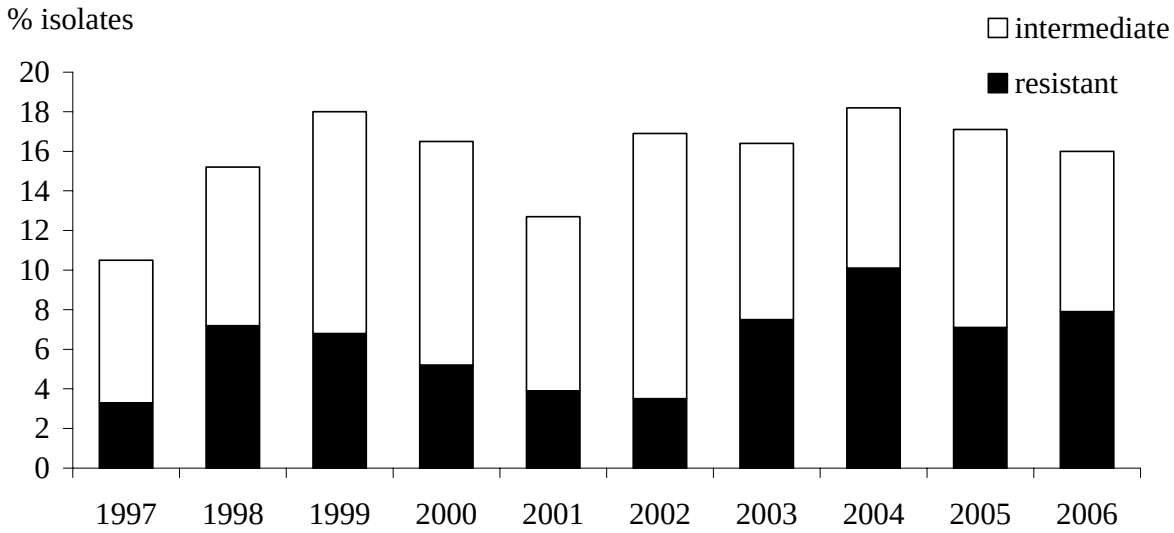
Antimicrobial susceptibility of invasive *Streptococcus pneumoniae*, 2006

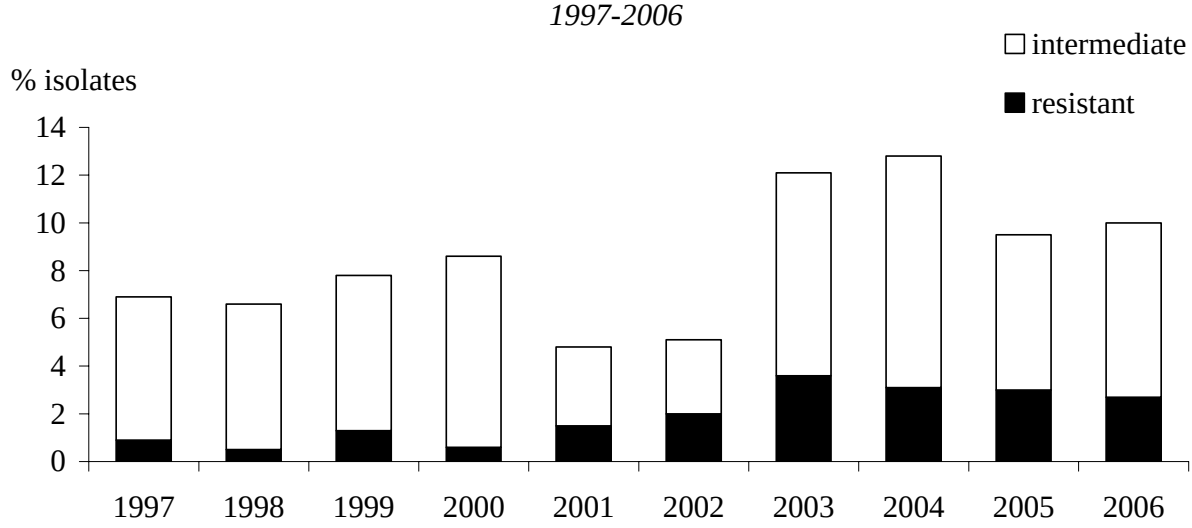
The antimicrobial susceptibility of all 522 viable invasive isolates of *S. pneumoniae* referred to ESR in 2006 was tested. 15.9% (83) were penicillin nonsusceptible (MIC ≥0.12 mg/L): 7.9% (41) resistant (MIC ≥2 mg/L) and 8.1% (42) intermediate (MIC 0.12-1 mg/L). Over the last decade there has been considerable variation in the prevalence of penicillin resistance, with a significant increase between 1995 and 1998-9, a decrease between 1999 and 2002, then an increase again until 2004 after which there has been little change (Figure 1). Penicillin nonsusceptibility increased between 1995 and 1999, but there has been no significant change since then.

Figure 1. Penicillin resistance and nonsusceptibility among pneumococci from invasive disease, 1997-2006



Applying the CLSI meningitis interpretive standards, 10.0% (52) of the 522 invasive isolates were cefotaxime nonsusceptible (MIC ≥1 mg/L): 2.7% (14) resistant (MIC ≥2 mg/L) and 7.3% (38) intermediate (MIC 1 mg/L). Applying the non-meningitis interpretive standards, 2.7% (14) were cefotaxime nonsusceptible (MIC ≥2 mg/L): 1.0% (5) resistant (MIC ≥4 mg/L) and 1.7% (9) intermediate (MIC 2 mg/L). Trends in cefotaxime resistance and nonsusceptibility over the last 10 years are shown in Figure 2, and indicate a trend of increasing resistance to 3rd-generation cephalosporins, although there has been no increase in the last three years.

Figure 2. Cefotaxime resistance and nonsusceptibility (meningitis interpretations) among pneumococci from invasive disease, 1997-2006



The rates of resistance to other antibiotics among the 522 invasive isolates tested in 2006 included 32.8% co-trimoxazole resistance, 11.1% erythromycin resistance, 6.2% constitutive clindamycin resistance with no inducible clindamycin resistance, and 7.1% tetracycline resistance. 3.1% of isolates had combined penicillin and erythromycin resistance, and 4.8% had combined penicillin-nonsusceptibility and erythromycin resistance. All isolates were susceptible to moxifloxacin and vancomycin.

Among the penicillin-resistant isolates, 39.0% (16/41) were multiresistant to ≥3 additional antibiotics, commonly co-trimoxazole, erythromycin and tetracycline with or without cefotaxime resistance. Among the penicillin-nonsusceptible isolates, 27.7 (23/83) were multiresistant to ≥3 additional antibiotics.

Penicillin and cefotaxime resistance and nonsusceptibility in each district health board (DHB) is shown in Figures 3 and 4. For the analyses presented in these two figures, the three DHBs in the greater Auckland area (Waitemata, Auckland and Counties Manukau) were combined, as were the Canterbury and South Canterbury DHBs. These DHB data are influenced to some extent by the small numbers of invasive pneumococci isolated in some DHBs. There were less than 20 isolates from the Northland (17), Lakes (13), Tairawhiti (4), Taranaki (6), Whanganui (0), MidCentral (14), Hutt (19), Wairarapa (0), Nelson-Marlborough (1), West Coast (0), Otago (19) and Southland (18) DHBs.

Figure 3. Penicillin resistance and nonsusceptibility by district health board, 2006

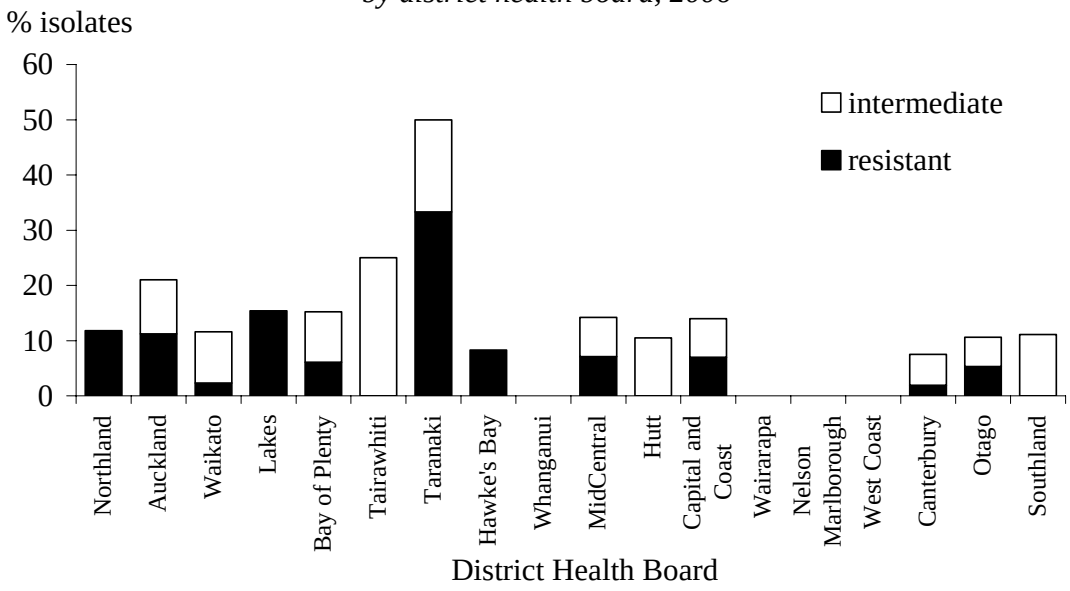
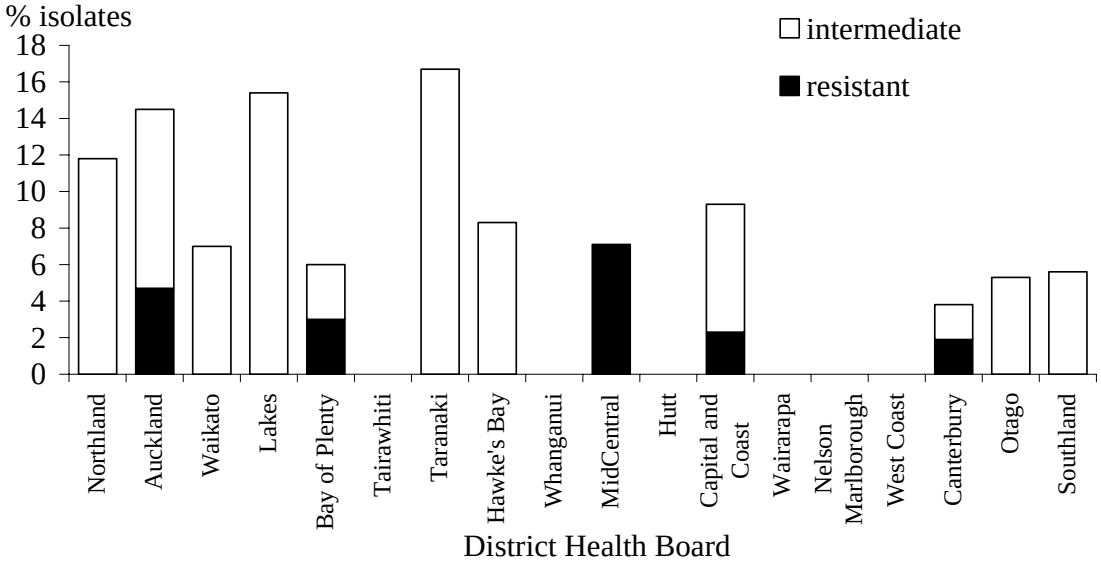


Figure 4. Cefotaxime resistance and nonsusceptibility (meningitis interpretations) by district health board, 2006



Penicillin and cefotaxime resistance and nonsusceptibility in the different age groups is shown in Table 1, and, for both antibiotics, was highest in pneumococci isolated from patients under 5 years of age.

Table 1. Penicillin and cefotaxime resistance and nonsusceptibility among invasive pneumococcal isolates by patient age, 2006

Age (years)	Percent			
	Penicillin		Cefotaxime	
	Nonsusceptible MIC ≥0.12 mg/L	Resistant MIC ≥2 mg/L	Nonsusceptible[1] MIC ≥1 mg/L	Resistant[1] MIC ≥2 mg/L
≤4 (n=151)	21.9	11.9	13.9	3.3
5-14 (n=20)	15.0	5.0	5.0	0
15-64 (n=182)	11.0	4.4	6.0	2.2
≥65 (n=169)	16.0	8.3	11.2	3.0
All ages (n=522)	15.9	7.9	10.0	2.7

[1] Based on meningitis interpretive standards

The majority of the penicillin-nonsusceptible isolates belonged to the capsular types usually associated with penicillin resistance (Table 2). Until 2000, serotype 9V was the prevalent penicillin-resistant serotype (Figure 5). Then between 2000 and 2003, serotype 19F was prevalent. Since 2003, no one serotype has been clearly predominant. Serotype 19F is the most common type among cefotaxime-resistant isolates. The majority of these cefotaxime-resistant serotype 19F isolates belong to a strain that is multiresistant to penicillin, cefotaxime, co-trimoxazole, erythromycin and tetracycline.

Table 2. Distribution of capsular types among penicillin and cefotaxime resistant and nonsusceptible invasive pneumococcal isolates, 2006

Capsular antigen type	Number (%[1]) isolates			
	Penicillin		Cefotaxime	
	Nonsusceptible MIC ≥0.12 mg/L	Resistant MIC ≥2 mg/L	Nonsusceptible[2] MIC ≥1 mg/L	Resistant[2] MIC ≥2 mg/L
19F	16 (19.3)	15 (36.6)	15 (28.9)	8 (57.1)
14	21 (25.3)	12 (29.3)	15 (28.9)	5 (35.7)
9V	24 (28.9)	8 (19.5)	15 (28.9)	1 (7.1)
6B	7 (8.4)	4 (9.8)	4 (7.7)	0
23F	7 (8.4)	2 (4.9)	3 (5.8)	0
19A	6 (7.2)	0	0	0
Others	2[3]	0	0	0
Total	83	41	52	14

[1] Percentage of the nonsusceptible or resistant isolates
[2] Based on meningitis interpretive standards
[3] One serogroup 15 and one serotype 23B

Figure 5. Capsular antigen type distribution among penicillin-resistant pneumococci from invasive disease, 1997-2006