

# ***Neisseria meningitidis* Surveillance Report 2014**

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 *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 2013 estimated population of 3,919,019.\* More information on the Oregon ABCs program is found at:

<http://public.health.oregon.gov/DiseasesConditions/CommunicableDisease/EmergingInfections/Pages/ActiveBacterialCoreSurveillance.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 2014, 15 cases of IMD were reported in Oregon, corresponding to an incidence rate of 0.38 per 100,000 persons. This is 55% lower than the average annual incidence rate in Oregon from 2008-2013 (0.85/100,000) and continues the overall trend of decreasing incidence seen over recent years (Figure 1). However, IMD incidence in Oregon was still higher than both the most recent national estimate (0.14/100,000) and the Healthy People 2020 goal for IMD (0.30/100,000).<sup>1</sup> 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).<sup>2</sup> The incidence of serogroup B IMD has since then



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

declined steadily, accounting for only twenty percent of our cases in 2014. The estimated incidence of serogroup B disease is 0.04 per 100,000 cases for all ABCs areas excluding Oregon, 48 percent lower than the Oregon-specific rate for serogroup B IMD (0.08 per 100,000).<sup>1</sup>

There was one IMD death in 2014, for an annual mortality rate of 0.03/100,000 (Figure 1). This is 51% lower higher than the average annual mortality rate in Oregon of 0.05/100,000 from 2009-2013, but 28% higher than the national projections (0.02/100,000).<sup>1</sup>

The 2014 case fatality rate (6.7%) for IMD in Oregon was 29 percent lower than the 9.4% percent reported for Oregon from 2009-2013 and 60% lower than the national projections (17%).<sup>1</sup>

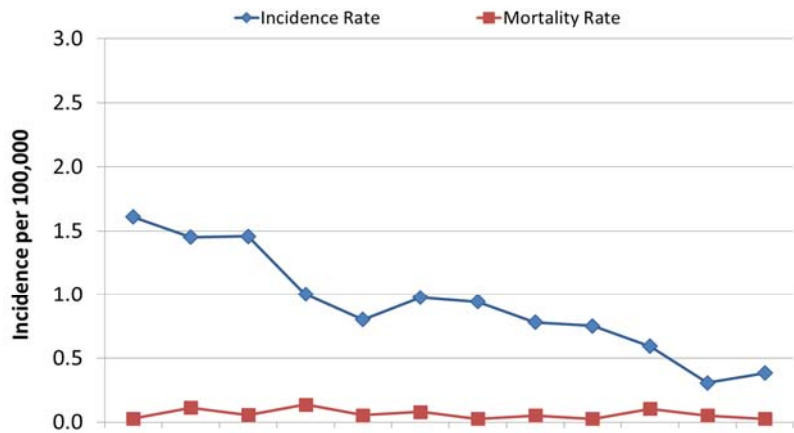
Sixty-seven percent of cases were female. Race and ethnicity were obtained on 100% of cases;, 93 percent were whiteand 7 percent (n=1) were American Indian/Alaska Native. Twenty-seven percent were Hispanic or Latino.

As depicted in Figure 2, the burden of IMD is typically highest in the very young (those 0-4 years of age). We observe a second, lower peak in incidence in young adults. Among those 65 and older, 2014 IMD incidence (0.66/100,000) and mortality (0.00/100,000) were lower than the respective 5-year averages (1.53/100,000 and 0.04/100,000). The previous 5-year mortality average among 0-4 year olds was 0.34/100,000. In 2014, Oregon saw a 24% increase in mortality (0.42/100,000) among this age group (1 death).

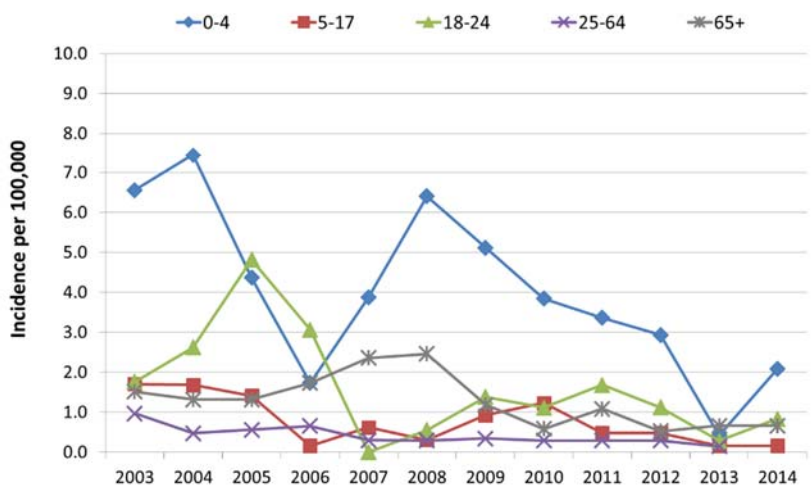
**Clinical Manifestations**

As is typical, the top two clinical manifestations of invasive meningococcal disease in 2014 were primary bacteremia and meningitis (Table 1). Meningitis, however, was the most common syndrome in 2014, which is unusual compared to the previous 5-year periodMeningitis was also the only clinical syndrome that was associated with an increased risk of a fatal outcome (OR 3.9, CI 1.008-15.7).

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



**Figure 2: Incidence of IMD Cases in Oregon by Age**



**Table 1: Percent of IMD Cases<sup>†</sup> Reporting Common Clinical Syndromes**

Syndrome	2014	2009-2013
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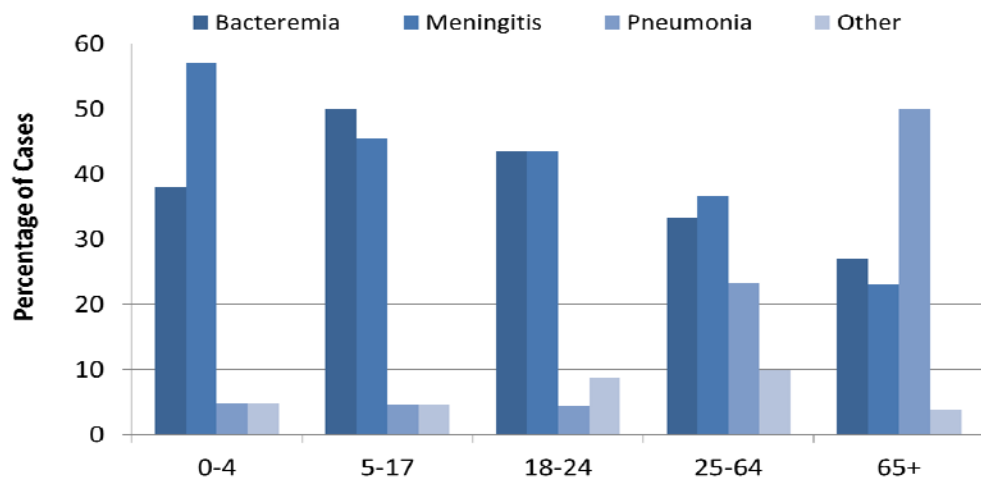
<b>Bacteremia</b>	20	40
<b>Meningitis</b>	73	39
<b>Pneumonia</b>	7	18
<b>Other<sup>††</sup></b>	0	7

† 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 2009-2014, meningitis was most common among those aged 0-4 and 25-64 years, while bacteremia was most common among those between 5 and 17 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 ( $p=0.0063$ ), and pneumonia increasing ( $p<0.0001$ ).

**Figure 3: Clinical Manifestation of IMD in Oregon by Age 2009-2014**



### 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 2008-2014. During this time period, forty-seven percent of all cases had no underlying conditions noted in the medical record, although this is not uniform across the age spectrum: 79 percent of children less than 18 years of age had no underlying conditions versus 25 percent of adults ( $p<0.0001$ ).

**Table 2: Underlying Conditions Reported Among Adult IMD Cases**

Underlying Condition	2014 only (n=9)	2008-2013 (n=70)
	N (%)	N (%)
<b>Asthma</b>	2 (22)	7 (10)
<b>Cancer</b>	0	2 (3)
<b>Cardiovascular disease</b>	0	11 (16)
<b>COPD</b>	3 (33)	10 (14)
<b>Diabetes</b>	2 (22)	10 (14)
<b>Immunosuppression</b>	2 (22)	4 (6)
<b>Obesity</b>	1 (11)	4 (6)
<b>Smoking</b>	3 (33)	18 (26)
<b>None</b>	1 (11)	19 (28)

Underlying conditions were further analyzed with regard to fatal outcome and clinical manifestation of IMD. After adjusting for age, none of the underlying conditions were significantly associated with a fatal outcome. COPD ( $p=0.0020$ ) and smoking ( $p=0.05$ ) were significantly associated with pneumonia after controlling for age. No underlying conditions were related to bacteremia or meningitis.

### Serogroup Analysis

In 2014, the serogroups of *N. meningitidis* causing invasive disease were determined for all but one case ( $n=14$ ). Of these, serogroup B comprised 21 percent; serogroup C, 57 percent; serogroup W-135, 7 percent; and serogroup Y, 15 percent. Historically in Oregon, serogroup B has been the predominant serogroup causing IMD. One isolate was found to be non-groupable.

Changes in serogroup distribution since 2001 can be observed in Figure 4. 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 C, W-135 and Y ( $p=0.01$ ,  $p<0.0001$  and  $p<0.0001$ , respectively) have been observed.

During the five-year period from 2009-2013, serogroup B was the most commonly identified serogroup among those 0-4 years of age (52%), while serogroups W-135 and Y were the least common (7% for both) in this age group (Figure 5). Among those 65 years of age and older, serogroup Y was the most commonly identified group (58%), followed by serogroup C (23%).

After controlling for age, no serogroup was significantly associated with a fatal outcome or any clinical manifestation.

Figure 4: Serogroup of *N. meningitidis* Causing Invasive Disease in Oregon, 2001-2014

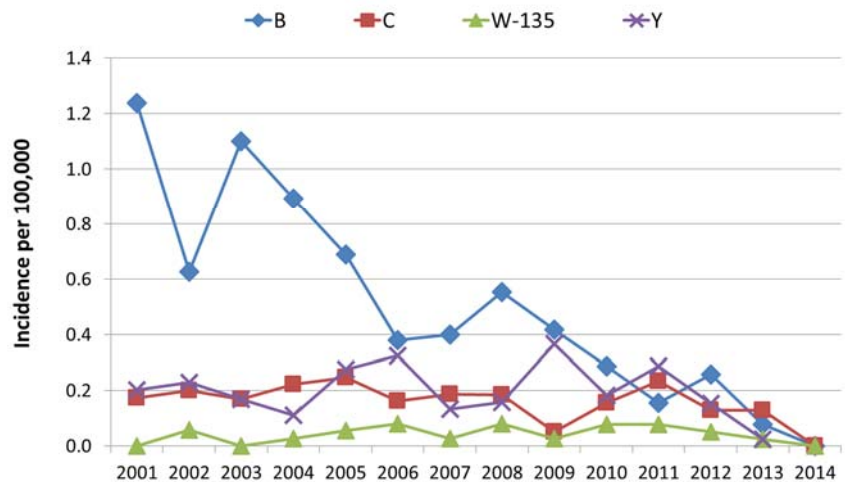
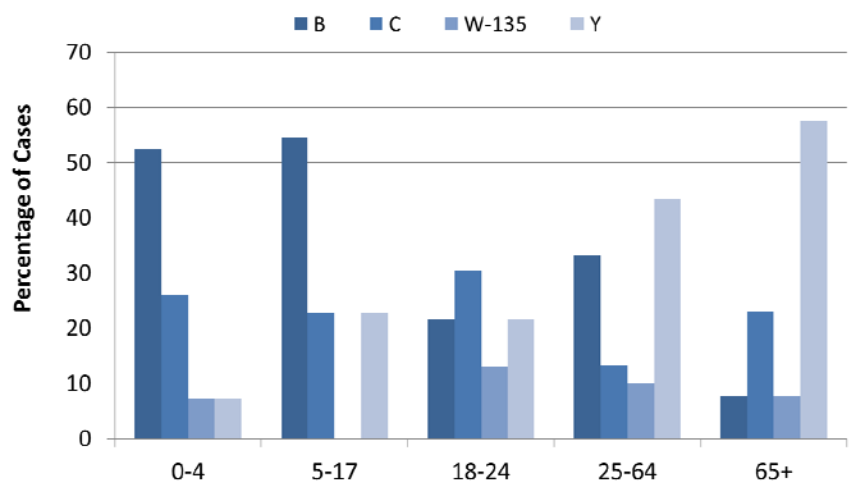


Figure 5: Serogroup of *N. meningitidis* Causing Invasive Disease in Oregon by Age Group, 2009-2014



## Antimicrobial Susceptibility

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

Antimicrobial results from CDC were available for 89 isolates cultured in 2008, 2010, and 2011 (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 and resistance to ciprofloxacin. 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<sup>†</sup>**

Antibiotic	2008 N=37 (100% of isolates tested)			2010 N=25 (83% of isolates tested)			2011 N=27 (93% of isolates tested)		
	S	I	R	S	I	R	S	I	R
	Ampicillin	NT	NT	NT	84	16		96	4
Azithromycin	100			100			100		
Cefotaxime	NT	NT	NT	100			100		
Ceftriaxone	100			100			100		
Chloramphenicol	NT	NT	NT	100			100		
Ciprofloxacin	100			100			96		4
Meropenem	NT	NT	NT	100			100		
Penicillin	92	8		88	12		81	19	
Rifampin	97	3		100			100		

<sup>†</sup> 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 2014, 15 cases of IMD were reported in the state, corresponding to an incidence rate of 0.38 cases per 100,000. This reflects an 89 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.

For updated meningococcal disease vaccination recommendations, visit:

<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6003a3.htm>

## References

- Centers for Disease Control and Prevention. 2012. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, *Neisseria meningitidis*, 2013. Available via the Internet: <http://www.cdc.gov/abcs/reports-findings/survreports/mening13.pdf>. Accessed 5 Aug 2015.

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.