Neisseria meningitidis Surveillance Report 2010

Oregon Active Bacterial Core Surveillance (ABCs)

Office of Disease Prevention & Epidemiology
Oregon Health Authority

Updated: August 2011

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 *N. meningitidis* disease represents almost 42 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 invasive *N. meningitidis* disease comprises the entire state, with a 2010 estimated population of 3,844,195.* More information on the Oregon ABCs program is found at: http://public.health.oregon.gov/DiseasesConditions/CommunicableDisease/Pages/abc.aspx.

Methods

Invasive meningococcal disease (IMD) is defined as the isolation of *N. meningitidis* from a normally sterile body site in a resident of Oregon. Since IMD is reportable in Oregon, hospital laboratories submit sterile site *N. meningitidis* microbiology isolates to the Oregon State Public Health Laboratory for serogrouping. Isolates are forwarded to a CDC laboratory for further testing. Additional cases are identified through regular laboratory record reviews. Health record reviews of each case provide standardized reports of demographic characteristics, clinical syndrome manifestations, underlying illnesses or conditions, and illness outcome.

Surveillance Results

Descriptive Epidemiology

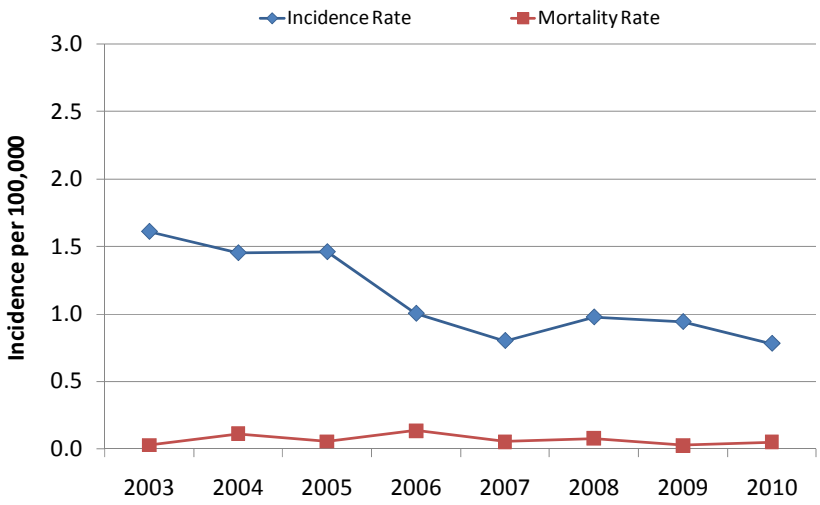
In 2010, 30 cases of IMD were reported in Oregon, corresponding to an incidence rate of 0.78 per 100,000 persons. This is lower than the average annual incidence rate in Oregon from 2005-2009 (1.0/100,000) and continues the overall trend of decreasing incidence seen over recent years (Figure 1). However, IMD incidence in Oregon was still higher than the most recent national estimate (0.28/100,000), but lower than the Healthy People 2010 goal for IMD (1.0/100,000).[1] Oregon's historically high rate of meningococcal disease was driven by a localized epidemic of serogroup B IMD that began in the early nineties and peaked in 1994 (3.4/100,000).[2] The incidence of serogroup B IMD has since then declined steadily, but B remains the most commonly

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

identified serogroup in Oregon, accounting for about half of our cases in recent years. The estimate for serogroup B disease is 0.09 per 100,000 cases for all ABCs areas excluding Oregon, 69 percent lower than the Oregon-specific rate for serogroup B IMD (0.29 per 100,000).[1]

There were two IMD deaths in 2010, for an annual mortality rate of 0.05/100,000 (Figure 1). This is lower than the average annual mortality rate in Oregon of 0.07/100,000 from 2005-2009, and similar to the national projections (0.04/100,000).[1]

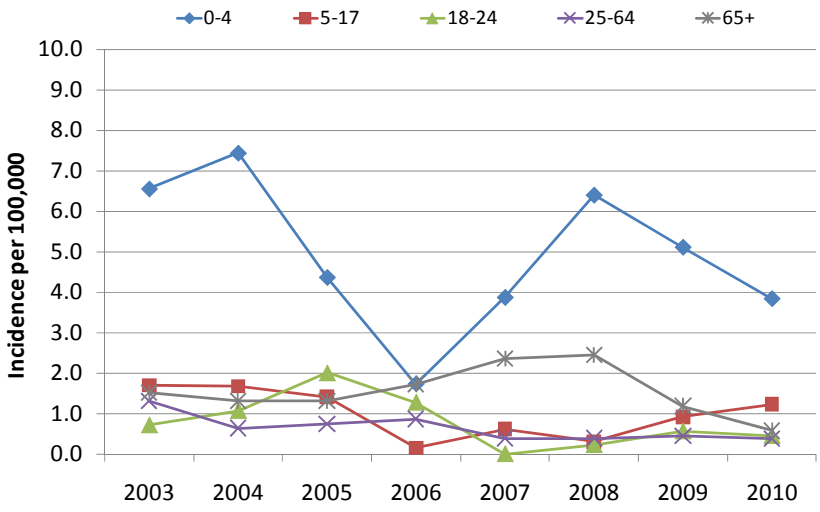
Figure 1: Incidence and Mortality Rates of IMD Cases in Oregon



The 2010 case fatality rate for IMD in Oregon was 7 percent, comparable to the 8 percent reported for Oregon from 2005-2009 and lower than the national projections (13%).[1]

Seventy percent of cases were male; of 24 cases for which race was known, 88 percent were white, 13 percent were black (n=3); and of 25 cases where ethnicity was known, 16 percent were Hispanic or Latino.

Figure 2: Incidence of IMD Cases in Oregon by Age



As depicted in figure 2, the burden of IMD is typically highest in the very young (those 0-4 years of age), with a second, lower peak in incidence in young adults. Among those 65 and older, 2010 IMD incidence (0.60/100,000) and mortality (0.20/100,000) were lower than the respective 5-year averages (1.8/100,000 and 0.43/100,000). For cases reported since 2005, fatal outcome from IMD is significantly associated with increasing age ($p<0.0001$).

Clinical Manifestations

As is typical, the top two clinical manifestations of invasive meningococcal disease in 2010 were primary bacteremia and meningitis; together, they accounted for 80 percent of cases (Table 1). Although the overall clinical profile of IMD in 2010 was not significantly different compared to the profile for the previous five years, the proportion of IMD cases with meningitis significantly decreased since 2005 (p=0.0202). No clinical syndrome was associated with an increased risk of a fatal outcome.

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

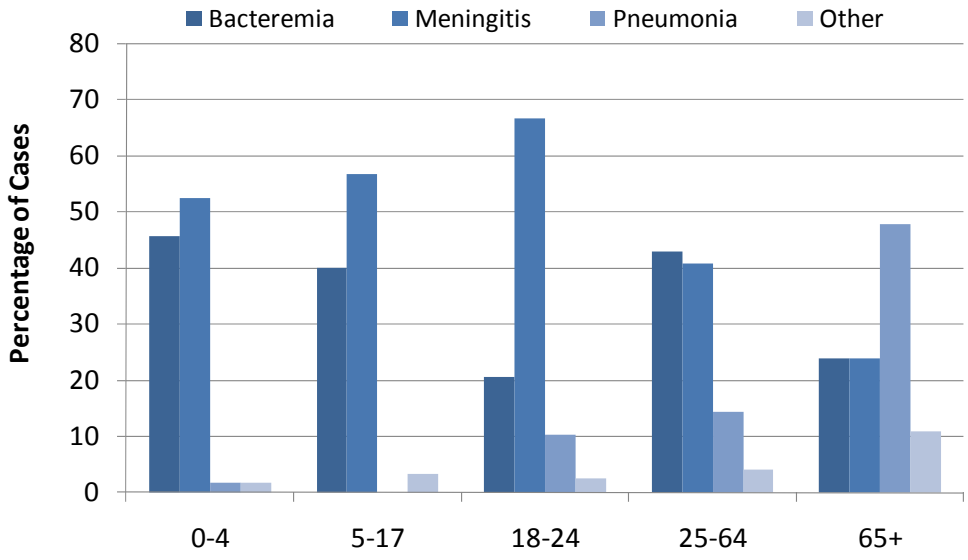
Syndrome	2010	2005-2009
Bacteremia	43	34
Meningitis	37	49
Pneumonia	17	15
Other††	7	4

† Some cases report more than 1 syndrome.

†† Other syndrome includes cellulitis, endometritis, epiglottitis, peritonitis, septic abortion, septic arthritis, and sterile abscess.

The clinical presentation of IMD varies according to age (Figure 3). From 2005-2010, meningitis was most common among all age groups under 25 years of age, while bacteremia was most common among those between 25 and 64 years, and pneumonia was most common among those 65 and over. The association between age and clinical manifestation is statistically significant, with meningitis decreasing with increasing age, p=0.0006, and pneumonia increasing, p<0.0001.

Figure 3: Clinical Manifestation of IMD in Oregon by Age 2005-2010



Underlying Conditions

Table 2 lists underlying conditions that are known risk factors for invasive meningococcal disease or were noted frequently among adult IMD cases in Oregon from 2005-2010. Half (50%) of all cases had no underlying conditions noted in the medical record, although this is not uniform across the age spectrum: 76 percent of children less than 18 years of age had no underlying conditions versus 32 percent of adults ($p<0.0001$). Only 28 percent of those 65 years and older did not have underlying conditions.

Table 2: Underlying Conditions Reported Among Adult IMD Cases

Underlying Condition	2010 only (n=13) N (%)	2005-2010 (n=134) N (%)
Smoking	6 (46)	36 (27)
Cardiovascular disease	2 (15)	18 (13)
Diabetes	1 (8)	12 (9)
COPD	2 (15)	10 (7)
Immunosuppression	1 (8)	8 (6)
Asthma	1 (8)	7 (5)
Cancer	1 (8)	4 (3)
None	1 (8)	43 (32)

Underlying conditions were further analyzed with regard to fatal outcome and clinical manifestation of IMD. Although diabetes was the only condition associated with a fatal outcome ($p=0.0363$), the association failed to remain significant after adjusting for age.

Only asthma ($p=0.0006$) and COPD ($p=0.0107$) were significantly associated with pneumonia after controlling for age. No underlying conditions were related to bacteremia or meningitis.

Serogroup Analysis

In 2010, the serogroups of *N. meningitidis* causing invasive disease were determined for 93% of all cases (n=28). Of these, serogroup B comprised 39 percent; serogroup C, 21 percent; serogroup W-135, 11 percent; and serogroup Y, 25 percent. Historically in Oregon, serogroup B has been the predominant serogroup causing IMD.

While the serogroup profile of cases reported in 2010 was not significantly different than that for cases reported during the previous five years, a statistically significant decreasing trend in the proportion of cases due to serogroup B ($p<0.0001$) and an increasing trend in the proportion of cases due to serogroups W-135 and Y ($p<0.0001$ and $p<0.0001$, respectively) have been observed. Changes in serogroup distribution since 2003 can be observed in figure 4.

Figure 4: Serogroup of *N. meningitidis* Causing Invasive Disease in Oregon, 2003-2010

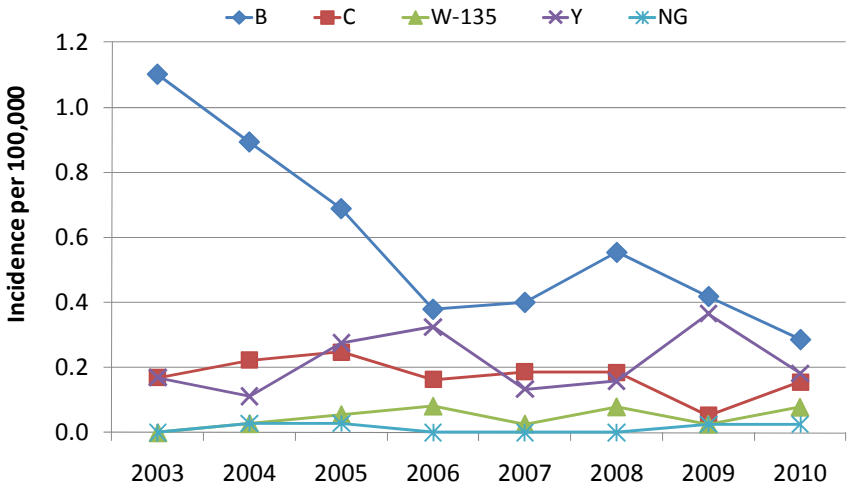
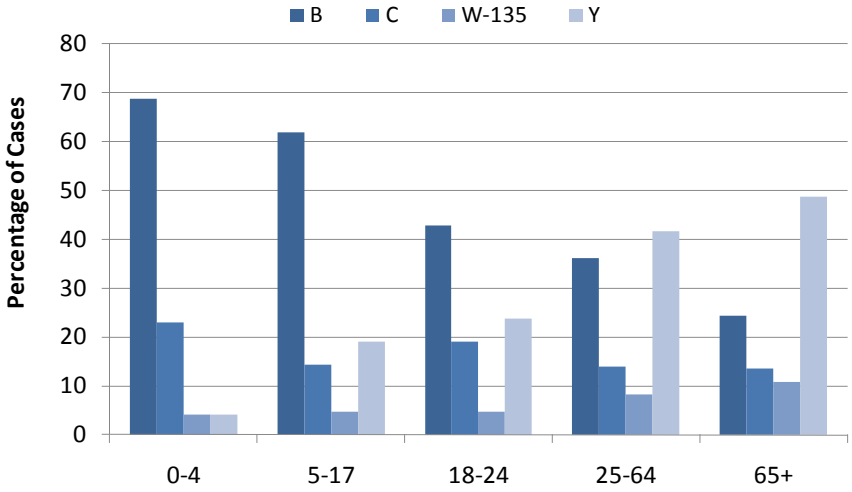


Figure 5: Serogroup of N. meningitidis Causing Invasive Disease in Oregon by Age Group, 2006-2010



During the five-year period from 2006-2010, serogroup B was the most commonly identified serogroup among those 0-4 years of age (69%), while serogroups W-135 and Y were the least common (4%) in this age group (Figure 5). Among those 65 years of age and older, serogroup Y was the most commonly identified group (49%).

After controlling for age, the only serogroup significantly associated with a fatal outcome among cases of IMD was serogroup W-135 ($p=0.0036$). Among clinical manifestations, serogroups B and C were negatively associated with pneumonia ($p<0.0001$ and $p=0.0154$, respectively) and serogroup C was positively associated with bacteremia ($p=0.0364$).

Antimicrobial Susceptibility

Although clinically significant antimicrobial resistance (AMR) in *N. meningitidis* has historically been low[3], the recent detection of ciprofloxacin-resistant *N. meningitidis* in the US[4] has led to routine antimicrobial susceptibility testing of ABCs isolates submitted to the CDC Meningitis Laboratory.

Antimicrobial results from CDC were available for 108 isolates cultured in 2004, 2008 and 2010 (Table 3). The majority of these isolates were susceptible to the antibiotics tested. However, a subset of isolates exhibited intermediate antibiotic resistance to ampicillin, penicillin and rifampin. Although the proportion of isolates with some level of resistance to penicillin has increased over time, the association cannot be statistically tested due to insufficient sample size.

Table 3: Antimicrobial Susceptibility of IMD Isolates†

Antibiotic	2004 N=46 (88% of isolates tested)			2008 N=37 (100% of isolates tested)			2010 N=25 (83% of isolates tested)		
	S	I	R	S	I	R	S	I	R
Ampicillin	NT	NT	NT	NT	NT	NT	84	16	
Azithromycin	100			100			100		
Cefotaxime	NT	NT	NT	NT	NT	NT	100		
Ceftriaxone	100			100			100		
Chloramphenicol	NT	NT	NT	NT	NT	NT	100		
Ciprofloxacin	100			100			100		
Meropenem	NT	NT	NT	NT	NT	NT	100		
Penicillin	96	4		92	8		88	12	
Rifampin	100			97	3		100		

† Abbreviations: NT=not tested; S=susceptible; I=intermediate resistance; R=full resistance

Discussion

Oregon's highest recorded rate of meningococcal disease – 3.4 cases per 100,000 in 1994 – was driven by a clonal epidemic of serogroup B disease that began in 1993 and lasted for several years. In 2010, 30 cases of IMD were reported in the state, corresponding to an incidence rate of 0.78 cases per 100,000. This reflects a 77 percent decrease in incidence since the peak in 1994. As serogroup B disease continues to decrease, the profile of IMD serogroup distribution is becoming more similar to the national profile.

Although the burden of IMD in 2010 was highest in the very young followed by young adults, during the last few years the incidence of IMD was highest among the 0-4 year olds followed by those over the age of 65. We are currently participating in an extensive retrospective chart review of IMD cases among those 65 years of age or older to better understand the burden of disease within this age group.

The changing epidemiology of *Neisseria meningitidis* in Oregon has major implications for the prevention of IMD. The Advisory Committee on Immunization Practices (ACIP) recommends

routine vaccination with the quadrivalent (antigens from serogroups A, C, Y, and W-135) meningococcal conjugate vaccine (MCV4) for all persons 11–18 years of age and for persons 2–55 years of age who are at increased risk for the disease. On October 27, 2010, the ACIP approved updated recommendations: 1) routine vaccination of adolescents, preferably at age 11 or 12 years, with a booster dose at age 16 years, and 2) a 2-dose primary series administered 2 months apart for persons aged 2 through 54 years with persistent complement component deficiency and functional or anatomic asplenia, and for adolescents with human immunodeficiency virus (HIV) infection.[5]

References

1. Centers for Disease Control and Prevention. 2010. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, *Neisseria meningitidis*, 2009. Available via the Internet: www.cdc.gov/abcs/reports-findings/survreports/mening09.pdf. Accessed 16 Aug 2011.
2. Diermayer M, Hedberg K, Hoesly F, et al. Epidemic Serogroup B Meningococcal Disease in Oregon: The Evolving Epidemiology of the ET-5 Strain. *JAMA*. 1999;281:1493-7.
3. Rosenstein NE, Stocker SA, Popovic T, Tenover FC, Perkins BA. Antimicrobial resistance of *Neisseria meningitidis* in the United States, 1997. The Active Bacterial Core Surveillance (ABCs) Team. Clin Infect Dis 2000 Jan;30(1):212-3.
4. Wu HM, Harcourt BH, Hatcher CP, et al. Emergence of ciprofloxacin-resistant *Neisseria meningitidis* in North America. N Engl J Med 2009 Feb 26;360(9):886-92.
5. Centers for Disease Control and Prevention. Updated Recommendations for Use of meningococcal Conjugate Vaccines - Advisory Committee on Immunization Practices (ACIP), 2010. MMWR 2011 Jan 28; 60(03);72-6. Available via the Internet: http://www.cdc.gov/mmwr/pdf/wk/mm6003.pdf. Accessed 17 Aug 2011.