Streptococcus pneumoniae Surveillance Report 2005

Oregon Active Bacterial Core Surveillance (ABCs)

Office of Disease Prevention & Epidemiology
Oregon Department of Human Services

Updated: March 2007

Background

Active Bacterial Core surveillance (ABCs) is a core component of the Emerging Infections Program (EIP) Network sponsored by the Centers for Disease Control and Prevention (CDC). The purpose of ABCs 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), and methicillin-resistant *Staphylococcus aureus* (MRSA). The entire EIP Network represents 29.7 million persons in 10 surveillance areas around the United States. More information on the EIP/ABCs Network is found at: http://www.cdc.gov/ncidod/dbmd/abcs.

In Oregon, the surveillance area for invasive pneumococcal disease (IPD) comprises the Tri-County (Clackamas, Multnomah, and Washington) Portland metropolitan area with a 2005 estimated population of 1,543,910. More information on the Oregon ABCs program is found at: http://oregon.gov/DHS/ph/acd/abc.shtml.

Methods

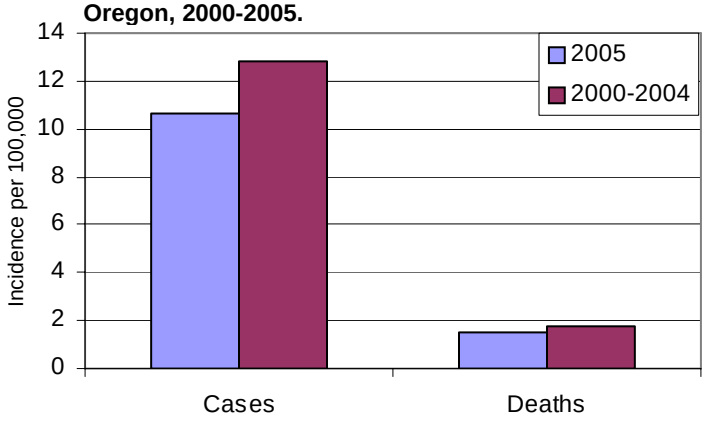
IPD is defined as the isolation of *S. pneumoniae* from a normally sterile body site in a Tri-County resident. Tri-County hospital laboratories submit *S. pneumoniae* isolates to the Oregon State Public Health Laboratory, which forwards them to a CDC-collaborative laboratory for serotyping and antimicrobial 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 conditions, and illness outcome.

Surveillance Results

Descriptive Epidemiology

In 2005, 165 cases of IPD were reported in the Tri-County Portland area, corresponding to an incidence rate of 10.7/100,000 persons (Figure 1). This is lower than the average annual incidence rate in the Portland area from 2000–2004 (12.8/100,000) and the 2005 national projection of invasive disease (13.7/100,000).[1] Of these cases, there were 23 deaths, for an annual mortality rate due to IPD of 1.5/100,000 (Figure 1). While lower than the 2000–2004 Portland area average annual mortality rate (1.8/100,000), this is in line with the 2005 national projections (1.5/100,000).[1] The mean and median ages of death due to IPD in 2005 were 70 and 68 years, respectively. The 2005 case fatality rate for IPD in the Portland area was 14%, the same as the 14% for the Portland area from 2000–2004 and higher than the 11% reported from the entire ABCs network in 2005.[1] Of 151 cases where sex was known, 54% were male; of 80 cases

Figure 1: Incidence of IPD Cases and Deaths in Oregon, 2000-2005.



where race was known, 86% were white, 13% were black, and 1% were another race; and of 44 cases where ethnicity was known, 16% were Hispanic or Latino.

As seen in Figure 2, the incidence rate of IPD in Multnomah County in 2005 (15.0/100,000) was higher than that reported from either Clackamas (7.5/100,000) or Washington (6.1/100,000) Counties. This is similar to the historical pattern throughout the Portland area from 2000-2004. However, the 2005 incidence rate in all three counties was lower than the previous 5-year average. In 2005, the mortality rate due to IPD was highest in Multnomah County (2.7/100,000), followed by Washington (0.8/100,000), and Clackamas (0/100,000). The mortality rate from 2000-2004 was 1.4/100,000 in Clackamas, 2.3/100,000 in Multnomah, and 1.3/100,000 in Washington County.

Figure 2: Incidence of IPD by County, 2000-2005.

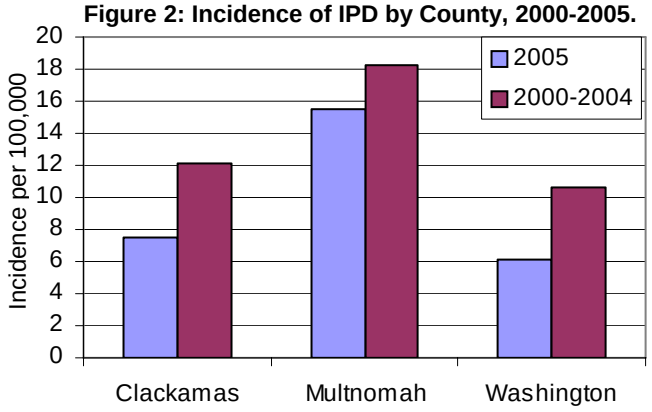
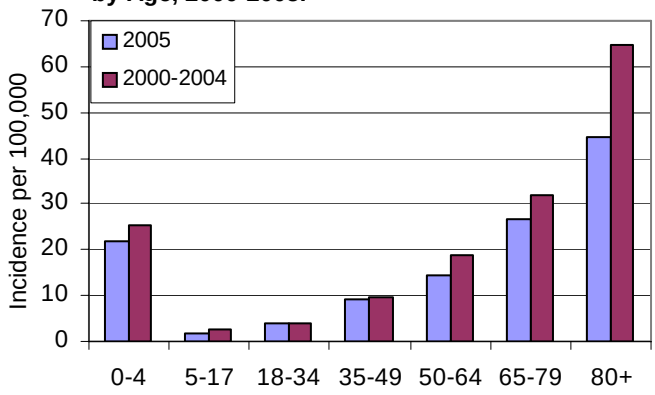


Figure 3: Incidence of IPD in the Portland Area by Age, 2000-2005.



The burden of disease was highest in those ≥80 years of age (22 cases; incidence of 44.7/100,000 persons), followed by those 65-79 four years of age (28 cases; incidence of 26.6/100,000) and those 0-4 years of age (23 cases; incidence of 21.7/100,000) (Figure 3). Since 2000, the incidence of IPD has declined across all age groups. The most dramatic of these declines occurred in those 0-4 years of age, with a 55% decrease in incidence since 2000 (incidence 48.1/100,000) followed by those 80 years of age and older (incidence 80.0/100,000; 44% decrease).

In 2005, IPD mortality was also highest in those ≥80 years of age (16.3/100,000), followed by those 65-79 years of age (4.8/100,000). There were zero deaths among individuals from 0-34 years of age. Increasing age did exhibit a significant, positive association with fatal outcome from IPD ($p<0.0001$). While the mortality rate due to IPD was lower in all age groups in 2005 than the previous 5-year average, no appreciable trends in the mortality rate have been seen 2000. Rather, those seen in 2005 follow a historical pattern of year-to-year variability.

Clinical Manifestations

The clinical syndromes reported for IPD cases are found in Table 1. In 2005, pneumonia was reported less frequently than the previous 5-year average. Additionally, since 2000, meningitis has shown a significantly increasing trend ($p=0.0162$). Bacteremia, meningitis, and

Table 1: Percent of IPD Reporting Clinical Syndromes.

Syndrome	2005	2000-2004	p-value
Pneumonia	67	74	**0.038**
Primary Bacteremia	19	14	0.081
Meningitis	10	7	0.154
Other Syndrome	4	6	0.244

other invasive syndrome are less common with increasing age (p<0.0001 for each) while pneumonia becomes more common (p<0.0001).

Figure 4a: Incidence of Clinical Syndromes Among Those 0-4 Years of Age, 2000-2005.

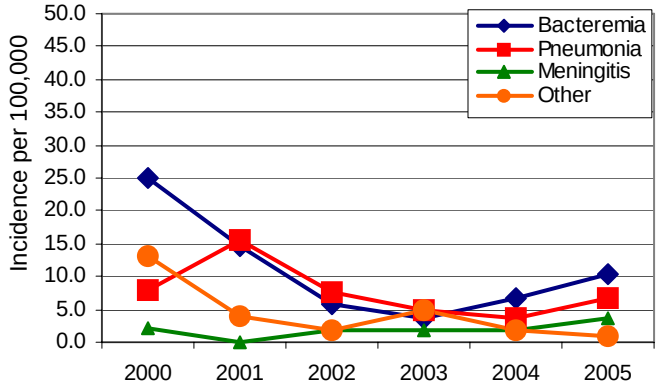
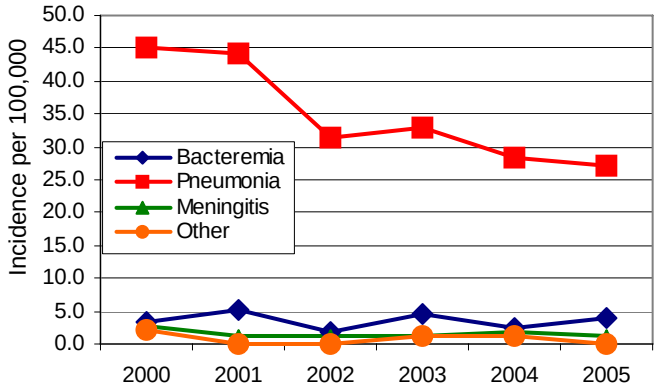


Figure 4b: Incidence of Clinical Syndromes Among Those 65+ Years of Age, 2000-2005.



Among those under 5 years of age, bacteremia was the most common clinical syndrome associated with IPD reported in 2005 (Figure 4a). From 2000-2003, the incidence of bacteremia in this age group declined 85%, from 25.0 to 3.8 per 100,000, at which point it was the third most common syndrome reported. However, since this time, it has increased to 10.4 per 100,000. The incidence rates of other reported syndromes have declined 93% during 2000-2005 in this age group, from 13.0 to 0.9 per 100,000. The incidence of pneumonia and meningitis have remained relatively stable over this time period, albeit more variable between years.

Among those 65 years of age and older, pneumonia is – and has been – the major clinical presentation of IPD (Figure 4b). However, the incidence of pneumonia in this age group has substantially decreased, from 45.0/100,000 (97% of all cases in this age group) in 2000 to 27.2/100,000 (68%) in 2005.

Clinical syndromes were further analyzed with regard to severity of disease, as measured by fatal outcome. In a multivariate, logistic regression model controlling for age, compared with other invasive syndrome, a fatal outcome was 2.3 times more likely (95% confidence interval [CI] 1.1, 4.7) with meningitis and 2.2 times (95% CI 1.03, 4.9) more likely with bacteremia. No difference in fatal outcome was seen between pneumonia and other invasive syndrome.

Underlying Conditions

Table 2 lists underlying conditions that were reported in greater than 5% of IPD cases in the Portland area during 2000–2005. With the exception of asthma, which was reported in 8% of cases among those 5-17 years of age, the frequency of underlying conditions in those less than 18 was low. Among adults, smoking (p<0.0001), alcohol abuse (p=0.0001), and asthma (p=0.0306) decreased with increasing age, while cardiovascular disease (p<0.0001), cancer (p<0.0001), chronic obstructive pulmonary disease (COPD) (p<0.0001), and diabetes (p<0.0001) increased with increasing age.

Table 2: Percent of IPD Cases with Reported Underlying Conditions.

	Percent
Cardiovascular Disease	27
Smoking	24
Cancer	17
COPD	16
Diabetes	14
Alcohol Abuse	11
Immunosuppression	10
Asthma	8

Table 3: Age-Adjusted Significant Positive Associations between Underlying Conditions and Syndrome or Death.

	aOR	95% CI
Pneumonia		
Smoking	2.4	(1.6, 3.5)
COPD	2.3	(1.5, 3.8)
Asthma	2.6	(1.5, 4.5)
Bacteremia		
Cancer	3.2	(2.1, 4.7)
Fatal Outcome		
Cardiovascular Disease	1.8	(1.3, 2.5)
Alcohol Abuse	2.6	(1.8, 3.8)

Table 3 lists significant, positive associations between underlying conditions and reported IPD clinical syndromes and fatal outcome of disease, adjusting for age. Pneumonia is positively associated with conditions affecting the lung (smoking, COPD, and asthma), while bacteremia is associated with cancer. Cardiovascular disease, while not associated with a particular clinical manifestation of disease, is associated with IPD mortality.

Serotype Analysis

Figure 5 depicts the incidence of IPD due to strains of *S. pneumoniae* that are (PCV+) and are not (PCV-) included in the pneumococcal conjugate vaccine (PCV) among those 0-4 years of age and the overall population. From 2000-2005, the incidence of PCV+ strains decreased 91% from 31.0 to 2.8 per 100,000 among those 0-4 years of age. This helped drive an 81% decrease in PCV+ strain incidence overall, while the percentage of IPD cases due to PCV+ strains declined from 57% in 2000 to 18% in 2005. Over the same time period, the incidence of IPD due to PCV- strains has stayed constant across all age groups.

Figure 5: Incidence of PCV+ and PCV- Strains in Those 0-4, 65+, and Overall, by Year.

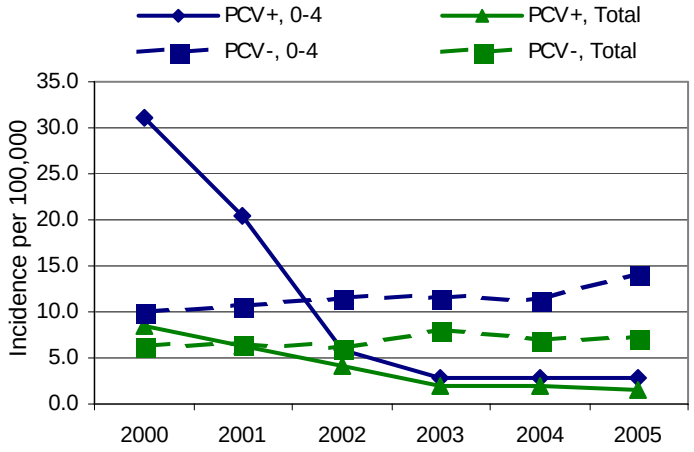
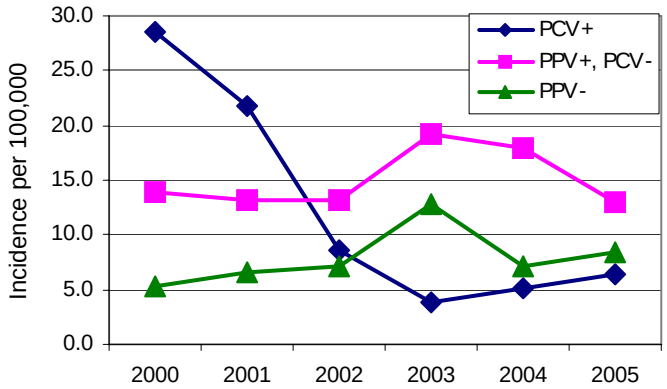


Figure 6: Incidence of PPV+ and PPV- Strains in Those 65+, by Year.

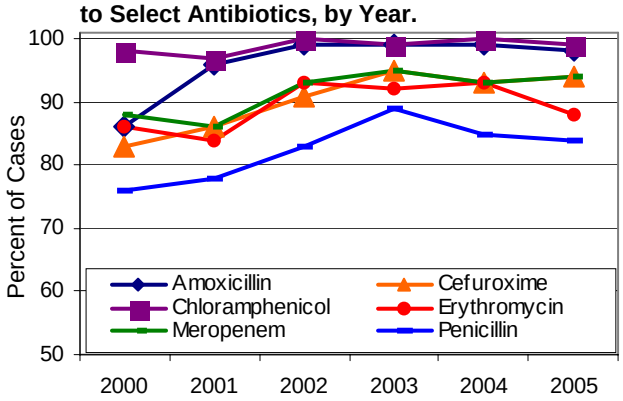


Incidences of IPD among those over 64 are shown in Figure 6. Since 2000, there has been a 54% decrease in strains included in the pneumococcal polysaccharide vaccine (PPV+), from 42.3 to 19.4 per 100,000. However, this decrease seems to correlate with the use of PCV in children, rather than the use of PPV among this population. From 2000 – 2005, the incidence of PCV+ strains declined 77% from 28.4 to 6.5 per 100,000 among those 65 years and older. During this same period, the incidence of the 16 strains included in PPV, but not PCV, as well as those not included in the polysaccharide vaccine (PPV-) remained relatively constant outside of brief peaks in incidence.

Antibiotic susceptibility

The susceptibilities of isolates to select antibiotics recommended for treatment of IPD are shown in Figure 7. Susceptibilities for all antibiotics increased from 2000-2002. Since that time, susceptibility to amoxicillin, cefuroxime, chloramphenicol, and meropenem has stayed relatively constant. After peaking in 2003, susceptibility to penicillin has begun to decline, while a decrease in susceptibility to erythromycin appeared after 2004. In 2005, the reported susceptibilities were: amoxicillin (98%), cefuroxime (94%), chloramphenicol (99%), erythromycin (88%), meropenem (94%), and penicillin (84%). Additionally, 99% of isolates were susceptible to rifampin – recommended only for meningitis – and 94% were susceptible to clindamycin – recommended only for non-meningeal infections. From 2000-2005, 100% of isolates were susceptible to linezolid and vancomycin. Non-susceptibility to any antibiotic is not significantly associated with a fatal outcome from IPD from 2000-2005.

Figure 7: Percent of IPD Cases Susceptible to Select Antibiotics, by Year.



Discussion

In March 2000, PCV was licensed for use and is currently recommended for all children 1-23 months of age as well as children from 24 to 59 months of age who are at high risk for invasive pneumococcal infection.[2] PCV has been found to be efficacious at protecting against IPD (meningitis, bacteremia, and pneumonia) and acute otitis media, although the latter is not assessed through this surveillance project.[2] Correlating with licensure and use of PCV in Oregon, the epidemiologic profile of IPD has changed dramatically, in ways that have mirrored national trends.[3] First, while the effect is most pronounced among the age group targeted for vaccination, the use of PCV has benefited all age groups, in terms of reduced incidence of IPD. Consequently, the 2005 rates of IPD have already fallen below the Healthy People 2010 Objectives of 46/100,000 in those less than 5 and 42/100,000 in those over 64.[1] Second, while the incidence of bacteremia and pneumonia have decreased, the incidence of meningitis has stayed relatively constant, thereby comprising a larger percentage of IPD cases. Third, the overall decrease in IPD incidence is due to a decrease in strains included in PCV, while that due to non-vaccine strains has stayed constant.

The profile of IPD in Oregon is also consistent with previous studies, which have demonstrated that all of the underlying conditions reported frequently among cases are recognized risk factors for invasive disease.[4-6] However, as assessment of the strength of these risk factors in causing IPD in Oregon is limited by the nature of surveillance.

The decline in penicillin resistance in the initial years after introduction of PCV in 2000 was attributed to use of PCV, which covers the 7 serotypes that accounted for the majority of cases of IPD in the pre-vaccine era. These 7 serotypes were also more likely to be resistant to antibiotics than the non-vaccine serotypes, so declines in the incidence of these serotypes explain the concomitant decrease in resistance. However, we have seen increases in antibiotic resistance in the last few years, both in Oregon and nationally, due to the emergence of resistance in a few serotypes not covered by the vaccine. These data continue to emphasize the judicious use of antibiotics within the health care setting. Further, research and information will be necessary to determine if these surveillance data represent the beginning of a new trend in drug-resistant *S. pneumoniae* infections.

References:

1. Centers for Disease Control and Prevention. 2006. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, *Streptococcus pneumoniae*, 2005-*provisional.* Available at http://www.cdc.gov/ncidod/dbmd/abcs/survreports/spneu05.pdf.
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.
4. Lipsky BA, Boyko EJ, Inui TS, Koepsell TD. Risk factors for acquiring pneumococcal infections. *Arch Int Med*. 1986; 146(11):2179-85.
5. Levine OS, Farley M, Harrison LH et al. Risk factors for invasive pneumococcal disease in children: a population-based case-control study in North America. *Pediatrics*. 1999; 103: E28.
6. Talbot TR, Hartert TV, Mitchel E. Asthma as a Risk Factor for Invasive Pneumococcal Disease. *N Engl J Med*. 2005;352:2082-90.