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Background and Aims

• Aim: Evaluate the direct and indirect impact of PCV13 on invasive pneumococcal disease (IPD) in the general population of children and adults and among adults with HIV
Methods

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

- **US Census Bureau:**
  - Race-bridged post-census population estimates as denominators

- **National HIV surveillance:**
  - People diagnosed with HIV in the ABCs catchment areas

- **Overall and serotype-specific IPD incidence rates (cases per 100,000)**
Methods

- Isolates serotyped by Quellung or PCR at reference labs and grouped for analysis:
  - **PCV13 serotypes**: 13 serotypes in PCV13 plus 6C due to cross-protection
  - **PPV11 serotypes**: 11 serotypes unique to PPSV23
  - **Non-vaccine types (NVT)**: all other pneumococcal serotypes

- Compared overall and serotype-specific IPD incidence (cases/100,000 population) pre and post pediatric PCV13 introduction
  - HIV denominator only available 2008–2014
  - Percent reduction in disease incidence (1-RR)

1. Serotypes 1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F, 23F
2. Cooper et al. 2011
IPD rates among children < 5 years old, 2007–2016

Cases per 100,000


PCV13 introduction for children

ALL IPD
PCV13 + 6C
NVT

-61% (-67, -54)

-87% (-91, -82)
IPD rates among children < 5 years old by PCV13 plus 6C serotypes, 2007–2016
IPD rates among adults ≥ 65 years, 2007–2016

-40% (-44, -35)

-68% (-72, -63)
IPD rates among adults ≥ 65 years by PCV13 plus 6C serotypes, 2007–2016

Cases per 100,000

PCV13 introduction for children

PCV13 introduction for adults
Rank order of non-PCV13 serotypes causing IPD, 2015-2016

<table>
<thead>
<tr>
<th>TYPE</th>
<th>Cases/100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>23B</td>
<td>0.62</td>
</tr>
<tr>
<td>22F</td>
<td>0.62</td>
</tr>
<tr>
<td>33F</td>
<td>0.57</td>
</tr>
<tr>
<td>15C</td>
<td>0.52</td>
</tr>
<tr>
<td>15A</td>
<td>0.48</td>
</tr>
<tr>
<td>35B</td>
<td>0.43</td>
</tr>
<tr>
<td>10A</td>
<td>0.33</td>
</tr>
<tr>
<td>12F</td>
<td>0.29</td>
</tr>
<tr>
<td>15B</td>
<td>0.29</td>
</tr>
<tr>
<td>38</td>
<td>0.19</td>
</tr>
<tr>
<td>other</td>
<td>1.67</td>
</tr>
</tbody>
</table>

Green denotes serotypes common to both age groups
**Changes in pneumococcal meningitis incidence by age and serotype group, 2007-2008 vs. 2016**

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Serotype group</th>
<th>2016 % change (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5</td>
<td>PCV13+6C</td>
<td>-81.9 (-93.7, -47.7)*</td>
</tr>
<tr>
<td></td>
<td>Non-PCV13</td>
<td>27.1 (-31.8, 137)</td>
</tr>
<tr>
<td></td>
<td>ALL IPD</td>
<td>-34 (-59.6, 7.8)</td>
</tr>
<tr>
<td>&gt;65</td>
<td>PCV13+6C</td>
<td>-76.1 (-90.6, -39.5)*</td>
</tr>
<tr>
<td></td>
<td>PPSV11</td>
<td>-5.3 (-57.9, 113.2)</td>
</tr>
<tr>
<td></td>
<td>NVT</td>
<td>-32.4 (-66.9, 38.3)</td>
</tr>
<tr>
<td></td>
<td>ALL IPD</td>
<td>-43.6 (-64, -11.7)*</td>
</tr>
</tbody>
</table>

* statistically significant decrease
Characteristics of IPD cases among adults ≥19 years with and without HIV, 2008–2014

- IPD cases with HIV more likely to be:
  - Younger (median age: 47yrs [19–88] vs. 61yrs [19–104])
  - Male (60.8% vs 50.9%)
  - Black race (69.6% vs 16.9%)

<table>
<thead>
<tr>
<th>Age groups</th>
<th>PLHIV (n=1,662)</th>
<th>Non-PLHIV (n=18,071)</th>
</tr>
</thead>
<tbody>
<tr>
<td>19–34 years</td>
<td>3.7</td>
<td>4.5</td>
</tr>
<tr>
<td>35–49 years</td>
<td>5.7</td>
<td>8.4</td>
</tr>
<tr>
<td>50–64 years</td>
<td>9.2</td>
<td>10.7</td>
</tr>
<tr>
<td>≥65 years</td>
<td>17.0</td>
<td>15.3</td>
</tr>
</tbody>
</table>
Changes in IPD incidence rate in adults ≥19 years living with HIV, 2008–2014

- Incidence rate (2008–09): 299/100,000
- Incidence rate (2011–2012): 218/100,000
  % Change (95% CI): -27 (-36, -18)
- Incidence rate (2013–2014): 193/100,000
  % Change (95% CI): -36 (-43, -27)

Incidence Rate Ratio 18 (95% CI: 16, 19)
Changes in IPD incidence rate by serotype group in adults ≥19 years living with HIV, 2008–2014

% Change from 2008–09 (95% CI)

- 2011–2012: -43 (-53, -31)
- 2013–2014: -61 (-68, -51)

PCV13+6C types

Incidence rate (Per 100,000 PLHIV)

Year

2008 2009 2010 2011 2012 2013 2014

Indirect effects

Indirect and direct effects

Incidence Rate Ratio 18 (95% CI: 15, 21)
Changes in IPD incidence rate by serotype group in adults ≥19 years living with HIV, 2008–2014

% Change from 2008–09 (95% CI)

2011–2012
0.5 (-21, 27)

2013–2014
-3.1 (-24, 23)

PPV11 types

Incidence rate (Per 100,000 PLHIV)

Year
2008 2009 2010 2011 2012 2013 2014

PPV11
PCV13+6C
NVT

Green line: PPV11
Blue line: PCV13+6C
Brown line: NVT

Red arrow indicates significant change.
Summary

• Significant reductions in overall and PCV13 serotype IPD among children and adults since PCV13 introduction
  - Reductions driven by types 19A and 7F
  - Rates plateaued in 2014–2016
  - No further reductions in PCV13 serotype IPD among adults ≥65 years since 2014 adult PCV13 recommendations
  - Despite reductions, IPD rates including PCV13 serotypes, remained high in adults with HIV compared to those without HIV

• No large increases in any non-PCV13 serotype among children or adults, including those living with HIV

• Similar trends observed for pneumococcal meningitis
Conclusions

• In the 6 years post-PCV13 introduction, sustained benefits in overall IPD and IPD caused by the PCV13 serotypes in children and adults

• No evidence of serotype replacement in children or general population of adults

• Continue monitoring changes in disease and serotype distribution to inform new vaccine policy
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