Epidemiology of Invasive Pneumococcal Disease (IPD) Following 18 years of Pneumococcal Conjugate Vaccine (PCV) Use in the United States

T. Pilishvili[1], R. Gierke[1], M. Farley[2], W. Schaffner[3], A. Thomas[4], A. Reingold[5], L. Harrison[6], C. Holtzman[7], K. Burzlaff[8], S. Petit[9], R. Herlihy[10], S. Torres[11] and B. Beall[1]

Background

- A 7-valent vaccine (PCV7) was introduced for U.S. children in 2000 and was replaced by a 13-valent vaccine (PCV13) in 2010
- PCV13 was recommended for adults with immune compromise in 2012 and adults ≥65 years in 2014
- New higher valency PCVs (PCV15 and PCV20) expected to be licensed for adults in 2021-2022
- We evaluated PCV13 impact on IPD eight years after introduction

Methods

- IPD cases (isolation of pneumococcus from sterile sites) were identified through CDC's Active Bacterial Core surveillance during 1998-2018
- Isolates were serotyped by Quellung or whole genome sequencing and classified as PCV13-type and non-vaccine-type (NVT)
- Incidence rates (cases/100,000) were calculated using U.S. Census Bureau population denominators

Results

- From 1998 through 2018, overall IPD rates among children aged <5 years decreased by 93% (from 95 to 7 cases/100,000) (Fig 1). PCV13-type IPD decreased by 98% (from 88 to 2 cases/100,000)
- Among adults aged ≥65 years, overall IPD rates decreased by 60% (from 61 to 25 cases/100,000). PCV13-type IPD rates declined 86% (from 46 to 7 cases/100,000) (Fig 2)
- The largest magnitude declines observed following PCV7 introduction (Figures 1 and 2)
- Serotypes 3, 19A, and 19F caused most of the remaining PCV13-type IPD among children and adults

Results

- From 1998 through 2018, the proportion of cases with meningitis increased from 5% to 14% (p<0.01), and the proportion with pneumonia/empyema increased from 17% to 31% (p<0.01) among children
- Among adults, the proportion with pneumonia/empyema increased from 72% to 76% (p=0.01)
- NVT IPD rates did not change significantly among children. Among adults aged 50-64 years, NVT IPD increased by 83% (from 6 to 12 cases/100,000) (p<0.01). Among adults aged ≥65 years, NVT IPD increased by 22% (from 15 to 18 cases/100,000) (p<0.01) (Fig 1 and 2)
- The most common NVTs in 2018 were 33F (10% of all IPD), 23B (8%) and 22F (7%) among children <5 years old, and 22F (10% of all IPD), 15A (6%) and 23A (6%) among adults ≥65 years old (Fig 3 and 4)
- Serotypes unique to PCV15 (22F and 33F) and PCV20 (8, 10A, 11A, 12F, and 15B/C) accounted for 16% and 21% of IPD among children <5 years old, 13% and 19% of IPD among adults 19-64 years old, 14% and 14% of IPD among adults ≥65 years old (Fig 5)

Figure 1. Incidence of IPD among children aged <5 years

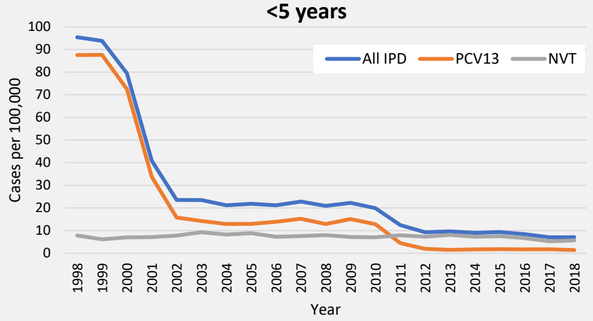


Figure 2. Incidence of IPD among adults aged ≥65 years

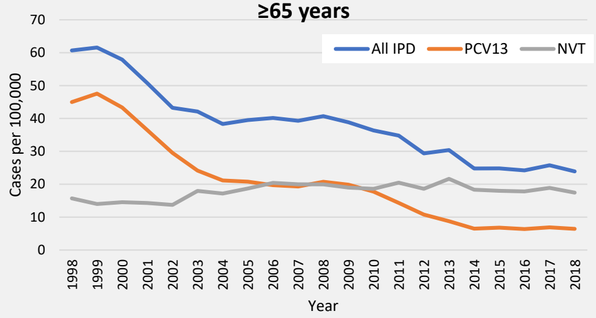


Figure 3. Incidence of IPD among children <5 years old, 2007-2018, top serotypes 2017-2018 (excluding 19A)

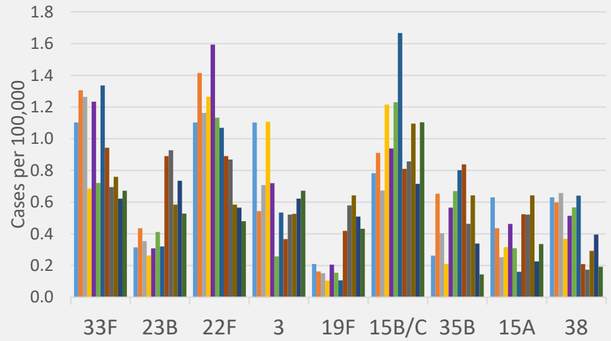


Figure 4. Incidence of IPD among adults ≥65 years old, 2007-2018, top serotypes 2017-2018

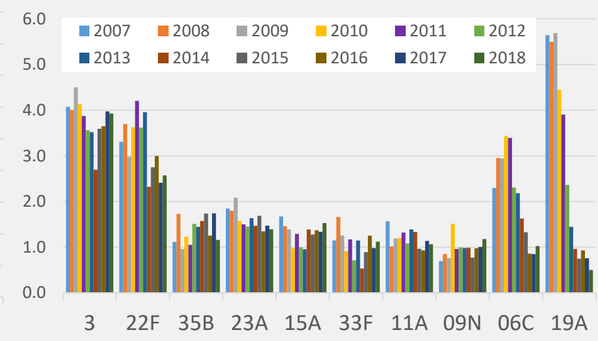
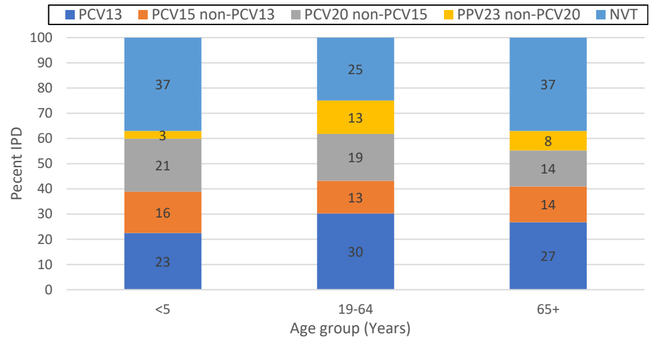


Figure 5. Proportion of IPD covered by PCV formulation and age group in 2017-2018



Conclusions

- Overall IPD incidence among children and adults decreased following PCV7 and PCV13 introduction for children, driven primarily by reductions in PCV-type IPD.
- NVT IPD increased in older adults, but these increases did not cancel out overall PCV benefits
- New PCVs targeting additional serotypes have the potential to further reduce IPD burden among children and adults

Affiliations

(1) Centers for Disease Control and Prevention, Atlanta, GA; (2) Emory University and Atlanta VAMC, Atlanta, GA; (3) Vanderbilt University, Nashville, TN; (4) Oregon Public Health Division, Portland, OR; (5) University of California, Berkeley, Berkeley, CA; (6) Johns Hopkins Bloomberg School of Public Health, Baltimore, MD; (7) Minnesota Department of Health, St. Paul, MN; (8) New York State Department of Health, Albany, NY; (9) Connecticut Department of Public Health, Hartford, CT; (10) Colorado Department of Public Health and Environment, Denver, CO; (11) New Mexico Emerging Infections Program, Santa Fe, NM

Contact Info

Tamara Pilishvili, CDC
tpilishvili@cdc.gov