Impact of 13-valent Pneumococcal Conjugate Vaccine (PCV13) on Non-bacteremic Pneumococcal Pneumonia (NBPP) among Adults in the United States, 2013-2017

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Background

- *Streptococcus pneumoniae* (pneumococcus) is a common etiology of all-cause pneumonia among adults
- True burden of pneumococcal pneumonia is unknown due to limitations of available diagnostic tests[1]
  - » Blood cultures have low sensitivity
  - » Commercially available pneumococcal urine antigen test (PUAT): 75% sensitivity and not routinely used by all providers[2, 3]
- In 2014, PCV13 recommended for adults aged ≥65 years, in series with 23-valent pneumococcal polysaccharide vaccine (PPSV23) based on demonstrated efficacy against NBPP[4,5]
- PCV13 coverage among adults ≥65 years was 43% in 2017
- We evaluated PCV13 impact on NBPP among adults

Methods

- NBPP defined as clinically or radiographically confirmed pneumonia and a positive PUAT in a hospitalized adult aged ≥18 years)
- NBPP cases identified at select hospitals in 10 sites within CDC's Active Bacterial Core surveillance from 2013-2017
- NBPP rates (per 100,000) were estimated using U.S. Census Bureau population denominators
- Rates adjusted for the proportion of pneumonia patients tested by PUAT and the number of pneumonia admissions in the catchment area
  - Generalized linear mixed model used to estimate the percent positive PUAT among all cause pneumonia
    - » Year and age group fixed effects
    - » Hospitals are treated as random effects
    - » Assume PUAT is randomly used within each hospital, age group, and year
  - Multiply the percent positive and test sensitivity (75%) to the all-cause pneumonia count to estimate incidence
- Percent change in incidence rates calculated comparing years 2013 to 2014 and years 2014 to 2017
  - 95% confidence intervals calculated using bootstrap resampling

Results

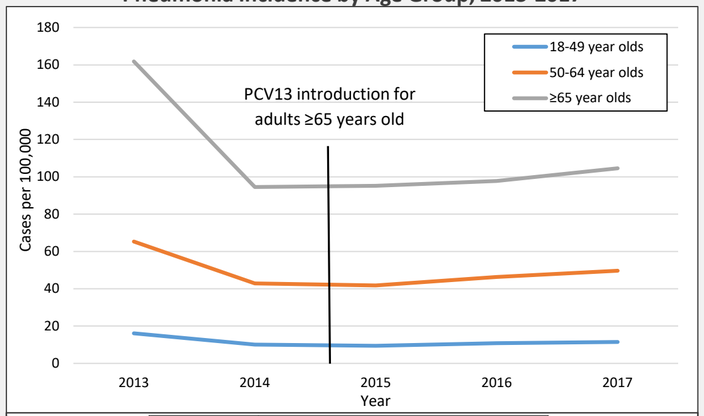
- Between 2013 and 2017, 4,435 NBPP cases were identified
- Adults aged ≥ 65 years accounted for 49% of cases (Table), with a case fatality ratio of 9%; compared to a case fatality ratio of 4% among adults aged 18-49 years
- From 2013 to 2014, rates of NBPP declined from 162 to 95 (41% reduction, 95%CI 30%, 51%) in ≥ 65 year-olds; 65 to 30 (34% reduction, 95%CI 22%, 45%) in 50-64 year-olds; and 16 to 10 (37% reduction, 95%CI 25%, 47%) in 18-49 year-olds (Figure)
- From 2014 to 2017, rates of NBPP increased slightly in all ages, but remained below 2013 rates (Figure)

Table. Demographics and Clinical Characteristics of PUAT Positive Case-Patients, 2013–2017

Demographics	Pre-PCV13, 2013-2014 (N= 1,856) n (%)	Post-PCV13, 2015-2017 (N= 2,579) n (%)
Age groups, years		
18–49	348 (19)	475 (19)
50–64	554 (30)	890 (35)
≥65	954 (52)	1214 (47)
Median age, years (range)	65 (18–102)	64 (18–105)
Male	855 (46)	1196 (46)
Hispanic	86 (5)	142 (6)
Race:		
White	1,200 (65)	1602 (62)
Black	433 (23)	686 (27)
Community onset[1]	1602 (86)	2211 (86)
Immunocompromising condition[2]	756 (41)	1495 (42)
High risk condition[3]	862 (47)	1190 (46)
Received PPSV23 0–3 days before UAT	61 (3)	32 (1)
Clincal Characteristics		
Radiographically diagnosed pneumonia	1608 (86)	2275 (88)
ICU care	655 (35)	812 (32)
Died	119 (7)	152 (6)
Median hospitalization (days) (range)	5 (0-152)	7 (0 – 120)
Pneumococcal vaccine receipt (current hospitalization)	259 (14)	230 (9)

[1]Not residing in a hospital setting or admitted at least 72 hours before UAT obtained
[2]Immuncompromising conditions defined as those for which PCV13 and PPSV23 are recommended for adults 19–64 years old
[3]High risk conditions defined as those for which PPSV23 is recommended for adults 19–64 years old

Figure. Estimated Annual Non-Bacteremic Pneumococcal Pneumonia Incidence by Age Group, 2013-2017



	% Change (95%CI)	
Age, years	2013 vs 2014	2014 vs. 2017
18-49	-37 (-47, -25)	14 (-3, 34)
50-64	-34 (-45, -22)	17 (-1, 37)
≥65	-41 (-51, -30)	11 (-6, 31)

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Conclusions

- NBPP incidence declined among adults
  - » Decrease most dramatic between 2013-2014 (indirect effects of vaccine use in children)
- No additional reductions in NBPP rates among adults since vaccine recommendation for adults aged ≥65 years and as vaccine coverage among adults increased
- New PCVs in phase 3 trials covering more serotypes and have potential to further reduce pneumococcal pneumonia among adults through both direct and indirect effects

Limitations

- Serotype distribution unknown
  - » Unable to determine burden of vaccine-type pneumonia
  - » Unable to determine if increases in non-vaccine type pneumonia minimize overall reductions
- UAT testing practices are likely not at random
- Adjusted incidence based on ICD codes for pneumonia
  - » coding practices may change over time and by hospital/site
- Relatively short time periods for both pre- and post-PCV13 data

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