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2002

**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, Health 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.

Laboratories report their results on anti-tuberculous drug susceptibility testing to TBPC for every patient that they receive a specimen or an isolate from each calendar year. TBPC subsequently produces an annual report. This report presents 2002 and adjusted 2001, 2000 and 1999 (to reflect duplicate removal and late reporting) drug susceptibility data for TB isolates across Canada as of February 28, 2003.

► METHODOLOGY

TBPC maintains a computerized database containing drug susceptibility test results of *Mycobacterium tuberculosis* (MTB) and MTB complex (MTBC) isolates. Isolates identified as *M. bovis* BCG are included in the CTBLSS but are excluded from 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 identifies the species and tests all isolates for drug resistance in Newfoundland. 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, Northwest Territories and some Nunavut isolates; Quebec: Quebec, New Brunswick, Northwest Territories and some Nunavut isolates; Ontario: Ontario and some 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 Bactec[®] 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. Results of susceptibility testing for second-line anti-tuberculous drugs are not included in this report.

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.
Streptomycin (SM)	2.0	Routine testing is not performed for isolates from Quebec, Nova Scotia, New Brunswick, Prince Edward Island and Nunavut isolates tested in Quebec.
Pyrazinamide (PZA)	100.0	Routine testing is not performed for isolates from British Columbia, Saskatchewan and the Yukon Territory.

In 2002, a total of nine laboratories participated in the proficiency for anti-microbial susceptibility testing of *M. tuberculosis* to anti-tuberculous first line drugs conducted by the National Reference Centre for Mycobacteriology. Three strains of *M. tuberculosis* were submitted for testing. Participant results are presented in Table B.

Table B: Proficiency panel results for anti-microbial susceptibility testing of *M. tuberculosis* to first-line drugs¹

Antibiotic	Strain D (201-221)	Strain K (237-260)	Strain M (266-284)
SM 2 µg/mL	Sensitive 6/6 (100% consensus)	Sensitive 6/6 (100% consensus)	Sensitive 6/6 (100% consensus)
INH 0.1 µg/mL	Sensitive 9/9 (100% consensus)	Sensitive 9/9 (100% consensus)	Sensitive 9/9 (100% consensus)
RMP 2.0 µg/mL	Sensitive 9/9 (100% consensus)	Sensitive 9/9 (100% consensus)	Sensitive 9/9 (100% consensus)
EMB 2.5 µg/mL	Sensitive 9/9 (100% consensus)	Resistant 9/9 (100% consensus)	Sensitive 9/9 (100% consensus)
PZA 100 µg/mL	Sensitive 6/7 (85.7% consensus)	Sensitive 7/7 (100% consensus)	Resistant 8/8 (100% consensus)

¹ Eight laboratories used the BACTEC® TB 460 as their test method. One laboratory used the MGIT 960 as its test method.

- *SM*: Six laboratories included results for streptomycin. Current National Committee for Clinical Laboratory Standards (NCCLS) guidelines no longer recommend that streptomycin be tested as a first-line anti-tuberculous agent.
- *INH*: No resistant strain was included in the 2002 panel. Current NCCLS guidelines recommend testing a higher concentration of INH for strains resistant to the critical concentration of INH.
- *EMB*: All laboratories using the BACTEC® TB 460 tested EMB at 2.5 µg/mL. The laboratory using the MGIT 960 tested EMB at 5.0 µg/mL, the manufacturer's recommended critical concentration. Two laboratories also tested EMB at the higher concentration of 7.5 µg/mL. The 2002 panel included a rare strain showing mono-resistance to EMB. Madison et al. reported that EMB resistance was coupled with INH resistance in 96.6% of strains and recommend that EMB mono-resistance based on BACTEC® 460TB results be confirmed with another NCCLS method (Madison et al. *J Clin Microbiol* 2000;40:3976-3979). Current NCCLS guidelines recommend confirmation of resistance by agar proportion or repeat testing following the manufacturer's instructions concerning EMB testing.
- *PZA*: All laboratories correctly identified PZA resistance. One laboratory reported a sensitive strain as showing low level resistance and indicated that the strain would be referred to the reference laboratory.

► RESULTS

Of the 1,385 isolates in 2002 included for analysis, 172 (12.7%) were resistant to one or more first-line anti-tuberculous drug(s). Resistance to INH was the most common type of drug resistance (8.2%). Twenty-two isolates (1.5%) were multi-drug resistant tuberculosis (MDR-TB) strains (defined as resistance to at least INH and RMP), of which 15 isolates demonstrated resistance to four or five first-line anti-tuberculous drugs tested. Reporting of these isolates was from Ontario, Manitoba and British Columbia. In addition, Alberta, British Columbia, Manitoba, Ontario and Quebec reported isolates with other patterns of multi-drug resistance. Five provinces and territories (Nunavut, Northwest Territories, Yukon, Newfoundland and Labrador and Prince Edward Island) 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 1,323 isolates for which the year of birth reporting was complete, 40% were between the ages 25 and 44. Males accounted for 53% of all the isolates and 49% of the drug resistant isolates.

► DISCUSSION

The number of reported TB isolates in 2002 decreased by 8.3% from the previous year (1,475 to 1,385 isolates). However, the percentage of isolates demonstrating any type of drug resistance increased from 10% in 2001 to 12.7% in 2002 and the proportion of isolates classified as MDR-TB increased slightly from 1.0% in 2001 to 1.5% in 2002.

Over 90% of the reported laboratory TB isolates in Canada in 2002 originated from five provinces. The three largest provinces (Ontario, Quebec and British Columbia) have consistently reported the majority of isolates and MDR-TB in the five years of data collection. Since the initiation of this laboratory-based surveillance system, which began January 1, 1998, 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 overall TB drug resistance among the participating countries was 11.1 % (as compared with 12.7 % for Canada) and the median prevalence of MDR-TB was 1.8%¹ (as compared with 1.5% for Canada).

► 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. Demographic information is sparse; only sex and year of birth are routinely reported in this surveillance system. As well, no differentiation can be made between primary and secondary/acquired drug resistance from the data.

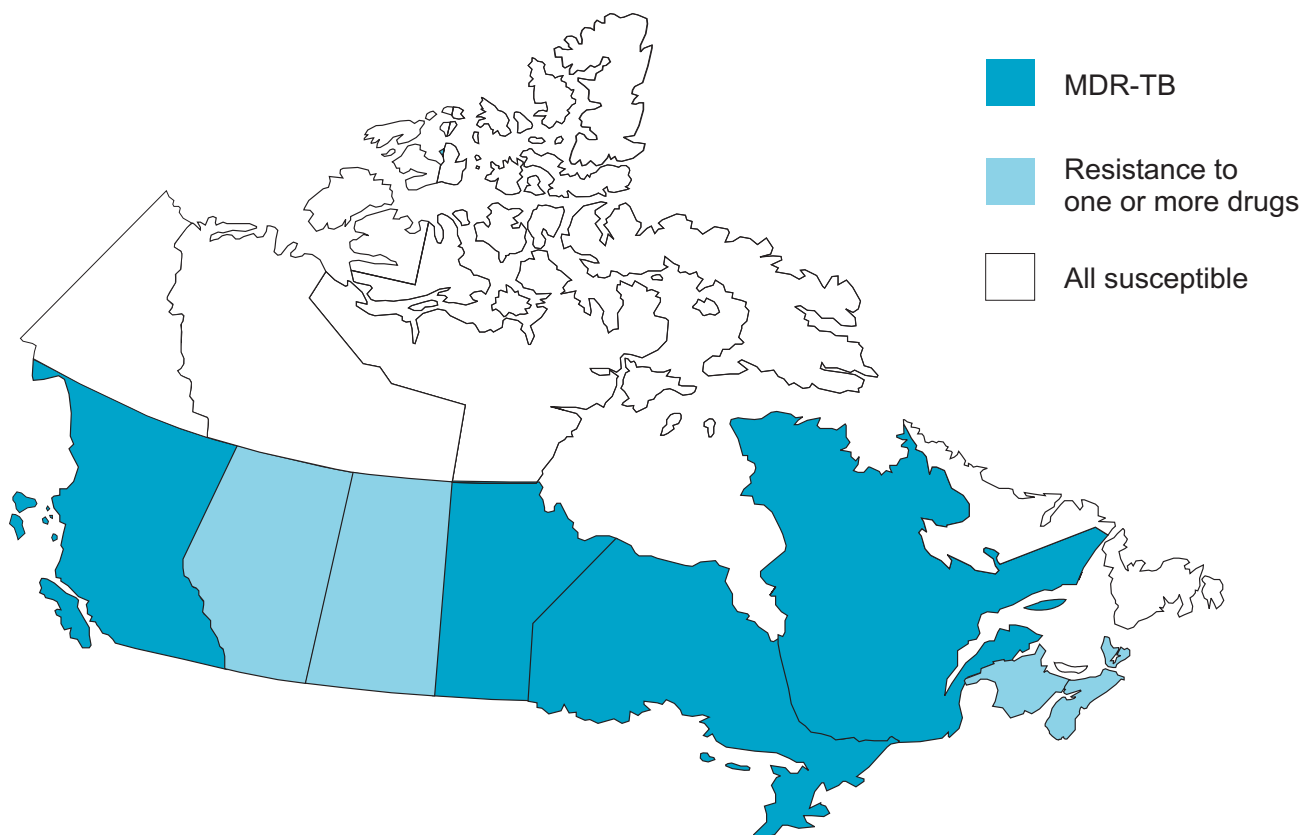
► CONCLUSIONS

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. Analysis reveals a slight increase in the reporting of MDR-TB for the latest reporting year; however, several more years of data will be required to determine whether this is a trend.

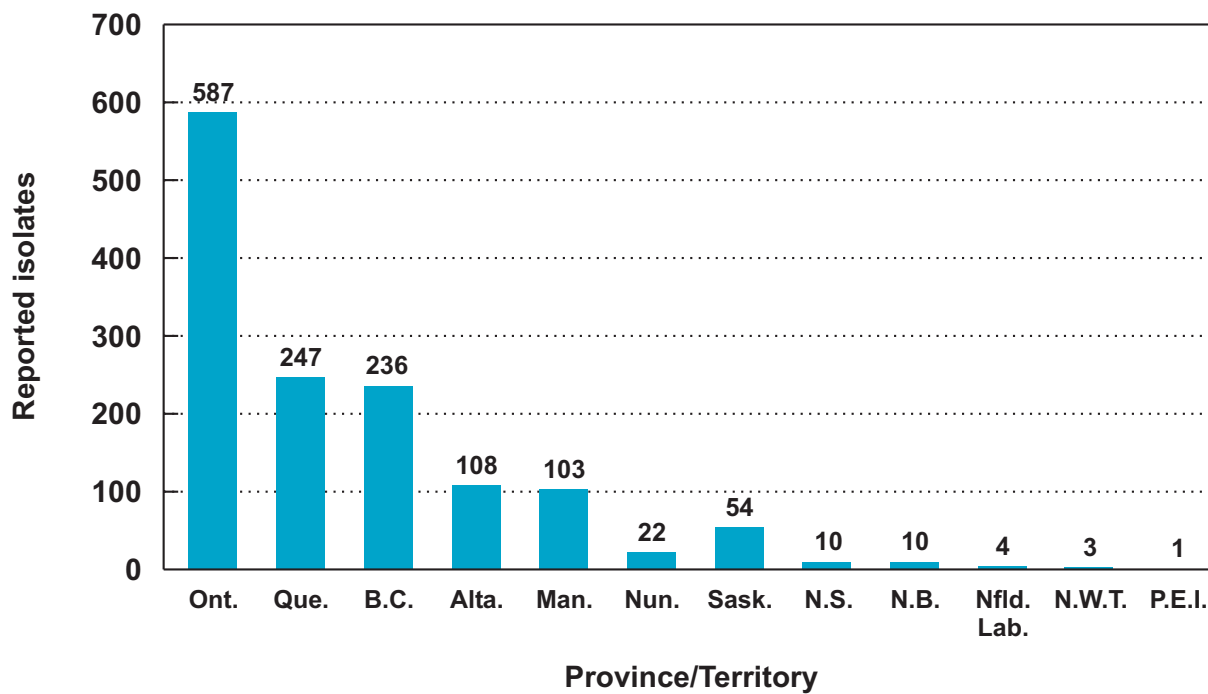
► REFERENCES

1. The WHO/IUATLD Global Project on Anti-tuberculous Drug Resistance Surveillance. *Anti-tuberculous drug resistance in the world*. Report No. 2. (WHO/CDS/TB/2000.278). Geneva: World Health Organization, 2000.

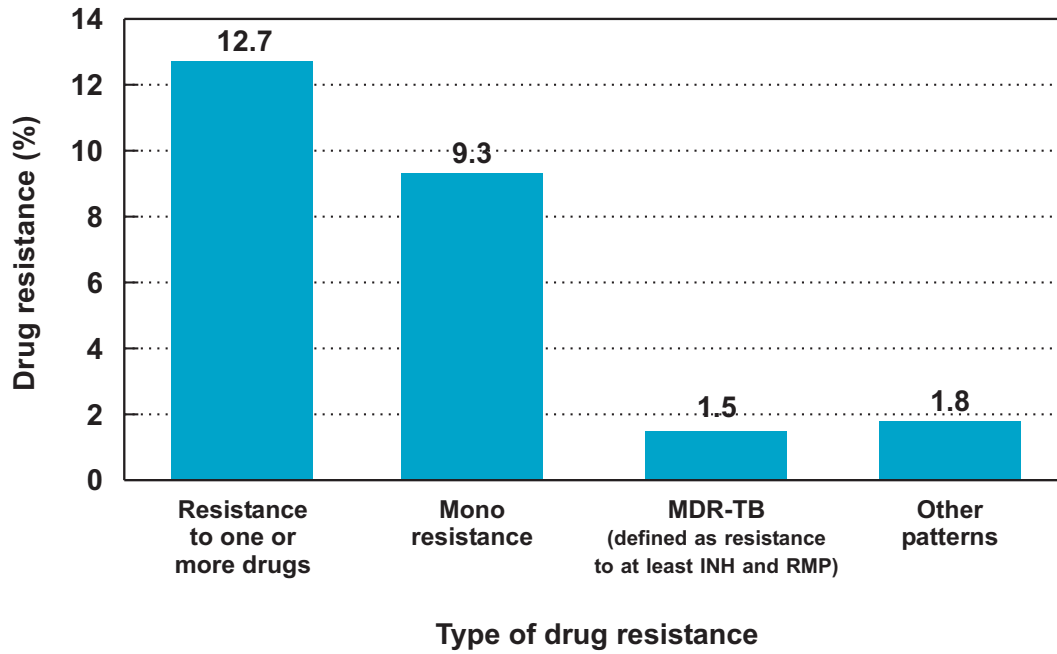
► **Figure 1**
Reported TB drug resistance in Canada by province/territory – 2002



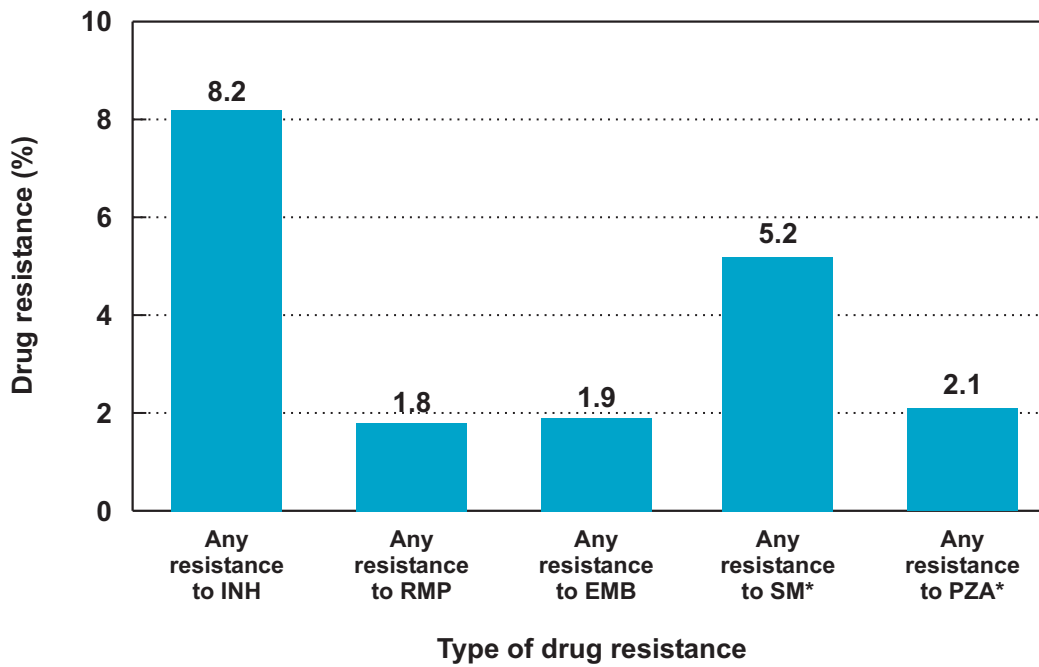
► **Figure 2**
Reported MTB isolates in Canada by province/territory – 2002



► **Figure 3**
Overall pattern of reported TB drug resistance in Canada – 2002

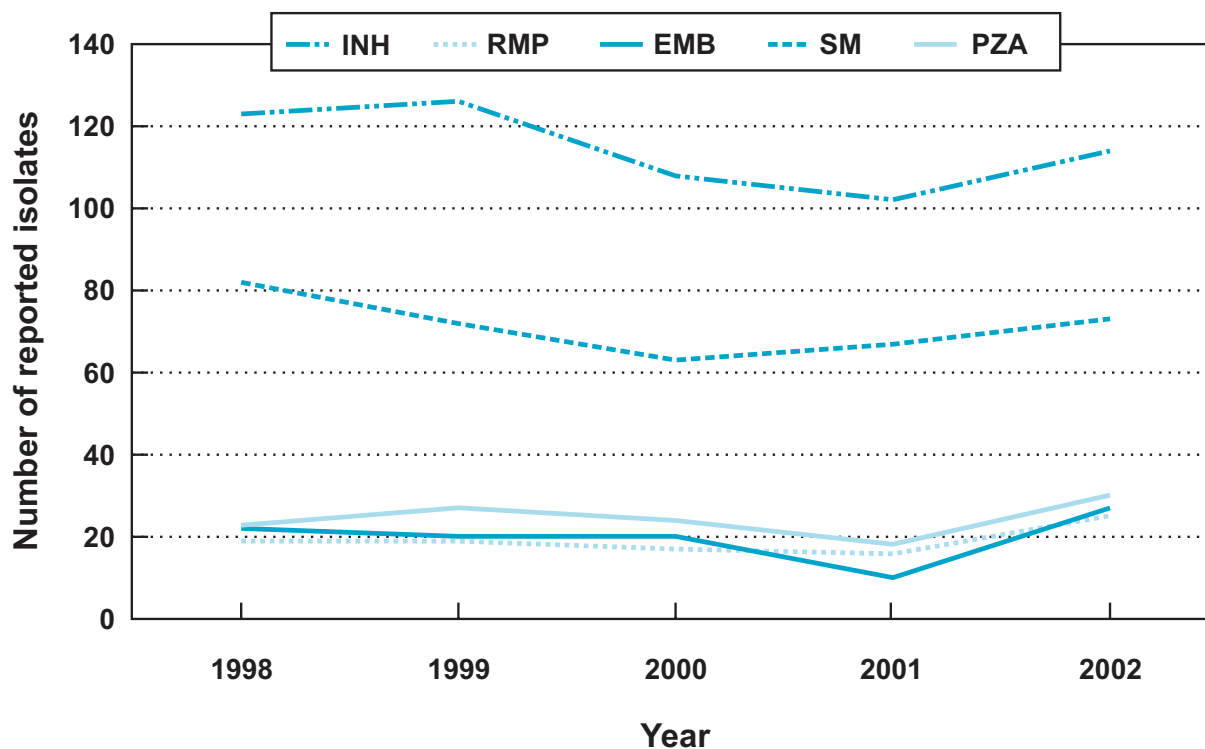


► **Figure 4**
Reported TB drug resistance in Canada by type of drug – 2002



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

► **Figure 5**
Any resistance to first-line anti-TB drugs in Canada – 1998-2002



► **Figure 6**
Overall pattern of reported TB drug resistance in Canada – 1998-2002

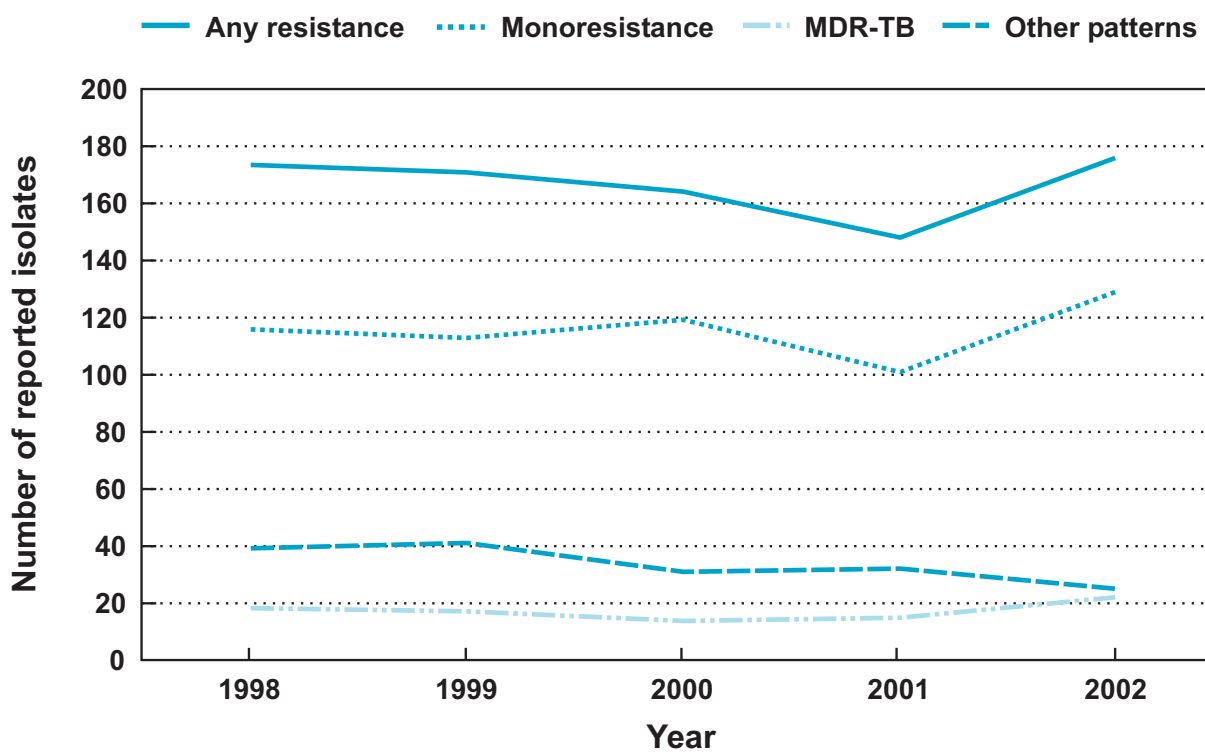


Table 1. Overall pattern of reported TB drug resistance in Canada – 1998-2002

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 Total (%)
Total number of isolates tested	1,461 (100.0)	1,415 (100.0)	1,491 (100.0)	1,475 (100.0)	1,385 (100.0)
Isolates susceptible	1,288 (88.2)	1,243 (87.8)	1,323 (88.7)	1,327 (90)	1,209 (87.2)
Any resistance to INH	123 (8.4)	127 (9)	111 (7.4)	102 (6.9)	114 (8.2)
Any resistance to RMP	19 (1.3)	20 (1.4)	18 (1.2)	16 (1.1)	25 (1.8)
Any resistance to EMB	22 (1.5)	20 (1.4)	21 (1.4)	10 (0.7)	25 (1.8)
Any resistance to SM	82 (5.6)	72 (5.1)	65 (4.4)	68 (4.6)	73 (5.2)
Any resistance to PZA	23 (1.6)	27 (1.9)	24 (1.6)	20 (1.4)	30 (2.1)
Resistance to one or more drugs	173 (11.8)	172 (12.2)	168 (11.3)	148 (10)	176 (12.7)
Monoresistance	116 (7.9)	113 (8)	121 (8.1)	101 (6.8)	129 (9.3)
MDR-TB*	18 (1.2)	18 (1.3)	15 (1)	15 (1)	22 (1.5)
Other patterns	39 (2.7)	41 (2.9)	32 (2.1)	32 (2.2)	25 (1.8)

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

Table 2. Reported MTB isolates by “reporting” and “originating” province/territory, Canada – 2002

Reporting Province	CANADA	Originating Province/Territory											
		Alta.	B.C.	Man.	N.B.	Nfld. Lab.	N.S.	Nun.	N.W.T.	Ont.	P.E.I.	Que.	Sask.
Number of isolates	1,352	108	236	103	10	4	10	22	3	587	1	247	54
Alta.	114	108	-	-	-	-	-	3	3	-	-	-	-
B.C.	236	-	236	-	-	-	-	-	-	-	-	-	-
Man.	103	-	-	103	-	-	-	-	-	-	-	-	-
N.B.	10	-	-	-	10	-	-	-	-	-	-	-	-
Nfld.Lab.	4	-	-	-	-	4	-	-	-	-	-	-	-
N.S.	11	-	-	-	-	-	10	-	-	-	1	-	-
Ont.	595	-	-	-	-	-	-	8	-	587	-	-	-
Que.	258	-	-	-	-	-	-	11	-	-	-	247	-
Sask.	21	-	-	-	-	-	-	-	-	-	-	-	54

Table 3. Reported MDR-TB* isolates by province/territory, Canada – 2002

	CANADA	Originating Province/Territory											
		Alta.	B.C.	Man.	N.B.	Nfld. Lab.	N.S.	Nun.	N.W.T.	Ont.	P.E.I.	Que.	Sask.
Total number of isolates tested	1,352	108	236	103	10	4	10	22	3	587	1	247	54
Total number of MDR-TB* isolates	22	-	2	3	-	-	-	-	-	16	-	1	-
INH & RMP	3	-	-	1	-	-	-	-	-	2	-	-	-
INH, RMP & SM	2	-	-	-	-	-	-	-	-	2	-	-	-
INH, RMP & EMB	2	-	-	-	-	-	-	-	-	1	-	1	-
INH, RMP, SM & EMB	5	-	-	-	-	-	-	-	-	5	-	-	-
INH, RMP, EMB & PZA	3	-	1	1	-	-	-	-	-	1	-	-	-
INH, RMP, SM, EMB & PZA	7	-	1	1	-	-	-	-	-	5	-	-	-

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

Table 4. Reported TB drug resistance by gender and age group, Canada – 2002

Age Group		Number of Isolates	Any Resistance	MDR-TB*
		No. (%)	No. (%)	No. (%)
Total		1,385 (100)	176 (100)	22 (100)
0-4	Males	7 (0.5)	- (0.0)	- (0.0)
	Females	6 (0.4)	1 (0.5)	- (0.0)
	Unknown	1 (0.1)	- (0.0)	- (0.0)
	Total	14 (1.0)	1 (0.5)	- (0.0)
5-14	Males	5 (0.3)	- (0.0)	- (0.0)
	Females	17 (1.2)	4 (2.2)	- (0.0)
	Unknown	2 (0.1)	1 (0.5)	- (0.0)
	Total	24 (1.7)	5 (2.8)	- (0.0)
15-24	Males	77 (5.5)	15 (8.5)	1 (4.5)
	Females	79 (5.7)	14 (7.9)	1 (4.5)
	Unknown	8 (0.5)	1 (0.5)	1 (4.5)
	Total	164 (11.8)	30 (17.0)	3 (13.6)
25-34	Males	132 (9.5)	23 (13.0)	3 (13.6)
	Females	109 (7.8)	14 (7.9)	4 (18.2)
	Unknown	12 (0.8)	3 (1.7)	1 (4.5)
	Total	253 (18.2)	40 (22.7)	8 (36.4)
35-44	Males	133 (9.6)	15 (8.5)	4 (18.2)
	Females	89 (6.4)	16 (9.0)	- (0.0)
	Unknown	6 (0.4)	1 (0.5)	- (0.0)
	Total	228 (16.4)	32 (18.1)	4 (18.2)
45-54	Males	91 (6.5)	5 (2.8)	- (0.0)
	Females	77 (5.5)	7 (3.9)	1 (4.5)
	Unknown	11 (0.7)	1 (0.5)	- (0.0)
	Total	179 (12.9)	13 (7.3)	1 (4.5)
55-64	Males	71 (5.1)	13 (7.3)	- (0.0)
	Females	53 (3.8)	8 (4.5)	2 (9.1)
	Unknown	3 (0.2)	1 (0.5)	- (0.0)
	Total	127 (9.1)	22 (12.5)	2 (9.1)
65-74	Males	101 (7.2)	5 (2.8)	- (0.0)
	Females	64 (4.6)	6 (3.4)	2 (9.1)
	Unknown	1 (0.1)	- (0.0)	- (0.0)
	Total	166 (11.9)	11 (6.2)	2 (9.1)
75+	Males	104 (7.5)	8 (4.5)	1 (4.5)
	Females	88 (6.3)	9 (5.1)	1 (4.5)
	Unknown	5 (0.3)	- (0.0)	- (0.0)
	Total	197 (14.2)	17 (9.7)	2 (9.1)
Unknown	Males	11 (0.7)	2 (1.1)	- (0.0)
	Females	9 (0.6)	- (0.0)	- (0.0)
	Unknown	13 (0.9)	3 (1.7)	- (0.0)
	Total	33 (2.3)	5 (2.8)	- (0.0)
Total	Males	732 (52.8)	86 (48.8)	9 (40.9)
	Females	591 (42.6)	79 (44.8)	11 (50.0)
	Unknown	62 (4.4)	11 (6.2)	2 (9.1)

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

Table 5. Reported results for routine drug susceptibility testing of MTB isolates to first-line anti-tuberculosis drugs, Alberta – 1998-2002

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 Total (%)
Total number of isolates tested for INH, RMP, SM, EMB and PZA	119 (100.0)	118 (100.0)	104 (100.0)	91 (100.0)	108 (100.0)
Isolates susceptible	107 (89.9)	111 (94.1)	92 (88.5)	79 (86.8)	94 (87.0)
Isolates resistant to one or more drugs	12 (10.1)	7 (5.9)	12 (11.5)	12 (13.2)	14 (13.0)
Monoresistance	9 (7.6)	6 (5.1)	7 (6.7)	8 (8.8)	12 (11.1)
INH	4 (3.4)	2 (1.7)	2 (1.9)	5 (5.5)	6 (5.6)
EMB	- (0.0)	- (0.0)	1 (1.0)	- (0.0)	- (0.0)
SM	5 (4.2)	4 (3.4)	3 (2.9)	3 (3.3)	6 (5.6)
PZA	- (0.0)	- (0.0)	1 (1.0)	- (0.0)	- (0.0)
MDR-TB*	1 (0.8)	- (0.0)	- (0.0)	- (0.0)	- (0.0)
INH & SM & EMB & RMP & PZA	1 (0.8)	- (0.0)	- (0.0)	- (0.0)	- (0.0)
Other Patterns	2 (1.7)	1 (0.8)	5 (4.8)	4 (4.4)	2 (1.9)
INH & SM	1 (0.8)	1 (0.8)	3 (2.9)	2 (2.2)	1 (0.9)
INH & SM & EMB	- (0.0)	- (0.0)	1 (1.0)	- (0.0)	- (0.0)
INH & SM & PZA	1 (0.8)	- (0.0)	1 (1.0)	2 (2.2)	1 (0.9)

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

Table 6. Reported results for routine drug susceptibility testing of MTB isolates to first-line anti-tuberculosis drugs, British Columbia – 1998-2002

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 Total (%)
Total number of isolates tested for INH, RMP, SM and EMB**	237 (100.0)	244 (100.0)	277 (100.0)	331 (100.0)	236 (100.0)
Isolates susceptible	212 (89.5)	224 (91.8)	245 (88.4)	296 (89.4)	208 (88.1)
Isolates resistant to one or more drugs	25 (10.5)	20 (8.2)	32 (11.6)	35 (10.6)	28 (11.9)
Monoresistance	17 (7.2)	15 (6.1)	23 (8.3)	22 (6.6)	23 (9.7)
INH	14 (5.9)	11 (4.5)	13 (4.7)	12 (3.6)	11 (4.7)
EMB	- (0.0)	1 (0.4)	1 (0.4)	- (0.0)	2 (0.8)
RMP	1 (0.4)	1 (0.4)	1 (0.4)	1 (0.3)	2 (0.8)
SM	2 (0.8)	2 (0.8)	8 (2.9)	9 (2.7)	7 (3.0)
PZA	- (0.0)	- (0.0)	- (0.0)	- (0.0)	1 (0.4)
MDR-TB*	2 (0.8)	1 (0.4)	5 (1.8)	8 (2.4)	2 (0.8)
INH & RMP	- (0.0)	- (0.0)	- (0.0)	4 (1.2)	- (0.0)
INH & RMP & EMB	- (0.0)	- (0.0)	1 (0.4)	- (0.0)	- (0.0)
INH & RMP & SM	1 (0.4)	- (0.0)	2 (0.7)	2 (0.6)	- (0.0)
INH & RMP & EMB & PZA	- (0.0)	- (0.0)	- (0.0)	- (0.0)	1 (0.4)
INH & RMP & SM & EMB	1 (0.4)	1 (0.4)	2 (0.7)	1 (0.3)	- (0.0)
INH & RMP & SM & EMB & PZA	- (0.0)	- (0.0)	- (0.0)	1 (0.3)	1 (0.4)
Other Patterns	6 (2.5)	4 (1.6)	4 (1.4)	5 (1.5)	3 (1.3)
INH & EMB	1 (0.4)	1 (0.4)	- (0.0)	- (0.0)	- (0.0)
INH & SM	5 (2.1)	2 (0.8)	2 (0.7)	5 (1.5)	3 (1.3)
INH & SM & EMB	- (0.0)	1 (0.4)	2 (0.7)	- (0.0)	- (0.0)

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

** Routine testing for PZA not conducted

Table 7. Reported results for routine drug susceptibility testing of MTB isolates to first-line anti-tuberculosis drugs, Manitoba – 1998-2002

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 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)	103 (100.0)
Isolates susceptible	98 (92.5)	89 (89.0)	94 (92.2)	101 (91.8)	95 (92.2)
Isolates resistant to one or more drugs	8 (7.5)	11 (11.0)	8 (7.8)	9 (8.2)	8 (7.8)
Monoresistance	4 (3.8)	6 (6.0)	6 (5.9)	6 (5.5)	4 (3.9)
INH	2 (1.9)	3 (3.0)	6 (5.9)	2 (1.8)	3 (2.9)
SM**	2 (1.9)	3 (3.0)	- (0.0)	4 (3.6)	- (0.0)
PZA***	- (0.0)	- (0.0)	- (0.0)	- (0.0)	1 (1.0)
MDR-TB*	2 (1.9)	2 (2.0)	- (0.0)	2 (1.8)	3 (2.9)
INH & RMP	- (0.0)	1 (1.0)	- (0.0)	1 (0.9)	1 (1.0)
INH & EMB & RMP & PZA	- (0.0)	- (0.0)	- (0.0)	- (0.0)	1 (1.0)
INH & EMB & RMP	1 (0.9)	- (0.0)	- (0.0)	- (0.0)	- (0.0)
INH & SM & EMB & RMP & PZA	1 (0.9)	- (0.0)	- (0.0)	1 (0.9)	1 (1.0)
INH & SM & RMP & PZA	- (0.0)	1 (1.0)	- (0.0)	- (0.0)	- (0.0)
Other Patterns	2 (1.9)	3 (3.0)	2 (2.0)	1 (0.9)	1 (1.0)
INH & PZA	- (0.0)	- (0.0)	- (0.0)	- (0.0)	1 (1.0)
INH & SM	2 (1.9)	1 (1.0)	2 (2.0)	1 (0.9)	- (0.0)
INH & SM & EMB	- (0.0)	1 (1.0)	- (0.0)	- (0.0)	- (0.0)
INH & SM & PZA	- (0.0)	1 (1.0)	- (0.0)	- (0.0)	- (0.0)

* MDR-TB is defined as resistance to at least INH and RMP
** Routine testing for SM not conducted for 2002.
*** Includes *M. bovis* isolates: 1 for 2002

Table 8. Reported results for routine drug susceptibility testing of MTB isolates to first-line anti-tuberculosis drugs, New Brunswick – 1998-2002

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 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)
Isolates susceptible	9 (90.0)	12 (100.0)	9 (100.0)	10 (100.0)	9 (90.0)
Isolates resistant to one or more drugs	1 (10.0)	- (0.0)	- (0.0)	- (0.0)	1 (10.0)
Monoresistance	1 (10.0)	- (0.0)	- (0.0)	- (0.0)	1 (10.0)
INH	1 (10.0)	- (0.0)	- (0.0)	- (0.0)	1 (10.0)

* Routine testing for SM not conducted.

Table 9. Reported results for routine drug susceptibility testing of MTB isolates to first-line anti-tuberculosis drugs, Newfoundland and Labrador – 1998-2002

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 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)
Isolates susceptible	8 (100.0)	9 (100.0)	11 (100.0)	9 (100.0)	4 (100.0)

Table 10. Reported results for routine drug susceptibility testing of MTB isolates to first-line anti-tuberculosis drugs, Northwest Territories – 1998-2002

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 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)
Isolates susceptible	27 (100.0)	11 (100.0)	8 (100.0)	6 (100.0)	3 (100.0)

Table 11. Reported results for routine drug susceptibility testing of MTB isolates to first-line anti-tuberculosis drugs, Nova Scotia – 1998-2002

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 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)
Isolates susceptible	8 (88.9)	7 (87.5)	4 (100.0)	7 (100.0)	9 (90.0)
Isolates resistant to one or more drugs	1 (11.1)	1 (12.5)	- (0.0)	- (0.0)	1 (10.0)
Monoresistance					
INH	1 (11.1)	1 (12.5)	- (0.0)	- (0.0)	- (0.0)
PZA	- (0.0)	- (0.0)	- (0.0)	- (0.0)	1 (10.0)

* Routine testing for SM not conducted.

Table 12. Reported results for routine drug susceptibility testing of MTB isolates to first-line anti-tuberculosis drugs, Nunavut* – 1998-2002

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 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)
Isolates susceptible	N/A	15 (100.0)	28 (96.6)	30 (96.8)	22 (100.0)
Isolates resistant to one or more drugs	N/A	- (0.0)	1 (3.4)	1 (3.2)	- (0.0)
Monoresistance	N/A	- (0.0)	1 (3.4)	- (0.0)	- (0.0)
INH		- (0.0)	1 (3.4)	- (0.0)	- (0.0)
MDR-TB**	N/A	- (0.0)	- (0.0)	1 (3.2)	- (0.0)
INH&RMP		- (0.0)	- (0.0)	1 (3.2)	- (0.0)

* Note: Nunavut began reporting in 1999.

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

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

Table 13. Reported results for routine drug susceptibility testing of MTB isolates to first-line anti-tuberculosis drugs, Ontario – 1998-2002

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 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)	587 (100.0)
Isolates susceptible	538 (85.5)	489 (83.0)	519 (86.6)	521 (88.5)	493 (84.0)
Isolates resistant to one or more drugs	91 (14.5)	100 (17.0)	80 (13.4)	68 (11.5)	94 (16.0)
Monoresistance	55 (8.7)	57 (9.7)	52 (8.7)	44 (7.5)	61 (10.4)
INH	34 (5.4)	34 (5.8)	23 (3.8)	20 (3.4)	30 (5.1)
EMB	4 (0.6)	- (0.0)	1 (0.2)	1 (0.2)	1 (0.2)
SM	11 (1.7)	19 (3.2)	16 (2.7)	16 (2.7)	25 (4.3)
PZA**	6 (1.0)	4 (0.7)	12 (2.0)	7 (1.2)	5 (0.9)
MDR-TB*	11 (1.7)	13 (2.2)	9 (1.5)	3 (0.5)	16 (2.7)
INH & RMP	2 (0.3)	3 (0.5)	1 (0.2)	- (0.0)	2 (0.3)
INH & RMP & EMB	- (0.0)	1 (0.2)	2 (0.3)	1 (0.2)	1 (0.2)
INH & RMP & SM	1 (0.2)	3 (0.5)	3 (0.5)	- (0.0)	2 (0.3)
INH & RMP & PZA	- (0.0)	1 (0.2)	- (0.0)	- (0.0)	- (0.0)
INH & RMP & EMB & PZA	- (0.0)	- (0.0)	- (0.0)	1 (0.2)	1 (0.2)
INH & RMP & SM & EMB	2 (0.3)	- (0.0)	2 (0.3)	- (0.0)	5 (0.9)
INH & RMP & SM & PZA	- (0.0)	- (0.0)	1 (0.2)	- (0.0)	- (0.0)
INH & RMP & SM & EMB & PZA	6 (1.0)	5 (0.8)	- (0.0)	1 (0.2)	5 (0.9)
Other Patterns	25 (4.0)	30 (5.1)	19 (3.2)	21 (3.6)	17 (2.9)
INH & EMB	2 (0.3)	4 (0.7)	2 (0.3)	- (0.0)	1 (0.2)
INH & PZA**	- (0.0)	- (0.0)	- (0.0)	2 (0.3)	- (0.0)
INH & SM	20 (3.2)	20 (3.4)	14 (2.3)	16 (2.7)	13 (2.2)
EMB & RMP	- (0.0)	- (0.0)	2 (0.3)	- (0.0)	- (0.0)
INH & SM & EMB	2 (0.3)	4 (0.7)	1 (0.2)	3 (0.5)	2 (0.3)
INH & SM & PZA	1 (0.2)	2 (0.3)	- (0.0)	- (0.0)	- (0.0)
INH & SM & EMB & PZA	- (0.0)	- (0.0)	- (0.0)	- (0.0)	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 and 1 *M. Bovis* isolate for 2002

Table 14. Reported results for routine drug susceptibility testing of MTB isolates to first-line anti-tuberculosis drugs, Prince Edward Island – 1998-2002

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 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)
Isolates susceptible	2 (100.0)	2 (100.0)	3 (100.0)	1 (50.0)	1 (100.0)
Isolates resistant to one or more drugs	- (0.0)	- (0.0)	- (0.0)	1 (50.0)	- (0.0)
Monoresistance	- (0.0)	- (0.0)	- (0.0)	1 (50.0)	- (0.0)
PZA**	- (0.0)	- (0.0)	- (0.0)	1 (50.0)	- (0.0)

* Routine testing for SM not conducted.
** Includes *M. bovis* isolates: 1 for 2001

Table 15. Reported results for routine drug susceptibility testing of MTB isolates to first-line anti-tuberculosis drugs, Québec – 1998-2002

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 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)
Isolates susceptible	231 (87.5)	236 (88.1)	249 (89.6)	202 (91.4)	222 (89.9)
Isolates resistant to one or more drugs	33 (12.5)	32 (11.9)	29 (10.4)	19 (8.6)	25 (10.1)
Monoresistance	28 (10.6)	28 (10.4)	28 (10.1)	18 (8.1)	23 (9.3)
INH	9 (3.4)	17 (6.3)	19 (6.8)	14 (6.3)	13 (5.3)
RMP	- (0.0)	1 (0.4)	- (0.0)	- (0.0)	1 (0.4)
SM**	13 (4.9)	NT**	NT**	NT**	NT**
PZA***	6 (2.3)	10 (3.7)	9 (3.2)	4 (1.8)	9 (3.6)
MDR-TB*	2 (0.8)	2 (0.7)	1 (0.4)	1 (0.5)	1 (0.4)
INH & RMP	- (0.0)	1 (0.4)	- (0.0)	1 (0.5)	- (0.0)
INH & RMP & EMB	1 (0.4)	- (0.0)	1 (0.4)	- (0.0)	1 (0.4)
INH & RMP & SM	1 (0.4)	NT**	NT**	NT**	NT**
INH & RMP & EMB & PZA	- (0.0)	1 (0.4)	- (0.0)	- (0.0)	- (0.0)
Other Patterns	3 (1.1)	2 (0.7)	- (0.0)	- (0.0)	1 (0.4)
INH & SM	2 (0.8)	NT**	NT**	NT**	NT**
INH & EMB	- (0.0)	- (0.0)	- (0.0)	- (0.0)	1 (0.4)
INH & PZA	1 (0.4)	2 (0.7)	- (0.0)	- (0.0)	- (0.0)

* MDR-TB is defined as resistance to at least INH and RMP
** 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 2002

Table 16. Reported results for routine drug susceptibility testing of MTB isolates to first-line anti-tuberculosis drugs, Saskatchewan – 1998-2002

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 Total (%)
Total number of isolates tested for INH, RMP, SM and EMB*	49 (100.0)	40 (100.0)	64 (100.0)	68 (100.0)	54 (100.0)
Isolates susceptible	47 (95.9)	39 (97.5)	58 (90.6)	65 (95.6)	49 (90.7)
Isolates resistant to one or more drugs	2 (4.1)	1 (2.5)	6 (9.4)	3 (4.4)	5 (9.3)
Monoresistance	1 (2.0)	- (0.0)	4 (6.3)	2 (2.9)	4 (7.4)
INH	1 (2.0)	- (0.0)	2 (3.1)	2 (2.9)	3 (5.6)
EMB	- (0.0)	- (0.0)	1 (1.6)	- (0.0)	1 (1.9)
SM	- (0.0)	- (0.0)	1 (1.6)	- (0.0)	- (0.0)
Other Patterns	1 (2.0)	1 (2.5)	2 (3.1)	1 (1.5)	1 (1.9)
INH & EMB	- (0.0)	- (0.0)	1 (1.6)	- (0.0)	1 (1.9)
INH & SM	1 (2.0)	1 (2.5)	1 (1.6)	1 (1.5)	- (0.0)

* Routine testing for PZA not conducted.

Table 17. Reported results for routine drug susceptibility testing of MTB isolates to first-line anti-tuberculosis drugs, Yukon Territory – 1998-2002

	1998 Total (%)	1999 Total (%)	2000 Total (%)	2001 Total (%)	2002 Total (%)
Total number of isolates tested for INH, RMP, SM and EMB*	1 (100.0)	- (0.0)	3 (100.0)	1 (100.0)	- (0.0)
Isolates susceptible	1 (100.0)	- (0.0)	3 (100.0)	1 (100.0)	- (0.0)

* Routine testing for PZA not conducted.

► Appendix 1

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

Alberta
(Alberta, Northwest Territories
and Nunavut)

North Marguerite Lovgren
Technical Supervisor
National Centre for Streptococcus
Provincial Laboratory of Public Health

Dr. K. Kowalewska
Mycobacteriology Program Director
Provincial Laboratory of Public Health

South Michelle Brown
Mycobacteriology Supervisor
Provincial Laboratory of Public Health

Dr. Peter Tilley
Mycobacteriology Program Director
Provincial Laboratory of Public Health

Dr. Jutta Preiksaitis
Director
Provincial Laboratory of Public Health

British Columbia
(British Columbia and Yukon Territory)

Dr. Mabel Rodrigues
Section Supervisor Mycobacteriology
BC Centre for Disease Control

Dr. W.A. Black
Medical Microbiologist
BCCDC Laboratory Services
Professor, Medical Microbiology, UBC

Dr. Judy Isaac-Renton
Director
BCCDC Laboratory Services
Professor, Medical Microbiology, UBC

Manitoba

Nancy Smart
Senior Technologist
Microbacteriology

Joanne Lamarre
Senior Technologist
Microbacteriology

Dr. Amin Kabani
National Reference Centre for Mycobacteriology
Federal Laboratories for Health Canada

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Newfoundland and Labrador	Sandra B. March Newfoundland Public Health Laboratory L.A. Miller Centre for Health Services Dr. G.J. Hardy Medical Microbiologist Department of Laboratory Medicine Saint John Regional Hospital
Northwest Territories (see also Alberta and Quebec)	Norine Fraley Supervisor – Bacteriology Stanton Territorial Health Authority
Nova Scotia (Nova Scotia and Prince Edward Island)	Carol Pelton - Chair Lab Tech II Microbiology Queen Elizabeth II Health Sciences Centre
Ontario	Pamela Chedore Head TB and Mycobacteriology Laboratory Central Public Health Laboratory Dr. Frances Jamieson Clinical Microbiologist Central Public Health Laboratory Job Babu Regional Laboratory Hamilton General Hospital
Prince Edward Island (see also Nova Scotia)	Dr. L.P. Abbott Clinical Head Microbiology Dept. Lab Medicine Queen Elizabeth Hospital
Québec (Quebec, New Brunswick, Northwest Territories and Nunavut)	Louise Thibert Head Mycobacteriology Laboratoire de santé publique du Québec – INSPQ

Saskatchewan

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Dr. P. Pieroni
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Dr. Edward Ellis
Chief, Tuberculosis Prevention and Control
Centre for Infectious Disease Prevention and
Control

Dr. Amin Kabani
National Reference Centre for Mycobacteriology
Federal Laboratories for Health Canada

Joyce Wolfe
Head, Mycobacteriology
Canadian Science Centre for
Human and Animal Health

Appendix 2



Health Canada Santé 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		Unique Source Laboratory ID No. - Identificateur unique du laboratoire déclarant:			
Date Rec'd at TBPC: Date de réception au LATB: Y / A M / J		Date specimen / culture received at laboratory: Date de réception échantillon / culture au laboratoire: Y / A M / J			
TBPC Number: Numéro du LATB:					
Specie: Espèce:		MTB Complex (species unknown) Complexe MTB (espèce inconnu)			
<input type="checkbox"/> M. tuberculosis (may include M. africanum or M. microti) (peut inclure M. africanum et M. microti)		<input type="checkbox"/> M. bovis <input type="checkbox"/> M. BCG bovis			
Have susceptibility test results been previously reported for this patient? - Des résultats d'antibiogramme ont-ils déjà été fournis pour ce patient?					
<input type="checkbox"/> No / Non <input type="checkbox"/> 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)	PROV / TERR CODES PROV / TERR 10 = NFLD / TN 46 = MAN 11 = PEI / IPÉ 47 = SASK 12 = NS / NE 48 = ALTA / ALB 13 = NB 59 = BC / BC 24 = QUÉ / Qc 60 = YUK 35 = ONT 61 = NWT / TNO 62 = NUN		
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:	(CCYYMMDD) (SSAA/MM/JJ) <input type="checkbox"/> Unknown / Inconnu			
4	Patient's gender: Sexe du patient:	<input type="checkbox"/> Male / Masculin <input type="checkbox"/> Female / Féminin <input type="checkbox"/> Unknown / Inconnu			
LABORATORY RESULTS RÉSULTATS DE LABORATOIRE		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)		
Antituberculous Drugs Agents Antituberculeux			Sensitive / Sensible Resistant / Résistant Other (specify) / Autre (préciser)		
SM (Streptomycin) (Streptomycine)		mg / L	<input type="checkbox"/>	<input type="checkbox"/>	
INH (Isoniazid) (Isoniazide)		mg / L	<input type="checkbox"/>	<input type="checkbox"/>	
RMP (Rifampin) (Rifampicine)		mg / L	<input type="checkbox"/>	<input type="checkbox"/>	
EMB (Ethambutol)		mg / L	<input type="checkbox"/>	<input type="checkbox"/>	
PZA (Pyrazinamide)		mg / L	<input type="checkbox"/>	<input type="checkbox"/>	
2nd line drugs (specify) Antibiotiques de 2^e ligne (préciser)		Concentration	Sensitive / Sensible Resistant / Résistant Other (specify) / Autre (préciser)		
1.		mg / L	<input type="checkbox"/>	<input type="checkbox"/>	
2.		mg / L	<input type="checkbox"/>	<input type="checkbox"/>	
3.		mg / L	<input type="checkbox"/>	<input type="checkbox"/>	
4.		mg / L	<input type="checkbox"/>	<input type="checkbox"/>	
5.		mg / L	<input type="checkbox"/>	<input type="checkbox"/>	
6.		mg / L	<input type="checkbox"/>	<input type="checkbox"/>	
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)