Streptococcus pneumoniae is a common gram-positive bacterial pathogen normally residing in the nasopharynx of healthy individuals. It can cause diseases such as otitis media and pneumonia if it spreads to adjacent organs. If the bacteria enter the bloodstream it can cause invasive pneumococcal disease (IPD) or travel to other sites in the body causing meningitis, septic arthritis and other diseases.

The burden of disease is not evenly distributed with those in at-risk groups (aged 65+, immunosuppression, use of cochlear implants, asthma, diabetes, alcoholism, chronic diseases of the lungs (e.g. COPD, heart, liver and kidneys) shouldering the bulk of this burden. The burden of disease in terms of non-invasive endpoints (e.g. pneumonia and otitis media) is less straight-forward to understand.

Public Health England (PHE) has access to the Hospital Episodes Statistics database (HES), a computerised hospital discharge database that covers all National Health Service hospitals in England to monitor disease trends of non-pneumococcal pneumonia. We have used this database to examine the burden of hospitalised pneumonias, as well as other invasive pneumococcal disease such as sepsis, empyema and otitis media.

In 2006 the 7-valent conjugate vaccine (PCV7) was introduced to the childhood immunisation programme in England and was later replaced by the 13-valent vaccine (PCV13) in 2010. Here we present an overview of an analysis of the estimated direct and indirect impact of the two pneumococcal conjugate vaccines on hospital-diagnosed pneumonia caused by S. pneumoniae (ICD-10: J13) and pneumonia of unknown cause (ICD-10: J18), as well as preliminary results of a wider analysis considering the hospitalised burden of disease caused by pneumonia in England from 2004-95 to 2014-15 using admissions data from the HES database.

RESULTS

PCV7 and pneumonia due to S. pneum (J13) 93.9% of all cases of pneumonia were for pneumonia of unknown cause (ICD-10: J18) for the study period (2,684,998 of 2,859,643). 73.5% of cases of all-cause pneumonia (ICD-10: J12-J18) were in individuals in all risk groups.

The largest increasing trend in pneumonia of unknown cause was seen in individuals in all age groups >14 years (Figure 1), particularly for those at-risk individuals aged 65+ years for which incidence increased by a factor of 2.75 above baseline (5,139 per 100,000 person-years in 2014-15 compared to 1,868 per 100,000 person-years). These relative increases were larger in relative incidence in UTI for all risk- and age-groups, which may suggest changes in pneumonia diagnosis procedures.

Following the introduction of PCV13 the age-groups 6-14 and 15-24 saw reductions in the incidence of J13 pneumonia by 49% and 46% respectively. PCV7 did not appear to offer indirect protection to 2-4 year olds for J13 pneumonia, but PCV13 conferred indirect protection to this age group for J13 pneumonia with a reduction in incidence of 54%.

The analysis suggests that the conjugate vaccine programme in England has contributed to reducing the hospitalised burden of some pneumonias in young children. We found evidence of some indirect protection for both J13 and J18 pneumonias offered by the PCV programme as well as direct protection to those included in the programme. We did not detect an impact on the incidence of disease in adults aged 25 years and older. Increasing disease trends for pneumonia of unknown cause (J18) may mask any effect by the introduction of the two vaccines.

Our results tally with other investigations of the impact of childhood PCV programmes on hospitalised all-cause pneumonia in the United States (Simonsen et al. 2014) and England (Saxena et al. 2015 and Koshy et al. 2010), where reductions in hospitalisations for all-cause pneumonia followed the introduction of PCV programmes, particularly for young children.

We did not extract data on admissions attributed to the period before April 2004, though doing so would have increased the data available to us for our baseline pneumonia activity estimates.

We have not considered the impact on all-cause pneumonia but a sub-set of pneumonias. This analysis can be extended to examine the impact of the PCV programme on all pneumonias, as well as other invasive pneumococcal disease such as sepsis, empyema and otitis media.

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