Streptococcus pneumoniae Surveillance Report 2011

Oregon Active Bacterial Core Surveillance (ABCs)

Center for Public Health Practice
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 2011 estimated population of 1,656,775.* More information on the Oregon ABCs program is found at: http://public.health.oregon.gov/DiseasesConditions/CommunicableDisease/EmergingInfections/Pages/ActiveBacterialCoreSurveillance.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 CDC 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

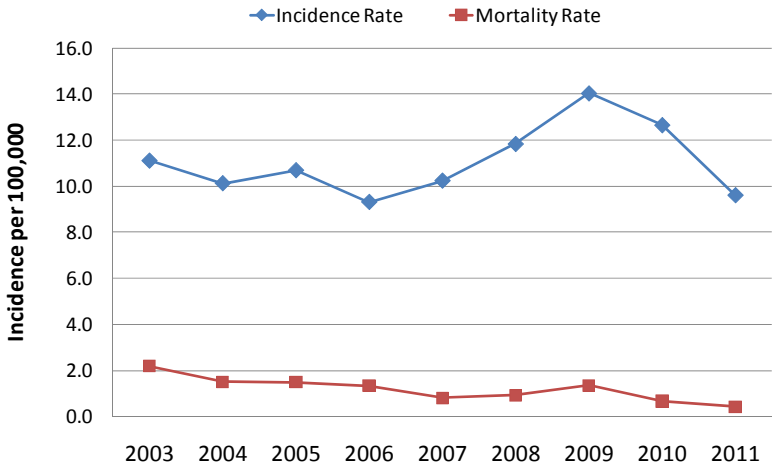
Descriptive Epidemiology

In 2011, 159 cases of IPD were reported in the tri-county Portland area, corresponding to an incidence rate of 9.6/100,000 persons (Figure 1). This is almost 17 percent lower than the average annual incidence rate in the Portland area from 2006–2010 (11.6/100,000), but 26 percent lower than the most recent national estimate of invasive disease (12.9/100,000).[1] Among these cases there were 7 deaths, for an annual mortality rate due to IPD of 0.4/100,000 (Figure 1). This is 60 percent lower than the 2006–2010 Portland area average annual mortality rate (1.0/100,000) and 69 percent lower than the most recent national estimate (1.3/100,000).[1]

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

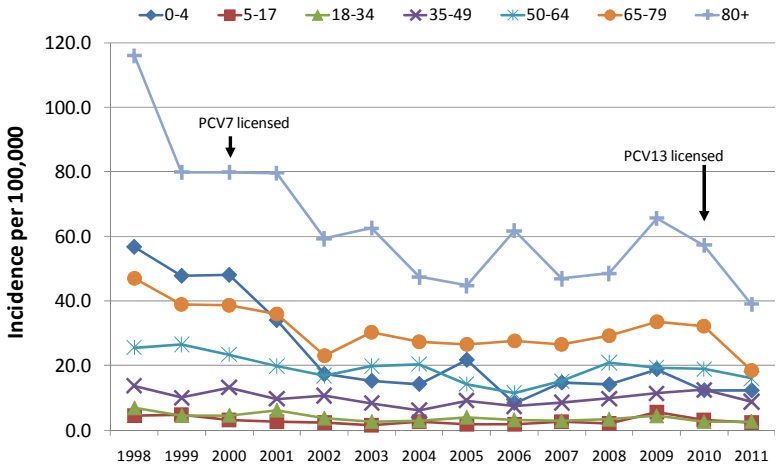
The mean and median ages of 2011 IPD cases were 54 and 56 years, respectively, while those of IPD deaths were 64 and 69 years, respectively. The 2011 case fatality rate for IPD in the Portland area was 4.4 percent, less than both the figures reported in the Portland area from 2006–2010 and the entire ABCs network in 2010.[1] Over half (52%) of the cases were male; of 118 cases where race was known, 92 percent were white, 5 percent were black, and 3 percent were another race; of 81 cases where ethnicity was known, 9 percent were Hispanic or Latino.

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



The 2011 incidence of IPD was highest in Multnomah county (12.5/100,000), followed by Clackamas (9.5/100,000), and Washington (5.6/100,000) counties. Compared with the previous five-year average, the 2011 incidence rates were lower in Clackamas, Multnomah, and Washington counties. In 2011, mortality due to IPD was highest in Clackamas county (1.1/100,000), followed by Multnomah (0.4/100,000). No deaths were reported in Washington county. Compared with the previous 5-year average, IPD mortality in 2011 was lower in all three counties.

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



In 2011, the burden of disease was highest in those ≥80 years of age (21 cases; incidence 39.0/100,000 persons), followed by those 65-79 years of age (25 cases; 18.5/100,000) and those 50-64 years of age (51 cases; 16.0/100,000) (Figure 2). Compared with the previous 5-year average, IPD incidence in 2011 was lower across all age groups. IPD mortality was also highest in 2011 in those > 65 years, with the highest incidence in those 65-79 years of age (3 deaths; 2.2/100,000), followed by those ≥80 years of age (1 death; 1.9/100,000) and 50-64 years of age (2 deaths; 0.63/100,000). There was one death reported in 2011 among individuals aged 0-34 years. Since 2003, four deaths due to IPD have been reported in this age group. We have not had a fatal case of IPD among children aged 0-4 since 2001.

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.

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

Syndrome	2011 (%)	2006-2010 (%)
Bacteremic pneumonia	79	78
Primary bacteremia	7	10
Meningitis	7	7
Other	7	6

† Some cases report more than 1 syndrome.

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 was less likely to be associated with mortality ($p=0.0008$), while bacteremia and meningitis were more likely to be associated with mortality ($p=0.0038$ and $p=0.0097$, respectively).

Underlying Conditions

Table 2 lists underlying conditions that were found in greater than 5 percent of IPD cases in the Portland metropolitan area during 2006–2011. Overall, 82 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, cancer, and immunosuppression were the most common conditions (each 10%).

Among adults, smoking ($p<0.0001$) decreased with increasing age, while cardiovascular disease ($p<0.0001$), cancer ($p<0.0001$), cerebrovascular accident (CVA) ($p<0.0001$), chronic obstructive pulmonary disease (COPD) ($p<0.0001$), diabetes ($p<0.0001$), and immunosuppression ($p=0.0261$) increased.

Table 2: Percent of IPD Cases† Reporting Underlying Conditions, 2006-2011

Condition	%
Smoking	29
Cardiovascular disease	20
COPD	18
Diabetes	18
Immunosuppression	17
Cancer	12
Asthma	10
Alcohol abuse	8
Nephrotic syndrome	7
Obesity	7
CVA (stroke)	6
None reported	18

† Some cases report more than 1 syndrome.

Serotype Analysis

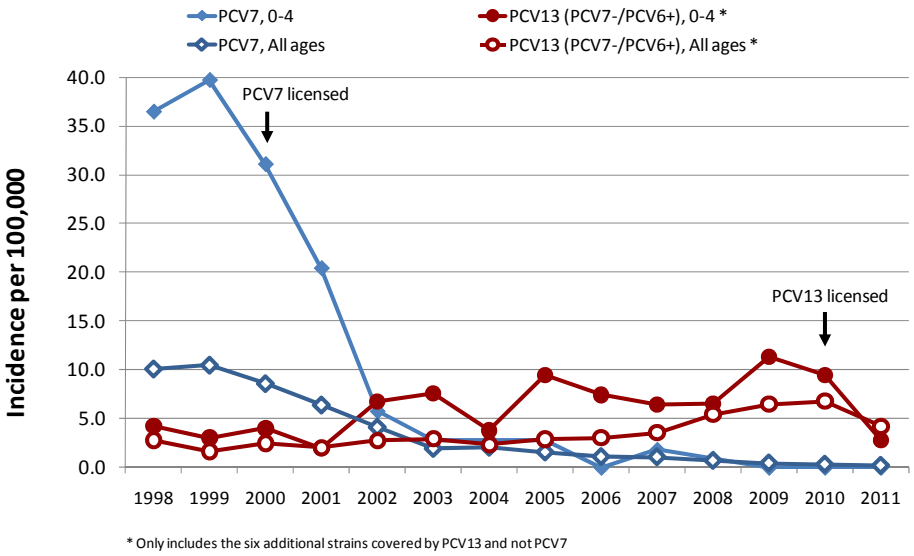
While rates of PCV7-type IPD declined dramatically following PCV7 introduction in 2000 (Figure 3), rates of IPD caused by some serotypes (3, 7F, 19A) not included in PCV7 increased since PCV7 introduction. Fortunately, a 13-valent pneumococcal conjugate vaccine (PCV13), which includes serotypes 3, 7F 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

In Oregon, almost half of the IPD cases in 2011 belonged to three serotypes not covered by PCV7: 3 (9%), 7F (29%), and 19A (8%). The most common 2011 serotypes in descending order were 7F, 22F (10%), 3, 19A, and 6C (7%). 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 2009, the incidence of PCV7 serotypes *decreased* 96 percent among all age groups and 100 percent among those 0–4 years of age. During this same time period, the incidence of IPD due to the six additional serotypes now covered by PCV13 *increased* 130 percent among all age groups and 160 percent among those 0–4 years. However, since the introduction of PCV13 in 2010, the incidence of IPD due to the six additional serotypes in PCV13 has *decreased* 38 percent among all ages and 71 percent among the youngest age group.

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

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 has provided a herd immunity effect for older adults. Data are insufficient to determine at this time whether use of PCV13 will contribute to decreases in the additional six serotypes in older age groups.

Antibiotic Susceptibility

In 2011, susceptibility testing was performed on 94 percent of the isolates (Table 4). At least 95 percent of the tested isolates were susceptible to amoxicillin, cefotaxime, ceftriaxone, cefuroxime, chloramphenicol, clindamycin, levofloxacin, linezolid, meropenem, synercid, and vancomycin.

Table 4: Antibiotic Susceptibility of IPD Isolates, 2011 (n=150)

Antibiotic	Susceptible (%)	Intermediate Resistance (%)	Full Resistance (%)
Levofloxacin	100		
Linezolid	100		
Synercid	100		
Vancomycin	100		
Ceftriaxone	99	1	
Chloramphenicol	99		1
Amoxicillin	97		3
Cefotaxime	97	3	
Cefuroxime	95		5
Clindamycin	95		5
Meropenem	95	1	4
Penicillin*	95	2	3
Tetracycline	94	1	5
Erythromycin	89	0	11
Penicillin†	89	6	5
Trimethoprim-sulfamethoxazole	87	7	6

* Based on 2011 CLSI (Clinical and Laboratory Standards Institute) breakpoints (**S** <=2; **I** =4 ; **R** >=8)

† Based on old breakpoints (**S**<=0.06; 0.12**<=I**<=1; **R** >=2)

Based on current CLSI (Clinical and Laboratory Standards Institute) breakpoints, five percent of the 2011 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, 2011

Serotype	Intermediate Resistance N (%)		Full Resistance N (%)	
	(n=9)†	(n=3)*	(n=7)†	(n=4)*
19A	3 (33)	3 (100)	5 (71)	2 (50)
16F	2 (22)			
23A	2 (22)			2 (50)
15A	1 (11)			
23B	1 (11)			
14			1 (14)	
35B			1 (14)	

* Based on 2011 CLSI (Clinical and Laboratory Standards Institute) breakpoints (**S** <=2; **I** =4 ; **R** >=8)

† Based on old breakpoints (**S**<=0.06; 0.12**<=I**<=1; **R** >=2)

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 declined dramatically following PCV7 introduction, rates of IPD caused by some serotypes (3, 7F, 19A) not included in PCV7 increased since PCV7 introduction. Fortunately, as was previously mentioned, a 13-valent pneumococcal conjugate vaccine, which includes serotypes 3, 7F, and 19A, was licensed by the FDA in February 2010. Since the introduction of PCV13 in 2010, the incidence of IPD due to the six additional serotypes in PCV13 has *decreased* 38 percent among all ages and 71 percent among the youngest age group.

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 the Portland metropolitan area.

References

1. Centers for Disease Control and Prevention. 2012. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, *Streptococcus pneumoniae*, 2010. Available via the Internet: http://www.cdc.gov/abcs/reports-findings/survreports/spneu10.pdf. Accessed 23 Jul 2012.
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.