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Tuberculosis

Drug resistance in Canada

2004

Reported susceptibility results of the Canadian Tuberculosis Laboratory Surveillance System

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INTRODUCTION

Tuberculosis Prevention and Control (TBPC) at the Centre for Infectious Disease Prevention and Control, Public Health Agency of Canada, in collaboration with the Canadian Tuberculosis Laboratory Technical Network and participating laboratories (representing all provinces and territories) in the Canadian Tuberculosis Laboratory Surveillance System (CTBLSS) (Appendix 1), established a laboratory-based national surveillance system in 1998 to monitor tuberculosis (TB) drug resistance patterns in Canada.

For each calendar year, laboratories report results of anti-tuberculosis drug susceptibility testing to TBPC for every patient for whom they receive a specimen or an isolate. TBPC subsequently produces this annual report.

METHODS

TBPC maintains a computerized database containing drug susceptibility test results of *Mycobacterium tuberculosis* (MTB) and MTB complex (MTBC) isolates. Isolates identified as *Mycobacterium bovis* BCG are included in the CTBLSS but are excluded from this report. *M. bovis* (BCG) is intrinsically resistant to pyrazinamide (PZA) and the identity of the majority of isolates of *M. bovis* (BCG) can be inferred from the history of recent vaccination. Results of susceptibility testing for second-line anti-tuberculosis drugs, although reported, are also not included in this report. Data are collected either through manual completion of a standard reporting form (Appendix 2) or by electronic transmission. Information collected includes sex, year of birth, province/territory from which the report originates, province/territory from which the specimen originates and susceptibility results. TBPC makes every effort to eliminate duplicate specimens. Only the most recent susceptibility results for a given patient in the current reporting year are included for analysis.

Newfoundland and Labrador identifies the species and tests all isolates for drug resistance in Newfoundland and Labrador. Some provinces identify the species and test their own isolates and those of other provinces/territories (British Columbia: British Columbia and Yukon Territory isolates; Alberta: Alberta and Northwest Territories isolates; Ontario: Ontario and Nunavut isolates; Nova Scotia: Nova Scotia and Prince Edward Island isolates). Saskatchewan tests for drug resistance on all MTBC isolates. Other provinces and territories report results at the species level.

Laboratories generally perform routine susceptibility testing of MTB or MTBC to first-line anti-tuberculous drugs using the radiometric proportion method (BACTEC®). Saskatchewan uses MGIT® 960 and all others use BACTEC® 460. Table A lists the first-line anti-tuberculosis drugs and the concentrations in mg/L used by the participating laboratories.

For this and subsequent annual reports a modification in the method used to calculate the proportion of isolates susceptible to each drug has been made. As not all isolates were tested for resistance to all drugs, the proportion of isolates showing monoresistance is expressed as the number of isolates resistant to the drug over the total number of isolates tested for sensitivity to that particular drug. An adjustment based on this method has been made to all data starting from 1998. These proportions for 1998 through 2004 are reported in Table 1, and Tables 5–17.

As noted in Table A, the number and specific first-line anti-tuberculous drugs that are subject to routine susceptibility testing differ among the provinces and territories. Accordingly, the number of isolates included in the descriptive analyses varies.

Table A: Minimal inhibitory concentrations for routine testing of first-line anti-tuberculosis drugs		
Anti-TB drugs	**MIC (mg/L)**	**Comments**
Isoniazid (INH)	0.1	
Rifampin (RMP)	2.0	
Ethambutol (EMB)	2.5	British Columbia uses an MIC of 4.0 mg/L.
Pyrazinamide (PZA)	100.0	Routine testing is not performed for isolates from British Columbia, Saskatchewan and the Yukon Territory.
Streptomycin (SM)	2.0	Routine testing is not performed for isolates from Quebec, Nova Scotia, New Brunswick, Prince Edward Island.

In 2004, a total of ten laboratories participated in the proficiency for anti-microbial susceptibility testing of *M. tuberculosis* to isoniazid (INH), rifampin (RMP), ethambutol (EMB), pyrazinamide (PZA) and streptomycin (SM) conducted by the National Reference Centre for Mycobacteriology, National Microbiology Laboratories in Winnipeg. Six strains of *M. tuberculosis* were submitted for testing. Participant results are presented in Appendix 3.

This report presents 2004 and adjusted 2003 (to reflect duplicate removal and late reporting) drug susceptibility data for TB isolates across Canada as of December 2005.

RESULTS

Of the 1,358 isolates in 2004 included for analysis, 168 (12.4%) were resistant to at least one of the following: INH, RMP, EMB, PZA or SM. Resistance to SM was the most common type of drug resistance (7.8%). The Ontario isolates showed a significant jump in SM resistance from the previous years (2.9% to 6.2%). For Canada as a whole, INH resistance was 7.4%. Twelve isolates (0.9%) were multi-drug resistant (MDR- TB) strains (defined as resistance to at least INH and RMP). Four isolates demonstrated resistance to more than three of the five anti-tuberculous drugs tested.

MDR-TB isolates were reported from Ontario, British Columbia, Alberta and Quebec. The Yukon Territory, Northwest Territories, Nunavut, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador reported that all isolates tested were susceptible to all the first-line anti-tuberculous drugs.

Demographic information on the individual patients from whom the isolates originated is limited in this laboratory-based surveillance system. Of the 1,307 isolates for which the year of birth and sex reporting was complete, 37% were between the ages 25 and 44. Males accounted for 53% of all the isolates and 53% of the drug resistant isolates.

DISCUSSION

The number of reported TB isolates in 2004 was relatively unchanged from the previous year (1,379 isolates in 2003 to 1,358 in 2004). In addition, the percentage of isolates demonstrating any type of drug resistance was also unchanged between the two reporting years (12.5% in 2003 to 12.4% in 2004). However, the proportion of isolates classified as MDR-TB was below that of the previous years (1.5% in 2003 and 0.9% in 2004). Although the drop in MDR-TB is encouraging, the overall, levels of TB drug resistance have shown no significant difference since the inception of this reporting system in 1998.

Seventy-eight percent of the reported laboratory TB isolates in Canada in 2004 originated from three provinces. Ontario, Quebec and British Columbia have consistently reported the majority of isolates and MDR-TB in the seven years of data collection. Since the initiation of this laboratory-based surveillance system Saskatchewan, the Atlantic Provinces, the Yukon and Northwest Territories have not reported any MDR-TB isolates.

The results observed to date in this surveillance system are consistent with international data. In the latest report of the global TB drug resistance surveillance project jointly conducted by the World Health Organization (WHO) and the International Union Against Tuberculosis and Lung Disease (IUATLD), the median prevalence of TB drug resistance among the participating countries was 10.5 (Range 0.0–57.1%) for new cases and 22.7% (Range 0.0–82.1%) for previously treated cases (as compared with 12.2% overall in Canada). The median prevalence of MDR-TB was 1.2% (Range 0.0–14.2%) for new cases and 7.6% (Range 0.0–58.3%) for previously treated cases (as compared with 0.9% overall in Canada).[1]

LIMITATIONS

Sensitivity testing for first-line anti-TB drugs is not uniform across the country. Therefore, there are limitations in interpreting the data, particularly the percentage of isolates that are resistant to SM and PZA.

More epidemiological information on the TB cases from which the isolates were submitted would be desirable to critically examine drug resistance patterns in Canada. However, this is difficult to collect as isolates often come to the lab with only sex and year of birth. As well, no differentiation can be made between primary and secondary/acquired drug resistance from the data. The annual tuberculosis in Canada report (http://www.publichealth.gc.ca/tuberculosis) includes additional drug resistance data for each reported TB case.

CONCLUSIONS

With growing worldwide concern regarding TB drug resistance, this surveillance system is vital in providing the necessary data in a timely fashion to monitor trends in TB drug resistance in Canada. The surveillance data collected to date indicate that the prevalence of TB drug resistance in this country is similar to that in the overall global situation.

REFERENCE

1. The WHO/IUATLD Global Project on Anti-tuberculosis Drug Resistance Surveillance. *Anti-TB drug resistance in the world History, Coverage, Issues, Future.* Joint Working Group meeting HIV and drug resistance surveillance and testing. Versailles, France 16, October 2005.

Figure 1
Reported TB drug resistance in Canada by province/territory – 2004

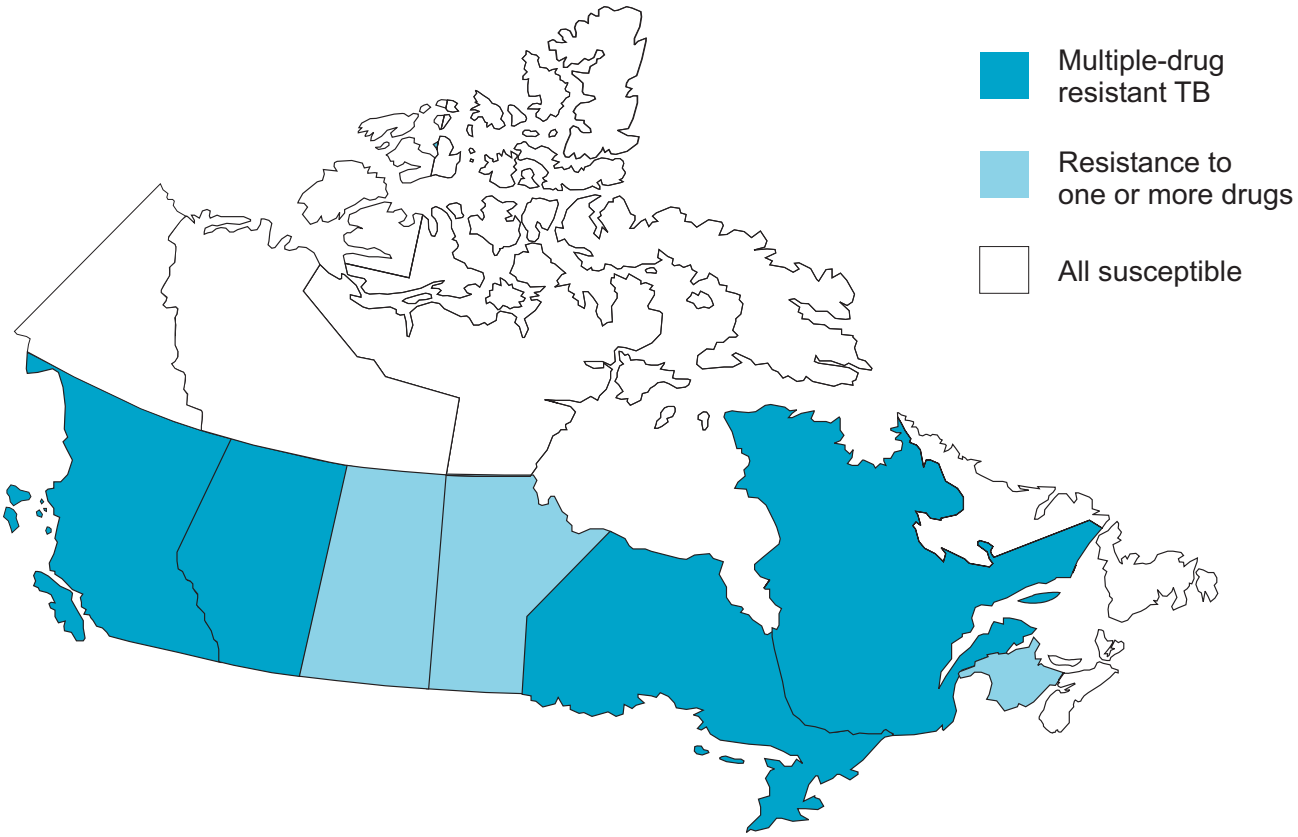


Figure 2
Reported *Mycobacterium tuberculosis* isolates in Canada by province/territory– 2004

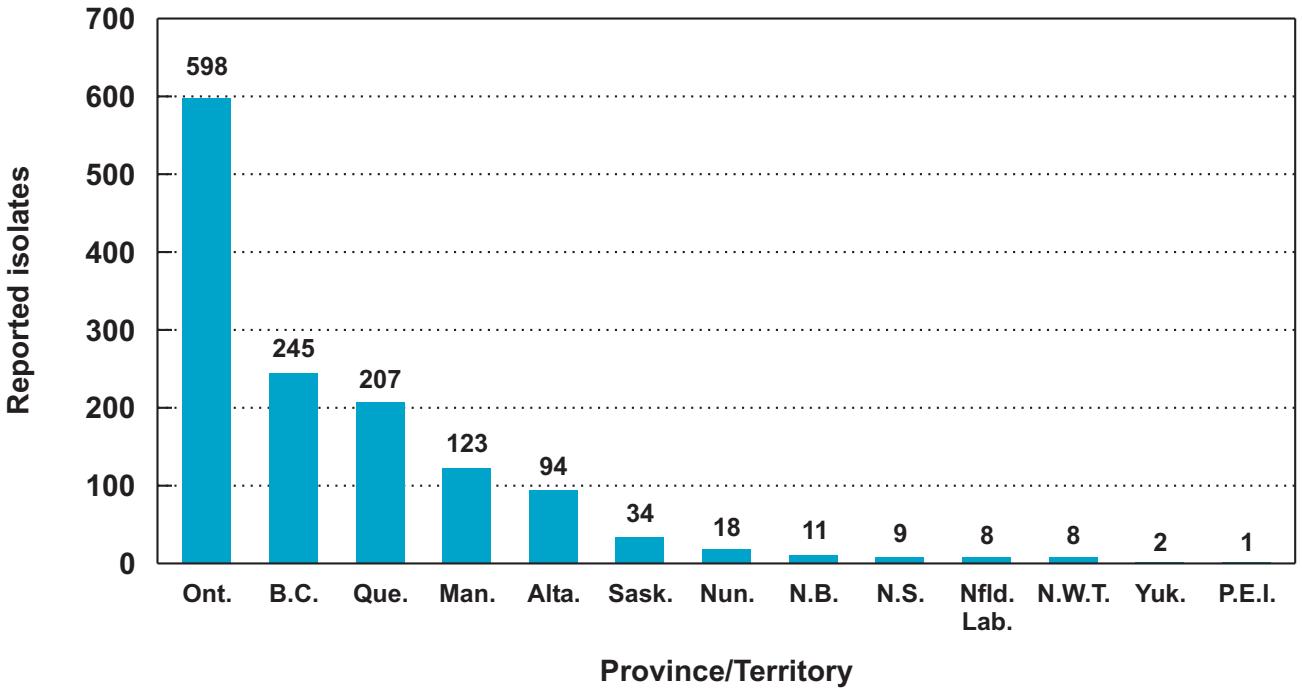
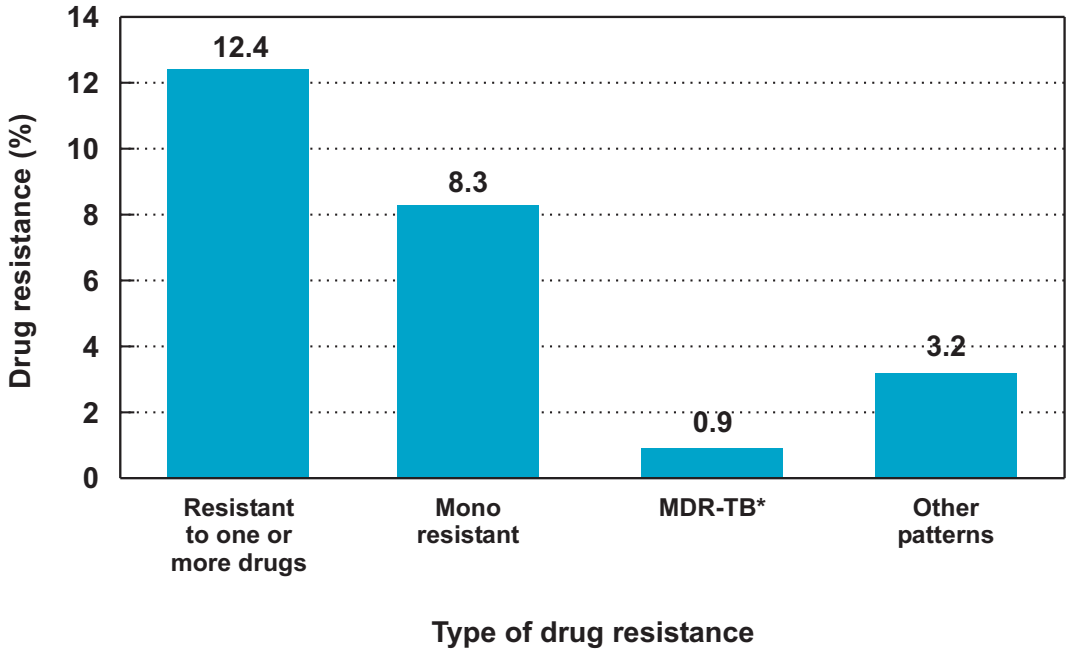
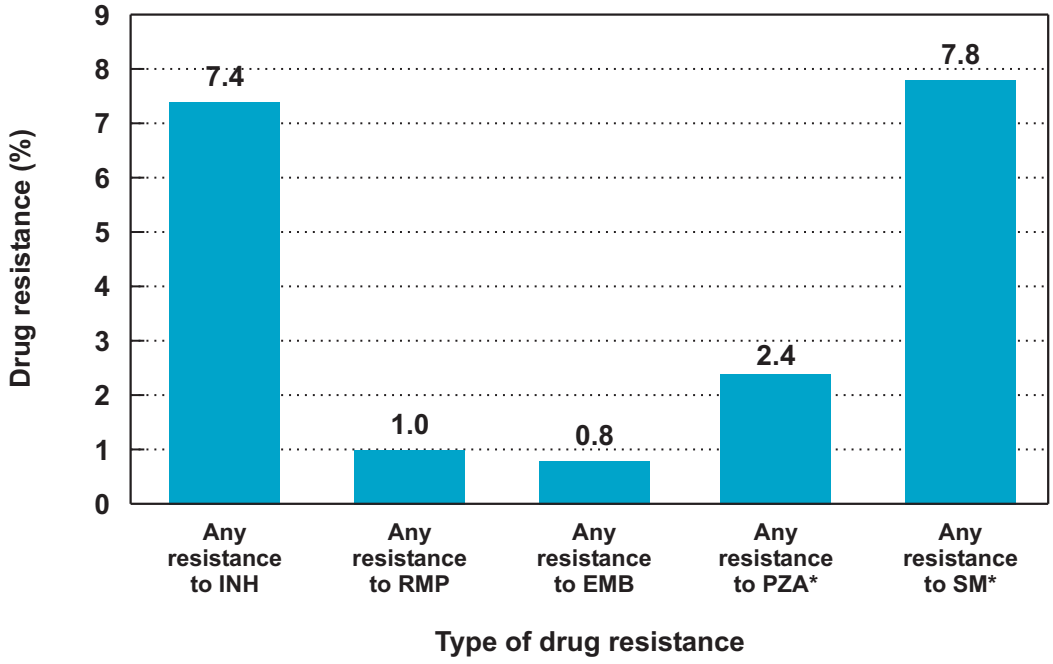


Figure 3
Overall pattern of reported TB drug resistance in Canada – 2004



* Multi-drug resistant TB (MDR-TB) is resistance to at least isoniazid and rifampin.

Figure 4
Reported TB drug resistance in Canada by type of drug – 2004



* SM and PZA are not part of routine first line drug testing in some provinces/territories.

Figure 5
Any resistance by type of drug in Canada – 1998-2004

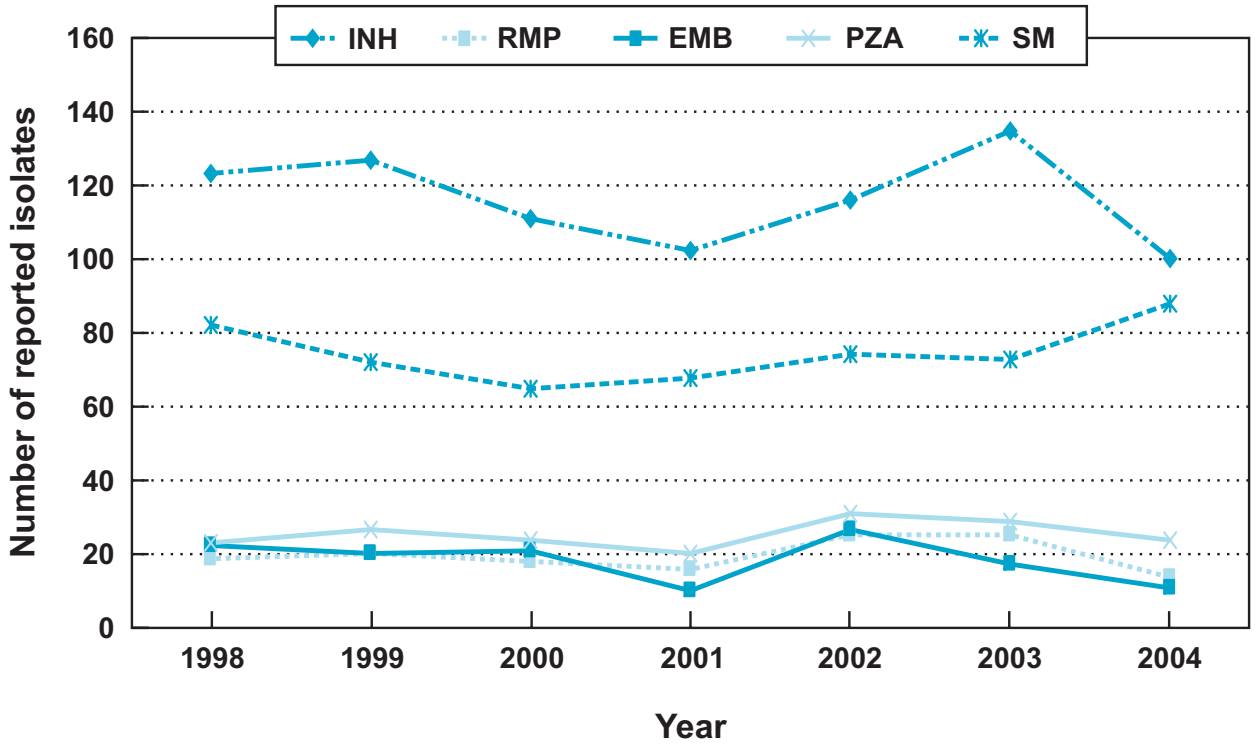


Figure 6
Any resistance by type of drug in Canada as a proportion of the number of isolates tested – 1998-2004

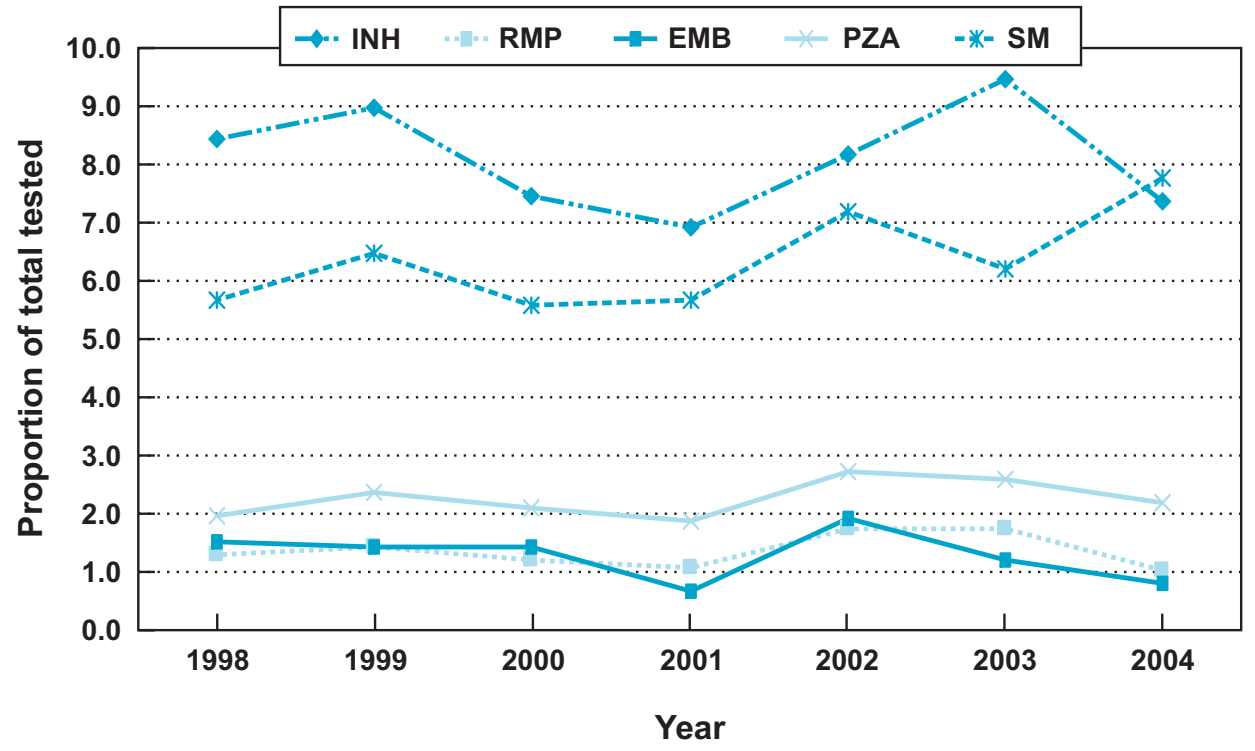


Figure 7
Overall pattern of reported TB drug resistance in Canada – 1998-2004

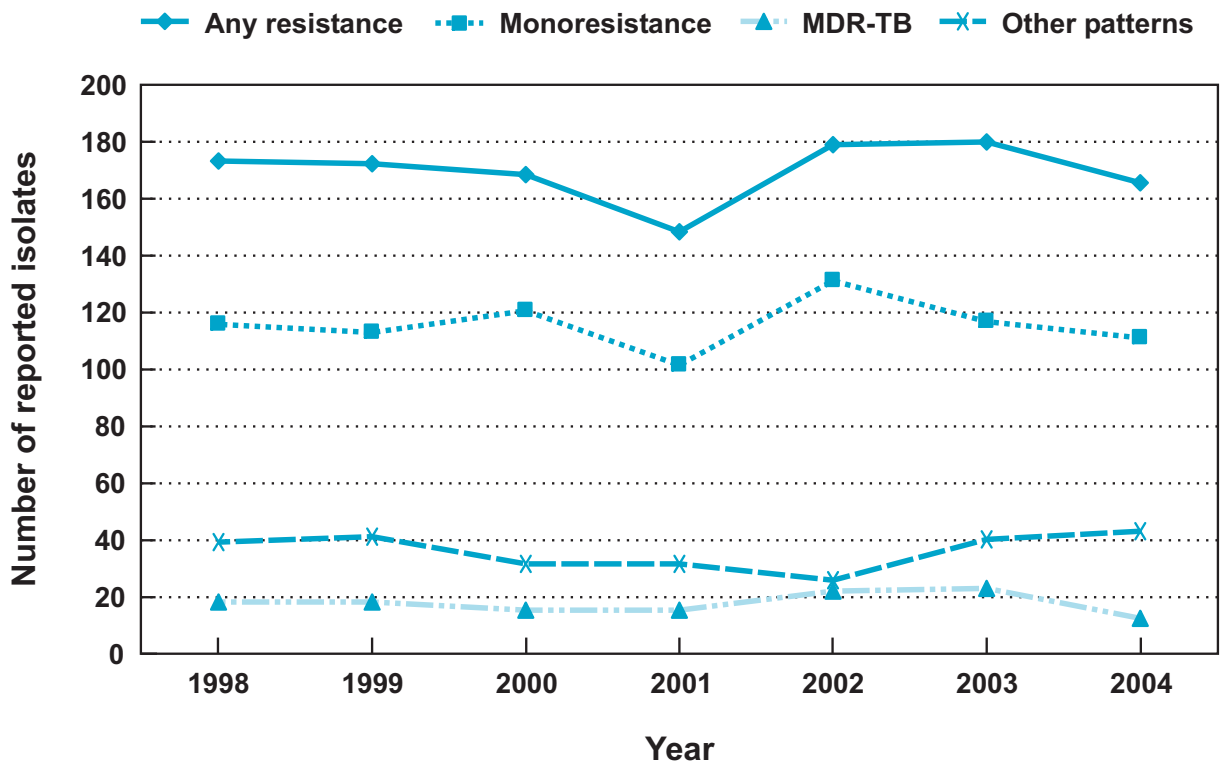


Figure 8
Overall pattern of reported TB drug resistance in Canada as a proportion of isolates tested – 1998-2004

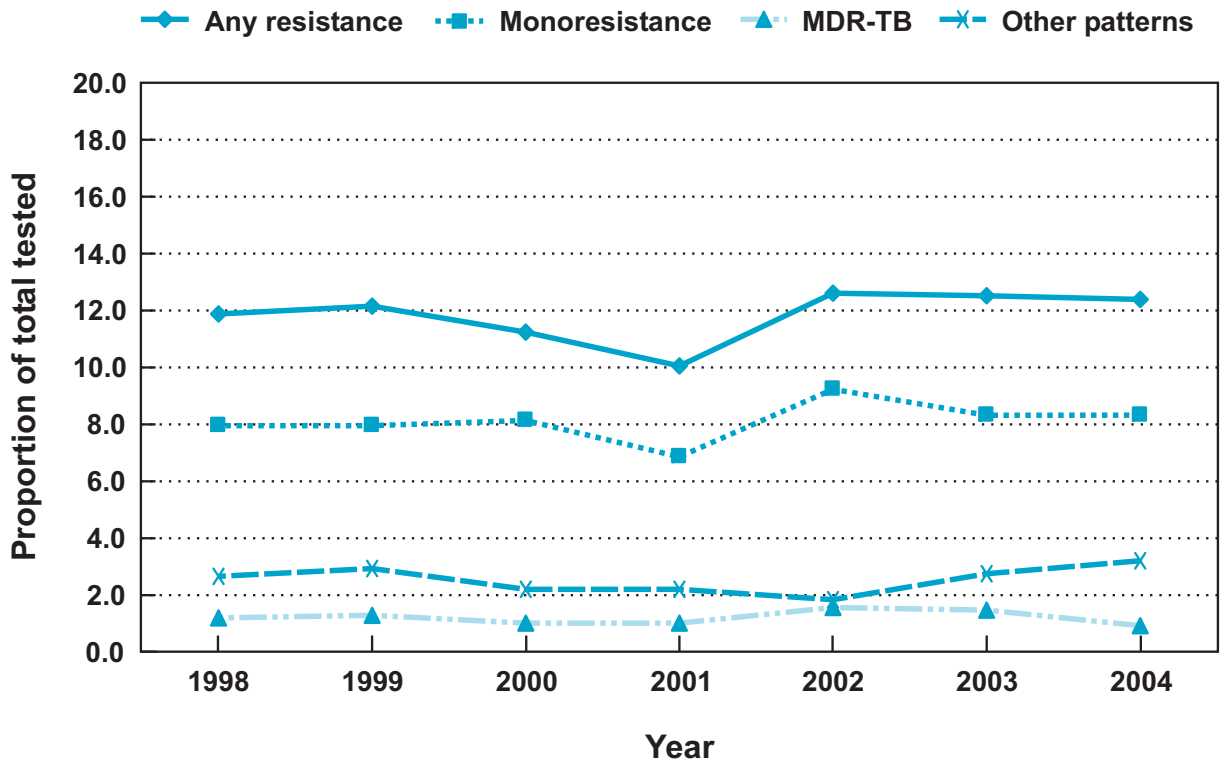


Table 1. Overall pattern of reported TB drug resistance in Canada – 1998-2004

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 Total (%)	2003 Total (%)	2004 Total (%)
Total number of isolates tested	**1,461 (100.0)**	**1,415 (100.0)**	**1,491 (100.0)**	**1,476 (100.0)**	**1,420 (100.0)**	**1,428 (100.0)**	**1,358 (100.0)**
Isolates susceptible	1,288 (88.2)	1,243 (87.8)	1,323 (88.7)	1,328 (90.0)	1,241 (87.4)	1,248 (87.4)	1,190 (87.6)
Any resistance to INH	123 (8.4)	127 (9.0)	111 (7.4)	102 (6.9)	116 (8.2)	135 (9.5)	100 (7.4)
Any resistance to RMP	19 (1.3)	20 (1.4)	18 (1.2)	16 (1.1)	25 (1.8)	25 (1.8)	14 (1.0)
Any resistance to EMB	22 (1.5)	20 (1.4)	21 (1.4)	10 (0.7)	27 (1.9)	17 (1.2)	11 (0.8)
Any resistance to PZA	23 (1.6)	27 (1.9)	24 (1.6)	20 (1.4)	31 (2.2)	29 (2.0)	26 (2.4)
Any resistance to SM	82 (5.7)	72 (6.5)	65 (5.6)	68 (5.7)	74 (7.2)	73 (6.2)	88 (7.8)
Resistance to one or more drugs	173 (11.8)	172 (12.2)	168 (11.3)	148 (10.0)	179 (12.6)	180 (13.1)	168 (12.4)
Monoresistance	116 (7.9)	113 (8.0)	121 (8.1)	101 (6.8)	131 (9.2)	117 (8.5)	113 (8.3)
MDR-TB	18 (1.2)	18 (1.3)	15 (1.0)	15 (1.0)	22 (1.5)	23 (1.7)	12 (0.9)
Other patterns	39 (2.7)	41 (2.9)	32 (2.1)	32 (2.2)	26 (1.8)	40 (2.9)	43 (3.2)

Table 2. Reported *Mycobacterium tuberculosis* isolates by "reporting" and "originating" province/territory, Canada – 2004

Reporting Province	CANADA	Originating Province/Territory												
		Nfld. Lab.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Yukon	N.W.T.	Nun.
Number of isolates	**1,358**	**8**	**1**	**9**	**11**	**207**	**598**	**123**	**34**	**94**	**245**	**2**	**8**	**18**
Nfld. Lab.	**8**	8	0	0	0	0	0	0	0	0	0	0	0	0
N.S.	**10**	0	1	9	0	0	0	0	0	0	0	0	0	0
N.B.	**11**	0	0	0	11	0	0	0	0	0	0	0	0	0
Que.	**207**	0	0	0	0	207	0	0	0	0	0	0	0	0
Ont.	**611**	0	0	0	0	0	598	0	0	0	0	0	0	13
Man.	**123**	0	0	0	0	0	0	123	0	0	0	0	0	0
Sask.	**33**	0	0	0	0	0	0	0	33	0	0	0	0	0
Alta.	**109**	0	0	0	0	0	0	0	1	94	1	0	8	5
B.C.	**246**	0	0	0	0	0	0	0	0	0	244	2	0	0

Table 3. Reported MDR-TB isolates by province/territory, Canada – 2004

	CANADA	Originating Province/Territory												
		Nfld. Lab.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Yukon	N.W.T.	Nun.
Total number of isolates tested	**1,358**	**8**	**1**	**9**	**11**	**207**	**598**	**123**	**34**	**94**	**245**	**2**	**8**	**18**
Total number of MDR-TB isolates*	**12**	**0**	**0**	**0**	**0**	**1**	**7**	**0**	**0**	**2**	**2**	**0**	**0**	**0**
INH & RMP	**6**	0	0	0	0	1	4	0	0	0	1	0	0	0
INH, RMP & EMB	**2**	0	0	0	0	0	0	0	0	1	1	0	0	0
INH, RMP & PZA	**1**	0	0	0	0	0	1	0	0	0	0	0	0	0
INH, RMP, PZA & EMB	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0
INH, RMP, EMB & SM	**1**	0	0	0	0	0	0	0	0	1	0	0	0	0
INH, RMP, PZA & SM	**1**	0	0	0	0	0	1	0	0	0	0	0	0	0
INH, RMP, EMB, PZA & SM	**1**	0	0	0	0	0	1	0	0	0	0	0	0	0

* MDR-TB is defined as resistance to at least INH and RMP.

Table 4. Reported TB drug resistance by gender and age group, Canada – 2004

Age Group		Isolates	Any Resistance	MDR-TB*
		Number (%)	Number (%)	Number (%)
Total		**1,358 (100)**	**168 (100)**	**12 (100)**
0-4	Males	6 (0.4)	1 (0.6)	0 (0.0)
	Females	2 (0.1)	0 (0.0)	0 (0.0)
	Unknown	0 (0.0)	0 (0.0)	0 (0.0)
	Total	**8 (0.6)**	**1 (0.6)**	**0 (0.0)**
5-14	Males	10 (0.7)	3 (1.8)	1 (8.3)
	Females	6 (0.4)	0 (0.0)	0 (0.0)
	Unknown	0 (0.0)	0 (0.0)	0 (8.3)
	Total	**16 (1.2)**	**3 (1.8)**	**1 (8.3)**
15-24	Males	71 (5.2)	6 (3.6)	1 (8.3)
	Females	86 (6.3)	8 (4.8)	1 (8.3)
	Unknown	8 (0.6)	1 (0.6)	0 (0.0)
	Total	**165 (12.2)**	**15 (8.9)**	**2 (16.7)**
25-34	Males	127 (9.4)	14 (8.3)	1 (8.3)
	Females	138 (10.2)	22 (13.1)	3 (25.0)
	Unknown	11 (0.8)	1 (0.6)	0 (0.0)
	Total	**276 (20.3)**	**37 (22.0)**	**4 (33.3)**
35-44	Males	100 (7.4)	18 (10.7)	1 (8.3)
	Females	101 (7.4)	17 (10.1)	1 (8.3)
	Unknown	4 (0.3)	1 (0.6)	0 (0.0)
	Total	**205 (15.1)**	**36 (21.4)**	**2 (16.7)**
45-54	Males	98 (7.2)	12 (7.1)	2 (16.7)
	Females	71 (5.2)	10 (6.0)	0 (0.0)
	Unknown	6 (0.4)	1 (0.6)	0 (0.0)
	Total	**175 (12.9)**	**23 (13.7)**	**2 (16.7)**
55-64	Males	84 (6.2)	6 (3.6)	0 (0.0)
	Females	64 (4.7)	6 (3.6)	1 (8.3)
	Unknown	0 (0.0)	0 (0.0)	0 (0.0)
	Total	**148 (10.9)**	**12 (7.1)**	**1 (8.3)**
65-74	Males	96 (7.1)	9 (5.4)	0 (0.0)
	Females	51 (3.8)	5 (3.0)	0 (0.0)
	Unknown	4 (0.3)	0 (0.0)	0 (0.0)
	Total	**151 (11.1)**	**14 (8.3)**	**0 (0.0)**
75+	Males	102 (7.5)	14 (8.3)	0 (0.0)
	Females	85 (6.3)	8 (4.8)	0 (0.0)
	Unknown	6 (0.4)	2 (1.2)	0 (0.0)
	Total	**193 (14.2)**	**24 (14.3)**	**0 (0.0)**
Unknown	Males	5 (0.4)	1 (0.6)	0 (0.0)
	Females	6 (0.4)	0 (0.0)	0 (0.0)
	Unknown	10 (0.7)	2 (1.2)	0 (0.0)
	Total	**21 (1.5)**	**3 (1.8)**	**0 (0.0)**
Total	**Males**	**699 (51.5)**	**84 (50.0)**	**6 (50.0)**
	Females	**610 (44.9)**	**76 (45.2)**	**6 (50.0)**
	Unknown	**49 (3.6)**	**8 (4.8)**	**0 (0.0)**

* MDR-TB is defined as resistance to at least INH and RMP.

Table 5. Reported results for routine drug susceptibility testing *of Mycobacterium tuberculosis* isolates, Alberta – 1998-2004

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 Total (%)	2003 Total (%)	2004 Total (%)
Total number of isolates tested for INH, RMP, SM, EMB and PZA	**119 (100.0)**	**117 (100.0)**	**104 (100.0)**	**91 (100.0)**	**108 (100.0)**	**106 (100.0)**	**94 (100.0)**
Isolates susceptible	**107 (89.9)**	**110 (94.0)**	**92 (88.5)**	**79 (86.8)**	**94 (87.0)**	**87 (82.0)**	**81 (86.2)**
Isolates resistant to one or more drugs	**12 (10.1)**	**7 (6.0)**	**12 (11.5)**	**12 (13.2)**	**14 (13.0)**	**19 (17.9)**	**13 (13.8)**
Monoresistance	**9 (7.6)**	**6 (5.1)**	**7 (6.7)**	**8 (8.8)**	**12 (11.1)**	**12 (11.3)**	**7 (7.4)**
INH	4 (3.4)	2 (1.7)	2 (1.9)	5 (5.5)	6 (5.6)	6 (5.7)	4 (4.3)
RMP	–	–	–	–	–	–	–
EMB	–	–	1 (1.0)	–	–	–	–
PZA	–	–	1 (1.0)	–	–	2 (1.9)	2 (2.1)
SM	5 (4.1)	4 (3.4)	3 (2.9)	3 (3.3)	6 (5.6)	4 (3.8)	1 (1.1)
MDR–TB*	**1 (0.8)**	**–**	**–**	**–**	**–**	**1 (1.1)**	**2 (2.1)**
INH & RMP	–	–	–	–	–	1 (1.1)	–
INH & RMP & EMB	–	–	–	–	–	–	1 (1.1)
INH & RMP & EMB & SM	–	–	–	–	–	–	1 (1.1)
INH & SM & EMB & RMP & PZA	1 (0.8)	–	–	–	–	–	–
Other Patterns	**2 (1.7)**	**1 (0.8)**	**5 (4.8)**	**4 (4.4)**	**2 (1.9)**	**6 (5.7)**	**4 (4.3)**
INH & SM	1 (0.8)	1 (0.8)	3 (2.9)	2 (2.2)	1 (0.9)	5 (4.8)	3 (3.2)
INH & SM & EMB	–	–	1 (1)	–	–	1 (1.1)	–
INH & SM & PZA	1 (0.8)	–	1 (1)	2 (2.2)	1 (0.9)	–	1 (1.1)

* MDR-TB is defined as resistance to at least INH and RMP.

Table 6. Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* isolates, British Columbia – 1998-2004

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 Total (%)	2003 Total (%)	2004 Total (%)
Total number of isolates tested for INH, RMP, SM and EMB**	**237 (100.0)**	**244 (100.0)**	**277 (100.0)**	**332 (100.0)**	**259 (100.0)**	**293 (100.0)**	**245 (100.0)**
Isolates susceptible	**212 (89.5)**	**224 (91.8)**	**245 (88.4)**	**297 (89.4)**	**228 (88.0)**	**259 (88.4)**	**210 (85.7)**
Isolates resistant to one or more drugs	**25 (10.5)**	**20 (8.2)**	**32 (11.6)**	**35 (10.6)**	**31 (12.0)**	**34 (11.0)**	**35 (14.3)**
Monoresistance	**17 (7.2)**	**15 (6.1)**	**23 (8.3)**	**22 (6.6)**	**25 (9.7)**	**18 (6.1)**	**22 (9.0)**
INH	14 (5.9)	11 (4.5)	13 (4.7)	12 (3.6)	12 (4.6)	11 (3.8)	7 (2.9)
RMP	1 (0.4)	1 (0.4)	1 (0.4)	1 (0.3)	2 (0.8)	–	–
EMB	–	1 (0.4)	1 (0.4)	–	2 (0.8)	1 (0.3)	1 (0.4)
PZA	–	–	–	–	1 (3.8)^	–	3 (10.0)^^
SM	2 (0.8)	2 (0.8)	8 (2.9)	9 (2.7)	8 (3.1)	5 (1.7)	11 (4.5)
MDR-TB*	**2 (0.8)**	**1 (0.4)**	**5 (1.8)**	**8 (2.4)**	**2 (0.8)**	**8 (2.7)**	**2 (0.8)**
INH & RMP	–	–	–	4 (1.2)	–	1 (0.3)	1 (0.4)
INH & RMP & EMB	–	–	1 (0.4)	–	–	–	1 (0.4)
INH & RMP & SM	1 (0.4)	–	2 (0.7)	2 (0.6)	–	3 (1.0)	–
INH & RMP & PZA	–	–	–	–	–	1 (0.3)	–
INH & RMP & EMB & PZA	–	–	–	–	1 (0.4)	1 (0.3)	–
INH & RMP & SM & EMB	1 (0.4)	1 (0.4)	2 (0.7)	1 (0.3)	–	–	–
INH & RMP & SM & EMB & PZA	–	–	–	1 (0.3)	1 (0.4)	2 (0.7)	–
Other Patterns	**6 (2.5)**	**4 (1.6)**	**4 (1.4)**	**5 (1.5)**	**4 (1.5)**	**8 (2.7)**	**11 (4.5)**
INH & EMB	1 (0.4)	1 (0.4)	–	–	–	–	1 (0.4)
INH & SM	5 (2.1)	2 (0.8)	2 (0.7)	5 (1.5)	3 (1.2)	7 (2.4)	4 (1.6)
INH & PZA	–	–	–	–	1 (0.4)	1 (0.3)	3 (1.2)
RMP & PZA	–	–	–	–	–	–	2 (0.8)
INH & SM & EMB	–	1 (0.4)	2 (0.7)	–	–	–	–
INH & SM & PZA	–	–	–	–	–	–	1 (0.4)

* MDR-TB is defined as resistance to at least INH and RMP.

** Routine testing for PZA not conducted.

*** Includes 1 *M. bovis* isolate for 2002 and 1 *M. bovis* isolate for 2003.

^ Only 26 patients tested

^^ Only 30 tests done

Table 7. Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* isolates, Manitoba – 1998-2004

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 Total (%)	2003 Total (%)	2004 Total (%)
Total number of isolates tested for INH, RMP, EMB, SM and PZA**	**106 (100.0)**	**100 (100.0)**	**102 (100.0)**	**110 (100.0)**	**114 (100.0)**	**122 (100.0)**	**123 (100.0)**
Isolates susceptible	**98 (92.5)**	**89 (89.0)**	**94 (92.2)**	**101 (91.8)**	**106 (93.0)**	**114 (93.4)**	**121 (98.0)**
Isolates resistant to one or more drugs	**8 (7.5)**	**11 (11.0)**	**8 (7.8)**	**9 (8.2)**	**8 (7.0)**	**8 (6.6)**	**2 (1.6)**
Monoresistance	**4 (3.8)**	**6 (6.0)**	**6 (5.9)**	**6 (5.5)**	**4 (3.5)**	**7 (5.7)**	**2 (1.6)**
INH	2 (1.9)	3 (3.0)	6 (5.9)	2 (1.8)	3 (2.6)	3 (2.5)	–
SM**	2 (1.9)	3 (3.0)	–	4 (3.8)^	–	3 (2.6)^^	1 (0.8)
PZA***	–	–	–	–	1 (0.9)	1 (0.8)	1 (0.8)
MDR-TB*	**2 (1.9)**	**2 (2.0)**	**–**	**2 (1.8)**	**3 (2.6)**	**1 (0.8)**	**–**
INH & RMP	–	1 (1.0)	–	1 (0.9)	1 (0.9)	1 (0.8)	–
INH & EMB & RMP & PZA	–	–	–	–	1 (0.9)	–	–
INH & EMB & RMP	1 (0.9)	–	–	–	–	–	–
INH & SM & EMB & RMP & PZA	1 (0.9)	–	–	1 (0.9)	1 (0.9)	–	–
INH & SM & RMP & PZA	–	1 (1.0)	–	–	–	–	–
Other Patterns	**2 (1.9)**	**3 (3.0)**	**2 (2.0)**	**1 (0.9)**	**1 (0.9)**	**–**	**–**
INH & PZA	–	–	–	–	1 (0.9)	–	–
INH & SM	2 (1.9)	1 (1.0)	2 (2.0)	1 (0.9)	–	–	–
INH & SM & EMB	–	1 (1.0)	–	–	–	–	–
INH & SM & PZA	–	1 (1.0)	–	–	–	–	–

* MDR-TB is defined as resistance to at least INH and RMP.

** Routine testing for SM not conducted for 2002.

*** Includes 1 *M. bovis* isolate for 2002.

^ 104 patients tested

^^ 114 patient tested

Table 8. Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* isolates, New Brunswick – 1998-2004

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 Total (%)	2003 Total (%)	2004 Total (%)
Total number of isolates tested for INH, RMP, EMB and PZA*	**10 (100.0)**	**12 (100.0)**	**9 (100.0)**	**10 (100.0)**	**10 (100.0)**	**14 (100.0)**	**11 (100.0)**
Isolates susceptible	**9 (90.0)**	**12 (100.0)**	**9 (100.0)**	**10 (100.0)**	**9 (90.0)**	**13 (92.9)**	**10 (91.0)**
Isolates resistant to one or more drugs	**1 (10.0)**	**–**	**–**	**–**	**1 (10.0)**	**1 (7.1)**	**1 (9.0)**
Monoresistance	**1 (10.0)**	**–**	**–**	**–**	**1 (10.0)**	**1 (7.1)**	**1 (9.0)**
INH	1 (10.0)	–	–	–	1 (10.0)	1 (7.1)	1 (9.0)

* Routine testing for SM not conducted.

Table 9. Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* isolates, Newfoundland and Labrador – 1998-2004

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 Total (%)	2003 Total (%)	2004 Total (%)
Total number of isolates tested for INH, RMP, EMB, SM and PZA	**8 (100.0)**	**9 (100.0)**	**11 (100.0)**	**9 (100.0)**	**4 (100.0)**	**6 (100.0)**	**8 (100.0)**
Isolates susceptible	**8 (100.0)**	**9 (100.0)**	**11 (100.0)**	**9 (100.0)**	**4 (100.0)**	**4 (66.7)**	**8 (100.0)**
Isolates resistant to one or more drugs	**–**	**–**	**–**	**–**	**–**	**2 (33.3)**	**–**
Monoresistance	**–**	**–**	**–**	**–**	**–**	**2 (33.3)**	**–**
INH	–	–	–	–	–	1 (16.7)	–
RMP	–	–	–	–	–	1 (16.7)	–

Table 10. Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* isolates, Northwest Territories – 1998-2004

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 Total (%)	2003 Total (%)	2004 Total (%)
Total number of isolates tested for INH, RMP, EMB, SM and PZA	**27 (100.0)**	**11 (100.0)**	**8 (100.0)**	**6 (100.0)**	**3 (100.0)**	**18 (100.0)**	**8 (100.0)**
Isolates susceptible	**27 (100.0)**	**11 (100.0)**	**8 (100.0)**	**6 (100.0)**	**3 (100.0)**	**18 (100.0)**	**8 (100.0)**

Table 11. Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* isolates, Nova Scotia – 1998-2004

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 Total (%)	2003 Total (%)	2004 Total (%)
Total number of isolates tested for INH, RMP, EMB and PZA*	**9 (100.0)**	**8 (100.0)**	**4 (100.0)**	**7 (100.0)**	**10 (100.0)**	**7 (100.0)**	**9 (100.0)**
Isolates susceptible	**8 (88.9)**	**7 (87.5)**	**4 (100.0)**	**7 (100.0)**	**9 (90.0)**	**7 (100.0)**	**9 (100.0)**
Isolates resistant to one or more drugs	**1 (11.1)**	**1 (12.5)**	**–**	**–**	**1 (10.0)**	**–**	**–**
Monoresistance	**1 (11.1)**	**1 (12.5)**	**–**	**–**	**1 (10.0)**	**–**	**–**
INH	1	1 (12.5)	–	–	–	–	–
PZA	–	–	–	–	1 (10.0)	–	–

* Routine testing for SM not conducted.

Table 12. Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* isolates, Nunavut* – 1998-2004

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 Total (%)	2003 Total (%)	2004 Total (%)
Total number of isolates tested for INH, RMP, SM, EMB and PZA**	**N/A**	**15 (100.0)**	**29 (100.0)**	**31 (100.0)**	**22 (100.0)**	**4 (100.0)**	**18 (100.0)**
Isolates susceptible	**N/A**	**15 (100.0)**	**28 (96.6)**	**30 (96.8)**	**22 (100.0)**	**4 (100.0)**	**18 (100.0)**
Isolates resistant to one or more drugs	**N/A**	**–**	**1 (3.4)**	**1 (3.2)**	**–**	**–**	**–**
Monoresistance	**N/A**	**–**	**1 (3.4)**	**–**	**–**	**–**	**–**
INH		–	1 (3.4)	–	–	–	–
MDR-TB	**N/A**	**–**	**–**	**1 (3.2)**	**–**	**–**	**–**
INH & RMP		–	–	1 (3.2)	–	–	–

* Note: Nunavut began reporting in 1999.

** Routine testing for SM not conducted when isolate tested by Quebec (n=13 for 1999, n=28 for 2000 and n=30 for 2001, n=11 for 2002).

Table 13. Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* isolates, Ontario – 1998-2004

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 Total (%)	2003 Total (%)	2004 Total (%)
Total number of isolates tested for INH, RMP, EMB, SM and PZA	**629 (100.0)**	**589 (100.0)**	**599 (100.0)**	**589 (100.0)**	**586 (100.0)**	**591 (100.0)**	**598 (100.0)**
Isolates susceptible	**538 (85.5)**	**489 (83.0)**	**519 (86.6)**	**521 (88.5)**	**492 (84.0)**	**508 (85.9)**	**501 (83.8)**
Isolates resistant to one or more drugs	**91 (14.5)**	**100 (17.0)**	**80 (13.4)**	**68 (11.5)**	**94 (16.0)**	**83 (14.0)**	**97 (16.2)**
Monoresistance	**55 (8.7)**	**57 (9.7)**	**52 (8.7)**	**44 (7.5)**	**61 (10.4)**	**45 (7.6)**	**63 (10.5)**
INH	34 (5.4)	34 (5.8)	23 (3.8)	20 (3.4)	30 (5.1)	24 (4.1)	23 (3.8)
RMP	–	–	–	–	–	1 (0.2)	–
EMB	4 (0.6)	–	1 (0.2)	1 (0.2)	1 (0.2)	–	–
PZA**	6 (1.0)	4 (0.7)	12 (2.0)	7 (1.2)	5 (0.9)	3 (0.5)	3 (0.5)
SM	11 (1.7)	19 (3.2)	16 (2.7)	16 (2.7)	25 (4.3)	17 (2.9)	37 (6.2)
MDR–TB*	**11 (1.7)**	**13 (2.2)**	**9 (1.5)**	**3 (0.5)**	**16 (2.7)**	**12 (2.0)**	**7 (1.2)**
INH & RMP	2 (0.3)	3 (0.5)	1 (0.2)	–	2 (0.3)	3 (0.5)	4 (0.7)
INH & RMP & EMB	–	1 (0.2)	2 (0.3)	1 (0.2)	1 (0.2)	1 (0.2)	–
INH & RMP & SM	1 (0.2)	3 (0.5)	3 (0.5)	–	2 (0.3)	1 (0.2)	–
INH & RMP & PZA	–	1 (0.2)	–	–	–	2 (0.3)	1 (0.2)
INH & RMP & EMB & PZA	–	–	–	1 (0.2)	1 (0.2)	1 (0.2)	–
INH & RMP & SM & EMB	2 (0.3)	–	2 (0.3)	–	5 (0.9)	–	–
INH & RMP & SM & PZA	–	–	1 (0.2)	–	–	–	1 (0.2)
INH & RMP & SM & EMB & PZA	6 (1.0)	5 (0.8)	–	1 (0.2)	5 (0.9)	4 (0.7)	1 (0.2)
Other Patterns	**25 (4.0)**	**30 (5.1)**	**19 (3.2)**	**21 (3.6)**	**17 (2.9)**	**26 (4.4)**	**27 (4.5)**
INH & EMB	2 (0.3)	4 (0.7)	2 (0.3)	–	1 (0.2)	2 (0.3)	1 (0.2)
INH & PZA**	–	–	–	2 (0.3)	–	–	1 (0.2)
INH & SM	20 (3.2)	20 (3.4)	14 (2.3)	16 (2.7)	13 (2.2)	18 (3.1)	23 (3.8)
SM & PZA	–	–	–	–	–	1 (0.2)	–
EMB & RMP	–	–	2 (0.3)	–	–	–	–
INH & SM & EMB	2 (0.3)	4 (0.7)	1 (0.2)	3 (0.5)	2 (0.3)	3 (0.5)	2 (0.3)
INH & SM & PZA	1 (0.2)	2 (0.3)	–	–	–	1 (0.2)	–
INH & EMB & PZA	–	–	–	–	–	1 (0.2)	–
INH & SM & EMB & PZA	–	–	–	–	1 (0.2)	–	–

* MDR-TB is defined as resistance to at least INH and RMP.

** Includes 1 *M. Bovis* isolate for 1999, 2 *M. Bovis* isolates for 2000, 2 *M. Bovis* isolates for 2001, 1 *M. Bovis* isolate for 2002 and 1 *M. Bovis* isolate for 2003.

Table 14. Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* isolates, Prince Edward Island – 1998-2004

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 Total (%)	2003 Total (%)	2004 Total (%)
Total number of isolates tested for INH, RMP, EMB and PZA*	**2 (100.0)**	**2 (100.0)**	**3 (100.0)**	**2 (100.0)**	**1 (100.0)**	**2 (100.0)**	**1 (100.0)**
Isolates susceptible	**2 (100.0)**	**2 (100.0)**	**3 (100.0)**	**1 (50.0)**	**1 (100.0)**	**2 (100.0)**	**1 (100.0)**
Isolates resistant to one or more drugs	**–**	**–**	**–**	**1 (50.0)**	**–**	**–**	**–**
Monoresistance	**–**	**–**	**–**	**1 (50.0)**	**–**	**–**	**–**
PZA**	–	–	–	1 (50.0)	–	–	–

* Routine testing for SM not conducted.

** Includes 1 *M. bovis* isolates for 2001.

Table 15. Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* isolates, Quebec – 1998-2004

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 Total (%)	2003 Total (%)	2004 Total (%)
Total number of isolates tested for INH, RMP, EMB and PZA	**264 (100.0)**	**268 (100.0)**	**278 (100.0)**	**221 (100.0)**	**247*** (100.0)**	**219*** (100.0)**	**207 (100.0)**
Isolates susceptible	**231 (87.5)**	**236 (88.1)**	**249 (89.6)**	**202 (91.4)**	**222 (89.9)**	**187 (85.4)**	**190 (91.8)**
Isolates resistant to one or more drugs	**33 (12.5)**	**32 (11.9)**	**29 (10.4)**	**19 (8.6)**	**25 (10.1)**	**32 (14.6)**	**17 (8.2)**
Monoresistance	**28 (10.6)**	**28 (10.4)**	**28 (10.1)**	**18 (8.1)**	**23 (9.3)**	**31 (14.2)**	**15 (7.2)**
INH	9 (3.4)	17 (6.3)	19 (6.8)	14 (6.3)	13 (5.3)	25 (11.4)	11 (5.3)
RMP	–	1 (0.4)	–	–	1 (0.4)	–	–
PZA**	6 (2.3)	10 (3.7)	9 (3.2)	4 (1.8)	9 (3.6)	6 (2.7)	4 (1.9)
SM*	13 (4.9)	–	–	–	–	–	–
MDR-TB	**2 (0.8)**	**2 (0.7)**	**1 (0.4)**	**1 (0.5)**	**1 (0.4)**	**1 (0.5)**	**1 (0.5)**
INH & RMP	–	1 (0.4)	–	1 (0.5)	–	1 (0.5)	1 (0.5)
INH & RMP & EMB	1 (0.4)	–	1 (0.4)	–	1 (0.4)	–	–
INH & RMP & SM	1 (0.4)	–	–	–	–	–	–
INH & RMP & EMB & PZA	–	1 (0.4)	–	–	–	–	–
Other Patterns	**3 (1.1)**	**2 (0.7)**	**–**	**–**	**1 (0.4)**	**–**	**1 (0.5)**
INH & SM	2 (0.8)	–	–	–	–	–	–
INH & EMB	–	–	–	–	1 (0.4)	–	1 (0.5)
INH & PZA	1 (0.4)	2 (0.7)	–	–	–	–	–

* Routine testing for SM not conducted in Quebec effective January 1, 1999 (NT = not tested).

** Includes *M. bovis* isolates: 1 for 1999, 2 for 2000, 1 for 2001, and 1 for 2003.

*** Includes 1 isolate of *M. caprae* in 2002, and 1 isolate of *M. africanum* in 2003.

Table 16. Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* isolates, Saskatchewan – 1998-2004

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 Total (%)	2003 Total (%)	2004 Total (%)
Total number of isolates tested for INH, RMP, SM and EMB*	**49 (100.0)**	**40 (100.0)**	**64 (100.0)**	**68 (100.0)**	**56 (100.0)**	**46 (100.0)**	**34 (100.0)**
Isolates susceptible	**47 (95.9)**	**39 (97.5)**	**58 (90.6)**	**65 (95.6)**	**51 (91.1)**	**45 (97.8)**	**31 (91.0)**
Isolates resistant to one or more drugs	**2 (4.1)**	**1 (2.5)**	**6 (9.4)**	**3 (4.4)**	**5 (8.9)**	**1 (2.2)**	**3 (8.8)**
Monoresistance	**1 (2.0)**	**–**	**4 (6.3)**	**2 (2.9)**	**4 (7.1)**	**1 (2.2)**	**3 (8.8)**
INH	1 (2.0)	–	2 (3.1)	2 (2.9)	3 (5.4)	1 (2.2)	2 (5.9)
EMB	–	–	1 (1.6)	–	1 (1.8)	–	–
SM	–	–	1 (1.6)	–	–	–	1 (2.9)
Other Patterns	**1 (2.0)**	**1 (2.5)**	**2 (3.1)**	**1 (1.5)**	**1 (1.8)**	**–**	**–**
INH & EMB	–	–	1 (1.6)	–	1 (1.8)	–	–
INH & SM	1 (2.0)	1 (2.5)	1 (1.6)	1 (1.5)	–	–	–

* Routine testing for PZA not conducted.

Table 17. Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* isolates, Yukon Territory – 1998-2004

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 Total (%)	2003 Total (%)	2004 Total (%)
Total number of isolates tested for INH, RMP, SM and EMB*	**1 (100.0)**	**–**	**3 (100.0)**	**1 (100.0)**	**–**	**1 (100.0)**	**2 (100.0)**
Isolates susceptible	**1 (100.0)**	**–**	**3 (100.0)**	**1 (100.0)**	**–**	**1 (100.0)**	**2 (100.0)**

* Routine testing for PZA not conducted.

Appendix 1

Participating Laboratories of the Canadian Tuberculosis Laboratory Surveillance System (CTBLSS)

Alberta **(Alberta and Northwest Territories)**	Cary Shandro Mycobacteriology Provincial Laboratory of Public Health Dr. Greg Tyrrell Medical Microbiologist Provincial Laboratory of Public Health Dr. Jutta Preiksaitis Director Provincial Laboratory of Public Health
British Columbia **(British Columbia and Yukon Territory)**	Mabel Rodrigues, Phd Section Supervisor TB B.C. Centre for Disease Control Dr. Judy L. Isaac-Renton Director, Provincial Laboratory B.C. Centre for Disease Control
Manitoba	Assunta Rendina Charge Technologist, Mycobacteriology
New Brunswick **(see also Quebec)**	Phyllis Bennett Microbiology Laboratory Dept. of Laboratory Medicine Dr. Glenna Hardy Medical Microbiologist Dept. of Laboratory Medicine Dr. Anne O'Brien Clinical Head Dept. of Laboratory Medicine Saint John Regional Hospital
Newfoundland and Labrador	Sandra B. March, MSc ART Clinical Microbiologist Newfoundland Public Health Laboratory Dr. Sam Ratnam Director Newfoundland Public Health Labs L.A. Miller Centre for Health Sciences

Northwest Territories **(see also Alberta)**	Norine M. Fraley, MLT Supervisor, Bacteriology Stanton Territorial Hospital Mr. Robin Greig Manager Therapeutic & Diagnostic Services
Nova Scotia **(Nova Scotia and Prince Edward Island)**	Carol Pelton, Tech II, MLT Division of Medical Microbiology Dept. of Pathology & Laboratory Medicine Dr David Haldane Director of Special Pathogens and Microbiology Dr. Kevin Forward Director Department of Public Health Pathology & Laboratory Medicine
Ontario	Pamela Chedore, MLT Head, Mycobacteriology Laboratory Branch Dr. Frances Jamieson Medical Microbiologist Clinical & Environmental Mr. Nicholas Paul Manager, Direct Services Laboratory Branch
Prince Edward Island **(see Nova Scotia)**	
Quebec **(Quebec, New Brunswick and Nunavut)**	Louise Thibert, MSc Head, Mycobacteriology and Aerobic Actinomycetes Laboratoire de sante publique du Québec Dr. Jean Joly Director, Laboratoire de sante publique du Québec

Saskatchewan	Evelyn Nagle, MLT Clinical Services/Microbiology Saskatchewan Health Dr. Paul Levett Microbiologist Provincial Laboratory Dr. Greg Horsman Director Saskatchewan Health Laboratory and Disease Control
Yukon **(see British Columbia)**	
Federal	Dr. Edward Ellis Manager Tuberculosis Prevention and Control Section Centre for Infectious Disease Prevention and Control Public Health Agency of Canada Joyce Wolfe, ART Head, Mycobacteriology National Reference Centre for Mycobacteriology Canadian Science Centre for Human and Animal Control

Appendix 2

Public Health Agency of Canada / Agence de santé publique du Canada

Serial No. - N° de série

The Canadian Tuberculosis Laboratory Surveillance System
M. TUBERCULOSIS COMPLEX ANTIMICROBIAL SUSCEPTIBILITY REPORTING FORM

Système de surveillance des laboratoires de tuberculose au Canada
RAPPORT SUR LA SENSIBILITÉ DES SOUCHES DU COMPLEXE M. TUBERCULOSIS AUX ANTIMICROBIENS

FOR INTERNAL USE ONLY - POUR USAGE INTERNE SEULEMENT

Date Rec'd at TBPC: / Date de réception au LATB: Y / A | M | D / J

TBPC Number: / Numéro du LATB:

Unique Source Laboratory ID No. - Identificateur unique du laboratoire déclarant:

Date specimen / culture received at laboratory: / Date de réception échantillon / culture au laboratoire: Y / A | M | D / J

Specie: / Espèce :
- ☐ M. tuberculosis (may include M. africanum or M. microti) / (peut inclure M. africanum et M. microti)
- ☐ M. bovis
- ☐ M. BCG bovis
- ☐ MTB Complex (species unknown) / Complexe MTB (espèce inconnu)

Have susceptibility test results been previously reported for this patient? - Des résultats d'antibiogramme ont-ils déjà été fournis pour ce patient?

☐ No / Non ☐ Yes / Oui → What is the **previous** Unique Source Laboratory ID No.? / Identificateur **antérieur**?

→ What is the **previous** Form No.? (If known) / N° de formulaire **antérieur**? (Si connu)

Note: Only DRUG TESTING RESULTS OF ONE ISOLATE are to be reported. No subsequent drug testing results for the same patient are to be reported unless the sensitivity pattern changes.

Note: Ne fournir que les RÉSULTATS POUR UNE SEULE SOUCHE par patient à moins d'un changement du profil de sensibilité.

1. Province / territory from which this report originates: / Province / territoire qui soumet ce rapport : ☐☐ (see code list) / (voir liste de codes)
2. Province / territory from which specimen originated: / Province / territoire d'où provient l'échantillon : ☐☐ (see code list) / (voir liste de codes)
3. Patient's date of birth: / Date de naissance du patient : Y / A | M | D / J (CCYY/MM/DD) / (SSAA/MM/JJ) ☐ Unknown / Inconnu
4. Patient's gender: / Sexe du patient : ☐ Male / Masculin ☐ Female / Féminin ☐ Unknown / Inconnu

PROV / TERR CODES PROV / TERR

10 = NFLD / TN	46 = MAN
11 = PEI / IPÉ	47 = SASK
12 = NS / NÉ	48 = ALTA / ALB
13 = NB	59 = BC / BC
24 = QUÉ / Qc	60 = YUK
35 = ONT	61 = NWT / TNO
	62 = NUN

5. **LABORATORY RESULTS / RÉSULTATS DE LABORATOIRE**

Antituberculous Drugs / Agents Antituberculeux	Concentration (if different from on file) / Concentration (si autre que spécifiée)	Results (check appropriate box for every drug) / Résultats (cocher la case pertinente pour chaque antibiotique)		
		Sensitive / Sensible	Resistant / Résistant	Other (specify) / Autre (préciser)
SM (Streptomycin) / (Streptomycine)	mg / L	☐	☐	
INH (Isoniazid) / (Isoniazide)	mg / L	☐	☐	
RMP (Rifampin) / (Rifampicine)	mg / L	☐	☐	
EMB (Ethambutol)	mg / L	☐	☐	
PZA (Pyrazinamide)	mg / L	☐	☐	
2nd line drugs (specify) / Antibiotiques de 2e ligne (préciser)	**Concentration**	Sensitive / Sensible	Resistant / Résistant	Other (specify) / Autre (préciser)
1.	mg / L	☐	☐	
2.	mg / L	☐	☐	
3.	mg / L	☐	☐	
4.	mg / L	☐	☐	
5.	mg / L	☐	☐	
6.	mg / L	☐	☐	

6. **Comments - Commentaires**

HC/SC 9061
(07-2000)

Copy 1 (White) - Reporting Laboratory
Copie 1 (Blanche) - Laboratoire déclarant

Copy 2 (Yellow) - Tuberculosis Prevention and Control (TBPC)
Copie 2 (Jaune) - Lutte anti-tuberculeuse (LATB)

▶Appendix 3

Proficiency panel results for anti-microbial susceptibility testing of *Mycobacterium tuberculosis*

Antibiotic	Strain A	Strain B	Strain C	Strain D	Strain E	Strain F
SM 2.0 µg/ml	Sensitive 6/6 (100% consensus)	Sensitive 6/6 (100% consensus)	Sensitive 7/7 (100% consensus)	Resistant 6/6 (100% consensus)	Resistant 6/6 (100% consensus)	Sensitive 6/6 (100% consensus)
INH 0.1 µg/ml	Resistant 10/10 (100% consensus)	Sensitive 9/10 (90% consensus)	Sensitive 10/10 (100% consensus)	Resistant 9/10 (90% consensus)	Resistant 9/10 (90% consensus)	Resistant 10/10 (100% consensus)
RMP 2.0 µg/ml	Sensitive 10/10 (100% consensus)	Sensitive 9/10 (90% consensus)	Resistant 10/10 (100% consensus)	Sensitive 10/10 (100% consensus)	Sensitive 10/10 (100% consensus)	Sensitive 10/10 (100% consensus)
EMB 2.5 µg/ml	Sensitive 10/10 (100% consensus)	Sensitive 8/10 (80% consensus)	Sensitive 10/10 (100% consensus)	Sensitive 9/10 (90% consensus)	Sensitive 10/10 (100% consensus)	Sensitive 10/10 (100% consensus)
PZA 100 µg/ml	Sensitive 8/8 (100% consensus)	Sensitive 6/7 (86% consensus)	Sensitive 7/8 (88% consensus)	Sensitive 7/7 (100% consensus)	Sensitive 6/6 (100% consensus)	Sensitive 7/7 (100% consensus)

Phase I: Susceptibility testing of *M. tuberculosis* – Comments

Six laboratories are using the radiometric BACTEC TB460 system. Two laboratories are using the MGIT 960 system. Two laboratories are using both the BACTEC TB460 and the MGIT 960 system. All laboratories are testing appropriate concentrations of first line drugs.

Streptomycin: Current CSLI (Clinical Laboratory Standards Institute) (formerly NCCLS) approved guidelines consider streptomycin as a second line drug and suggest the laboratory director should consult with pulmonary/ infectious disease specialist and TB control officer to decide if streptomycin should be routinely tested based on the following:

1. Availability and timelines of testing if resistance or intolerance is encountered
2. Patient population
3. Prevalence of drug resistance
4. Use in community

Note: As of 2005, streptomycin is not considered a first line tuberculosis drug in Canada.

Isoniazid: Most laboratories tested the recommended critical concentration of INH (0.1 ìg/ml). CSLI recommends testing a higher concentration of INH (0.4 ìg/ml) when resistance is encountered. Although clinicians may not agree on the usefulness of this data, information of the level of resistance can be provided and used at their discretion. When an isolate exhibits resistance to 0.1 ìg/ml and sensitivity to 0.4 ìg/ml, CLSI recommends the following comment to be added to the report: "*These test results indicate low-level resistance to INH. Some experts believe that patients infected with strains exhibiting this level of INH resistance may benefit from continuing therapy with INH. A specialist in the treatment of tuberculosis should be consulted concerning the appropriate therapeutic regimen and dosages."*