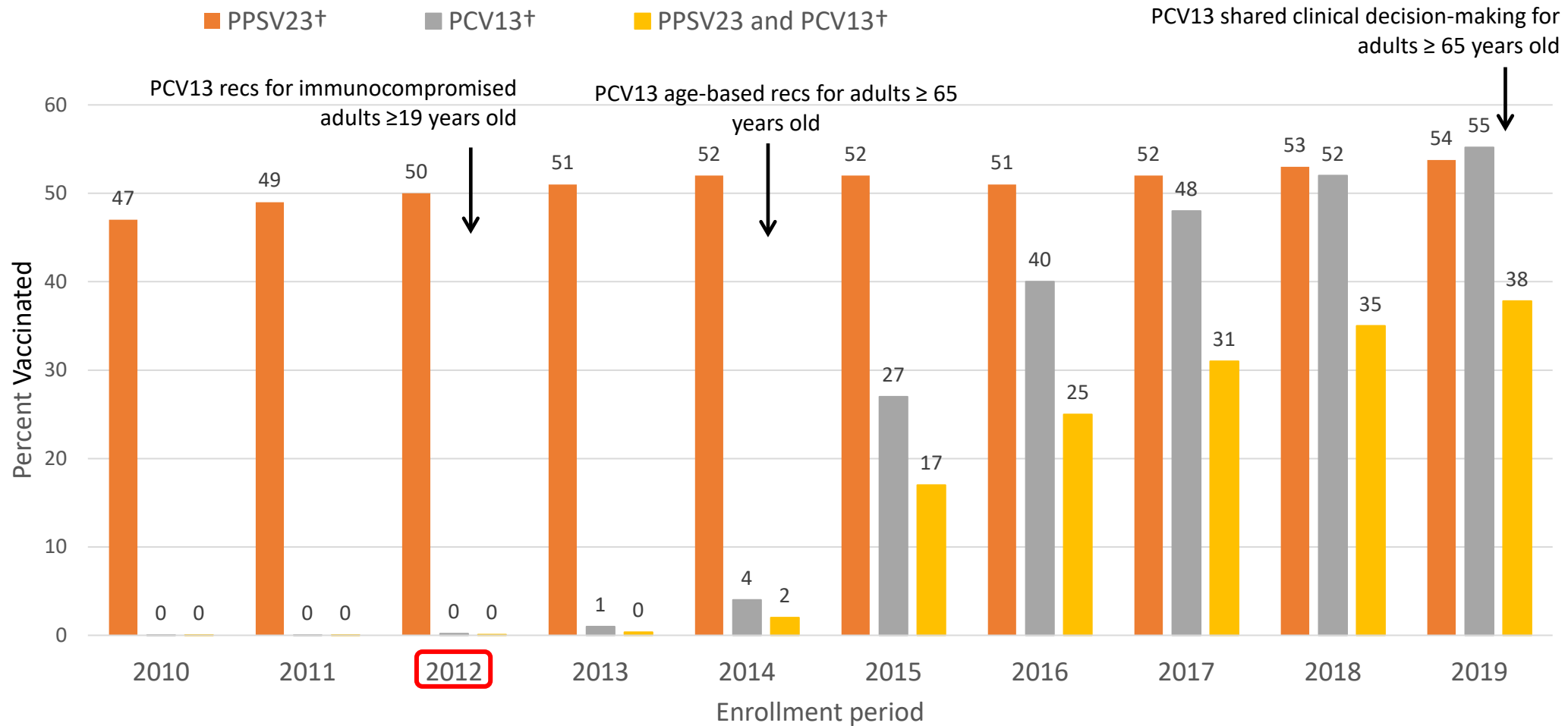
[†]Percentage with at least one claim for various vaccines categories since January 1, 1999 through the end of the enrollment period.

Proportion of Medicare beneficiaries aged ≥ 65 years with claims submitted for pneumococcal vaccination, by race/ethnicity, 2019*

Category	Total enrolled beneficiaries	Any pneumococcal	≥ 1 dose PPSV23	≥ 1 dose PCV13	Both PPSV23 and PCV13
Race/ethnicity					
<i>White</i>	14,248,613	65%	48%	51%	34%
<i>Black</i>	888,826	49%	35%	35%	21%
<i>Asian</i>	313,314	60%	43%	42%	25%
<i>Hispanic</i>	184,605	46%	32%	30%	16%
<i>Native American</i>	69,870	57%	38%	40%	21%
<i>Other Race</i>	272,851	60%	44%	46%	29%

*Denominator in each subgroup includes all beneficiaries continuously enrolled in Medicare parts A and B from January 1, 2019 to December 31, 2019

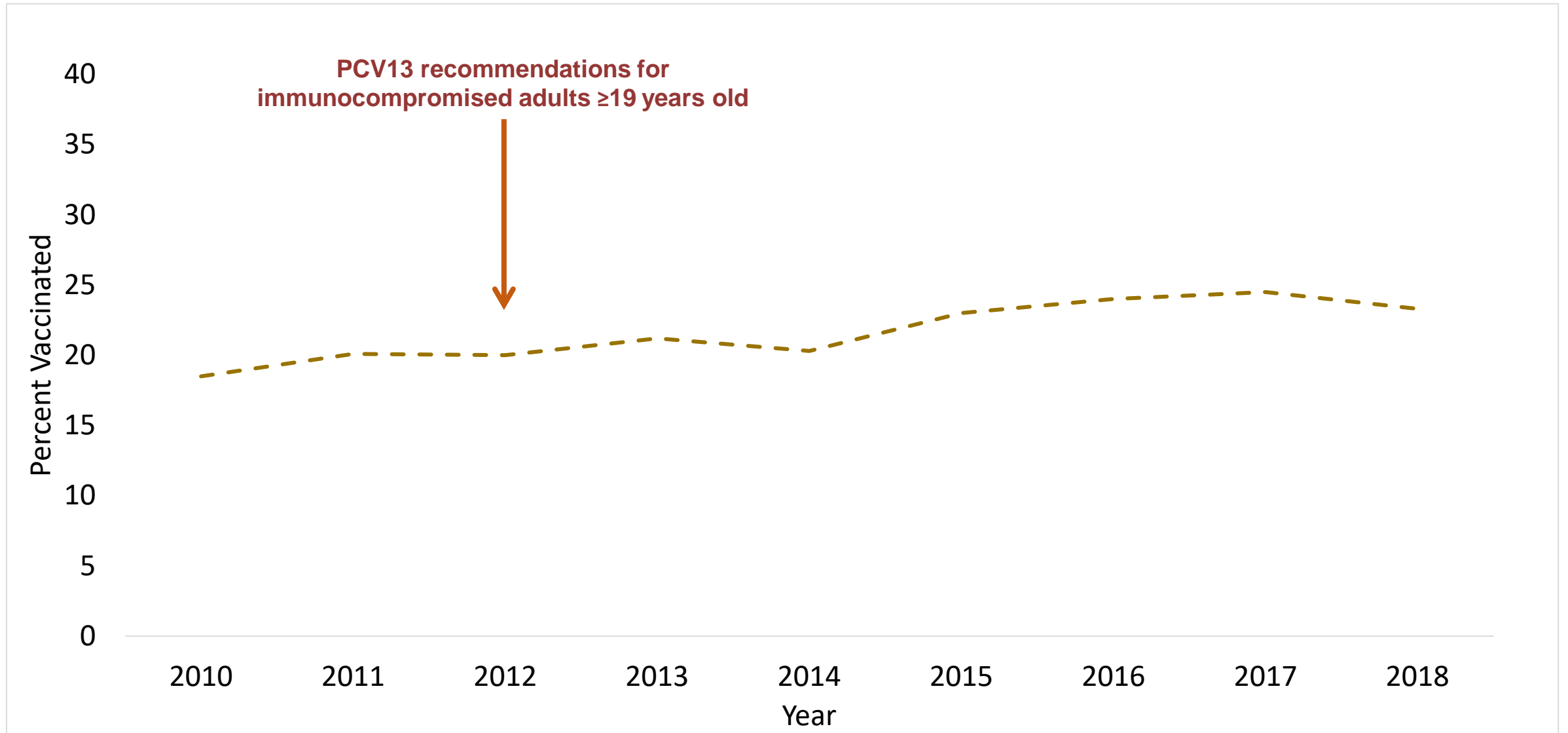
Changes in pneumococcal vaccine coverage among Medicare beneficiaries aged ≥65 years with immunocompromising conditions, U.S., 2010-2018



* Each enrollment period is from January 1 through December 31 of the year. Denominators in each subgroup include all beneficiaries continuously enrolled in Medicare Parts A and B at least one year prior to December 31 of the respective year.

†Percentage with at least one claim for various vaccines categories since January 1, 1999 through the end of the enrollment period.

Vaccination coverage in adults aged 19–64 years with underlying conditions, National Health Interview Survey (NHIS) 2010–2018



Estimated proportion of adults aged 19–64 years with underlying conditions who ever received pneumococcal vaccination, NHIS 2018

	Sample size	%	(95% CI)	Simple difference from 2017
Overall	5,851	23.3	(22.0, 24.6)	-1.2
White	4,048	23.6	(22.1, 25.2)	-1.3
Black	696	25.7	(21.8, 30.0)	3.1
Hispanic	656	18.5	(15.2, 22.4)*	-4.5
Asian	192	25.0	(17.3, 34.5)	1.7
Other	259	25.8	(19.3, 33.5)	-6.5

*p<0.05 for comparisons with white as the reference.

Conclusions (Invasive Disease)

- Among children and adults, overall and PCV13-type IPD incidence plateaued since 2013-2014
- Incidence of invasive disease caused by PCV15 and PCV20 serotypes has also remained stable
- There are opportunities to prevent additional 30% IPD burden among adults through new PCV use

Conclusions (Pneumonia)

- All-cause pneumonia after pediatric PCV13 introduction
 - Modest declines among adults
 - Less impact among older adults
- Pneumococcal Pneumonia declined in adults after introduction of PCV13
 - Largest impact through indirect effects
 - Direct effects through adult PCV13 use not documented
- Reductions in vaccine-type pneumococcal pneumonia documented through PCV13 direct effects among adults
 - ST3 most common remaining PCV13-type pneumonia
- Burden estimates of all-cause, pneumococcal, and VT pneumococcal pneumonia vary across studies
- There are opportunities to prevent additional disease burden among adults through new PCV use

Conclusions (Coverage)

- Among adults age 65 years and older:
 - PPSV23 coverage has been relatively stable
 - PCV13 coverage has increased to around 50%, since 2014 recommendation for adults 65 or older
- PCV13 coverage among adults age ≥ 65 years with immunocompromising conditions remained low before 2014
- Pneumococcal vaccine coverage has been low (<25%) among adults 19-64 years with underlying conditions, despite long-standing recommendation for PPSV23 use and 2012 PCV13 recommendation for adults with immunocompromising conditions

Questions

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

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

