



Canadian Bacterial Surveillance Network

Annual Report: 2005

Streptococcus pneumoniae

In 2005, a total of 2,488 isolates of pneumococci were collected from 59 clinical microbiology laboratories across Canada. Of these, 733 (29.5%) were isolated from blood cultures or CSF, 1095 (44.1%) from lower respiratory tract specimens, 354 (14.3%) from conjunctival swabs, 169 (6.8%) from ear swabs, 21 (0.9%) from cerebrospinal fluid, and 112 (4.5%) from other sites. Of the 2,479 isolates for which ages of patients were available, 605 (24.4%) were from patients <17 years of age, 1061 (42.6%) were from patients between 17 to 64 years of age, and 813 (32.8%) were from patients ≥ 65 years of age. The results of in vitro susceptibility testing are found in Tables 1 and 2 below.

Table 1. Antimicrobial Susceptibility Results for 2,488 Isolates of *S. pneumoniae* Collected Nationally, 2005

	MIC (µg/ml)			Intermediate No. (%)	Resistant No. (%)
	50s	90s	Range		
<i>Penicillin</i>	≤0.06	0.25	≤0.06 - 8	261 (10.5)	114 (4.6)
<i>Erythromycin</i>	≤0.12	16	≤0.12 - ≥64	5 (0.2)	472 (19%)
<i>Clindamycin</i>	≤0.25	≤0.25	≤0.25 - ≥32	9 (0.4)	200 (8.0)
<i>Telithromycin</i>	≤0.015	≤0.015	≤0.015 - 8	1 (0.04)	1 (0.04)
<i>Ceftriaxone</i>					
<i>non-meningeal</i>	≤0.25	≤0.25	≤0.25 - 4	40 (1.6)	4 (0.2)
<i>meningeal</i>	≤0.25	≤0.25	≤0.25 - 4	109 (4.4)	44 (1.8)
<i>TMP/SMX</i>	≤0.5	4	≤0.5 - ≥16	201 (8.1)	309 (12.4)
<i>Ciprofloxacin</i> [†]	1	2	0.5 - ≥64	-	57 (2.3)
<i>Levofloxacin</i>	1	1	0.5 - ≥64	3 (0.12)	36 (1.5)
<i>Moxifloxacin</i>	0.12	0.12	≤0.03 - ≥8	18 (0.7)	17 (0.7)

[†] Ciprofloxacin: Intermediate MIC=2, Resistant MIC≥4

Table 2. In Vitro Activities of Several Antimicrobials Against 2,488 Isolates of *S. pneumoniae* Collected Nationally, 2005

	MIC (µg/ml)												
	0.015	0.03	0.06	0.12	0.25	0.5	1	2	4	8	16	32	≥64
<i>Penicillin</i>			2113 ^a	114	62	25	60	74	38	2			
<i>Erythromycin</i>				2007 ^a	4	5	14	41	74	93	32	13	205 ^b
<i>Clindamycin</i>					2279 ^a	9	5	6	2	4	7	176 ^b	
<i>Ceftriaxone</i>					2296 ^a	39	109 [*]	40 [†]	4				
<i>TMP/SMX</i>						1978 ^a	127	74	84	16	8	57 ^b	
<i>Ciprofloxacin</i>						696	1475	260	17	7	8	14	11 ^b
<i>Levofloxacin</i>						857	1550	42	3	9	17	5	5 ^b
<i>Moxifloxacin</i>		6 ^a	485	1805	153	2	2	18	12	4	1 ^b		
<i>Gatifloxacin</i>			4 ^a	544	1784	116	3	5	21	3	6	2 ^b	
<i>Telithromycin</i>	2136 ^a	49	84	61	76	61	19	1	1				

Underlined number denotes NCCLS intermediate category where applicable

^a MICs for these isolates were less than or equal to the value given

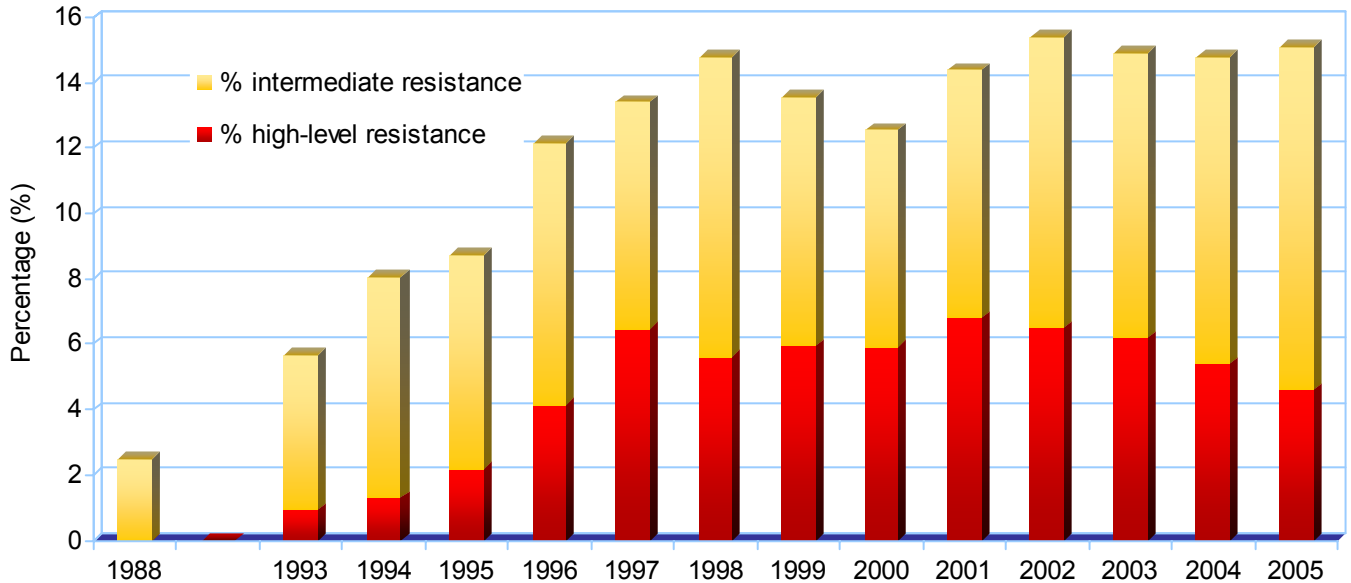
^b MICs for these isolates were greater than or equal to the value given

* NCCLS intermediate for meningitis

[†] NCCLS intermediate for non-meningitis

In 2005, we found that 15.1% of *S. pneumoniae* were penicillin non-susceptible, 10.5% fell in the intermediate category (MIC = 0.12 to 1 µg/ml), and 4.6% were penicillin resistant (MIC ≥ 2µg/ml) (Table 1). Figure 1 shows the evolution of penicillin non-susceptible pneumococci over last several years.

Figure 1. Percentage of Penicillin Non-Susceptible *S. pneumoniae* in Canada: 1988-2005



Figures 2 and 3 show distribution of non-susceptible isolates with regards to sterile versus non-sterile sites and age ≤15 and >64 years.

Figure 2. Percentage of Non-susceptible Sterile Site vs. Non-sterile Site Isolates of *S. pneumoniae*, 2005

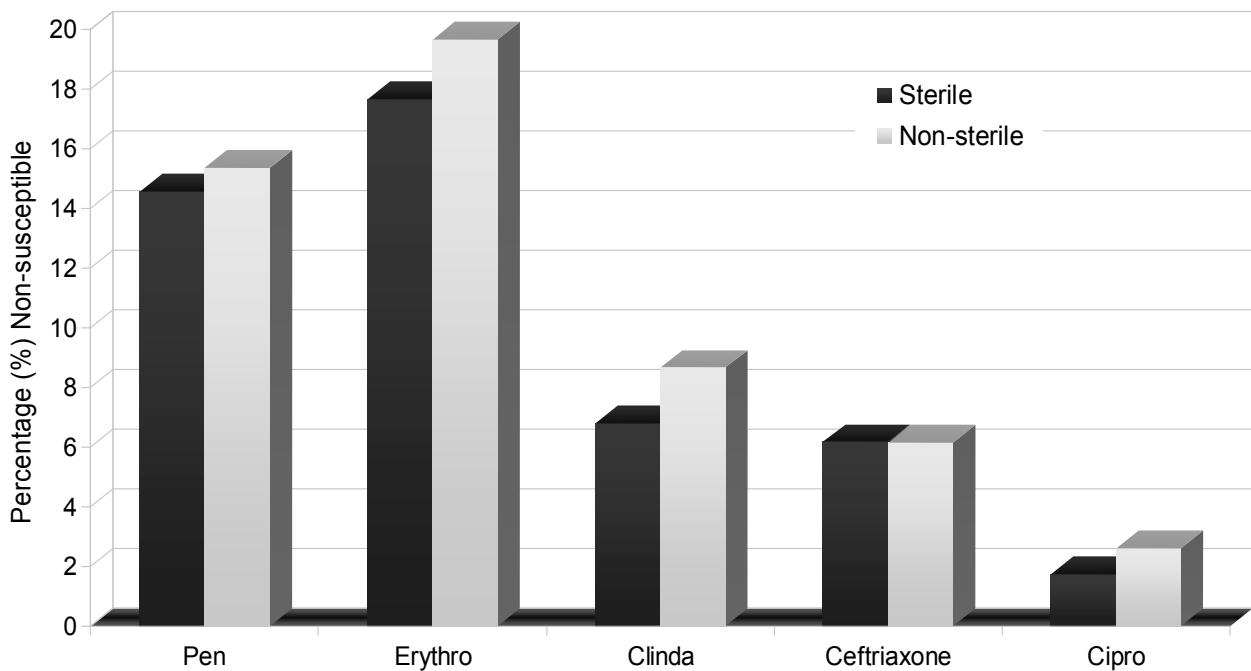
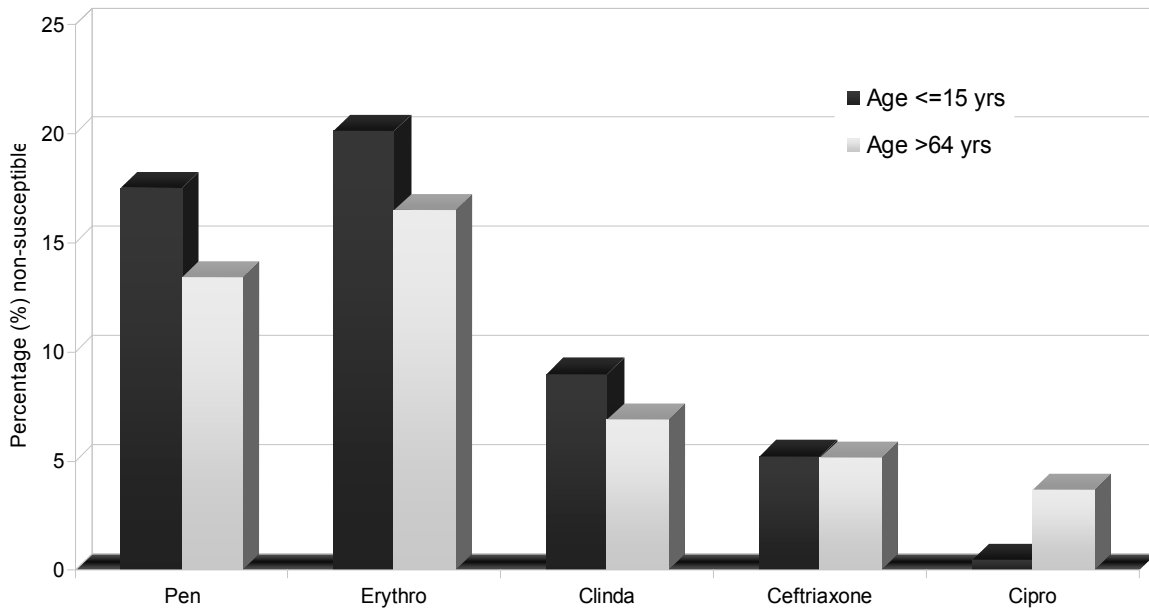


Figure 3. Percentage of Non-susceptible Isolates of *S. pneumoniae* in Ages <15 and >64, 2005



The prevalence of resistance in various regions or provinces across Canada is shown in Table 3 and Figure 4. Rates of intermediate susceptibility varied from 1.9% in Alberta to 12.5% in Newfoundland. Rates of resistance varied from 5.7% in PEI to 13.9% in Manitoba.

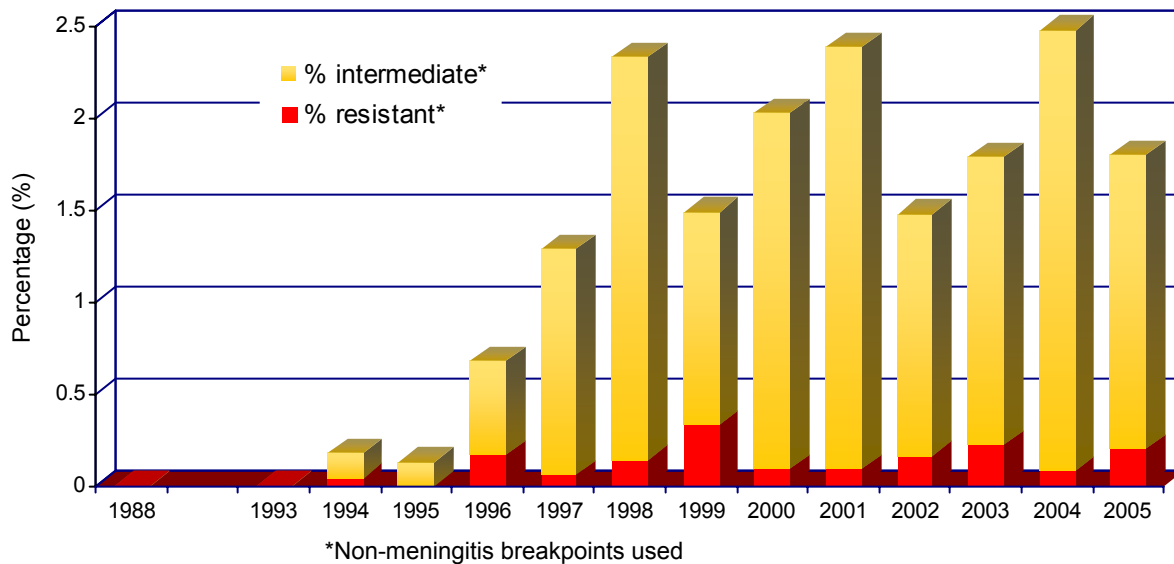
Table 3. Percentage of Intermediate/Resistant *S. pneumoniae* Isolates by Geographic Region in Canada in 2004

	Canada	BC	Prairies	Ontario	Quebec	Atlantic Canada
Penicillin	10.5/4.6	9.8/3.3	11.4/7.4	9.2/4.1	12.4/4.4	14.5/4.4
Erythromycin	0.2/19.0	0/15.2	0.3/19.1	0.1/16.4	1.2/26.8	0/25.5
Clindamycin	0.4/8.0	0/4.4	0.3/4.3	0.2/7.7	1.6/13.2	0.3/10.4
Ceftriaxone: non-meningeal	1.6/0.2	0/0	1.7/0	1.8/0	1.6/0.4	1.5/0.9
meningeal	4.4/1.8	3.3/0	7.7/1.7	3.6/1.8	4.4/2.0	4.9/2.3
TMP/SMX	8.1/12.4	5.4/13.0	6.0/14.6	8.6/10.8	6.8/12.8	10.1/16.5
Ciprofloxacin [¶]	10.5/2.3	13.0/1.1	16.3/2.3	9.6/2.7	8.8/2.4	8.7/1.2
Levofloxacin	0.1/2.5	0/1.1	0/2.3	0.1/1.5	0/1.6	0.3/0.3
Moxifloxacin	0.7/0.7	0/1.1	1.7/0.6	0.7/0.8	0.8/0.8	0/0.3
Gatifloxacin	0.2/1.3	0/1.1	0/2.3	0.4/1.3	0/1.6	0/0.3

[¶] Ciprofloxacin: Intermediate MIC=2, Resistant MIC_≥4

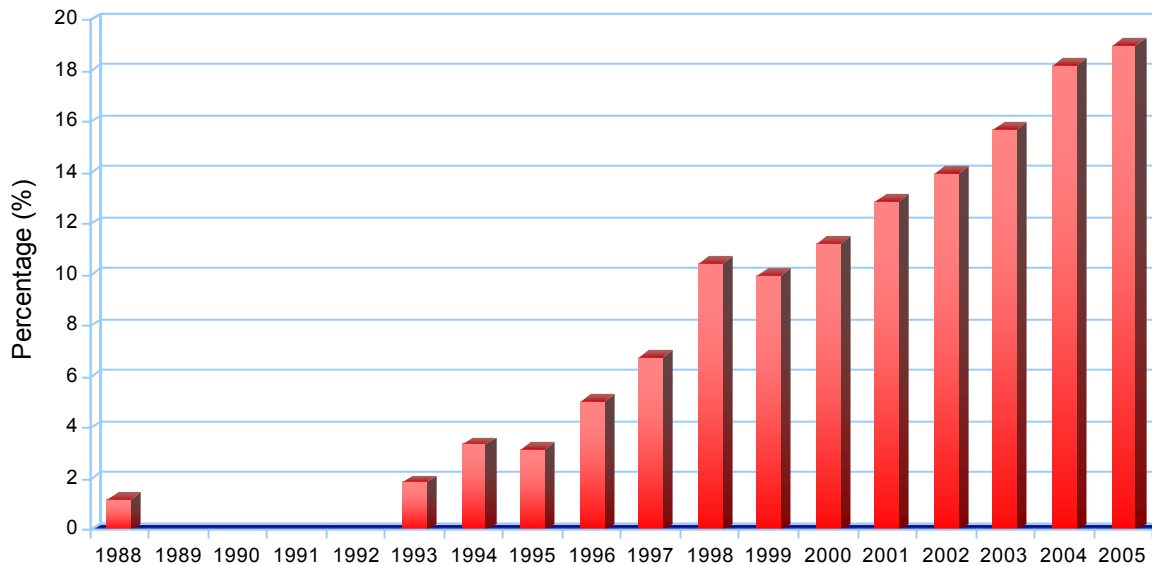
Using the NCCLS interpretive criteria for non-meningeal isolates ($\leq 1/2/\geq 4$)³, we found that only 1.6% of isolates had intermediate susceptibility to ceftriaxone and 0.2% were resistant (Table 1). Forty-four isolates had MICs ≥ 2 $\mu\text{g/ml}$, while none had MICs of 8 $\mu\text{g/ml}$ or greater (Table 2). Figure 8 shows the trend in ceftriaxone resistance in pneumococci over the last decade.

Figure 4. Ceftriaxone-Resistant Pneumococci (According to Non-meningeal Breakpoints), 1988-2005



A total of 472 (19%) isolates were macrolide resistant, of which 198(42%) were clindamycin resistant. Therefore, 42% of macrolide-resistant strains had the MLS_B phenotype and 58% the M phenotype. The evolution of macrolide resistance over the last several years is shown in Figure 5.

Figure 5. Macrolide-Resistant Pneumococci: 1988-2005



There were 57 (2.3%) isolates that were resistant to ciprofloxacin (Table 1). Ages of patients from whom the ciprofloxacin resistant pneumococci were isolated were available for all 57 isolates. Eleven of the 612 (0.5%) isolates from children was ciprofloxacin resistant, compared to 24 of 1063 (2.3%) from those aged 16 to 64, and 3 of 813 (3.7%) from those aged >64.

3.7% of lower respiratory tract isolates were resistant to ciprofloxacin, compared to 1.2% of blood isolates and 1.3% from the remaining sites. Ten of these resistant isolates were penicillin non-susceptible.

The striking increase observed in fluoroquinolone resistance over the years of the study, especially in respiratory isolates from patients >64 years of age, declined for the first time in 2003 and appears to have stabilized.

The MIC₉₀ for each fluoroquinolone tested against the 57 ciprofloxacin-resistant isolates remained stable at: ciprofloxacin, ≥ 64 µg/ml; levofloxacin, 32 µg/ml; gatifloxacin, 16 µg/ml; and moxifloxacin 4 µg/ml.

Figure 6. Fluoroquinolone-Resistant Pneumococci: 1997-2004

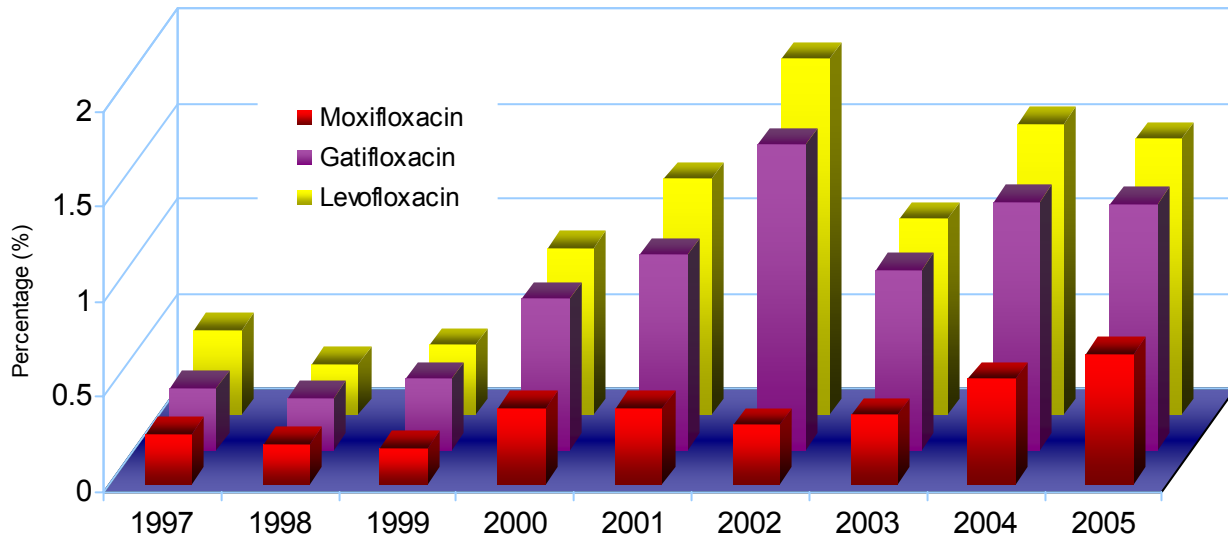
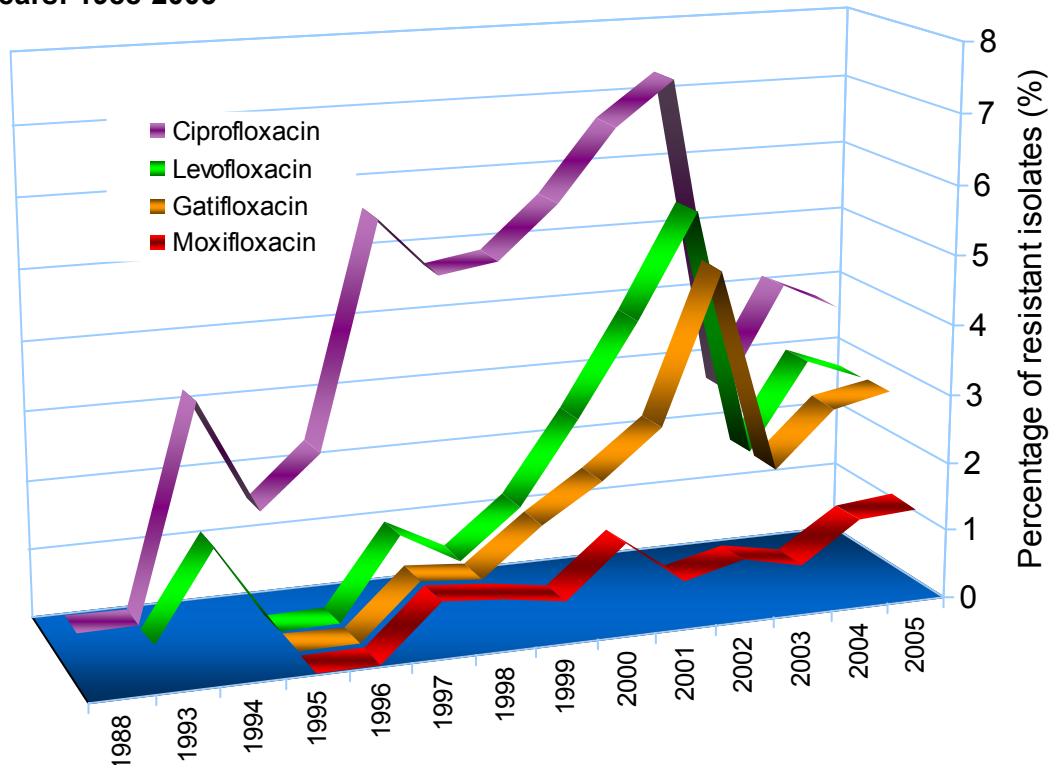


Figure 7. Fluoroquinolone-Resistant Pneumococci in Respiratory Isolates from Adults >64 years: 1988-2005



Staphylococcus aureus

We have continued to collect *Staphylococcus aureus* isolates since 2002 to monitor susceptibility trends. We are currently in the process of completing susceptibility testing on 2004 and 2005 isolates and reports will be available later this year. The geographic distribution of isolates is shown in table 4 below.

Table 4: Geographic Distribution of CBSN *S.aureus* isolates

	2002	2003	2004	2005
British Columbia	52 (6%)	45 (7%)	35 (10%)	33 (6%)
Alberta	66 (8%)	39 (6%)	10 (3%)	0
Saskatchewan	24 (3%)	25 (4%)	0	24 (4%)
Manitoba	60 (7%)	74 (11%)	51 (15%)	59 (10%)
Ontario	359 (41%)	253 (39%)	126 (37%)	249 (43%)
Quebec	83 (9%)	59 (9%)	9 (3%)	44 (8%)
Atlantic Provinces	213 (24%)	136 (21%)	96 (28%)	157 (27%)
Total	869	641	340	576

CBSN slide presentations available on www.microbiology.mtsinai.on.ca



Reference List and CBSN publications

1. **National Committee for Clinical Laboratory Standards.** 2000. Methods for dilution antimicrobial susceptibility tests for bacteria that grow aerobically, 5th ed. Approved standard M7-A5. National Committee for Clinical Laboratory Standards, Wayne, Pa.
2. **National Committee for Clinical Laboratory Standards.** 2000. Performance standards for antimicrobial disk susceptibility tests, 7th ed. Approved standard M2-A7. National Committee for Clinical Laboratory Standards, Wayne, Pa.
3. **National Committee for Clinical Laboratory Standards.** 2004. Performance standards for antimicrobial susceptibility testing. Fourteenth informational supplement, M100-S14. Wayne, Pa.
4. **Chen, D., A. McGeer, J. C. de Azavedo, D. E. Low, and The Canadian Bacterial Surveillance Network.** 1999. Decreased susceptibility of *Streptococcus pneumoniae* to fluoroquinolones in Canada. N.Eng.J.Med. **341**:233-239.
5. **Low, D. E., J. de Azavedo, K. Weiss, T. Mazzulli, M. Kuhn, D. Church, K. Forward, G. Zhanel, A. Simor, and A. McGeer.** 2002. Antimicrobial resistance among clinical isolates of *Streptococcus pneumoniae* in Canada during 2000. Antimicrob Agents Chemother **46**:1295-1301.
6. **Simor, A. E., M. Louie, and D. E. Low.** 1996. Canadian national survey of prevalence of antimicrobial resistance among clinical isolates of *Streptococcus pneumoniae*. Canadian Bacterial Surveillance Network. Antimicrob Agents Chemother **40**:2190-2193.
7. **Powis J, McGeer A, Green K, Vanderkooi O, Weiss K, Zhanel G, Mazzulli T, Kuhn M, Church D, Davidson R, Forward K, Hoban D, Simor A, the Canadian Bacterial Surveillance Network, and Low DE.** 2004. Antimicrobial susceptibility among clinical isolates of *Streptococcus pneumoniae* in Canada during 2002. in press AAC.