INVASIVE PNEUMOCOCCAL DISEASE (IPD) AND PATTERNS OF PENICILLIN AND CEPHALOSPORIN NON-SUSCEPTIBILITY FOLLOWING ROUTINE USE OF 13-VALENT PNEUMOCOCCAL CONJUGATE INFANT VACCINATION IN THE UNITED STATES

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Background and Aim
• The use of the 13-valent pneumococcal conjugate (PCV13) vaccine in the U.S. routine infant pneumococcal vaccination program started in February 2010 as a replacement of the 7-valent (PCV7), in use since 2000. The use of PCVs in children has reduced the incidence of IPD and other pneumococcal diseases not only in children but also across all-age groups. Antimicrobial resistance to pneumococcal bacteria has been observed. We assess trends in all-cause, all-ages cumulative incidence of non-susceptible IPD to penicillins and cephalosporins from 2005 to 2013. Both antibiotic classes are the most commonly used to treat IPD.

Methods
• Data sources consisted of publications from the U.S. Active Bacterial Core surveillance for Streptococcus pneumoniae [Tomczyk et al.], and U.S. Census Bureau.[3]
• First, we calculated age-specific penicillin and cephalosporin non-susceptible annual IPD projected cases, based on non-susceptible IPD rates reported by Tomczyk et al. and census data. Second, we calculated all-ages combined, non-susceptible annual IPD incidence to these antimicrobial classes. Third, based on all-ages IPD incidence stated in annual reports, we calculated the annual (age adjusted) proportions of all IPD that were non-susceptible to penicillins and cephalosporins.
• We also estimated relative and cumulative reductions in non-susceptible IPD compared against 2009, the year preceding the implementation of PCV13 infant vaccination.

Results
• Following PCV13 use in infants starting in 2010, all-ages non-susceptible to penicillins IPD incidence dropped (monotonically) 61% from 1.54 to 0.60 cases per 100,000 population from 2009 to 2013. (Fig. 1) Non-susceptible to cephalosporins IPD incidence dropped (monotonically) 55% from 2.20 to 0.98 cases per 100,000 population also from 2009 to 2013. (Fig. 1) These reductions were larger than the 25% reduction observed for overall all-ages IPD incidence (14.3 to 10.7) (not shown) for the same period. Compared to 2005, by 2013, non-susceptible IPD incidence dropped 44% and 46% for penicillins and cephalosporins. (Fig. 1)
• By 2013, 6% and 9% of all IPD cases were non-susceptible to penicillins and cephalosporins compared to 11% and 15% in 2009, respectively. (Fig. 2 and Fig. 3)
• Compared to 2009 non-susceptible IPD rates, there were cumulative reductions in ~16,000 non-susceptible IPD cases consisting of 6,550 and 9,436 IPD cases non-susceptible to penicillins and cephalosporins (non-mutually exclusive).

Conclusions
• The PCV13 vaccination program is associated with observed reductions in penicillins and cephalosporins’ non-susceptibility in IPD. As it has been reported elsewhere, vaccine-type and serotype-19A—a serotype commonly associated with antimicrobial resistance—have declined with PCV13 use.[4][1] Observed reductions in antimicrobial non-susceptibility extend to other antimicrobial classes[1], and would be expected for pneumococcal (non-bacteremic) pneumonia and AOM.[5]

Results (cont.)
Table 1. Changes in Non-susceptible IPD Following PCV13 Use in Infants

<table>
<thead>
<tr>
<th>Year</th>
<th>Pre-PCV13</th>
<th>Post-PCV13</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>1.54</td>
<td>0.60</td>
<td>-61%</td>
</tr>
<tr>
<td>2013</td>
<td>0.98</td>
<td>0.60</td>
<td>-55%</td>
</tr>
</tbody>
</table>

![Figure 1](image1.png)

![Figure 2](image2.png)

![Figure 3](image3.png)

References

Conflicts of interest: All authors are Pfizer employees.