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Tuberculosis

Drug resistance in Canada

1998

**Reported susceptibility results of the
Canadian Tuberculosis Laboratory
Network Surveillance System**

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► INTRODUCTION

The Division of Tuberculosis Prevention and Control in the Bureau of HIV/AIDS, STD and TB at the Laboratory Centre for Disease Control (LCDC), Health Canada, in collaboration with the Canadian Tuberculosis Laboratory Technical Network (CTLTN) (Appendix 1), established a laboratory based national surveillance system in 1998 in order to monitor tuberculosis drug resistance patterns in Canada. Participating laboratories (representing all provinces and territories) report their results on *Mycobacterium tuberculosis* (MTB) drug sensitivity testing to the Division for every patient for whom a specimen or an isolate has been received for each calendar year. The Division subsequently analyzes the collected data on an ongoing basis and has agreed to produce, as a minimum, an annual report. This initial report presents the 1998 results on drug sensitivity data received as of June 9, 1999.

► METHODOLOGY

A computerized database containing information on drug susceptibility patterns is maintained at the Division of Tuberculosis Prevention and Control at LCDC, Health Canada. The data were collected either through the manual completion and mailing of a standard reporting form (Appendix 2) or the electronic transmission of the data to the Division. Information collected include gender, year of birth, province/territory from which the report originates, province/territory from which the specimen originates and sensitivity results. Every effort was made to eliminate duplicate specimens. For the purposes of analysis, only the most recent sensitivity results for a given patient are included.

Routine sensitivity testing of MTB to first-line antituberculosis drugs is generally performed using the radiometric proportion method (Bactec®). These first-line drugs include isoniazid (INH), rifampin (RMP), ethambutol (EMB), streptomycin (SM) and pyrazinamide (PZA). Routine testing for SM is not conducted for isolates from Nova Scotia and Prince Edward Island. For isolates from Saskatchewan, British Columbia and the Yukon Territory, routine testing is not performed for PZA. Second-line drug resistance was not examined in this report.

Because of the variations in routine sensitivity testing, descriptive analyses of the testing results have been conducted to reflect the various drugs tested. Analyses were performed using Epi-Info 6.04 and SAS 6.12.

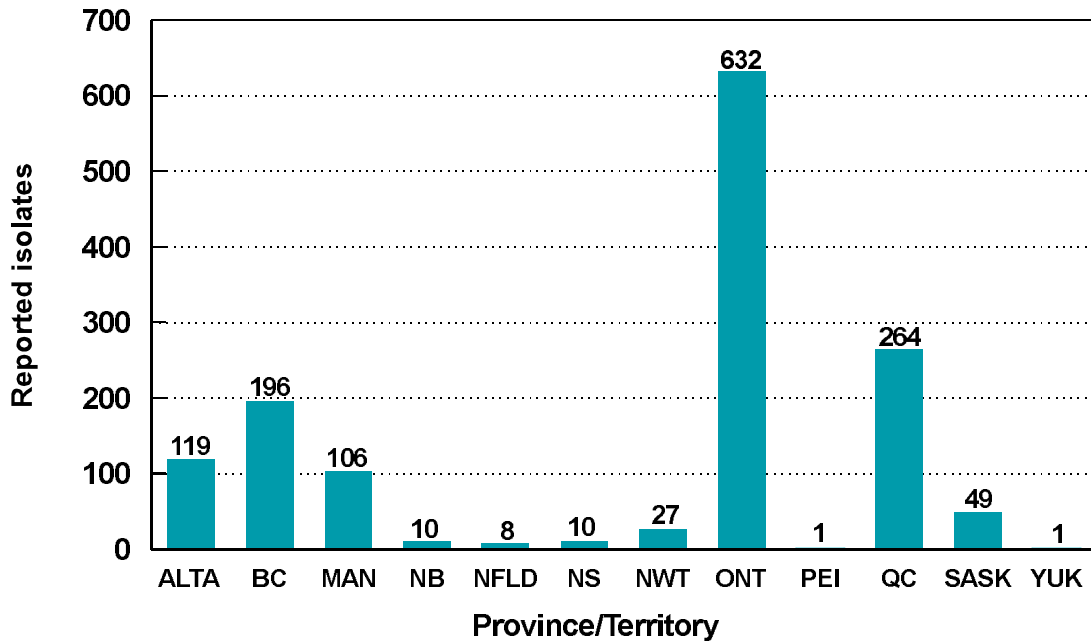
► RESULTS

In 1998, 1,423 *M. tuberculosis* isolates were reported across Canada. Of these, 168 (11.8%) were resistant to one or more first-line TB drug(s). Resistance to INH was the most common type of drug resistance (8.4%). Multi-drug resistant tuberculosis (MDR-TB) (defined as resistance to at least to INH and RMP) accounted for 1.2% of the isolates.

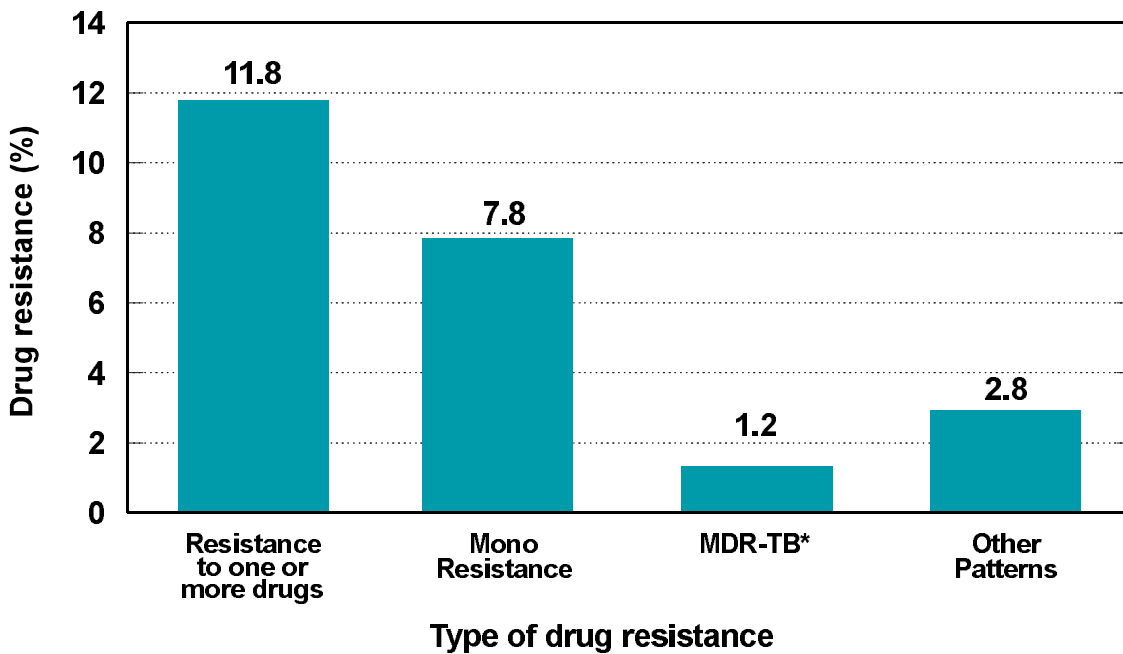
Ontario and Quebec reported the majority of isolates and had the highest percentage of MDR-TB. Certain provinces (New Brunswick, Nova Scotia) reported only INH resistance, while others (Newfoundland, Prince Edward Island, Northwest Territories, Yukon Territory) reported isolates that were sensitive to all first-line TB drugs tested.

Demographic information on patients was limited. Resistant MTB isolates were evenly distributed between males and females; more were found in those born between 1941 and 1980.

► **Figure 1**
 Reported MTB isolates in Canada by province/territory – 1998 (n = 1,423)

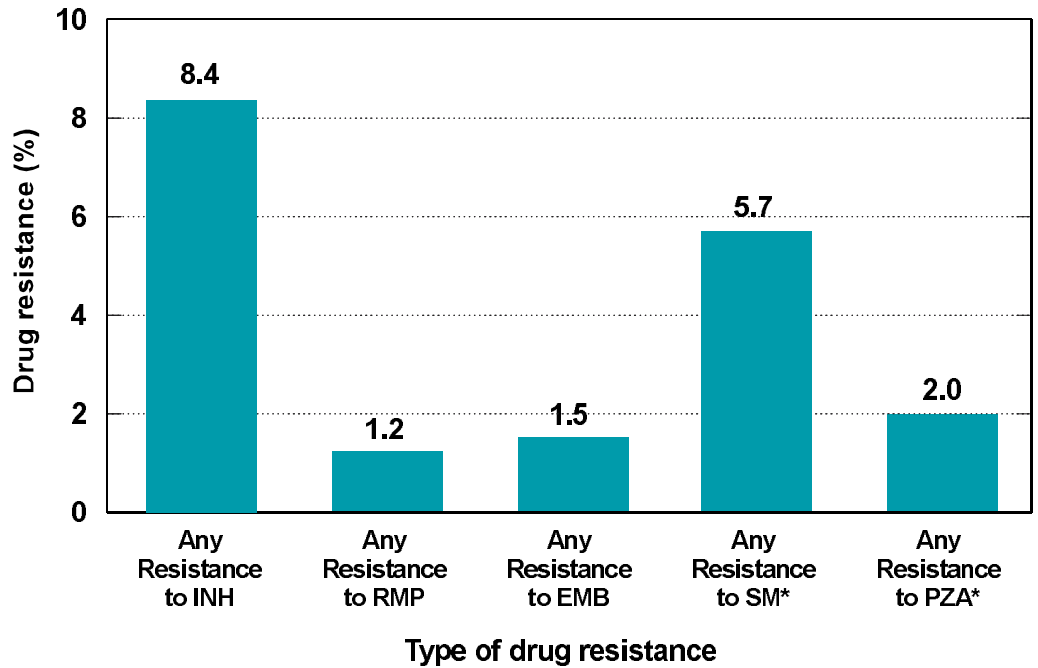


► **Figure 2**
 Overall pattern of reported TB drug resistance in Canada – 1998 (n = 168)



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

► **Figure 3**
Reported TB drug resistance in Canada by type of drug – 1998 (n = 168)



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

► **Figure 4**
Percentage of TB drug resistance in Canada by sex and year of birth – 1998 (n = 168)

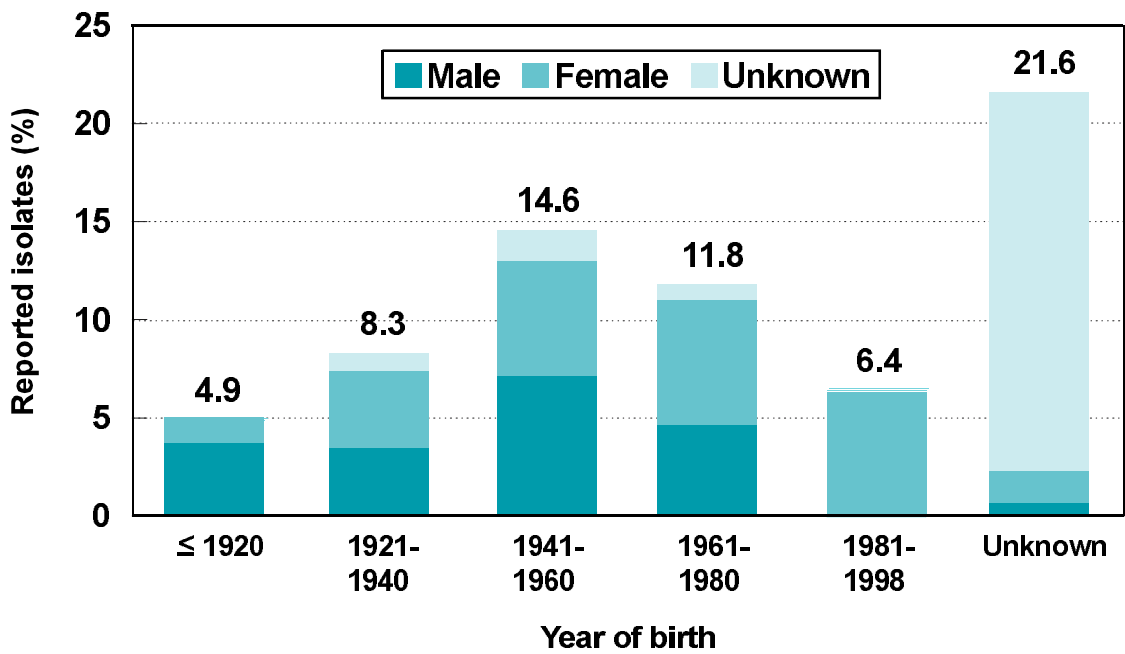


Table 1. Reported MTB isolates by “reporting” and “originating” province/territory, Canada – 1998

Reporting Province	CANADA	Originating Province/Territory												
		ALTA	BC	MAN	NB	NFLD	NS	NWT	ONT	PEI	QC	SASK	YUK	
Number of isolates	1,423	119	196	106	10	8	10	27	632	1	264	49	1	
ALTA	133	119	-	-	-	-	-	14	-	-	-	-	-	
BC	197	-	196	-	-	-	-	-	-	-	-	-	1	
MAN	106	-	-	106	-	-	-	-	-	-	-	-	-	
NFLD	8	-	-	-	-	8	-	-	-	-	-	-	-	
NS	11	-	-	-	-	-	10	-	-	1	-	-	-	
ONT	632	-	-	-	-	-	-	-	632	-	-	-	-	
QC	287	-	-	-	10	-	-	13	-	-	264	-	-	
SASK	49	-	-	-	-	-	-	-	-	-	-	49	-	

Table 2. Overall pattern of reported TB drug resistance in Canada – 1998

	Total	Percentage of total isolates reported (%)
Total number of isolates tested	1,423	100.0
Any resistance to INH	120	8.4
Any resistance to RMP	17	1.2
Any resistance to EMB	22	1.5
Any resistance to SM*	81	5.7
Any resistance to PZA*	24	2.0
Resistance to one or more drugs	168	11.8
Mono-resistance	111	7.8
MDR-TB**	17	1.2
Other patterns	40	2.8

* Because SM and PZA are not part of the routine first-line drugs in some provinces and territories, denominators for any resistance to these drugs have been modified to reflect this (SM n = 1,412 and PZA n = 1,177).

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

Table 3. Reported MDR-TB* isolates by province/territory, Canada – 1998

	CANADA	Province/Territory											
		ALTA	BC	MAN	NB	NFLD	NS	NWT	ONT	PEI	QC	SASK	YUK
Total number of isolates tested	1,423	119	196	106	10	8	10	27	632	1	264	49	1
Total number of MDR-TB* isolates	17	1	1	2	-	-	-	-	11	-	2	-	-
INH & RMP	2	-	-	-	-	-	-	-	2	-	-	-	-
INH, RMP & EMB	2	-	-	1	-	-	-	-	-	-	1	-	-
INH, RMP & SM	2	-	-	-	-	-	-	-	1	-	1	-	-
INH, RMP, EMB & SM	3	-	1	-	-	-	-	-	2	-	-	-	-
INH, RMP, EMB, SM & PZA	8	1	-	1	-	-	-	6	-	-	-	-	-

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

Table 4. Reported TB drug resistance by sex and year of birth, Canada – 1998

	Number of isolates		Any type of resistance		MDR-TB*	
	No.	%	No.	%	No.	%
Sex						
Male	665	46.7	58	4.1	4	0.3
Female	568	39.9	65	4.6	10	0.7
Unknown	190	13.4	45	3.2	3	0.2
Total	1,423	100.0	168	11.8	17	1.2
Year of Birth						
≤1920	164	11.6	8	0.6	0	0.0
1921-1940	327	23.0	27	1.9	7	0.5
1941-1960	317	22.3	46	3.2	2	0.2
1961-1980	392	27.5	46	3.2	5	0.4
1981-1998	47	3.3	3	0.2	0	0.0
Unknown	176	12.4	38	2.7	3	0.2
Total	1,423	100.0	168	11.8	17	1.2

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

Table 5. Reported results for routine drug sensitivity testing of MTB isolates to first-line antituberculosis drugs, Alberta 1998

	Total	Percentage of total isolates reported (%)
Total number of isolates tested for INH, RMP, EMB, SM and PZA	119	100.0
Isolates sensitive	107	89.9
Isolates resistant to one or more drugs	12	10.1
Monoresistance	9	7.6
INH	4	3.4
SM	5	4.2
MDR-TB*	1	0.8
INH, RMP, SM, EMB & PZA	1	0.8
Other Patterns	2	1.7
INH & SM	1	0.8
INH, SM & PZA	1	0.8

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

Table 6. Reported results for routine drug sensitivity testing of MTB isolates to first-line antituberculosis drugs, British Columbia 1998

	Total	Percentage of total isolates reported (%)
Total number of isolates tested for INH, RMP, EMB and SM*	196	100.0
Isolates sensitive	177	90.3
Isolates resistant to one or more drugs	19	9.7
Monoresistance	12	6.1
INH	11	5.6
SM	1	0.5
MDR-TB**	1	0.5
INH, RMP, SM & EMB	1	0.5
Other Patterns	6	3.1
INH & EMB	1	0.5
INH & SM	5	2.6

* Routine testing for PZA not conducted in British Columbia.

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

Table 7. Reported results for routine drug sensitivity testing of MTB isolates to first-line antituberculosis drugs, Manitoba 1998

	Total	Percentage of total isolates reported (%)
Total number of isolates tested for INH, RMP, EMB, SM and PZA	106	100.0
Isolates sensitive	98	92.5
Isolates resistant to one or more drugs	8	7.5
Monoresistance	4	3.8
INH	2	1.9
SM	2	1.9
MDR-TB*	2	1.9
INH, RMP & EMB	1	0.95
INH, RMP, EMB, SM & PZA	1	0.95
Other Patterns	2	1.9
INH & SM	2	1.9

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

Table 8. Reported results for routine drug sensitivity testing of MTB isolates to first-line antituberculosis drugs, New Brunswick 1998

	Total	Percentage of total isolates reported (%)
Total number of isolates tested for INH, RMP, EMB, SM and PZA	10	100.0
Isolates sensitive	9	90.0
Isolates resistant to one or more drugs	1	10.0
Monoresistance	1	10.0
INH	1	10.0

Table 9. Reported results for routine drug sensitivity testing of MTB isolates to first-line antituberculosis drugs, Newfoundland 1998

	Total	Percentage of total isolates reported (%)
Total number of isolates tested for INH, RMP, EMB, SM and PZA	8	100.0
Isolates sensitive	8	100.0

Table 10. Reported results for routine drug sensitivity testing of MTB isolates to first-line antituberculosis drugs, Northwest Territories 1998

	Total	Percentage of total isolates reported (%)
Total number of isolates tested for INH, RMP, EMB, SM and PZA	27	100.0

Table 11. Reported results for routine drug sensitivity testing of MTB isolates to first-line antituberculosis drugs, Nova Scotia 1998

	Total	Percentage of total isolates reported (%)
Total number of isolates tested for INH, RMP, EMB and PZA*	10	100.0
Isolates sensitive	9	90.0
Isolates resistant to one or more drugs	1	10.0
Monoresistance	1	10.0
INH	1	10.0

* Routine testing for SM not conducted in Nova Scotia.

Table 12. Reported results for routine drug sensitivity testing of MTB isolates to first-line antituberculosis drugs, Ontario 1998

	Total	Percentage of total isolates reported (%)
Total number of isolates tested for INH, RMP, EMB, SM and PZA	632	100.0
Isolates sensitive	540	85.4
Isolates resistant to one or more drugs	92	14.6
Monoresistance	55	8.7
INH	34	5.4
EMB	4	0.6
SM	11	1.7
PZA	6	0.9
MDR-TB*	11	1.7
INH & RMP	2	0.3
INH, RMP & SM	1	0.2
INH, RMP, SM & EMB	2	0.3
INH, RMP, EMB, SM & PZA	6	0.9
Other Patterns	26	4.1
INH & EMB	2	0.3
INH & SM	20	3.2
INH, SM & PZA	2	0.3
INH, SM & EMB	2	0.3

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

Table 13. Reported results for routine drug sensitivity testing of MTB isolates to first-line antituberculosis drugs, Prince Edward Island 1998

	Total	Percentage of total isolates reported (%)
Total number of isolates tested for INH, RMP, EMB and PZA*	1	100.0
Isolates sensitive	1	100.0

* Routine testing for SM not conducted in Prince Edward Island.

Table 14. Reported results for routine drug sensitivity testing of MTB isolates to first-line antituberculosis drugs, Québec 1998

	Total	Percentage of total isolates reported (%)
Total number of isolates tested for INH, RMP, EMB, SM and PZA	264	100.0
Isolates sensitive	231	87.5
Isolates resistant to one or more drugs	33	12.5
Monoresistance	28	10.6
INH	9	3.4
SM	13	4.9
PZA	6	2.3
MDR-TB*	2	0.8
INH, RMP & EMB	1	0.4
INH, RMP & SM	1	0.4
Other Patterns	3	1.1
INH & SM	2	0.8
INH & PZA	1	0.4

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

Table 15. Reported results for routine drug sensitivity testing of MTB isolates to first-line antituberculosis drugs, Saskatchewan 1998

	Total	Percentage of total isolates reported (%)
Total number of isolates tested for INH, RMP, EMB and SM*	49	100.0
Isolates sensitive	47	95.9
Isolates resistant to one or more drugs	2	4.1
Monoresistance	1	2.0
INH	1	2.0
MDR-TB**	0	0.0
Other Patterns	1	2.0
INH & SM	1	2.0

* Routine testing for PZA not conducted in Saskatchewan.
 ** MDR-TB is defined as resistance to at least INH and RMP.

Table 16. Reported results for routine drug sensitivity testing of MTB isolates to first-line antituberculosis drugs, Yukon Territory 1998

	Total	Percentage of total isolates reported (%)
Total number of isolates tested for INH, RMP, EMB and SM*	1	100.0
Isolates sensitive	1	100.0

* Routine testing for PZA not conducted in Yukon Territory.

▶ LIMITATIONS

Because SM and PZA are not part of the first-line drugs routinely tested in some provinces and territories, there were some limitations in presenting standard results for all of Canada. The full date of birth for individual patients was not available and so the year of birth was used as a proxy to look at the profile of drug resistance by age. More epidemiologic information is needed on the cases from which the isolates were submitted in order to critically examine drug resistance patterns in Canada. Future collaboration is needed to link the epidemiological data to the laboratory data in order to guide appropriate public health interventions.

► Appendix 1

Participating Laboratories of the Canadian Tuberculosis Laboratory Technical Network (CTLTN)

Alberta (Alberta and Northwest Territories)	Mycobacteriology, Provincial Laboratory of Public Health / UAH, Microbiology and Public Health, Edmonton
British Columbia (British Columbia and Yukon Territory)	Mycobacteriology, Provincial Laboratory, B.C. Centre for Disease Control Society, Vancouver
Manitoba	Clinical Microbiology, Health Sciences Centre, Winnipeg
Newfoundland	Newfoundland Public Health Laboratory, L.A Miller Centre for Health Services, St. John's
Nova Scotia (Nova Scotia and Prince Edward Island)	Pathology and Laboratory Medicine, Queen Elizabeth II Health Sciences Centre, Halifax
Ontario	Laboratories Branch, Ontario Minister of Health, Toronto
Québec (Québec, New Brunswick and Northwest Territories)	Mycobactériologie, Laboratoire de santé publique du Québec, Ste-Anne-de-Bellevue
Saskatchewan	<i>North</i> TB Laboratory, Clinical Microbiology, Royal University Hospital, Saskatoon <i>South</i> Microbiology, Saskatchewan Health, H.E. Roberston Laboratory, Regina

▶ **Appendix 2**