Streptococcus pneumoniae Surveillance Report 2009

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 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 2009 estimated population of 1,631,665.* 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

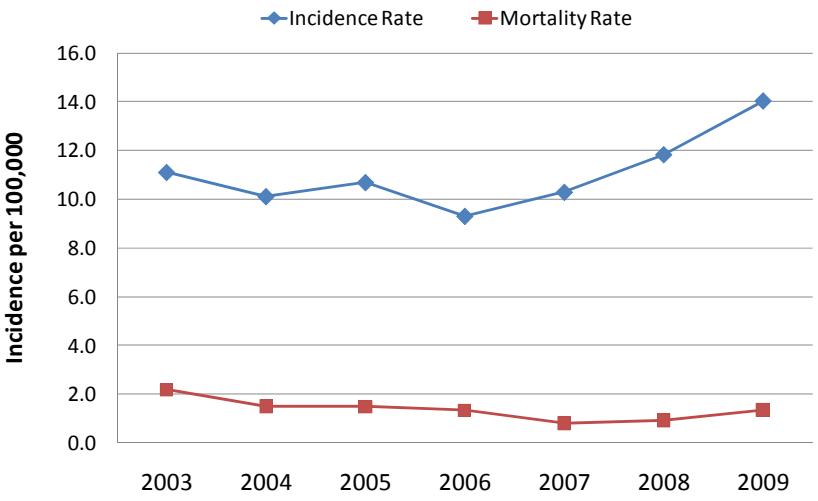
Descriptive Epidemiology

In 2009, 229 cases of IPD were reported in the tri-county Portland area, corresponding to an incidence rate of 14.0/100,000 persons (Figure 1). This is almost 33 percent higher than the average annual incidence rate in the Portland area from 2004–2008 (10.5/100,000), and almost equivalent to the 2009 national estimate of invasive disease (14.3/100,000).[1] Among these cases there were 22 deaths, for an annual mortality rate due to IPD of 1.4/100,000 (Figure 1). This is similar to the 2004–2008 Portland area average annual mortality rate (1.2/100,000) and the 2009 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 2009 IPD cases were 52 and 54 years, respectively, while those of IPD deaths were 67 and 68 years, respectively. The 2009 case fatality rate for IPD in the Portland area was 9.6 percent, less than both the figures reported in the Portland area from 2004–2008 and the entire ABCs network in 2009.[1] Over half (53%) of the cases were male; of 121 cases where race was known, 83 percent were white, 11 percent were black, and 6 percent were another race; and of 105 cases where ethnicity was known, 10 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.

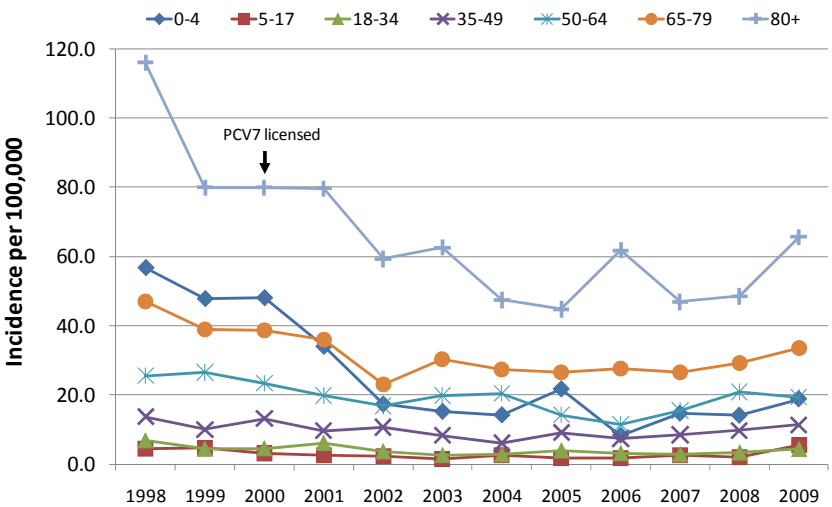
Figure 1: Incidence and Mortality Rates of IPD Cases in Tri-county Area



The 2009 incidence of IPD was highest in Multnomah county (17.5/100,000), followed by Clackamas (13.2/100,000), and Washington (9.9/100,000) counties. Compared with the previous five-year average, the 2009 incidence was 47 percent higher in Clackamas, 26 percent higher in Multnomah, and 50 percent higher in Washington counties. In 2009, mortality due to IPD was highest in Multnomah county (1.8/100,000), followed by Washington (1.1/100,000), and Clackamas (0.8/100,000) counties. Compared with the previous 5-year average, IPD mortality in 2009 was 11 percent lower in Clackamas, 6 percent higher in Multnomah, and 38 percent higher in Washington counties.

In 2009, the burden of disease was highest in those ≥80 years of age (33 cases; incidence 65.6/100,000 persons), followed by those 65-79 years of age (41 cases; 33.4/100,000) and those 50-64 years of age (60 cases; 19.4/100,000) (Figure 2). Compared with the previous 5-year average, IPD incidence in 2009 was higher across all age groups. However, the overall incidence in 2009 was still 33 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 2009 in those ≥80 years of age (6 deaths; 11.9/100,000), followed by those 65-79 years of age (6 deaths; 4.9/100,000). There was one death reported in 2009 among individuals aged 0-34 years and only two deaths due to IPD had been reported previously throughout the six-year surveillance period (2004-2009) in this age group. Increasing age did exhibit a significant, positive association with fatal outcome from IPD (p=0.0044).

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). Using a multivariate logistic regression model, we also found that age, and not any particular syndrome, was the best predictor of mortality.

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

Syndrome	2009 (%)	2004-2008 (%)
Bacteremic pneumonia	75	75
Primary bacteremia	15	12
Meningitis	5	9
Other	6	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 2004–2009. Overall, 83 percent of cases had at least one underlying condition, with the presence of any underlying conditions 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 (6%). Among adults, smoking (p<0.0001) and alcohol abuse (p=0.0285) 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, 2004-2009

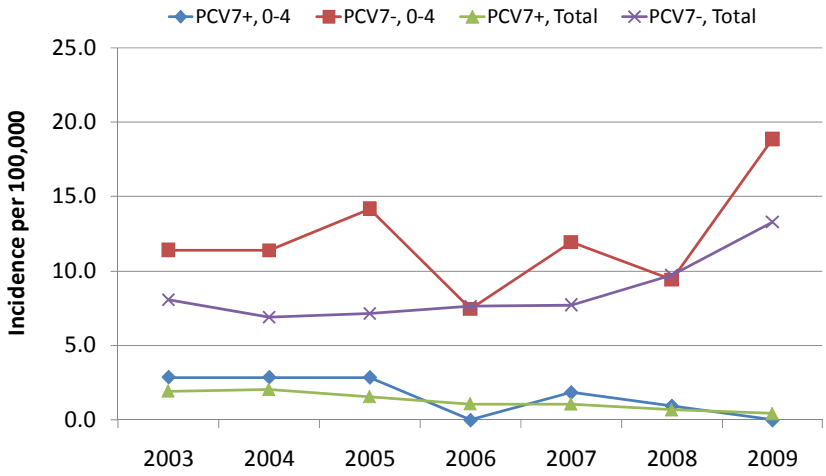
Condition	%
Smoking	28
Cardiovascular disease	20
COPD	17
Diabetes	17
Immunosuppression	17
Cancer	16
Alcohol abuse	9
Asthma	9
CVA (stroke)	6
None reported	17

† Some cases report more than 1 syndrome.

Serotype Analysis

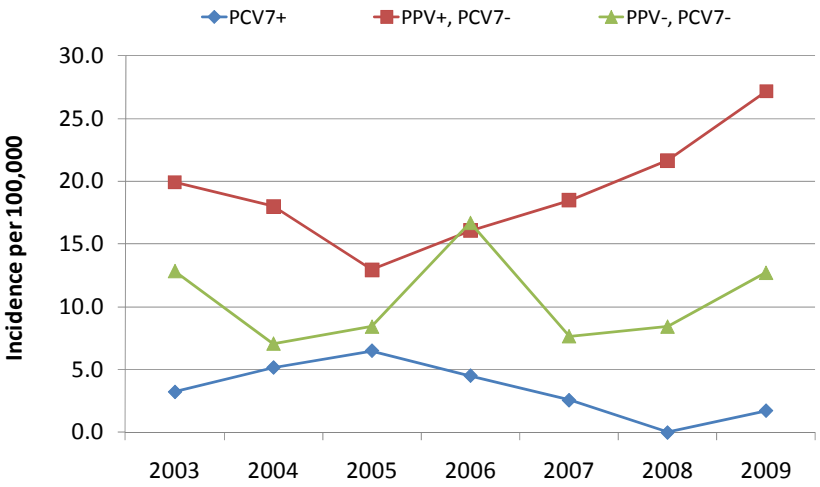
Figure 3 depicts the incidence of IPD due to strains of *S. pneumoniae* that are (PCV7+) and are not (PCV7-) included in the PCV7 among those 0-4 years of age and the overall population. From 2003-2009, the incidence of PCV7+ strains decreased among those 0-4 years of age. Overall, IPD incidence due to PCV7+ strains decreased 79 percent over this time period.

Figure 3: Incidence of PCV7+ and PCV7- Strains in Those 0-4 and Overall



The incidence of PCV7+ strains among those 65 or older has also decreased over the past six years (Figure 4). In 2009, there were only two cases of IPD due to PCV7+ strains in individuals 65 or older. However, the roughly stable IPD occurrence within this age group can be largely attributed to a sustained increase in incidence due to the 16 strains included in pneumococcal polysaccharide vaccine (PPV), but not PCV7 (PPV+/PCV7-). The finding that the incidence of PCV7+ strains has declined in the face of increased incidence of the remaining pneumococcal strains covered by the 23-valent PPV suggests that use of PCV7 in children provides a herd immunity effect for older adults.

Figure 4: Incidence of PPV+ and PPV- Strains in Those 65+



In Oregon, almost half of the IPD cases in 2009 were serotypes 3 (10%), 7F (27%) and 19A (9%). Since 2003, these three non-PCV7 vaccine serotypes have increased in incidence. Serotype 3 has increased 44 percent, from 0.9 to 1.3 cases per 100,000 in 2009; serotype 7F has increased six-fold, from 0.5 to 3.7 cases; and serotype 19A has increased 86 percent, from 0.7 to 1.3 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.

Antibiotic Susceptibility

In 2009, susceptibility testing was performed on 98 percent of the isolates (Table 3). At least 95 percent of the tested isolates were susceptible to amoxicillin, cefotaxime, ceftriaxone, chloramphenicol, clindamycin, linezolid, and vancomycin. Ninety-four percent of tested isolates were susceptible to meropenem and tetracycline, 92 percent to cefuroxime, 88 percent to erythromycin and trimethoprim-sulfamethoxazole (TMP/SULFA), and 86 percent to penicillin.

Table 3: Antibiotic Susceptibility of IPD Isolates, 2009 (n=224)

Antibiotic	Susceptible (%)	Intermediate Resistance n (%)	Full Resistance n (%)
Linezolid	100		
Vancomycin	100		
Ceftriaxone	98	1	1
Chloramphenicol	97		3
Cefotaxime	96	3	1
Clindamycin	96		4
Amoxicillin	95	1	4
Meropenem	94	2	4
Tetracycline	94	1	5
Cefuroxime	92		8
Erythromycin	88		12
Trimethoprim-sulfamethoxazole	88	5	7
Penicillin	86	8	6

Fourteen percent of the 2009 IPD isolates were resistant to penicillin. Of these, serotype 19A displayed the highest proportion of penicillin resistance (Table 4).

Table 4: Penicillin Resistance by Serotype, 2009

Serotype	Intermediate Resistance (n=18) N (%)	Full Resistance (n=13) N (%)
19A	8 (44)	9 (69)
23A	4 (22)	
6C	3 (17)	
35B		3 (23)
15A	2 (11)	
6B	1 (6)	
19F		1 (8)

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]

However, the higher than expected numbers of IPD cases in 2009 are coincident with increases in influenza-associated (H1N1) hospitalizations during the same time period. Influenza predisposes individuals to developing bacterial pneumonia, and the pneumococcus is historically one of the most common etiologies of this complication of influenza infection.

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 recently licensed by the FDA. 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 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 12 Jul 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.