

INVASIVE PNEUMOCOCCAL DISEASE AND ANTIMICROBIAL SUSCEPTIBILITY PATTERNS FOR STREPTOCOCCUS PNEUMONIAE IN LOS ANGELES COUNTY, 2001

BACKGROUND

Streptococcus pneumoniae infection is a leading cause of pneumonia, bacteremia, and meningitis in the United States. Since 1995, the Los Angeles County (LAC) Department of Health Services (DHS) has operated a laboratory- and hospital infection control-based surveillance system for invasive pneumococcal disease (IPD). IPD was selected for surveillance in order to: measure the incidence in LAC, track antibiotic resistance patterns, potentially monitor immunization efficacy, and target vaccine usage.

A major development for IPD in 2000 was the Food and Drug Administration's approval of a conjugate vaccine protecting children less than two years of age. Previously, the only available vaccine, polysaccharide vaccine, could not protect this high-risk age group. Studies have indicated that the vaccine is safe and effective [1].

Increasing antimicrobial resistance continues to be a problem with pneumococcal disease. In a report by the Centers for Disease Control and Prevention Working Group on *S. pneumoniae*, their nationwide population-based surveillance system observed an increase of penicillin nonsusceptible *S. pneumoniae* isolates from 14% in 1993-1994 to 27% in 2000 [2,3]. Other classes of antimicrobials such as the macrolides, cephalosporins, and fluoroquinolones have also developed resistance.

The following is a description of the 2001 incidence of reported IPD and *S. pneumoniae* antimicrobial susceptibility patterns in individuals residing in LAC (excluding the cities of Long Beach and Pasadena).

Table 1: MIC Breakpoints for Selected Agents Used to Treat *Streptococcus pneumoniae* Infection

Antimicrobial	MIC ($\mu\text{g/mL}$)		
	Susceptible	Intermediate	Resistant
Penicillin	≤ 0.06	0.12-1.0	≥ 2.0
3 rd generation Cephalosporin (cefotaxime, ceftriaxone, cefuroxime)	≤ 0.5	1.0	≥ 2.0
Erythromycin	≤ 0.25	0.5	≥ 1.0
Trimethoprim-sulfamethoxazole (TMP-S)	$\leq 0.5/9.5$	1/19-2/38	$\geq 4/76$

Table 2: Characteristics of IPD Cases Los Angeles County, 1997-2001

Characteristics*	1998 (N=814)	1999 (N=894)	2000 (N=760)	2001 (N=603)
Male:Female Rate Ratio	1.05:1.00	1.02:1.00	1.03:1.00	1.15:1.00
Age (years)				
Mean	44	47	43	51
Median	50	53	48	55
Range	<1 day-102	1 day-100	<1 day -101	1.5 mo. -103
Case fatality rate	15% (53/346)	17% (55/328)	13% (42/320)	15% (39/252)
Culture site				
Blood only	776 (96%)	836 (94%)	703 (93%)	540 (90%)
CSF/CSF&Blood	28 (3%)	44 (5%)	33 (4%)	34 (6%)
Other	10 (1%)	14 (2%)	24 (3%)	29 (5%)

*Data not available on race/ethnicity and characteristic information not available for all cases.

METHODS

Cases were defined as LAC residents with a positive isolate for *S. pneumoniae* from a normally sterile site collected in 2001. To calculate incidence rates, population data were derived from the 2000 census using sophisticated estimation techniques developed by the LAC Urban Research Section. Antimicrobial susceptibility was determined by disk diffusion or dilution diffusion. It was assumed that minimum inhibitory concentration (MIC) breakpoints utilized by participating laboratories were based on the National Committee for Clinical Laboratory Standards. The breakpoints for selected antimicrobial agents are illustrated in Table 1. An isolate of *S. pneumoniae* was considered nonsusceptible to an Antimicrobial

agent if the results indicated intermediate or high-level resistance. Data were entered in Microsoft Access 2000 and analyzed using Epi-Info 6.04 and SAS Version 8.02.

DATA ANALYSIS

The annual incidence rate of reported IPD decreased 31% from 9.8 cases per 100,000 (n=894) in 1999 to 6.8 cases in 2001 (n=603). As indicated by Table 2, the male-to-female ratios indicated that there were slightly more males who acquired IPD. In 2001, the mean age for IPD cases was 51 years (median 55 years, range 1.5 months to 103 years), which was higher than the previous three years.

In 2001, the case fatality rate was 15%, which was the lowest rate in four years (Table 2). The validity of this data is questionable since outcome status of 58% of the cases for 2001 were reported as Aunknown®, although it should be noted that the percent "unknown" stayed constant for the previous three years. The case fatality rate may be underestimated since reporting of positive isolates is required within 24 hours and many times the final outcome of current infection has not yet been determined. In 2001, a higher proportion of cases had cultures taken from the CSF and other sites such as chest fluid, pleural fluid, peritoneal fluid, and vitreous fluid than previous years. The mortality rate in 2001 was not significantly associated with having meningitis (odds ratio [OR]: 2.10; 95% confidence interval: 0.82 to 5.21, p=0.26).

For 2001, the highest age-specific incidence rates occurred in adults' 75 years and over, which is common with IPD. LAC data also shows a noticeable decrease of IPD in children <5 years for 2001 (Figure 1).

The IPD cases for 1997-2001 followed the typical seasonal pattern, peaking in late winter then gradually declining through spring. The pattern observed by month for the first three quarters in 2001 was very similar to previous years but cases started to deviate from October to December from the normal pattern seen in previous years (Figure 2).

In 2001, Harbor District had the highest crude rate of IPD at 14.3 per 100,000 population (28 cases) followed by Southwest with a rate of 10.8 (39) and Torrance with 9.0 (39). The West Valley District had the highest number of cases (40). Harbor District continued to have the highest rate (12.9 cases per 100,000) even after adjusting for age (using

Figure 1: Incidence Rates of IPD Cases by Age, Los Angeles County, 1997-2001

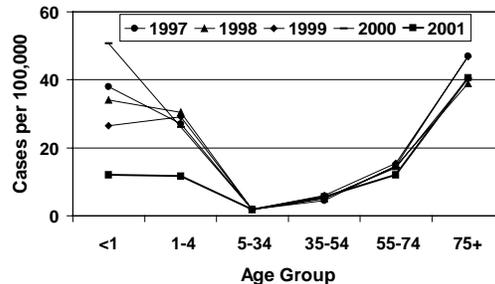


Figure 2: IPD Cases By Month of Culture Los Angeles County, 1997-2001

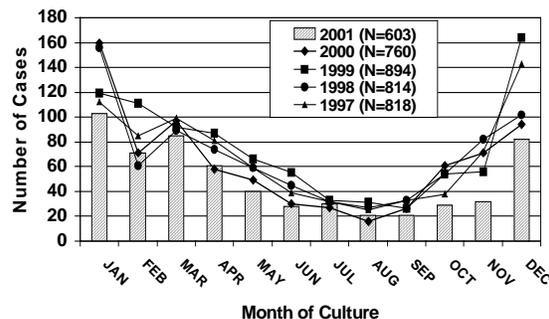
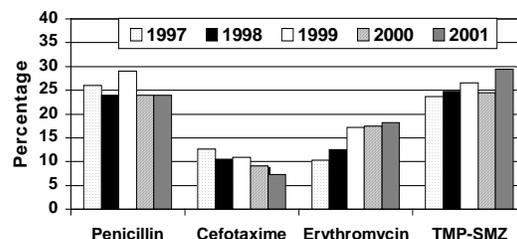


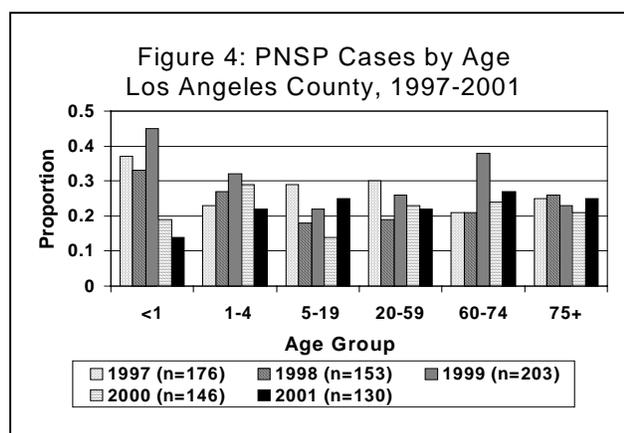
Figure 3: IPD Cases Nonsusceptible to Selected Antimicrobial Agents Los Angeles County, 1997-2001



the age groups in Figure 1). For 2000, Harbor District was also among the top five districts for crude and age-adjusted rates.

From 1997 to 2001, the proportion of penicillin nonsusceptible *Streptococcus pneumoniae* (PNSP) isolates has remained stable at around 24% for all years except for 1999 (29%) (Figure 3). Ninety-three percent of the cases had antimicrobial resistance information provided. The fluctuation of PNSP by year was not significant ($\chi^2=7.98$, p-value=0.09). The percent of cases nonsusceptible to erythromycin and trimethoprim-sulfamethoxazole (TMP-SMZ) increased from 1997 to 2001 and cefotaxime decreased. Of the 212 cases with data on levofloxacin resistance, only 1% were nonsusceptible which is greater than 0.3% seen in 2000 from a nationwide population-based surveillance system for IPD [3].

From 2000 to 2001, the proportion of PNSP cases did not fluctuate greatly for most of the age groups. The largest increase of 79% was observed in the 5-19 age group but was similar to previous levels (Figure 4). Comparing 2000 and 2001 to 1999, there has been a large decrease (68%) in the proportion of PNSP cases in children less than one year. In 2001, there was not a significant difference between age groups and penicillin nonsusceptibility ($\chi^2=1.63$, p-value=0.90). Also mortality was not significantly associated with penicillin nonsusceptibility.



DISCUSSION

Compared to previous years, the DHS observed a decrease in IPD incidence in 2001 while the resistance pattern toward selected antibiotics varied. Once again the elderly were at a higher risk of acquiring IPD. Unlike previous years, there was a dramatic decrease in the incidence of IPD in children less than five years, which may be attributed to the use of the newly licensed pneumococcal conjugate vaccine. Resistance was not associated with increased mortality.

REFERENCES

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