

Invasive Pneumococcal Disease, New Mexico, 2006–2010

Invasive pneumococcal disease (IPD) is caused by the bacteria *Streptococcus pneumoniae* and is considered invasive when bacteria are isolated from a normally sterile body site, such as blood or cerebrospinal fluid.¹ According to the World Health Organization, pneumococcal disease is a public health concern for children and adults worldwide. In the U.S., the estimate of IPD between 2006 and 2009 was approximately 14.1 cases per 100,000 population per year. The estimated national death rate from IPD between 2006–2009 was 1.6 deaths per 100,000 population per year. Surveillance for IPD is conducted through the Active Bacterial Core Surveillance (ABCs) program, a 10-site network collaboration with the Centers for Disease Control and Prevention (CDC).^{2,3}

In 2004, New Mexico began participating in the Active Bacterial Core Surveillance (ABCs) program, a component of the national Emerging Infections Program (EIP). Through the program, NM conducts surveillance for cases of IPD as well as four other invasive bacterial pathogens. When IPD is diagnosed in a New Mexico resident, a review of the medical chart is conducted by an NM EIP Surveillance Officer using a standardized case report form. *S. pneumoniae* isolates are sent to the NM Department of Health (NMDOH) Scientific Laboratory Division (SLD), state public health lab where they are sub-cultured, logged, and shipped to the CDC, or a CDC contract laboratory for further testing, including serotype and antimicrobial susceptibility testing. CDC uses the information to calculate national estimates of IPD, summaries of trends in antimicrobial resistance of *S. pneumoniae*, and serotype information for vaccine development.^{1,3}

Risk of infection with IPD is greater among certain ages and racial/ethnic groups. Persons at higher risk of IPD infection included the elderly (aged ≥ 65 years), and children aged less than two years. Risk is increased in children or adults attending or working in day care centers, immunocompromised individuals,

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and those who are Black or American Indian/Alaskan Native (AIAN).¹ The AIAN population has historically experienced higher rates of disease, including IPD, compared to the White U.S. population.⁴ Risk of infection with drug resistant *S. pneumoniae* is increased among persons who have recently completed antimicrobial therapy.^{1,9} Vaccination is the only available tool in preventing pneumococcal disease, especially among high risk groups, and developing antimicrobial resistance highlights the need for use of effective vaccines.^{2,5}

Pneumococcal conjugate vaccine, targeting seven pneumococcal serotypes was licensed in the United States for children on February 17, 2000. After the introduction of the PCV7 vaccine, a decrease in IPD occurred among vaccinated children, as well as unvaccinated children and adults nationally. Indirect (herd) immunity is thought to result from the reduced nasopharyngeal carriage in vaccinated children, therefore preventing transmission to unvaccinated children and adults.⁶

In February 2010, a new vaccine for children which targets 13 pneumococcal serotypes (PCV13) became available. The recommended vaccination series includes doses at ages 2, 4, 6, and 12-15 months, with a recommended single supplemental dose available to all children aged 14-59 months. The PCV13 vaccine consists of the serotypes in PCV7 plus six additional serotypes. In NM between 2006 and 2010, 649 (46%) cases of IPD occurred from strains that are exclusive to the new PCV13 vaccine. The introduction of PCV13 is anticipated to decrease the burden of IPD as a result of broader serotype coverage.^{6,7} The objective of this investigation was to describe IPD rates, outcome, sero-

type prevalence and antimicrobial resistance patterns among NM IPD cases from 2006–2010.

Methods

The epidemiology of IPD in NM was examined by comparing rates of disease and death by age, sex, and race/ethnicity. National IPD rates were obtained from the Emerging Infections Program Network, annual ABCs Report for *S. pneumoniae*.³ NM population data were obtained from the University of New Mexico Bureau of Business and Economic Research population estimates for 2006–2009 for the purpose of calculating IPD rates in NM; 2009 data were also used to calculate 2010 rates. Demographics, outcome, serotype, and susceptibility information on NM IPD cases from 2006–2010 were obtained through the NM Emerging Infections ABCs Program database. Race/ethnicity of cases was determined following NM Department of Health guidelines for combining race and ethnicity coding. Cases were categorized as Hispanic if ethnicity was “Hispanic” and race was “white” or “unknown” and cases were designated as “American Indian”, “black”, or “Asian/Pacific Islander” regardless of ethnicity. The Clinical and Laboratory Standards Institute (CLSI) breakpoints were used to interpret antimicrobial resistance; CLSI breakpoints changed in 2008 for assigning penicillin resistance.⁸

Results

There were 1,426 CDC culture-confirmed cases of IPD reported among NM residents from 2006–2010. The average rate of IPD in NM from 2006–2010 was 13.9 cases per 100,000 population per year. Fifty-five percent of cases were males. The rate of IPD among those aged ≥ 65 years in NM was 39.5 cases per 100,000 population in NM. The rate of IPD among those aged less than one year was 41.9 cases per 100,000 population in NM. The majority of cases occurred among Whites, 525 (36.8%), followed by Hispanics, 450 (31.6%), American Indians 296 (20.8%), unknown race/ethnicity 105 (7.4%), Blacks 44 (3.1%), and Asian/Pacific Islanders 6(0.4%). The American Indian rate of IPD was highest (Figure). The rate of IPD varied by region. The highest percent of IPD occurred in the Northwest (32%), followed by Bernalillo County, 29% , Southwest, 15%, Southeast, 14% and Northeast, 10%.

Deaths. From 2006–2010, 190 (13.3% of cases) deaths occurred due to IPD among NM residents. One hun-

dred fifty three (12.3% of cases) deaths occurred among hospitalized cases. Of the 190 cases who died, 76 (40.0%) were Hispanic, 67 (37.1%) were White, 31 (16.3%) were American Indian, 14 (7.4%) had unknown race/ethnicity, and 2 (1.0%) occurred among Blacks. No deaths occurred among Asian/Pacific Islander cases. Similar to the combined ABCs sites’ data, the number of cases and percentage of deaths (20%) was highest among those aged ≥ 65 years in NM.

Serotypes. The top ten serotypes causing IPD in NM from 2006–2010 were 7F, 19A, 003, 12F, 001, 22F, 008, 06C, 33F, and 35B; of these, four are included in the PCV13 vaccine. Of the 1,426 cases occurring in NM from 2006–2010, 58 (4%) were infected with a serotype found in the PCV7 vaccine. Of those, none were aged < 4 years; 20 (34.5%) of those infected with a serotype found in the PCV7 vaccine were aged 40–59 years. Among the NM cases, 707 (50%) were infected with a serotype found in the PCV13 vaccine – of these, 649 were infected with one of the six new serotypes included in the PCV13 vaccine. Among the cases of IPD resulting from serotypes included in the PCV13 vaccine, 31 (4.4%) occurred in infants aged ≤ 1 year. Sixty-two cases (8.8%) occurred in children aged 1–4 years, and the majority of cases, 214 (30%) occurred among those aged ≥ 65 years.

Resistance patterns. Serotype 19A was the second-most frequently isolated serotype among IPD cases in NM, and was associated with the highest percentage of antimicrobial resistance. Of those patients infected with serotype 19A, 33 (18%) died. In NM, with all serotypes combined, resistance to erythromycin was seen in 296 (20.8%) cases, trimethoprim/sulfamethoxazole (tmp/smx) in 191 (13.4%) cases, tetracycline in 133 (9.3%) cases, and penicillin resistance was seen in 122 (8.6%) cases. However, using 2008 CLSI breakpoint changes for penicillin, resistance was seen in 31 (2.2%) of IPD cases. The highest amount of antimicrobial resistance was seen in the ≥ 65 age group, and in children aged less than 4. Resistance to erythromycin occurred in 116 (23.9%) of cases aged ≥ 65 , 28 (30.8%) of children aged 1–4 and 21 (36.8%) of infants < 1 . Resistance to tmp/smx occurred in 75 (15.4%) of cases aged ≥ 65 , 21 (23.1%) of children aged 1–4, and 15 (26.3%) of infants < 1 .

Conclusion

NM is a participant in the ABCs program and contributed data used in conjunction with data from the other ABCs sites to estimate national IPD rates, and collect serotype and antimicrobial resistance information that is vital for vaccine development and treatment guidelines. While NM IPD rates for most age groups were similar to national estimates, rates were higher among NM infants (42/100,000 vs. 37/100,000). This may be due to differences in vaccine coverage in NM. Further study regarding trends in vaccine coverage in NM is needed. Similar to that seen in other publications, IPD rates in NM among AIANs were higher than rates among Whites.^{1,4} AIAN populations have been shown to have a higher prevalence of underlying conditions such as diabetes, heart disease, COPD, and alcohol abuse than the White population, which might account for the higher rate of IPD among the AIAN population in NM.⁴

Rates of IPD decreased after the introduction of the PCV7; however, non-PCV7 serotypes still cause disease. With the recent introduction of PCV13, assuming the effectiveness will be similar to the effect of the PCV7 vaccine, overall IPD rates and antimicrobial resistance due to serotypes included in the PCV13 vaccine, such as 19A, should decrease in the population. This may result in an overall decrease in the burden of IPD. However, other non-PCV13 vaccine serotypes may emerge to replace the PCV13 serotypes in the NM population.^{6,9}

Increased antimicrobial resistance can be attributed to the widespread overuse of antimicrobial agents, and spread of resistant bacterial strains.^{1,5} Antimicrobial resistance patterns did vary in different regions of NM and may be attributed to local prescribing patterns, prevalence of resistant serotypes in each region, or variability of underlying conditions in the regional population. Higher resistance among the elderly and young children may be attributed to the increased likelihood of hospitalization in these groups, or to crowded day care facilities where the possibility of contacting a resistant bacterial strain may be more likely. Further study is needed to better understand the reasons for regional and age differences in antimicrobial resistance patterns.

Clinical and Laboratory Standards breakpoint changes in January 2008 for penicillin were the result of exten-

sive evaluation of combined ABCs site data of IPD treatment information. Breakpoints are the standards set for interpreting the minimum inhibitory concentration (MIC) of an antibiotic that defines an infection as treatable (susceptible), treatable with a higher amount of the antibiotic (intermediate) or not treatable with the antibiotic (resistant). Prior to the 2008 changes, cases of non-meningitis IPD deemed resistant to penicillin were not reflective of what actually was happening in the patient. As a result, non-meningitis cases of IPD were found to be more sensitive to penicillin than was expected by the previous CLSI standards. Because of this, penicillin remains the preferred antimicrobial drug of choice for treatment of susceptible non-meningitis cases of IPD.⁸

As the PCV13 vaccine becomes more widely used, the role of the ABCs program will be important in determining the estimated annual national burden of invasive pneumococcal disease, the detection of emergent non-PCV13 serotypes and emerging antimicrobial resistance. This information is useful to determine if new vaccines will need to be developed, or if changes need to occur in antibiotic prescribing patterns antibiotics for IPD.

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**Figure. Invasive Pneumococcal Disease Cases by Race/Ethnicity per 100,000 population
New Mexico, 2006–2010**

