Streptococcus pneumoniae Surveillance Report 2010

Oregon Active Bacterial Core Surveillance (ABCs)

Office of Disease Prevention & Epidemiology
Oregon Health Authority

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Background

The Active Bacterial Core surveillance (ABCs) program is a core component of the Emerging Infections Program (EIP) Network sponsored by the Centers for Disease Control and Prevention (CDC). The purpose of the ABCs program is to determine the incidence and epidemiologic characteristics of invasive disease due to *Haemophilus influenzae*, *Neisseria meningitidis*, group A streptococcus (GAS), group B streptococcus (GBS), *Streptococcus pneumoniae*, and methicillin-resistant *Staphylococcus aureus* (MRSA). The entire EIP Network for invasive pneumococcal disease (IPD) represents almost 30 million persons in 10 surveillance areas around the United States. More information on the EIP/ABCs Network is found at: http://www.cdc.gov/abcs/index.html.

In Oregon, the surveillance area for IPD comprises the tri-county (Clackamas, Multnomah, and Washington) Portland metropolitan area, with a 2010 estimated population of 1,644,536.* More information on the Oregon ABCs program is found at: http://public.health.oregon.gov/DiseasesConditions/CommunicableDisease/Pages/abc.aspx.

Methods

IPD is defined as the isolation of *S. pneumoniae* from a normally sterile body site in a tri-county resident. Tri-county hospital laboratories submit *S. pneumoniae* isolates to the Oregon State Public Health Laboratory, which forwards them to a CDC-collaborative laboratory for serotyping and antimicrobial susceptibility testing. Additional cases are identified through regular laboratory record reviews. Health record reviews of each case allow standardized reports of demographic characteristics, clinical syndrome manifestations, underlying illnesses or conditions, and illness outcome.

Surveillance Results

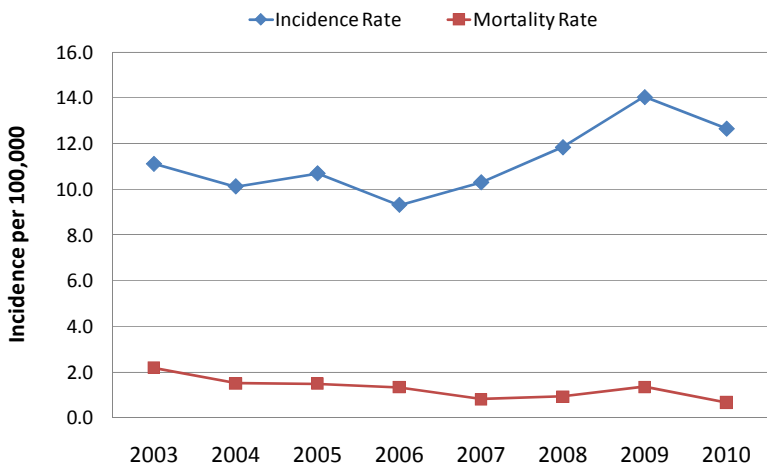
Descriptive Epidemiology

In 2010, 208 cases of IPD were reported in the tri-county Portland area, corresponding to an incidence rate of 12.7/100,000 persons (Figure 1). This is almost 13 percent higher than the average annual incidence rate in the Portland area from 2005–2009 (11.2/100,000), but 11 percent lower than the most recent national estimate of invasive disease (14.3/100,000).[1] Among these cases there were 11 deaths, for an annual mortality rate due to IPD of 0.7/100,000 (Figure 1). This is 42 percent lower than the 2005–2009 Portland area average annual mortality rate (1.2/100,000) and 56 percent lower than the most recent national estimate (1.6/100,000).[1]

* Source: Portland State University Population Research Center (http://www.pdx.edu/prc/)

The mean and median ages of 2010 IPD cases were 55 and 57 years, respectively, while those of IPD deaths were 80 and 85 years, respectively. The 2010 case fatality rate for IPD in the Portland area was 5.3 percent, less than both the figures reported in the Portland area from 2005–2009 and the entire ABCs network in 2009.[1] Over half (51%) of the cases were male; of 109 cases where race was known, 86 percent were white, 8 percent were black, and 8 percent were another race; of 100 cases where ethnicity was known, 9 percent were Hispanic or Latino. These data should be interpreted with caution, however, given that race and ethnicity were not obtained on a majority of the cases.

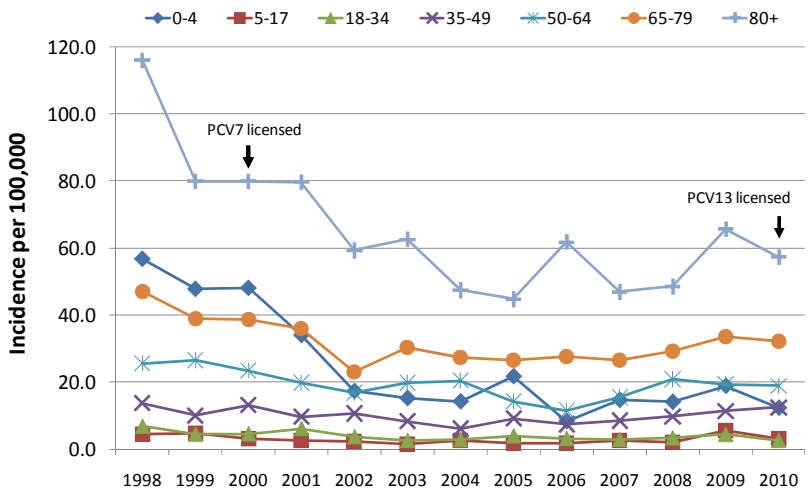
Figure 1: Incidence and Mortality Rates of IPD Cases in Tri-county Area



The 2010 incidence of IPD was highest in Multnomah county (17.0/100,000), followed by Clackamas (9.4/100,000), and Washington (9.0/100,000) counties. Compared with the previous five-year average, the 2010 incidence was 8 percent lower in Clackamas, 16 percent higher in Multnomah, and 25 percent higher in Washington counties. In 2010, mortality due to IPD was highest in Clackamas county (0.79/100,000), followed by Washington (0.75/100,000), and Multnomah (0.55/100,000) counties. Compared with the previous 5-year average, IPD mortality in 2010 was 14 percent lower in Clackamas, 65 percent lower in Multnomah, and 9 percent lower in Washington counties.

In 2010, the burden of disease was highest in those ≥80 years of age (29 cases; incidence 57.3/100,000 persons), followed by those 65-79 years of age (41 cases; 32.1/100,000) and those 50-64 years of age (60 cases; 19.0/100,000) (Figure 2). Compared with the previous 5-year average, IPD incidence in 2010 was higher across all age groups, except among the 0-4 and 18-34 age groups. However, the overall incidence in 2010 was still 40 percent lower than that in 1998, prior to the licensure of the 7-valent pneumococcal conjugate vaccine (PCV7).

Figure 2: Incidence of IPD Cases in Tri-county Area by Age



IPD mortality was also highest in 2010 in those ≥80 years of age (7 deaths; 13.8/100,000), followed by those 65-79 years of age (2 deaths; 1.6/100,000) and 50-64 years of age (2 deaths; 0.63/100,000). There was one death reported in 2009 among individuals aged 0-34 years; only two deaths due to IPD had been reported previously throughout the six-year surveillance period (2004-2009) in this age group. We have not had a fatal case of IPD among children aged 0-4 since 2001. Increasing age did exhibit a significant, positive association with fatal outcome from IPD (p=0.0004).

Clinical Manifestations

The common clinical syndromes tracked by our IPD surveillance system – bacteremic pneumonia (clinical pneumonia with a positive blood culture), primary bacteremia, and pneumococcal meningitis – are found in Table 1. While the profile of IPD clinical syndromes has been stable over time, the syndromes do vary by age. For instance, with increasing age, bacteremic pneumonia becomes more common while bacteremia, meningitis, and other syndromes all become less common (p<0.0001 for all). After adjusting for age, pneumonia and bacteremia were both found to be associated with mortality (p=0.0010 and p=0.0014, respectively).

Table 1: Percent of IPD Cases† Reporting Common Clinical Syndromes

Syndrome	2010 (%)	2005-2009 (%)
Bacteremic pneumonia	80	75
Primary bacteremia	7	12
Meningitis	6	7
Other	8	6

† Some cases report more than 1 syndrome.

Underlying Conditions

Table 2 lists underlying conditions that were found in greater than 5 percent of IPD cases in the Portland metropolitan area during 2005–2010. Overall, 83 percent of cases had at least one underlying condition, with the presence of any underlying condition increasing with age (p<0.0001). Among those less than 18 years of age, asthma was the most common condition (8%), followed by immunosuppression (8%) and cancer (7%). Among adults, smoking (p<0.0001) decreased with increasing age, while cardiovascular disease (p<0.0001), cancer (p<0.0001), chronic obstructive pulmonary disease (COPD) (p<0.0001), diabetes (p<0.0001), and cerebrovascular accident (CVA) (p<0.0001) increased.

Table 2: Percent of IPD Cases† Reporting Underlying Conditions, 2005-2010

Condition	%
Smoking	28
Cardiovascular disease	20
Diabetes	18
COPD	17
Immunosuppression	17
Cancer	14
Alcohol abuse	9
Asthma	9
CVA (stroke)	6
Nephrotic syndrome	6
Obesity	6
None reported	17

† Some cases report more than 1 syndrome.

Serotype Analysis

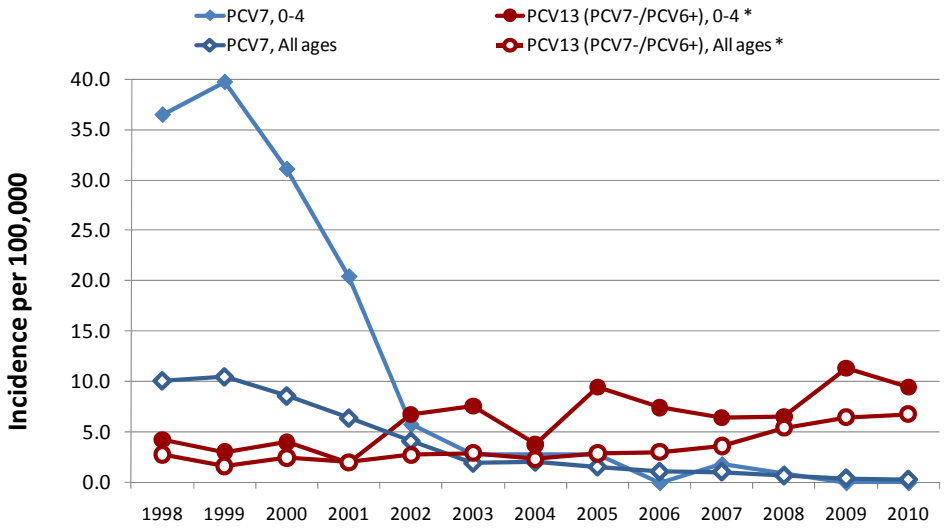
While rates of PCV7-type IPD have declined dramatically following PCV7 introduction in 2000, rates of IPD caused by some serotypes (3, 7F, 19A) not included in PCV7, have increased since PCV7 introduction. In Oregon, slightly over half of the IPD cases in 2010 were serotypes 3 (9%), 7F (32%) and 19A (13%). Since 2003, these three non-PCV7 vaccine serotypes have increased in incidence. Serotype 3 has increased 22 percent, from 0.9 to 1.1 cases per 100,000 in 2010; serotype 7F has increased over six-fold, from 0.5 to 3.8 cases; and serotype 19A has increased 2.3 times, from 0.7 to 1.6 cases. Of these three serotypes, 7F is the only one to demonstrate a statistically significant increasing trend as a proportion of IPD cases ($p<0.0001$). Fortunately, a new 13-valent pneumococcal conjugate vaccine (PCV13), which includes serotypes 3, 7F and 19A, was licensed by the U.S. Food and Drug Administration (FDA) in February 2010 (Table 3).

Table 3: Pneumococcal Conjugate Vaccines Serotype Coverage

Vaccine	FDA Licensure	Serotypes Covered
PCV13	February 2010	4, 6B, 9V, 14, 18C, 19F, 23F, **1, 3, 5, 6A, 7F, 19A**
PCV7	February 2000	4, 6B, 9V, 14, 18C, 19F, 23F

Figure 3 depicts the incidence of IPD due to serotypes of *S. pneumoniae* that are included in PCV7 and the six additional serotypes included in PCV13. From 1998 to 2010, the incidence of PCV7 serotypes decreased significantly among all age groups, especially among those 0-4 years of age. Overall, IPD incidence due to PCV7 serotypes decreased 97 percent over this time period, while incidence due to the six additional serotypes now covered by PCV13 increased almost 150 percent. Although not shown here, the incidence of PCV7 serotypes among those 65 or older has also decreased over this time period. The finding that the incidence of PCV7 serotypes has declined in the face of increased incidence of the remaining pneumococcal serotypes covered by the 23-valent pneumococcal polysaccharide vaccine (PPSV23) suggests that use of PCV7 in children provides a herd immunity effect for older adults.

Figure 3: Incidence of PCV7 and PCV13* in Those 0-4 and Overall



* Only includes the six additional strains covered by PCV13 and not PCV7

Antibiotic Susceptibility

In 2010, susceptibility testing was performed on 96 percent of the isolates (Table 4). At least 95 percent of the tested isolates were susceptible to amoxicillin, cefotaxime, ceftriaxone, chloramphenicol, levofloxacin, linezolid, meropenem, synercid, telithromycin and vancomycin.

Table 4: Antibiotic Susceptibility of IPD Isolates, 2010 (n=200)

Antibiotic	Susceptible (%)	Intermediate Resistance (%)	Full Resistance (%)
Levofloxacin	100		
Linezolid	100		
Synercid	100		
Telithromycin	100		
Vancomycin	100		
Ceftriaxone	98	2	
Amoxicillin	96		4
Cefotaxime	96	3	1
Chloramphenicol	96		4
Meropenem	95	1	4
Cefuroxime	92	1	7
Clindamycin	92	1	7
Tetracycline	91	1	8
Penicillin	88	7	5
Erythromycin	87	1	12
Trimethoprim-sulfamethoxazole	85	4	11

Twelve percent of the 2010 IPD isolates were resistant to penicillin. Of these, serotype 19A displayed the highest proportion of penicillin resistance (Table 5).

Table 5: Penicillin Resistance by Serotype, 2010

Serotype	Intermediate Resistance (n=14) N (%)	Full Resistance (n=11) N (%)
19A	8 (57)	9 (82)
6C	3 (21)	
19F	1 (7)	1 (9)
35B		1 (9)
15A	1 (7)	
15B	1 (7)	

Discussion

The results of IPD surveillance in Oregon through ABCs are largely consistent with those seen nationally. After the February 2000 licensure of PCV7, the incidence of IPD decreased dramatically. In 1998, two years prior to the introduction of the vaccine, the incidence rate was 56.8 per 100,000 among children under the age of five. In 2002, two years post-vaccine use, the incidence rate had decreased 70 percent to 17.3 per 100,000. While the year-to-year decreases were largest immediately following this event, our data indicate that IPD incidence, particularly those cases due to PCV7 serotypes, remains low compared to the pre-vaccine era. Additionally, while PCV7 is most effective within the target population[2], the benefits of decreased incidence of PCV7-covered serotypes extend to other ages, due to the phenomenon of herd immunity.[3]

While rates of PCV7-type IPD have declined dramatically following PCV7 introduction, rates of IPD caused by some serotypes (3, 7F, 19A) not included in PCV7, have increased since PCV7 introduction. Fortunately, as was previously mentioned, a new 13-valent pneumococcal conjugate vaccine, which includes serotypes 3, 7F, and 19A, was licensed by the FDA in February 2010. The Oregon ABCs program is participating in a post-licensure evaluation of PCV13 effectiveness to assess how well the vaccine works among children who receive the vaccine as part of routine immunization schedules. With the introduction of PCV13, the epidemiology of IPD will undoubtedly continue to evolve. We will continue to closely monitor these trends in Oregon.

References

1. Centers for Disease Control and Prevention. 2010. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, *Streptococcus pneumoniae*, 2009. Available via the Internet: http://www.cdc.gov/abcs/reports-findings/survreports/spneu09.pdf. Accessed 28 Sep 2011.
2. Advisory Committee on Immunization Practices. Preventing pneumococcal invasive disease among infants and young children: recommendations of the Advisory Committee on Immunization Practices (ACIP) *MMWR Recomm Rep*. 2000;49(RR-9)1-35.
3. Lexau CA, Lynfield R, Danila R, et al. Changing Epidemiology of Invasive Pneumococcal Disease Among Older Adults in the Era of Pediatric Pneumococcal Conjugate Vaccine. *JAMA*. 2005;294(16):2043-51.