TUBERCULOSIS:

DRUG RESISTANCE IN CANADA 2013

PROTECTING CANADIANS FROM ILLNESS

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

Canada

TO PROMOTE AND PROTECT THE HEALTH OF CANADIANS THROUGH LEADERSHIP, PARTNERSHIP, INNOVATION AND ACTION IN PUBLIC HEALTH.

—Public Health Agency of Canada

Également disponible en français sous le titre :
La tuberculose : La résistance aux antituberculeux au Canada 2013

To obtain additional information, please contact:

Public Health Agency of Canada
Address Locator 0900C2
Ottawa, ON K1A 0K9
Tel.: 613-957-2991
Toll free: 1-866-225-0709
Fax: 613-941-5366
TTY: 1-800-465-7735
E-mail: publications@hc-sc.gc.ca

This publication can be made available in alternative formats upon request.

Suggested citation: Public Health Agency of Canada. *Tuberculosis: Drug Resistance in Canada 2013*. Ottawa (Canada): Minister of Public Works and Government Services Canada; 2014.

Publication date: December 2014

Cat.: HP37-4/2013E-PDF
ISBN: 1498-5071
Pub.: 140403

TUBERCULOSIS:
DRUG RESISTANCE IN CANADA 2013

ACKNOWLEDGEMENTS

The Public Health Agency of Canada would like to acknowledge the members of the Canadian Tuberculosis Laboratory Technical Network and their teams for their contribution to and their participation in the Canadian Tuberculosis Laboratory Surveillance System.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

Alta.	Alberta
AK	Amikacin
B.C.	British Columbia
BCG	Bacillus Calmette-Guérin
CLSI	Clinical and Laboratory Standards Institute
CM	Capreomycin
CPHLN	Canadian Public Health Laboratory Network
CTBLSS	Canadian Tuberculosis Laboratory Surveillance System
CTLTN	Canadian Tuberculosis Laboratory Technical Network
EMB	Ethambutol
ETH	Ethionamide
INH	Isoniazid
KM	Kanamycin
LIN	Linezolid
M. africanum	*Mycobacterium africanum*
M. bovis	*Mycobacterium bovis*
M. canetti	*Mycobacterium canetti*
M. caprae	*Mycobacterium caprae*
M. microti	*Mycobacterium microti*
M. pinnipedii	*Mycobacterium pinnipedii*
M. tuberculosis	*Mycobacterium tuberculosis*
Man.	Manitoba
MDR-TB	Multidrug-resistant tuberculosis
MOX	Moxifloxacin
MTBC	*Mycobacterium tuberculosis* complex
N.B.	New Brunswick
N.L.	Newfoundland and Labrador
NRCM	National Reference Centre for Mycobacteriology
N.S.	Nova Scotia
Nvt.	Nunavut
N.W.T.	Northwest Territories
OFL	Ofloxacin
Ont.	Ontario
PAS	*Para*-amino salicylic acid
P.E.I.	Prince Edward Island
PZA	Pyrazinamide
Que.	Quebec
RBT	Rifabutin

RMP	Rifampin
Sask.	Saskatchewan
SM	Streptomycin
TB	Tuberculosis
XDR-TB	Extensively drug-resistant tuberculosis
Y.T.	Yukon

INTRODUCTION

Drug-resistant strains of tuberculosis (TB) pose a serious threat to TB prevention and control efforts. Although drug-resistant TB has not yet been identified as a major problem in Canada, the potential for it to become an issue is high because of the frequency with which Canadians travel abroad.

In response to a growing worldwide concern about TB drug resistance, the Public Health Agency of Canada ("the Agency") established the Canadian Tuberculosis Laboratory Surveillance System (CTBLSS) in partnership with the Canadian Tuberculosis Laboratory Technical Network (CTLTN) and participating laboratories in 1998. The CTBLSS was designed to monitor emerging trends and patterns in anti-tuberculosis drug resistance in Canada.

Participating laboratories submit data annually on the results of anti-tuberculosis drug susceptibility testing to the Agency for inclusion in the CTBLSS database.

This report is the next iteration of an annual surveillance report that describes data collected through the CTBLSS; specifically, this report provides details on the overall level of TB drug resistance in Canada for the period 2003 to 2013, focusing on 2013.

The data presented in this report provide timely information to inform public health action, as well as policy and program development and assessment.

BACKGROUND

PATTERNS OF DRUG RESISTANCE

TB drug resistance is determined through susceptibility testing of cultures (isolates) grown from clinical specimens obtained from individuals with culture-positive TB.[1] People with TB are said to have drug-resistant TB if the strain of *Mycobacterium tuberculosis* causing their disease is resistant to one or more of the four first-line drugs. The following resistance patterns are described in this report:

- *Monoresistance*—defined as resistance to one first-line anti-TB drug only (isoniazid, rifampin, ethambutol or pyrazinamide);
- *Multidrug-resistant tuberculosis (MDR-TB)*—defined as TB due to bacteria resistant to isoniazid and rifampin with or without resistance to other anti-tuberculosis drugs;
- *Polyresistance (other patterns)*—defined as resistance to more than one first-line anti-TB drug, not including the isoniazid and rifampin combination of MDR-TB;
- *Extensively drug-resistant TB (XDR-TB)*—defined as TB due to bacteria resistant to isoniazid and rifampin and any fluoroquinolone and at least one of the three injectable second-line drugs (amikacin, capreomycin or kanamycin).[2]

TB DRUG RESISTANCE STANDARDS AND TESTING IN CANADA

The CTLTN, whose mission is to promote excellence, standardization and quality assurance in mycobacteriology services, is a network of provincial and territorial TB laboratories with representation from the technical or scientific heads of TB programs of provincial and territorial laboratories across Canada (Appendix I). The goals of the CTLTN are to

- standardize methodologies;
- improve biosafety operational practices and physical requirements;
- implement biosafety guidelines;
- participate in national surveillance and proficiency programs; and
- exchange services and information about new technologies.

Generally speaking, all laboratory testing methods in Canada, including drug selection and concentrations, are in line with recommended laboratory standards.[i,3,4] Participating CTLTN laboratories are now performing routine susceptibility testing of *Mycobacterium tuberculosis* or *Mycobacterium tuberculosis* complex (MTBC) to first-line anti-tuberculosis drugs using fluorometric proportion method BACTEC® MGIT 960. Table 1 provides a list of recommended first-line and second-line anti-tuberculosis drugs and the critical concentrations in mg/L.[3,4]

With respect to first-line drug-resistance testing, all participating laboratories test for all first-line TB drugs (isoniazid, ethambutol, rifampin, and pyrazinamide). The exception is British Columbia, which does not routinely test for resistance to pyrazinamide but does test for streptomycin resistance.

Second-line drug-resistance testing and capacity also varies across jurisdictions, but typically isolates are tested for resistance to amikacin, kanamycin, capreomycin, ethionamide, linezolid, ofloxacin, moxifloxacin, *para*-amino salicylic acid and rifabutin.

Because not all of the Canadian provinces and territories have the capacity to perform susceptibility testing, some will process and send isolates for testing to laboratories in other provinces. Please refer to the methods section for further details.

[i] The CLSI offers practical operating guidelines that lead to consistent laboratory practices, precision, and efficient use of resources. The CLSI recommends that, once drug-resistance testing against first-line anti-tuberculosis agents is complete, isolates found to be monoresistant to rifampin or to any two of the first-line anti-tuberculosis drugs be tested against a panel of second-line drugs. When fluoroquinolones are added to the drug regimen for cases monoresistant to isoniazid, second-line antimicrobial drug resistance testing is recommended.

METHODS

OVERVIEW OF THE CANADIAN TUBERCULOSIS LABORATORY SURVEILLANCE SYSTEM

Established in 1998, the CTBLSS is an isolate-based surveillance system designed to collect timely data on TB drug resistance across Canada. Information on the results of all unique isolates tested for drug resistance during the previous calendar year are voluntarily submitted by provincial TB laboratories to the Agency for inclusion in the CTBLSS. Participating laboratories include members of the CTLTN (covering all provinces and territories).

Data for the CTBLSS are collected either through manual completion of a standard reporting form (Appendix II) or electronically. Standardized data recoding procedures are applied to all data to create a national dataset for analysis. The following information is submitted to the Agency:

- the date the isolate or specimen was received at the laboratory;
- the specimen identification number provided by the laboratory;
- the province/territory where the isolate was tested;
- the province/territory from which the isolate originates;
- the sex of the individual from whom the isolate originates;
- the date of birth or age at time of testing of the individual from whom the isolate originates; and
- drug susceptibility results (drug tested, including concentration of the drug tested).

Data are submitted for all confirmed cases of MTBC including *Mycobacterium tuberculosis, M. africanum, M. canetti, M. caprae, M. microti, M. pinnipedii or M. bovis* demonstrated on culture. Results may be submitted at the species level or for MTBC only without species identification. Some laboratories also submit results for the *M. bovis* BCG strain, but these results are excluded from this report because this strain is not infectious.

With respect to drug susceptibility results, all participating laboratories are asked to submit results for all first-line TB drugs (isoniazid, ethambutol, rifampin, and pyrazinamide). British Columbia does not routinely test for resistance to pyrazinamide, but if resistance to any first-line drug is detected, isolates are subsequently tested for resistance to pyrazinamide. If isolates show resistance to isoniazid and rifampin, second-line drug testing is conducted. To rule out XDR-TB, laboratories are asked to report on the results for at least one of the fluoroquinolones (ofloxacin, moxifloxacin or levofloxacin), and the injectable agents (amikacin, kanamycin and capreomycin).

Because not all provinces and territories have the capacity to perform susceptibility testing, some will send isolates to other provincial laboratories for testing. In some cases, the laboratory that tests the sample will submit the results to the Agency on behalf of the originating province or territory.

For first-line susceptibility testing, British Columbia tests and reports results for British Columbia and Yukon, Alberta tests and reports isolates for Alberta and Northwest Territories, and Ontario tests and reports results for Ontario and Nunavut. The National Reference Centre for Mycobacteriology (NRCM)[ii] in Manitoba conducts first-line susceptibility testing for New Brunswick, Nova Scotia and Prince Edward Island. In this case, the NRCM returns test results to the originating province and the originating province submits their results to the Agency. All remaining provinces conduct their own first-line testing and do not report results for any other jurisdiction.

Four laboratories in Canada conduct second-line testing: the provincial laboratories in Alberta, Ontario and Quebec and the NRCM. The NRCM tests the susceptibility of isolates to second-line drugs for all provinces and territories that do not conduct such testing at their laboratories. Upon request the NRCM will also test isolates submitted by any provincial laboratory to confirm resistance patterns.

TABULATION AND PRESENTATION OF RESULTS

This report provides an overview of TB drug resistance in Canada for the period 2003 to 2013, along with a complementary series of data tables (Appendix III). Select data are presented by province/territory and by age and sex where feasible. Data from 2013, the most recent reporting year for which data are available, are highlighted, as are important trends over time.

The data presented in this report were extracted from the CTBLSS database on March 31, 2014. Results from cultures that grow in a given year are included in the statistics for that calendar year; otherwise, the results are reflected in the subsequent year's report. For example, if a specimen was received by the laboratory on December 20, 2013, and the culture didn't grow *M. tuberculosis* until January 2014, these results are reflected in the 2014 report.

Samples submitted to the laboratory for drug susceptibility testing may be obtained at any time during a patient's TB diagnosis and/or treatment, and samples from the same case may be submitted to laboratories over the course of a number of years. Therefore, the number of isolates described in this report is not equal to the number of culture-positive cases reported through case-based surveillance over the same time. This is because a case of culture-positive tuberculosis is only reported once in the year of diagnosis but may be tested for drug resistance over the course of several years until they are cured or until the prescribed treatment is completed. In the event that two specimens are confirmed to have been taken from the same individual in a given calendar year, only the most recent susceptibility result is included in the analysis for this report.

No statistical procedures were used for comparative analyses in this report; nor were any statistical techniques applied to account for missing data. Data in tables with small cell sizes ($n \leq 5$) were not suppressed, since disclosure is not deemed to pose any risk of identifying individual cases. These procedures are in line with the Agency's *Directive for the collection, use and dissemination of information relating to public health*.[5]

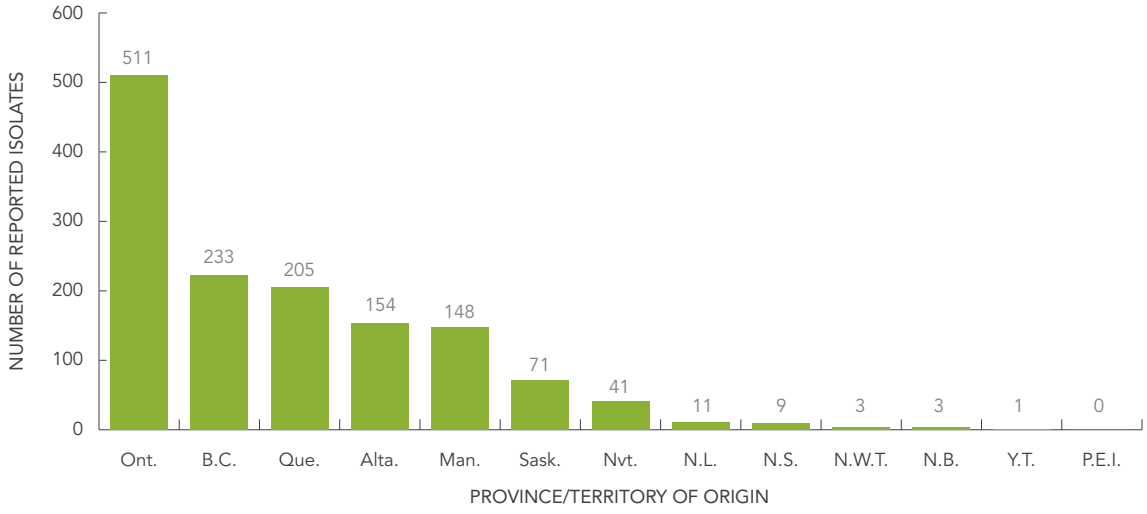
[ii] For more information about the National Reference Centre of Mycobacteriology please see: www.nml-lnm.gc.ca/eb-be/myco-eng.htm

RESULTS

In 2013, anti-tuberculosis drug susceptibility test results for 1,397 isolates were reported to the Agency. Of these, 762 (54%) were reported as MTBC where the species was known (750 were *M. tuberculosis*; 8 were *M. africanum* and 4 were *M. bovis)*, and 618 (44%) were MTBC of an unknown species. Seventeen (1.2%) isolates were identified as *M. bovis* BCG and were excluded from further analyses (data not shown). As a result, laboratory results for 1,380 isolates were analyzed for this report (Table 2).

In addition to testing isolates from Alberta and three isolates from Northwest Territories, the Provincial Laboratory of Public Health for Alberta tested and reported results for two isolates from British Columbia, one isolate from Saskatchewan and four from Nunavut. Similarly, the Central Public Health Laboratory in Ontario tested and reported results for three isolates from Quebec (Table 2). Figure 1 provides a breakdown of the number of isolates tested by the province or territory of origin.

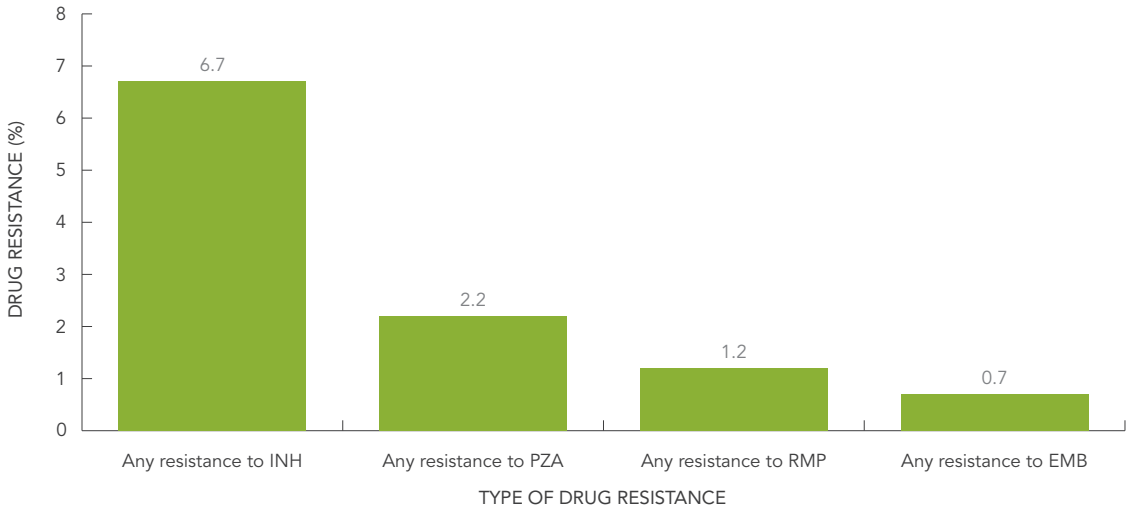
FIGURE 1: Number of *Mycobacterium tuberculosis* complex isolates tested by province or territory of origin, 2013



ANY FIRST-LINE DRUG RESISTANCE

In 2013, all 1,380 isolates were tested for resistance to isoniazid, rifampin and ethambutol, and 1,186 (86%) were tested for resistance to pyrazinamide. Overall, 112 (8.1%) of the isolates tested were resistant to at least one first-line drug. Ninety-three (6.7%) of the isolates tested were resistant to isoniazid, 26 (2.2%) were resistant to pyrazinamide, 17 (1.2%) were resistant to rifampin, and 10 (0.7%) were resistant to ethambutol (Table 3, Figure 2).

FIGURE 2: Reported tuberculosis drug resistance in Canada by first-line drug, 2013



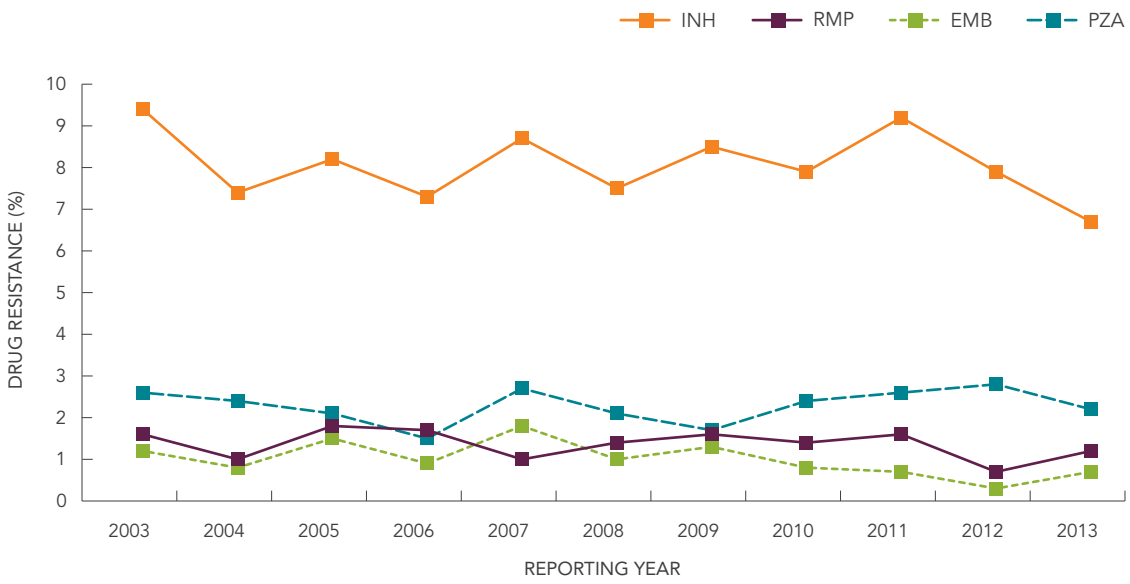
For the period 2003 to 2013, drug susceptibility results were reported for 14,841 isolates. On average, 1,349 results were received each year ranging from a high of 1,405 in 2003 to a low of 1,267 in 2007 (Table 4).

Of all the reported results received from 2003 to 2013, 1,399 (approximately 9%) were resistant to one or more of the first-line medications, ranging from a high of 10.5%, reported in 2003, 2007 and 2011, to a low of 8.1% in 2013 (Table 3).

Over this same period, 8% (range: 6.7%–9.4%) of all isolates tested were isoniazid resistant. From 2011 to 2013, isoniazid resistance dropped slightly, from 9.2% in 2011 to 7.9% in 2012 and then to an all-time low of 6.7% in 2013. For the period 2003 to 2013, ethambutol, rifampin and pyrazinamide resistance have consistently remained below 3% (Table 3).

Figure 3 shows changes over time in the percentage of isolates resistant to each of the first-line drugs for the period 2003 to 2013.

FIGURE 3: Any drug resistance, by type of first-line drug, as a percentage of all isolates tested, 2003–2013



MONORESISTANCE

In 2013, of the 112 TB isolates reported to be resistant to at least one of the four first-line drugs, the majority, 93 (83%), were monoresistant (Table 3). Of these, 74 (80%) were isoniazid resistant, 17 (18%) were pyrazinamide resistant and 2 (2%) were rifampin resistant. No isolates were identified as ethambutol-monoresistant (data not shown).

From 2003 to 2013, 7.8% of all isolates tested were monoresistant, ranging from a high of 9.0% in 2011 to a low of 6.7% in 2013 (Table 3).

In 2013, four of the pyrazinamide-monoresistant isolates were identified as *M. bovis*, which is known to be inherently resistant to pyrazinamide, and results for nine of the 17 isolates were only recorded at the complex level. Between 2003 and 2013, there were 48 reports of *M. bovis* isolates, and 43 (89%) were resistant to pyrazinamide (data not shown).

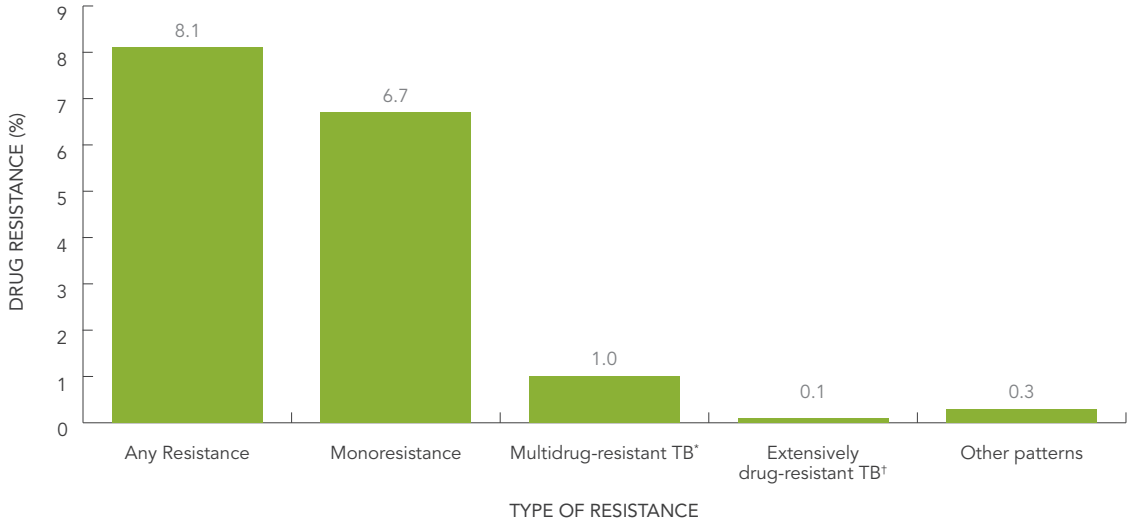
For the period 2003 to 2013, 25 isolates (0.2% of all results) were identified as rifampin-monoresistant. Of these, 13 (52%) originated from British Columbia; six (25%) from Ontario, two (8%) from Quebec and one (4%) each from Manitoba, Newfoundland and Labrador, Northwest Territories and Nunavut. With the exception of 2004 and 2010 in which there were no reports of rifampin-monoresistant isolates, between one and three rifampin-monoresistant isolates were reported each year from 2003 to 2013. Of note, in 2006, eight (0.6% of all reports) rifampin-monoresistant isolates were reported, representing an atypically high number for a one-year period (data not shown).

MULTIDRUG-RESISTANT AND EXTENSIVELY DRUG-RESISTANT TB

In 2013, 15 isolates were resistant to both isoniazid and rifampin (classifying these isolates as MDR-TB at a minimum), six (40%) of which were resistant only to isoniazid and rifampin. In addition to being resistant to isoniazid and rifampin, three of these 15 (20%) were also resistant to ethambutol, one (6%) to pyrazinamide and five (33%) to all first-line drugs (Table 5). An additional four isolates (0.3%) were resistant to two or more of the first-line drugs excluding the isoniazid and rifampin combination (data not shown).

To rule out XDR-TB, all 15 isolates that were resistant to both isoniazid and rifampin were subsequently tested for resistance to select second-line drugs. Of these, 12 isolates were susceptible to both the injectable agents and the fluoroquinolones, one was resistant to an injectable and one was resistant to a fluoroquinolone. As a result, these 14 isolates (1.0% of all isolates tested) were classified as MDR-TB. The remaining isolate was resistant to at least one of the injectables and to a fluoroquinolone, which classified it as XDR-TB (0.1 % of all isolates tested). In other words, results from additional second-line testing in 2013 identified 14 isolates as MDR-TB and one as XDR-TB (Table 5). Figure 4 presents patterns of TB drug resistance as a percentage of all isolates tested in 2013.

FIGURE 4: Tuberculosis drug resistance patterns as a percentage of isolates tested, 2013



* Multidrug-resistant TB (MDR-TB) is TB that is resistant to at least isoniazid and rifampin, but which does not meet the definition of XDR-TB.

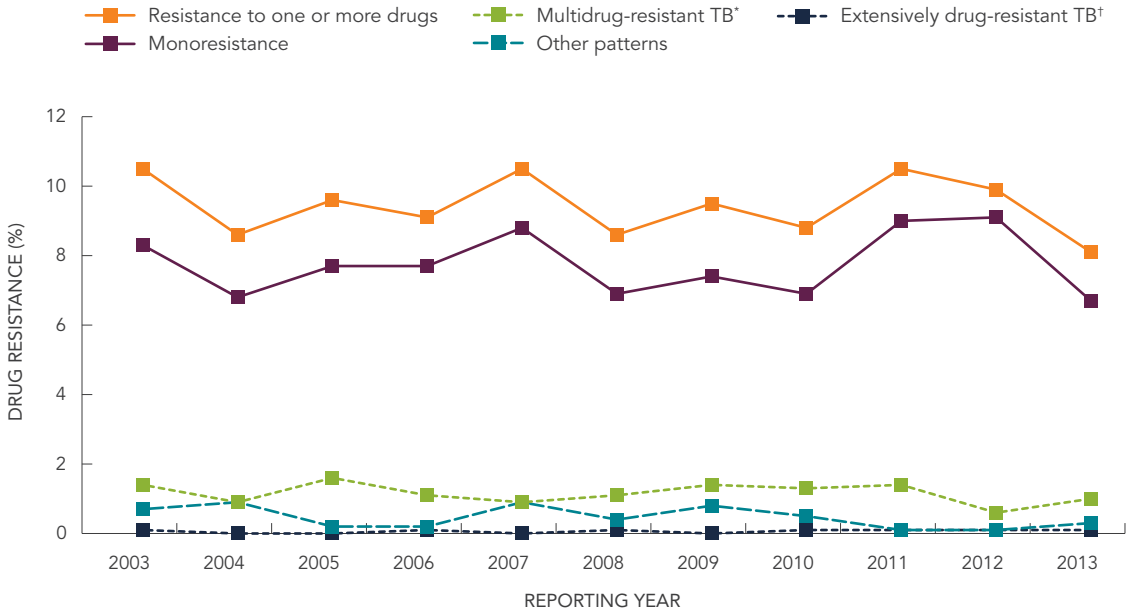
† Extensively drug-resistant TB (XDR-TB) is TB that is resistant to at least the two best first-line drugs isoniazid and rifampin plus resistant to second–line drugs including any fluoroquinolone and at least one of three injectable agents, amikacin, capreomycin and kanamycin.

For the period 2003 to 2013, 177 isolates were found to be resistant to both isoniazid and rifampin, classifying these isolates as MDR-TB at a minimum. To rule out XDR-TB, all of these isolates were subsequently tested for resistance to select second-line drugs. On average, 77% of the isolates were susceptible to both the fluoroquinolones and the injectables, 10.2% were resistant to a fluoroquinolone but susceptible to the injectables; 8% were resistant to at least one of the injectables but susceptible to the fluoroquinolones; and 4% were resistant to both (a) fluoroquinolone(s) and (an) injectable(s) (data not shown).

Based on these findings, for the period 2003 to 2013, 170 isolates were classified as MDR-TB, representing 1.1% of isolates tested over this time. Seven isolates were classified as XDR-TB, representing an annual average of less than 0.1% of the total number of isolates tested for the period 2003 to 2013. An average of 16 MDR-TB isolates were reported each year, ranging from a high of 22 (1.6% of all isolates tested) in 2005 to a low of eight (0.6% of all isolates) in 2012 (Table 4).

Figure 5 shows the overall pattern of reported TB drug resistance as a percentage of isolates tested for the period 2003 to 2013. While there have been small fluctuations in the percentage of isolates showing various resistance patterns, there has been no notable change over this time.

FIGURE 5: Tuberculosis drug resistance patterns as a percentage of isolates tested, 2003–2013



* Multidrug-resistant TB (MDR-TB) is TB that is resistant to at least isoniazid and rifampin, but which does not meet the definition of XDR-TB.

† Extensively drug-resistant TB (XDR-TB) is TB that is resistant to at least the two best first-line drugs isoniazid and rifampin plus resistant to second–line drugs including any fluoroquinolone and at least one of three injectable agents, amikacin, capreomycin and kanamycin.

GEOGRAPHICAL DISTRIBUTION

In 2013, 68% of all the reported isolates originated from the three largest provinces, British Columbia, Ontario and Quebec (Table 2). All isolates from Northwest Territories, Nunavut, Yukon, and Newfoundland and Labrador were fully susceptible to all the first-line drugs tested (Table 5). Prince Edward Island did not report a case of TB in 2013 and no laboratory results were reported by that province (Table 5). Of the 15 isolates resistant to both isoniazid and rifampin in 2013, 13 originated from Ontario and two from Quebec (Table 5).

For the period 2003 to 2013, all 170 MDR-TB isolates originated from six provinces: Alberta, British Columbia, Manitoba, Ontario, Quebec and Saskatchewan (Table 6). Of the additional seven isolates identified as XDR-TB, five were reported from Ontario, one from Manitoba and one from Quebec (Table 6).

Tables 7 through 19 present results for routine drug susceptibility testing of MTBC isolates to anti-tuberculosis drugs for the period 2003 to 2013 for each province and territory.

DEMOGRAPHIC INFORMATION

In 2013, age or date of birth was available for all individuals from whom all 1,380 isolates were reported (Table 20).

Of the 112 isolates for which any drug-resistance pattern was identified, 23% were from individuals between the ages of 24 and 34 years and another 21% were from individuals 45 to 54 years of age. Less than 2% of isolates were from individuals under 15 years of age (Table 20).

All MDR-TB isolates were from individuals between the ages of 15 and 64 years. There were no MDR-TB cases reported for individuals less than 15 years of age or over 65 years of age (Table 20).

In 2013, sex was known for patients from whom 1,378 of the 1380 isolates were obtained. Among these, males accounted for 55% of all reports (Table 20).

Females accounted for 56% of the isolates showing any resistance and 67% (10/15) of the isolates with resistance to both isoniazid and rifampin (Table 20).

DISCUSSION

In many parts of the world, the increase in drug resistance is a major challenge to preventing and controlling TB. Available data confirm that Eastern Europe and Central Asia continue to have the world's highest proportion of MDR-TB cases.[6]

Organisms resistant to both isoniazid and rifampin pose a considerable challenge to treatment and prevention efforts because effective anti-tuberculosis drugs are limited. Data published by the World Health Organization shows that globally, in 2012, about 3.6% (95% CI: 2.1%–5.1%) of new TB cases and 20.2% (95% CI: 13.3%–27.2%) of previously treated TB cases were MDR-TB.[6] Although the data captured through the CTBLSS do not distinguish between isolates from new versus previously treated cases of TB, that 1% of isolates tested in 2013 were MDR-TB is a considerably lower finding than global estimates. In addition, the identification of seven XDR-TB cases over the period 2003 to 2013 indicates that XDR-TB in Canada is still a relatively rare event.

Overall, there has been no notable change in the proportion of isolates showing any resistance to first-line medications in Canada for the period 2003 to 2013.

STRENGTHS AND LIMITATIONS

The CTBLSS is the result of successful collaboration between federal, provincial and territorial governments and the CTLTN. The primary objective of the CTBLSS is to monitor emerging trends and patterns in anti-tuberculosis drug resistance in Canada. This report presents detailed data on the extent of first- and second-line TB drug resistance in Canada disaggregated by province/territory and, where feasible, sex and age. As the primary source of national data on TB drug resistance in Canada, the data within this report provide timely information for public health action, as well as policy and program development and assessment.

Prior to analysis and report preparation, all data are reviewed for errors, inconsistencies and completeness. Submitting laboratories are provided with a summary report of their data for review. If required, they are asked to make corrections and resubmit their data. Once the laboratories agree that the submissions are correct, the data are then integrated into the CTBLSS database. However, like most surveillance data, the data in this report are subject to possible coding, reporting and processing errors.

Previously published data are subject to updates resulting from late reporting or when revisions are received from the participating laboratories. Any revisions to previously reported data are reflected in subsequent reports.

Although efforts are made to ensure that multiple records for any one individual within a given year are removed, given the minimal identifying information available for each isolate (age and sex), it is possible that multiple records from one individual are included in the database. However, this bias is believed to be minimal.

The demographic and clinical data collected through the CTBLSS are limited. For example, no data are collected on origin, detailed diagnostic or clinical information, or treatment outcome status. Additional demographic and clinical information on individuals from whom the TB isolates were obtained would facilitate more in-depth epidemiological assessment of drug-resistance patterns in Canada. For example, no differentiation can be made between primary and secondary/acquired drug resistance and differing resistance patterns for new cases versus re-treatment cases from the data collected through this surveillance system. However, the annual *Tuberculosis in Canada* report, which provides a comprehensive overview of the overall number of reported active TB cases and corresponding incidence rates in Canada by select demographic and clinical characteristics also presents case-based (vs. isolate-based) data on primary and acquired drug resistance in Canada that are not presented here. Collectively, these two reports provide a comprehensive overview of TB-case and drug-resistance surveillance data from a national perspective.

Typically, only isolates with MDR-TB or other extensive resistance patterns will undergo drug sensitivity testing to select second-line drugs. Although the CLSI recommends that isoniazid-monoresistant isolates, as well as other polyresistant, non-MDR isolates, be tested for second-line drug resistance, this is not universally reported in Canada. Other isolates which are not MDR-TB may be resistant to a fluoroquinolone because of the widespread use of these antibiotics for other respiratory infections. To some extent, this limits our understanding of the emergence of second-line resistance within Canada.

CONCLUSION

Data collected to date indicate that the presence of TB drug resistance in Canada is below the global average and that it has remained relatively stable since reporting began. However, with growing worldwide concern about resistance and the emergence of XDR-TB, the CTBLSS remains vital to the monitoring of TB drug resistance in Canada.

APPENDIX I: PARTICIPATING LABORATORIES OF THE CANADIAN TUBERCULOSIS LABORATORY TECHNICAL NETWORK

ALBERTA Provincial Laboratory of Public Health Calgary, Alberta	Cary Shandro Technologist Mycobacteriology Marguerite Lovgren Microbiology Laboratory Dr. Greg Tyrrell Clinical Microbiologist Dr. Marie Louie, MD, FRCPC Associate Medical Director
BRITISH COLUMBIA British Columbia Centre for Disease Control, Public Health Microbiology and Reference Laboratory Vancouver, British Columbia	Dr. Mabel Rodrigues, PhD Mycobacteriology/TB Laboratory, Section Head Monica Ng, BSc Mycobacteriology/TB Laboratory, Section Supervisor Dr. Patrick Tang, MD, PhD, FRCPC Medical Microbiologist Dr. Judy L. Isaac-Renton, MD, DPH, FRCPC Director, Laboratory Services
MANITOBA Diagnostics Services Manitoba Health Sciences Centre Winnipeg, Manitoba	Assunta Rendina, MLT Charge Technologist, Mycobacteriology Doug Swidinsky Senior Technologist Dr. Michelle Alfa Medical Director
NEW BRUNSWICK Department of Laboratory Medicine Saint John Regional Hospital Saint John, New Brunswick	Hope MacKenzie MLT3- supervisor CL3 Lab Janet Reid Microbiology Manager Dr. Duncan Webster Medical Microbiologist/ Infectious Disease Dr. Marek Godlewski Laboratory Director
NEWFOUNDLAND AND LABRADOR Newfoundland and Labrador Public Health Laboratory St. John's, Newfoundland and Labrador	Bernadette Noftall Tech II Ella Keough Tech Lourens Robberts, PhD, D(ABMM), FCCM Director & Clinical Microbiologist
NORTHWEST TERRITORIES Stanton Territorial Hospital Yellowknife, Northwest Territories	Sherrill Webber Tech II, Microbiology April Darrach Technologist, Microbiology Sean Davies Laboratory Supervisor Cheryl Cooper Manager, Therapeutic & Diagnostic Services

NOVA SCOTIA Department of Pathology & Laboratory Medicine Queen Elizabeth II Health Sciences Centre Halifax, Nova Scotia	Sherry Maston Division of Medical Microbiology Jimmy MacDonald Technical Supervisor, Division of Microbiology Dr. David Haldane Director, Provincial Public Health Laboratory Network and Special Pathogens Dr. Todd Hatchette Director, Pathology and Laboratory Medicine
ONTARIO Central Public Health Lab Ontario Agency for Health Protection and Promotion Toronto, Ontario	Joanne Blair Head, Mycobacteriology Kevin May Public Health Lab-Toronto Dr. Frances Jamieson Medical Microbiologist—TB and Mycobacteriology Nicholas Paul Manager, Direct Services Alex Marchand-Austin Manager, Laboratory Surveillance and Data Management
QUEBEC Laboratoire de santé publique du Québec Institut national de santé publique du Québec Sainte-Anne-de-Bellevue, Quebec	Hafid Soualhine, Ph.D. Head, Mycobacteriology & Aerobic Actinomycetes Lise Côté Mycobacteriology and Aerobic Actinomycetes Dr. Cécile Tremblay Director
SASKATCHEWAN Royal University Hospital Saskatoon, Saskatchewan Saskatchewan Disease Control Laboratory Regina, Saskatchewan	***NORTH*** Nancy Hanson TB Laboratory/Clinical Microbiology Bonnie Kirkpatrick MLT—Technologist in Dr. J. Blondeau Interim Head for Pathology and Laboratory Medicine ***SOUTH*** Rita Thomas Technologist, TB/Bacteriology Dr. Christine Turenne Microbiologist Dr. Paul Levett Microbiologist Dr. David Alexander Microbiologist Dr. Greg Horsman Director, Saskatchewan Health
FEDERAL National Microbiology Laboratory Public Health Agency of Canada	Joyce Wolfe Program Manager, Mycobacteriology

APPENDIX II: *M. TUBERCULOSIS* COMPLEX ANTIMICROBIAL SUSCEPTIBILITY REPORTING FORM

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

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

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

Species: / **Espèce :**
☐ M. tuberculosis complex (species known)* / Complexe M. tuberculosis (espèce connue)*
☐ M. bovis
☐ M. bovis BCG
☐ MTB Complex (species unknown) / Complexe MTB (espèce inconnue)

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 UN SEUL ISOLAT 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 originates: / 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 = N.L. / T.N.-L.		46 = Man.	
11 = P.E.I. / Î.-P.-É.		47 = Sask.	
12 = N.S. / N.-É.		48 = Alta. / Alb.	
13 = N.B. / N.-B.		59 = B.C. / C.-B.	
24 = Que. / Qc		60 = Y.T. / Yn	
35 = Ont.		61 = N.W.T. / T.N.-O.	
		62 = Nvt. / Nt	

5

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)		
		Sensitive / Sensible	Resistant / Résistant	Other (specify) / Autre (préciser)
Antituberculous Drugs/Antituberculeux				
INH (Isoniazid/Isoniazide)	mg / L	☐	☐	
RMP (Rifampin/Rifampicine)	mg / L	☐	☐	
EMB (Ethambultol/Éthambutol)	mg / L	☐	☐	
PZA (Pyrazinamide)	mg / L	☐	☐	
2nd line drugs/Antituberculeux mineurs				
AK (Amikacin/Amikacine)	mg / L	☐	☐	
CM (Capreomycin/Capréomycine)	mg / L	☐	☐	
CIPRO (Ciprofloxacin/Ciprofloxacine)	mg / L	☐	☐	
CF (Clofazamine)	mg / L	☐	☐	
CS (Cycloserine/Cyclosérine)	mg / L	☐	☐	
ETH (Ethinoamide/Éthionamide)	mg / L	☐	☐	
KM (Kanamycin/Kanamycine)	mg / L	☐	☐	
LEV (Levofloxacin/Lévofloxacine)	mg / L	☐	☐	
MOX (Moxifloxacin/Moxifloxacine	mg / L	☐	☐	
OFL (Ofloxacin/Ofloxacine)	mg / L	☐	☐	
PAS (Para-Aminosalicylic Acid/Acide Para-aminosalicylique)	mg / L	☐	☐	
RBT (Rifabutin/Rifabutine)	mg / L	☐	☐	
SM (Streptomycin/Streptomycine)	mg / L	☐	☐	
Other/Autre (specify/préciser)				
1.	mg / L	☐	☐	
2.	mg / L	☐	☐	
3.	mg / L	☐	☐	
4.	mg / L	☐	☐	
5.	mg / L	☐	☐	

6 **Comments - Commentaires**

* include/inclus: M. tuberculosis, M. africanum, M. canetti, M. caprae, M. microti, M. pinnipedii.

PHAC/ASPC 9061
(01-2010)

APPENDIX III: TABLES

TABLE 1: Critical concentrations* for routine testing of anti-tuberculosis drugs

FIRST-LINE ANTI-TUBERCULOSIS DRUG		
Anti-tuberculosis drugs	**Critical Concentrations (mg/L) BACTEC® 960**	**Comments**
Isoniazid (INH)	0.1	When resistance to INH is 0.1 mg/L, tests are repeated with INH 0.4 mg/L to determine the level of resistance. Nevertheless, the isolate is reported as resistant using the 0.1 mg/L cut-off level.
Rifampin (RMP)	1.0	
Ethambutol (EMB)	5.0	
Pyrazinamide (PZA)	100	Routine testing is not performed for isolates from British Columbia and Saskatchewan.
SECOND-LINE ANTI-TUBERCULOSIS DRUGS		
Anti-tuberculosis drugs	**Critical Concentrations (mg/L) BACTEC® 960**	
Amikacin (AK)	1	
Capreomycin (CM)	2.5	
Ethionamide (ETH)	5	
Kanamycin (KM)	2.5	
Linezolid (LIN)	1	
Moxifloxacin (MOX)	0.25	
Ofloxacin (OFL)	2	
Para-amino salicylic acid (PAS)	4	
Rifabutin (RBT)	0.5	
Streptomycin (SM)	1	

* Critical concentrations: the lowest concentration of drug that will inhibit 95% of wild strains of *Mycobacterium tuberculosis* that have never been exposed to drugs while at the same time not inhibiting strains of *Mycobacterium tuberculosis* that have been isolated from patients who are not responding to therapy and that are considered resistant.

TABLE 2: Reported *Mycobacterium tuberculosis* complex isolates by reporting and originating province/territory, Canada: 2013

REPORTING PROVINCE	CANADA	ORIGINATING PROVINCE/TERRITORY												
		N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nvt.
Number of isolates	**1,380**	**11**	**0**	**9**	**3**	**205**	**511**	**148**	**71**	**154**	**223**	**1**	**3**	**41**
N.L.	**11**	11	0	0	0	0	0	0	0	0	0	0	0	0
N.S.	**9**	0	0	9	0	0	0	0	0	0	0	0	0	0
N.B.	**3**	0	0	0	3	0	0	0	0	0	0	0	0	0
Que.	**202**	0	0	0	0	202	0	0	0	0	0	0	0	0
Ont.	**551**	0	0	0	0	3	511	0	0	0	0	0	0	37
Man.	**148**	0	0	0	0	0	0	148	0	0	0	0	0	0
Sask.	**70**	0	0	0	0	0	0	0	70	0	0	0	0	0
Alta.	**164**	0	0	0	0	0	0	0	1	154	2	0	3	4
B.C.	**222**	0	0	0	0	0	0	0	0	0	221	1	0	0

ABBREVIATIONS: Alta., Alberta; B.C., British Columbia; Man., Manitoba; N.B., New Brunswick; N.L., Newfoundland and Labrador; N.S., Nova Scotia; Nvt., Nunavut; N.W.T., Northwest Territories; Ont., Ontario; P.E.I., Prince Edward Island; Que., Quebec; Sask., Saskatchewan; Y.T., Yukon Territory.

TABLE 3: Overall pattern of reported tuberculosis drug resistance, Canada: 2003–2013

	REPORTING YEAR																					
	2003		2004		2005		2006		2007		2008		2009		2010		2011		2012		2013	
	TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%
Total number of isolates tested	**1,405**	**100.0**	**1,376**	**100.0**	**1,335**	**100.0**	**1,389**	**100.0**	**1,267**	**100.0**	**1,356**	**100.0**	**1,331**	**100.0**	**1,279**	**100.0**	**1,319**	**100.0**	**1,404**	**100.0**	**1,380**	**100.0**
Isolates susceptible	**1,257**	**89.5**	**1,257**	**91.4**	**1,207**	**90.4**	**1,263**	**90.9**	**1,134**	**89.5**	**1,240**	**91.4**	**1,204**	**90.5**	**1,167**	**91.2**	**1,180**	**89.5**	**1,265**	**90.1**	**1,268**	**91.9**
Any Resistance																						
INH	132	9.4	102	7.4	109	8.2	101	7.3	110	8.7	102	7.5	113	8.5	101	7.9	122	9.2	111	7.9	93	6.7
RMP	23	1.6	14	1.0	24	1.8	24	1.7	13	1.0	19	1.4	21	1.6	18	1.4	21	1.6	10	0.7	17	1.2
EMB	17	1.2	11	0.8	20	1.5	12	0.9	23	1.8	13	1.0	17	1.3	10	0.8	9	0.7	4	0.3	10	0.7
PZA*	29	2.6	26	2.4	22	2.1	16	1.5	27	2.7	22	2.1	18	1.7	25	2.4	28	2.6	33	2.8	26	2.2
Resistance to one or more drugs	**148**	**10.5**	**119**	**8.6**	**128**	**9.6**	**126**	**9.1**	**133**	**10.5**	**116**	**8.6**	**127**	**9.5**	**112**	**8.8**	**139**	**10.5**	**139**	**9.9**	**112**	**8.1**
Monoresistance	117	8.3	94	6.8	103	7.7	107	7.7	111	8.8	94	6.9	98	7.4	88	6.9	119	9.0	128	9.1	93	6.7
MDR-TB†	20	1.4	12	0.9	22	1.6	15	1.1	11	0.9	15	1.1	18	1.4	17	1.3	18	1.4	8	0.6	14	1.0
Other Patterns	10	0.7	13	0.9	3	0.2	3	0.2	11	0.9	6	0.4	11	0.8	6	0.5	1	0.1	2	0.1	4	0.3
XDR-TB‡	1	0.1	—	—	—	—	1	0.1	—	—	1	0.1	—	—	1	0.1	1	0.1	1	0.1	1	0.1

ABBREVIATIONS : AK, amikacin; CM, capreomycin; EMB, ethambutol; INH, isoniazid; KM, kanamycin; MDR-TB, multidrug-resistant tuberculosis; PZA, pyrazinamide; RMP, rifampin; TB, tuberculosis; XDR-TB, extensively drug-resistant tuberculosis.

* PZA is not routinely tested across all jurisdictions. The number of isolates tested against PZA each year was as follows: 2003 = 1,097; 2004 = 1,105; 2005 = 1,063; 2006 = 1,080; 2007 = 991; 2008 = 1,048; 2009 = 1,042; 2010 = 1,042; 2011 = 1,097; 2012 = 1,175; 2013 = 1,186.

† MDR-TB is TB that is resistant to at least INH and RMB but which does not meet the definition of XDR-TB.

‡ XDR-TB is TB that is resistant to at least INH and RMB plus resistance to any fluoroquinolone and at least one of three injectable second-line drugs: AK, CM, and KM.

TABLE 4: Total number of *Mycobacterium tuberculosis* complex isolates tested and number and percentage identified as multidrug-resistant tuberculosis and extensively drug-resistant tuberculosis, Canada: 2003–2013

YEAR	TOTAL NUMBER OF MTBC ISOLATES	MDR-TB* (%)	XDR-TB (%)
2003	1,405	20 (1.4%)	1 (0.1%)
2004	1,376	12 (0.9%)	0
2005	1,335	22 (1.6%)	0
2006	1,389	15 (1.1%)	1 (0.1%)
2007	1,267	11 (0.9%)	0
2008	1,356	15 (1.1%)	1 (0.1%)
2009	1,331	18 (1.4%)	0
2010	1,279	17 (1.3%)	1 (0.1%)
2011	1,319	18 (1.4%)	1 (0.1%)
2012	1,404	8 (0.6%)	1 (0.1%)
2013	1,380	14 (1.0%)	1 (0.1%)
TOTAL	**14,841**	**170 (1.1%)**	**7 (0.05%)**

ABBREVIATIONS: MDR-TB, multidrug-resistant tuberculosis; MTBC, *Mycobacterium tuberculosis* complex; XDR-TB, extensively drug-resistant tuberculosis.

* Does not include the XDR-TB.

TABLE 5: Reported multidrug-resistant tuberculosis and extensively drug-resistant tuberculosis isolates by province/territory, Canada: 2013

	CANADA	ORIGINATING PROVINCE/TERRITORY												
		N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nvt.
Total number of isolates tested	**1,380**	**11**	**0**	**9**	**3**	**205**	**511**	**148**	**71**	**154**	**223**	**1**	**3**	**41**
Multidrug-resistant														
INH & RMP	**6**	0	0	0	0	0	6	0	0	0	0	0	0	0
INH & RMP & EMB	**3**	0	0	0	0	0	3	0	0	0	0	0	0	0
INH & RMP & PZA	**1**	0	0	0	0	0	1	0	0	0	0	0	0	0
INH & RMP & EMB & PZA	**4**	0	0	0	0	1	3	0	0	0	0	0	0	0
Total number of MDR-TB isolates*	**14**	0	0	0	0	1	13	0	0	0	0	0	0	0
Extensively drug-resistant														
INH & RMP & EMB & PZA & SM & KM & OFL & ETH & RBT & MOX	**1**	0	0	0	0	1	0	0	0	0	0	0	0	0
Total number of XDR-TB isolates†	**1**	0	0	0	0	1	0	0	0	0	0	0	0	0

ABBREVIATIONS: Alta., Alberta; B.C., British Columbia; Man., Manitoba; N.B., New Brunswick; N.L., Newfoundland and Labrador; N.S., Nova Scotia; Nvt., Nunavut; N.W.T., Northwest Territories; Ont., Ontario; P.E.I., Prince Edward Island; Que., Quebec; Sask., Saskatchewan; Y.T., Yukon Territory.

* MDR-TB is TB that is resistant to at least INH and RMP but which does not meet the definition of XDR-TB.

† XDR-TB is TB that is resistant to at least INH and RMP plus resistance to any fluoroquinolone and at least one of three injectable second-line drugs, AK, CM and KM.

TABLE 6: Provincial/territorial breakdown by any resistance, multidrug-resistant tuberculosis and extensively drug-resistant tuberculosis, Canada: 2003–2013

PROVINCE/TERRITORIES	TOTAL NUMBER OF MTBC ISOLATES	ANY RESISTANCE TO FIRST LINE MEDICATIONS (% OF TOTAL ISOLATES TESTED)	MDR-TB* (% OF TOTAL ISOLATES TESTED)	XDR-TB
Ontario	5,821	649 (11.1%)	101 (1.7%)	5 (0.1%)
British Columbia	2,632	247 (9.4%)	23 (0.9%)	0
Quebec	2,250	239 (10.6%)	18 (0.8%)	1 (0.04%)
Alberta	1,390	143 (10.3%)	21 (1.5%)	0
Manitoba	1,244	70 (5.6%)	5 (0.4%)	1 (0.1%)
Saskatchewan	693	27 (3.9%)	2 (0.3%)	0
Nunavut	452	5 (1.1%)	0	0
Northwest Territories	89	3 (3.4%)	0	0
Newfoundland and Labrador	81	3 (3.7%)	0	0
Nova Scotia	79	5 (6.3%)	0	0
New Brunswick	72	7 (9.7%)	0	0
Yukon	29	0	0	0
Prince Edward Island	9	1 (11.1%)	0	0
TOTAL	**14,841**	**1,399 (9.4%)**	**170 (1.1%)**	**7 (0.05%)**

ABBREVIATIONS: MDR-TB, multidrug-resistant tuberculosis; MTBC, *Mycobacterium tuberculosis* complex; XDR-TB, extensively drug-resistant tuberculosis.

* Does not include XDR-TB.

TABLE 7: Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* complex isolates to anti-tuberculosis drugs, Alberta: 2003–2013

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
Total number of isolates tested for INH, RMP, EMB and PZA*	**92 (100.0)**	**94 (100.0)**	**129 (100.0)**	**104 (100.0)**	**98 (100.0)**	**134 (100.0)**	**159 (100.0)**	**107 (100.0)**	**156 (100.0)**	**163 (100.0)**	**154 (100.0)**
Isolates susceptible	**78 (84.8)**	**82 (87.2)**	**115 (89.1)**	**95 (91.3)**	**92 (93.9)**	**123 (91.8)**	**145 (91.2)**	**96 (89.7)**	**133 (85.3)**	**148 (90.8)**	**140 (90.9)**
Isolates resistant to one or more of the first line drugs (INH, RMP, EMB, PZA)	**14 (15.2)**	**12 (12.8)**	**14 (10.9)**	**9 (8.7)**	**6 (6.1)**	**11 (8.2)**	**14 (8.8)**	**11 (10.3)**	**23 (14.7)**	**15 (9.2)**	**14 (9.1)**
Monoresistance	**11 (12.0)**	**9 (9.6)**	**10 (7.8)**	**8 (7.7)**	**6 (6.1)**	**8 (6.0)**	**12 (7.5)**	**6 (5.6)**	**16 (10.3)**	**13 (8.0)**	**13 (8.4)**
INH	9 (9.8)	7 (7.4)	10 (7.8)	7 (6.7)	5 (5.1)	8 (6.0)	8 (5.0)	6 (5.6)	14 (9.0)	10 (6.1)	9 (5.8)
RMP	0	0	0	0	0	0	1 (0.6)	0	0	0	0
EMB	0	0	0	0	0	0	0	0	0	0	0
PZA	2 (2.2)	2 (2.1)	0	1 (1.0)	1 (1.0)	0	3 (1.9)	0	2 (1.3)	3 (1.9)	4 (2.6)
Other Patterns	**2 (2.2)**	**1 (1.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**1 (0.7)**	**2 (1.3)**	**2 (1.9)**	**0 (0.0)**	**1 (0.6)**	**1 (0.6)**
INH & EMB	1 (1.1)	0	0	0	0	1 (0.7)	1 (0.6)	0	0	0	0
INH & PZA	1 (1.1)	1 (1.0)	0	0	0	0	1 (0.6)	1 (0.9)	0	1 (0.6)	0
INH & EMB & PZA	0	0	0	0	0	0	0	1 (0.9)	0	0	1 (0.6)
Multidrug-resistant†	**1 (1.1)**	**2 (2.1)**	**4 (3.1)**	**1 (1.0)**	**0 (0.0)**	**2 (1.5)**	**0 (0.0)**	**3 (2.8)**	**7 (4.5)**	**1 (0.6)**	**0 (0.0)**
INH & RMP	0	0	0	0	0	0	0	0	1 (0.6)	1 (0.6)	0
INH & RMP & EMB	0	0	1 (0.8)	0	0	0	0	0	0	0	0
INH & RMP & PZA	0	0	0	0	0	0	0	1 (0.9)	0	0	0
INH & RMP & RBT	0	0	0	0	0	0	0	0	1 (0.6)	0	0
INH & RMP & ETH	1 (1.1)	0	0	0	0	0	0	0	0	0	0
INH & RMP & ETH & RBT	0	0	0	0	0	0	0	0	2 (1.3)	0	0

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
INH & RMP & SM	0	0	1 (0.8)	0	0	0	0	0	0	0	0
INH & RMP & EMB & PZA	0	0	1 (0.8)	0	0	1 (0.7)	0	0	0	0	0
INH & RMP & EMB & SM	0	0	0	1 (1.0)	0	1 (0.7)	0	0	0	0	0
INH & RMP & EMB & PZA & SM	0	0	1 (0.8)	0	0	0	0	0	0	0	0
INH & RMP & EMB & SM & OFL	0	1 (1.0)	0	0	0	0	0	0	0	0	0
INH & RMP & EMB & AK & RBT	0	1 (1.0)	0	0	0	0	0	0	0	0	0
INH & RMP & EMB & PZA & SM & RBT	0	0	0	0	0	0	0	1 (0.9)	1 (0.6)	0	0
INH & RMP & PZA & SM & ETH	0	0	0	0	0	0	0	0	1 (0.6)	0	0
INH & RMP & PZA & SM & RBT	0	0	0	0	0	0	0	0	1 (0.6)	0	0
INH & RMP & PZA & SM & RBT & OFL	0	0	0	0	0	0	0	1 (0.9)	0	0	0

ABBREVIATIONS: EMB, ethambutol; ETH, ethionamide; INH, isoniazid; MDR-TB, multidrug-resistant tuberculosis; OFL, ofloxacin; PZA, pyrazinamide; RBT, rifabutin; RMP, rifampin; SM, streptomycin; TB, tuberculosis; XDR-TB, extensively drug-resistant tuberculosis.

* Includes *Mycobacterium africanum* isolate: 1 in 2011 and 2013, 2 in 2007 and 2009, and 3 in 2010; *Mycobacterium bovis*: 1 in 2012, 2 in 2009, 2011 and 2013.

† MDR-TB is TB that is resistant to at least INH and RMP but which does not meet the definition of XDR-TB (see methods section for definition of XDR-TB).

TABLE 8: Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* complex isolates to anti-tuberculosis drugs, British Columbia: 2003–2013

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
Total number of isolates tested for INH, RMP, EMB and PZA*	**291 (100.0)**	**263 (100.0)**	**204 (100.0)**	**275 (100.0)**	**231 (100.0)**	**254 (100.0)**	**239 (100.0)**	**204 (100.0)**	**194 (100.0)**	**254 (100.0)**	**223 (100.0)**
Isolates susceptible	**264 (90.7)**	**237 (90.1)**	**182 (89.2)**	**257 (93.5)**	**210 (90.9)**	**230 (90.6)**	**215 (90.0)**	**185 (90.7)**	**170 (87.6)**	**231 (90.9)**	**204 (91.5)**
Isolates resistant to one or more of the first line drugs (INH, RMP, EMB, PZA)†	**27 (9.3)**	**26 (9.9)**	**22 (10.8)**	**18 (6.5)**	**21 (9.1)**	**24 (9.4)**	**24 (10.0)**	**19 (9.3)**	**24 (12.4)**	**23 (9.1)**	**19 (8.5)**
Monoresistance	**20 (6.9)**	**17 (6.5)**	**17 (8.3)**	**16 (5.8)**	**17 (7.4)**	**21 (8.3)**	**23 (9.6)**	**18 (8.8)**	**22 (11.3)**	**21 (8.3)**	**19 (8.5)**
INH	19 (6.5)	13 (4.9)	11 (5.4)	7 (2.5)	13 (5.6)	18 (7.1)	22 (9.2)	16 (7.8)	21 (10.8)	21 (8.3)	19 (8.5)
RMP	0	0	2 (1.0)	6 (2.2)	0	3 (1.2)	1 (0.4)	0	1 (0.5)	0	0
EMB	1 (0.3)	1 (0.4)	4 (2.0)	3 (1.1)	4 (1.7)	0	0	1 (0.5)	0	0	0
PZA†	0	3 (1.1)	0	0	0	0	0	1 (0.5)	0	0	0
Other Patterns	**1 (0.3)**	**7 (2.7)**	**1 (0.5)**	**0 (0)**	**2 (0.9)**	**0 (0)**	**1 (0.4)**	**0 (0)**	**1 (0.5)**	**0 (0)**	**0 (0)**
INH & EMB	0	1 (0.4)	1 (0.5)	0	2 (0.9)	0	1 (0.4)	0	0	0	0
INH & PZA	1 (0.3)	4 (1.5)	0	0	0	0	0	0	1 (0.5)	0	0
RMP & PZA	0	2 (0.8)	0	0	0	0	0	0	0	0	0
Multidrug-resistant‡	**6 (2.1)**	**2 (0.8)**	**4 (2.0)**	**2 (0.7)**	**2 (0.9)**	**3 (1.2)**	**0 (0)**	**1 (0.5)**	**1 (0.5)**	**2 (0.8)**	**0 (0)**
INH & RMP	0	0	0	1 (0.4)	0	1 (0.4)	0	0	0	0	0
INH & RMP & EMB	0	1 (0.4)	0	0	0	0	0	0	0	0	0
INH & RMP & PZA	1 (0.3)	0	0	0	0	0	0	1 (0.5)	0	0	0
INH & RMP & SM	1 (0.3)	0	0	0	0	0	0	0	0	0	0
INH & RMP & EMB & PZA	0	0	0	0	0	2 (0.8)	0	0	0	0	0
INH & RMP & PZA & SM	0	0	1 (0.5)	0	0	0	0	0	0	0	0

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
INH & RMP & PZA & ETH	1 (0.3)	0	0	0	0	0	0	0	0	0	0
INH & RMP & PZA & SM & ETH & RBT	0	0	1 (0.5)	0	0	0	0	0	0	0	0
INH & RMP & PZA & SM & PAS & RBT	0	0	0	0	0	0	0	0	1 (0.5)	0	0
INH & RMP & EMB & SM & RBT	0	0	0	0	0	0	0	0	0	1 (0.4)	0
INH & RMP & EMB & PZA & SM	1 (0.3)	0	1 (0.5)	0	0	0	0	0	0	0	0
INH & RMP & EMB & PZA & ETH	1 (0.3)	1 (0.4)	0	0	0	0	0	0	0	0	0
INH & RMP & EMB & PZA & SM & ETH	1 (0.3)	0	0	0	0	0	0	0	0	0	0
INH & RMP & EMB & SM & ETH & PAS	0	0	1 (0.5)	1 (0.4)	0	0	0	0	0	0	0
INH & RMP & EMB & SM & KM & RBT	0	0	0	0	0	0	0	0	0	1 (0.4)	0
INH & RMP & EMB & PZA & SM & OFL & ETH & PAS	0	0	0	0	1 (0.4)	0	0	0	0	0	0
INH & RMP & EMB & PZA & KM & CM & ETH	0	0	0	0	1 (0.4)	0	0	0	0	0	0

ABBREVIATIONS: CM, capreomycin; EMB, ethambutol; ETH, ethionamide; INH, isoniazid; MDR-TB, multidrug-resistant tuberculosis; OFL, ofloxacin; KM, kanamycin; PAS, para-amino salicylic acid; PZA, pyrazinamide; RBT, rifabutin; RMP, rifampin; SM, streptomycin; TB, tuberculosis; XDR-TB, extensively drug-resistant tuberculosis.

* Includes *Mycobacterium bovis* isolates: 1 in 2003, 2006 and 2007; *Mycobacterium africanum*: 1 in 2008 and 2009; 5 in 2012 and 2013.

† Routine testing for PZA not conducted.

‡ MDR-TB is TB that is resistant to at least INH and RMP but which does not meet the definition of XDR-TB (see methods section for definition of XDR-TB).

TABLE 9: Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* complex isolates to anti-tuberculosis drugs, Manitoba: 2003–2013

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
Total number of isolates tested for INH, RMP, EMB and PZA*	**122 (100.0)**	**122 (100.0)**	**94 (100.0)**	**119 (100.0)**	**84 (100.0)**	**116 (100.0)**	**106 (100.0)**	**113 (100.0)**	**97 (100.0)**	**123 (100.0)**	**148 (100.0)**
Isolates susceptible	**117 (95.9)**	**121 (99.2)**	**92 (97.9)**	**113 (95.0)**	**75 (89.3)**	**111 (95.7)**	**99 (93.4)**	**99 (87.6)**	**90 (92.8)**	**113 (91.9)**	**144 (97.3)**
Isolates resistant to one or more of the first line drugs (INH, RMP, EMB, PZA)	**5 (4.1)**	**1 (0.8)**	**2 (2.1)**	**6 (5.0)**	**9 (10.7)**	**5 (4.3)**	**7 (6.6)**	**14 (12.4)**	**7 (7.2)**	**10 (8.1)**	**4 (2.7)**
Monoresistance	**4 (3.3)**	**1 (0.8)**	**2 (2.1)**	**6 (5.0)**	**8 (9.5)**	**4 (3.4)**	**5 (4.7)**	**11 (9.7)**	**5 (5.2)**	**10 (8.1)**	**4 (2.7)**
INH	3 (2.5)	0	2 (2.1)	6 (5.0)	7 (8.3)	4 (3.4)	4 (3.8)	10 (8.8)	5 (5.2)	10 (8.1)	4 (2.7)
PZA	1 (0.8)	1 (0.8)	0	0	1 (1.2)	0	1 (0.9)	1 (0.9)	0	0	0
Other Patterns	**0**	**0**	**0**	**0**	**1 (1.2)**	**0**	**2 (1.8)**	**1 (0.9)**	**0**	**0**	**0**
INH & PZA	0	0	0	0	0	0	1 (0.9)	1 (0.9)	0	0	0
INH & EMB	0	0	0	0	1 (1.2)	0	1 (0.9)	0	0	0	0
Multidrug-resistant†	**1 (0.8)**	**0**	**0**	**0**	**0**	**1 (0.9)**	**0**	**1 (0.9)**	**2 (2.1)**	**0**	**0**
INH & RMP	0	0	0	0	0	0	0	1 (0.9)	0	0	0
INH & RMP & RBT	1 (0.8)	0	0	0	0	0	0	0	1 (1.1)	0	0
INH & RMP & PZA & SM & RBT	0	0	0	0	0	1 (0.9)	0	0	0	0	0
INH & RMP & EMB & PZA & SM & AK & KM & CM & ETH	0	0	0	0	0	0	0	0	1 (1.1)	0	0

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
Extensively drug-resistant‡	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1 (0.9)**	**0**	**0**	**0**
INH & RMP & EMB & PZA & OFL & ETH & RBT & KM	0	0	0	0	0	0	0	1 (0.9)	0	0	0

ABBREVIATIONS: AK, amikacin; CM, capreomycin; EMB, ethambutol; ETH, ethionamide; INH, isoniazid; OFL, ofloxacin; KM, kanamycin; MDR-TB, multidrug-resistant tuberculosis; PZA, pyrazinamide; RBT, rifabutin; RMP, rifampin; SM, streptomycin; TB, tuberculosis; XDR-TB, extensively drug-resistant tuberculosis.

* Includes *Mycobacterium bovis* isolates: 1 in 2003, 2006 and 2007; *Mycobacterium africanum*: 1 in 2008.

† MDR-TB is TB that is resistant to at least INH and RMP but which does not meet the definition of XDR-TB.

‡ XDR-TB is TB that is resistant to at least INH and RMP plus resistance to any fluoroquinolone and at least one of three injectable second-line drugs: AK, CM and KM.

TABLE 10: Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* complex isolates to anti-tuberculosis drugs, New Brunswick: 2003–2013

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
Total number of isolates tested for INH, RMP, EMB and PZA*	**14 (100.0)**	**11 (100.0)**	**5 (100.0)**	**3 (100.0)**	**5 (100.0)**	**3 (100.0)**	**10 (100.0)**	**9 (100.0)**	**5 (100.0)**	**4 (100.0)**	**3 (100.0)**
Isolates susceptible	**13 (92.9)**	**10 (90.9)**	**4 (80.0)**	**3 (100.0)**	**5 (100.0)**	**3 (100.0)**	**10 (100.0)**	**7 (77.8)**	**5 (100.0)**	**3 (75.0)**	**2 (66.7)**
Isolates resistant to one or more of the first line drugs (INH, RMP, EMB, PZA)	**1 (7.1)**	**1 (9.1)**	**1 (20.0)**	**0**	**0**	**0**	**0**	**2 (22.2)**	**0**	**1 (25.0)**	**1 (33.3)**
Monoresistance	**1 (7.1)**	**1 (9.1)**	**1 (20.0)**	**0**	**0**	**0**	**0**	**2 (22.2)**	**0**	**1 (25.0)**	**1 (33.3)**
INH	1 (7.1)	1 (9.1)	0	0	0	0	0	2 (22.2)	0	1 (25.0)	1 (33.3)
PZA	0	0	1 (20.0)	0	0	0	0	0	0	0	0

ABBREVIATIONS: EMB, ethambutol; INH, isoniazid; PZA, pyrazinamide; RMP, rifampin.

* Includes 1 *Mycobacterium africanum* isolate for 2007.

TABLE 11: Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* complex isolates to anti-tuberculosis drugs, Newfoundland and Labrador: 2003–2013

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
Total number of isolates tested for INH, RMP, EMB and PZA	6 (100.0)	8 (100.0)	6 (100.0)	11 (100)	5 (100.0)	5 (100.0)	10 (100.0)	9 (100.0)	5 (100.0)	5 (100.0)	11 (100.0)
Isolates susceptible	4 (66.7)	8 (100.0)	5 (83.3)	11 (100)	5 (100.0)	5 (100.0)	10 (100.0)	9 (100.0)	5 (100.0)	5 (100.0)	11 (100.0)
Isolates resistant to one or more of the first line drugs (INH, RMP, EMB, PZA)	2 (33.3)	0	1 (16.7)	0	0	0	0	0	0	0	0
Monoresistance	2 (33.3)	0	1 (16.7)	0	0	0	0	0	0	0	0
INH	1 (16.7)	0	1 (16.7)	0	0	0	0	0	0	0	0
RMP	1 (16.7)	0	0	0	0	0	0	0	0	0	0

ABBREVIATIONS: EMB, ethambutol; INH, isoniazid; PZA, pyrazinamide; RMP, rifampin.

TABLE 12: Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* complex isolates to anti-tuberculosis drugs, Northwest Territories: 2003–2013

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
Total number of isolates tested for INH, RMP, EMB and PZA	11 (100.0)	9 (100.0)	6 (100.0)	4 (100.0)	14 (100.0)	13 (100.0)	10 (100.0)	5 (100.0)	8 (100.0)	6 (100.0)	3 (100.0)
Isolates susceptible	11 (100.0)	9 (100.0)	6 (100.0)	3 (75.0)	14 (100.0)	13 (100.0)	9 (90.0)	4 (80.0)	8 (100.0)	6 (100.0)	3 (100.0)
Isolates resistant to one or more of the first line drugs (INH, RMP, EMB, PZA)	0	0	0	1 (25.0)	0	0	1 (10.0)	1 (20.0)	0	0	0
Monoresistance	0	0	0	1 (25.0)	0	0	1 (10.0)	1 (20.0)	0	0	0
INH	0	0	0	1 (25.0)	0	0	0	1 (20.0)	0	0	0
RMP	0	0	0	0	0	0	1 (10.0)	0	0	0	0

ABBREVIATIONS: EMB, ethambutol; INH, isoniazid; PZA, pyrazinamide; RMP, rifampin.

TABLE 13: Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* complex isolates to anti-tuberculosis drugs, Nova Scotia: 2003–2013

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
Total number of isolates tested for INH, RMP, EMB and PZA*	7 (100.0)	9 (100.0)	7 (100.0)	8 (100.0)	5 (100.0)	3 (100.0)	7 (100.0)	8 (100.0)	7 (100.0)	9 (100.0)	9 (100.0)
Isolates susceptible	7 (100.0)	9 (100.0)	6 (85.7)	8 (100.0)	5 (100.0)	3 (100.0)	7 (100.0)	5 (62.5)	7 (100.0)	9 (100.0)	8 (88.9)
Isolates resistant to one or more of the first line drugs (INH, RMP, EMB, PZA)	0	0	1 (14.3)	0	0	0	0	3 (37.5)	0	0	0
Monoresistance	0	0	1 (14.3)	0	0	0	0	2 (25.0)	0	0	1 (11.1)
INH	0	0	0	0	0	0	0	1 (12.5)	0	0	1 (11.1)
PZA	0	0	1 (14.3)	0	0	0	0	1 (12.5)	0	0	0
Other Patterns	0	0	0	0	0	0	0	1 (12.5)	0	0	0
INH & PZA	0	0	0	0	0	0	0	1 (12.5)	0	0	0

ABBREVIATIONS: EMB, ethambutol; INH, isoniazid; PZA, pyrazinamide; RMP, rifampin.

* Includes 1 *Mycobacterium africanum* isolate for 2010.

TABLE 14: Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* complex isolates to anti-tuberculosis drugs, Nunavut: 2003–2013

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
Total number of isolates tested for INH, RMP, EMB and PZA	**4 (100.0)**	**16 (100.0)**	**28 (100.0)**	**37 (100.0)**	**25 (100.0)**	**51 (100.0)**	**50 (100.0)**	**71 (100.0)**	**64 (100.0)**	**65 (100.0)**	**41 (100.0)**
Isolates susceptible	**4 (100.0)**	**16 (100.0)**	**28 (100.0)**	**37 (100.0)**	**25 (100.0)**	**51 (100.0)**	**49 (98.0)**	**70 (98.6)**	**62 (96.9)**	**65 (100.0)**	**41 (100.0)**
Isolates resistant to one or more of the first line drugs (INH, RMP, EMB, PZA)	**0**	**0**	**0**	**0**	**0**	**0**	**1 (2.0)**	**1 (1.4)**	**2 (3.1)**	**0**	**0**
Monoresistance	**0**	**0**	**0**	**0**	**0**	**0**	**1 (2.0)**	**1 (1.4)**	**2 (3.1)**	**0**	**0**
INH	0	0	0	0	0	0	1 (2.0)	1 (1.4)	1 (1.6)	0	0
RMP	0	0	0	0	0	0	0	0	1 (1.6)	0	0

ABBREVIATIONS: EMB, ethambutol; INH, isoniazid; PZA, pyrazinamide; RMP, rifampin.

TABLE 15: Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* complex isolates to anti-tuberculosis drugs, Ontario: 2003–2013

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
Total number of isolates tested for INH, RMP, EMB and PZA*	**590 (100.0)**	**599 (100.0)**	**553 (100.0)**	**567 (100.0)**	**538 (100.0)**	**479 (100.0)**	**488 (100.0)**	**496 (100.0)**	**507 (100.0)**	**493 (100.0)**	**511 (100.0)**
Isolates susceptible	**524 (88.8)**	**539 (90.0)**	**487 (88.1)**	**504 (88.9)**	**466 (86.6)**	**427 (89.1)**	**428 (87.7)**	**456 (91.9)**	**454 (89.5)**	**429 (87.0)**	**458 (89.6)**
Isolates resistant to one or more of the first line drugs (INH, RMP, EMB, PZA)	**66 (11.2)**	**60 (10.0)**	**66 (11.9)**	**63 (11.1)**	**72 (13.4)**	**52 (10.9)**	**60 (12.3)**	**40 (8.1)**	**53 (10.5)**	**64 (13.0)**	**53 (10.4)**
Monoresistance	**47 (8.0)**	**49 (8.2)**	**51 (9.2)**	**49 (8.6)**	**61 (11.3)**	**40 (8.4)**	**44 (9.0)**	**29 (5.8)**	**45 (8.9)**	**57 (11.5)**	**37 (7.2)**
INH	42 (7.1)	46 (7.7)	44 (8.0)	39 (6.9)	50 (9.3)	33 (6.9)	39 (8.0)	27 (5.4)	39 (7.7)	45 (9.1)	27 (5.3)
RMP	1 (0.2)	0	0	1 (0.2)	1 (0.2)	0	0	0	0	1 (0.2)	2 (0.4)
EMB	0	0	0	0	1 (0.2)	1 (0.2)	1 (0.2)	0	0	1 (0.2)	0
PZA	4 (0.7)	3 (0.5)	7 (1.3)	9 (1.6)	9 (1.7)	6 (1.3)	4 (0.8)	2 (0.4)	6 (1.2)	10 (2.0)	8 (1.5)
Other Patterns	**7 (1.2)**	**4 (0.7)**	**2 (0.4)**	**3 (0.5)**	**4 (0.7)**	**4 (0.8)**	**5 (1.0)**	**1 (0.2)**	**0**	**1 (0.2)**	**3 (0.6)**
INH & EMB	5 (0.8)	3 (0.5)	2 (0.4)	3 (0.5)	1 (0.2)	2 (0.4)	3 (0.6)	0	0	0	1 (0.2)
INH & PZA	1 (0.2)	1 (0.2)	0	0	2 (0.4)	0	0	1 (0.2)	0	1 (0.2)	2 (0.4)
EMB & RMP	0	0	0	0	0	0	0	0	0	0	0
EMB & PZA	0	0	0	0	1 (0.2)	0	0	0	0	0	0
INH & EMB & PZA	1 (0.2)	0	0	0	0	2 (0.4)	2 (0.4)	0	0	0	0
Multidrug-resistant†	**11 (1.9)**	**7 (1.2)**	**13 (2.4)**	**10 (1.8)**	**7 (1.3)**	**7 (1.5)**	**11 (2.3)**	**10 (2.0)**	**7 (1.3)**	**5 (1.0)**	**13 (2.5)**
INH & RMP & SM & RBT	0	0	2 (0.4)	0	0	3 (0.6)	1 (0.2)	1 (0.2)	1 (0.2)	1 (0.2)	2 (0.4)
INH & RMP & RBT	1 (0.2)	0	3 (0.5)	1 (0.2)	0	0	0	1 (0.2)	0	0	2 (0.4)
INH & RMP & RBT & PAS	0	0	0	0	0	0	0	1 (0.2)	0	0	0

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
INH & RMP & EMB & PZA & SM & RBT & ETH	1 (0.2)	0	1 (0.2)	0	0	0	0	2	1 (0.2)	0	1 (0.2)
INH & RMP & EMB & RBT	0	0	0	2 (0.3)	1 (0.2)	1 (0.2)	2 (0.4)	0	0	0	0
INH & RMP & EMB & PZA & SM & RBT	0	0	0	0	1 (0.2)	1 (0.2)	1 (0.2)	0	1 (0.2)	0	1 (0.2)
INH & RMP & RBT & ETH	1 (0.2)	0	0	1 (0.2)	0	1 (0.2)	1 (0.2)	0	0	0	1 (0.2)
INH & RMP	1 (0.2)	1 (0.2)	0	2 (0.3)	0	0	1 (0.2)	0	0	0	0
INH & RMP & EMB & PZA & SM	1 (0.2)	0	1 (0.2)	0	0	0	0	0	1 (0.2)	0	0
INH & RMP & EMB & SM & RBT	0	0	2 (0.4)	0	0	0	0	0	0	0	1 (0.2)
INH & RMP & PZA & RBT	2 (0.3)	1 (0.2)	0	0	0	0	0	0	0	0	0
INH & RMP & PZA & SM & RBT	0	0	0	0	0	0	0	1 (0.2)	1 (0.2)	0	1 (0.2)
INH & RMP & PZA & SM & RBT & ETH	0	0	0	0	1 (0.2)	1 (0.2)	1 (0.2)	1 (0.2)	0	0	0
INH & RMP & EMB & PZA & RBT	1 (0.2)	0	0	0	1 (0.2)	0	0	0	0	0	0
INH & RMP & EMB & PZA & RBT & ETH	0	0	0	0	2 (0.4)	0	0	0	0	0	0
INH & RMP & EMB & PZA & SM & OFL & RBT & ETH	1 (0.2)	1 (0.2)	0	0	0	0	0	0	0	0	0
INH & RMP & EMB & RBT & ETH	1 (0.2)	0	0	0	0	0	0	0	0	0	1 (0.2)
INH & RMP & EMB & SM & OFL & RBT	0	0	1 (0.2)	0	0	0	0	1 (0.2)	0	0	0

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
INH & RMP & EMB & SM & RBT & ETH	0	0	1 (0.2)	0	0	0	1 (0.2)	0	0	0	0
INH & RMP & OFL & RBT & ETH	0	2 (0.3)	0	0	0	0	0	0	0	0	0
INH & RMP & PZA & RBT & ETH	0	0	1 (0.2)	1 (0.2)	0	0	0	0	0	0	0
INH & RMP & SM	0	0	0	0	0	0	0	0	0	1 (0.2)	1 (0.2)
INH & RMP & SM & OFL & RBT & ETH	0	0	0	0	0	0	1 (0.2)	1 (0.2)	0	0	0
INH & RMP & AK & CM & RBT	0	0	0	1 (0.2)	0	0	0	0	0	0	0
INH & RMP & CM & RBT	0	0	0	1 (0.2)	0	0	0	0	0	0	0
INH & RMP & CM & RBT & ETH	0	1 (0.2)	0	0	0	0	0	0	0	0	0
INH & RMP & EMB & PZA & AK & CM & RBT & ETH	0	0	0	0	1 (0.2)	0	0	0	0	0	0
INH & RMP & EMB & PZA & CM & RBT	0	0	0	0	0	0	0	0	0	1 (0.2)	0
INH & RMP & EMB & PZA & RBT & PAS	0	0	0	0	0	0	0	0	1 (0.2)	0	0
INH & RMP & EMB & PZA & SM & OFL & MOX & RBT & ETH	0	0	0	0	0	0	0	0	0	0	1 (0.2)
INH & RMP & EMB & PZA & SM & OFL & RBT	0	0	1 (0.2)	0	0	0	0	0	0	0	0
INH & RMP & EMB & SM & AK & CM	0	0	0	0	0	0	0	1 (0.2)	0	0	0

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
INH & RMP & EMB & SM & KM & RBT & PAS	0	0	0	0	0	0	0	1 (0.2)	0	0	0
INH & RMP & EMB & SM & OFL & MOX & RBT & ETH	0	0	0	0	0	0	0	0	1 (0.2)	0	0
INH & RMP & EMB & SM & OFL & RBT & ETH	0	0	0	0	0	0	1 (0.2)	0	0	0	0
INH & RMP & EMB & SM & RBT & PAS & ETH	0	0	0	0	0	0	0	0	0	0	1 (0.2)
INH & RMP & OFL & RBT & PAS & ETH	0	0	0	1 (0.2)	0	0	0	0	0	0	0
INH & RMP & PZA & SM	0	1 (0.2)	0	0	0	0	0	0	0	0	0
INH & RMP & PZA & SM & OFL & MOX & RBT	0	0	0	0	0	0	0	0	0	1 (0.2)	0
INH & RMP & RBT & PAS & ETH	0	0	0	0	0	0	0	1 (0.2)	0	0	0
INH & RMP & SM & KM & RBT & ETH	0	0	0	0	0	0	0	0	0	1 (0.2)	0
INH & RMP & SM & OFL & RBT	1 (0.2)	0	0	0	0	0	0	0	0	0	0
INH & RMP & SM & RBT & ETH	0	0	0	0	0	0	1 (0.2)	0	0	0	0

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
Extensively drug-resistant‡	**1 (0.2)**	**0**	**0**	**1 (0.2)**	**0**	**1 (0.2)**	**0**	**0**	**1 (0.2)**	**1 (0.2)**	**0**
INH & RMP & EMB & PZA & SM & KM & OFL & ETH & RBT & MOX	0	0	0	0	0	0	0	0	0	1 (0.2)	0
INH & RMP & EMB & PZA & SM & AK & CM & ETH & OFL & RBT	1 (0.2)	0	0	0	0	0	0	0	0	0	0
INH & RMP & AK & CM & OFL & ETH & RBT	0	0	0	1 (0.2)	0	0	0	0	0	0	0
INH & RMP & EMB & PZA & CM & OFL & RBT & PAS	0	0	0	0	0	1 (0.2)	0	0	0	0	0
INH & RMP & EMB & PZA & SM & KM & OFL & ETH & RBT & PAS & MOX	0	0	0	0	0	0	0	0	1 (0.2)	0	0

ABBREVIATIONS: AK, amikacin; CM, capreomycin; EMB, ethambutol; ETH, ethionamide; INH, isoniazid; KM, kanamycin; MDR-TB, multidrug-resistant tuberculosis; MOX, moxifloxacin; OFL, ofloxacin; PAS, para-amino salicylic acid; PZA, pyrazinamide; RBT, rifabutin; RMP, rifampin; SM, streptomycin; TB, tuberculosis; XDR-TB, extensively drug-resistant tuberculosis.

* Includes Mycobacterium bovis isolates: 1 isolate for 2003 and 2004; 2 for 2009, 2005 and 2010; 3 for 2011, and 4 for 2006.

† MDR-TB is TB that is resistant to at least INH and RMP but which does not meet the definition of XDR-TB.

‡ XDR-TB is TB that is resistant to at least INH and RMP plus resistance to any fluoroquinolone and at least one of three injectable second-line drugs: AK, CM and KM.

TABLE 16: Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* complex isolates to anti-tuberculosis drugs, Prince Edward Island: 2003–2013

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
Total number of isolates tested for INH, RMP, EMB and PZA	**2 (100.0)**	**1 (100.0)**	**1 (100.0)**	**0**	**0**	**0**	**1 (100.0)**	**1 (100.0)**	**3 (100.0)**	**0**	**0**
Isolates susceptible	**2 (100.0)**	**1 (100.0)**	**1 (100.0)**	**0**	**0**	**0**	**1 (100.0)**	**1 (100.0)**	**2 (66.7)**	**0**	**0**
Isolates resistant to one or more of the first line drugs (INH, RMP, EMB, PZA)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1 (33.3)**	**0**	**0**
Monoresistance	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1 (33.3)**	**0**	**0**
PZA	0	0	0	0	0	0	0	0	1 (33.3)	0	0

ABBREVIATIONS: EMB, ethambutol; INH, isoniazid; PZA, pyrazinamide; RMP, rifampin.

TABLE 17: Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* complex isolates to anti-tuberculosis drugs, Quebec: 2003–2013

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
Total number of isolates tested for INH, RMP, EMB and PZA*	**219 (100.0)**	**207 (100.0)**	**226 (100.0)**	**201 (100.0)**	**200 (100.0)**	**210 (100.0)**	**171 (100)**	**197 (100.00)**	**205 (100.0)**	**209 (100.0)**	**205 (100.0)**
Isolates susceptible	**187 (85.4)**	**190 (91.8)**	**207 (91.6)**	**173 (86.1)**	**177 (88.5)**	**188 (90.0)**	**156 (91.2)**	**179 (90.9)**	**180 (87.8)**	**187 (89.5)**	**187 (91.2)**
Isolates resistant to one or more of the first line drugs (INH, RMP, EMB, PZA)	**32 (14.6)**	**17 (8.2)**	**19 (8.4)**	**28 (13.9)**	**23 (11.5)**	**22 (10.5)**	**15 (8.8)**	**18 (9.1)**	**25 (12.2)**	**22 (10.5)**	**18 (8.8)**
Monoresistance	**31 (14.2)**	**15 (7.2)**	**18 (8.0)**	**26 (12.9)**	**17 (8.5)**	**19 (9.0)**	**9 (5.3)**	**16 (8.1)**	**24 (11.7)**	**22 (10.5)**	**16 (7.8)**
INH	25 (11.4)	11 (5.3)	14 (6.2)	21 (10.4)	12 (6.0)	15 (7.1)	7 (4.1)	11 (5.6)	18 (8.8)	13 (6.2)	12 (5.9)
RMP	0	0	0	1 (0.5)	1 (0.5)	0	0	0	0	0	0
EMB	0	0	0	0	0	0	0	0	0	0	0
PZA	6 (2.7)	4 (1.9)	4 (1.8)	4 (2.0)	4 (2.0)	4 (1.9)	2 (1.2)	5 (2.5)	6 (2.9)	9 (4.3)	4 (1.9)
Other Patterns	**0 (0.0)**	**1 (0.5)**	**0 (0.0)**	**0 (0.0)**	**4 (2.0)**	**1 (0.5)**	**0 (0.0)**	**1 (0.5)**	**0 (0.0)**	**0 (0.0)**	**0**
INH & PZA	0	1 (0.5)	0	0	3 (1.5)	0	0	0	0	0	0
INH & EMB	0	0	0	0	1 (0.5)	1 (0.5)	0	1 (0.5)	0	0	0
Multidrug-resistant†	**1 (0.5)**	**1 (0.5)**	**1 (0.4)**	**2 (1.0)**	**2 (1.0)**	**2 (1.0)**	**6 (3.5)**	**1 (0.5)**	**1 (0.5)**	**0 (0.0)**	**1 (0.5)**
INH & RMP & ETH	1 (0.5)	0	0	0	0	0	0	0	0	0	0
INH & RMP & RBT	0	1 (0.5)	0	0	0	0	0	0	0	0	0
INH & RMP & EMB & ETH	0	0	0	1 (0.5)	1 (0.5)	0	0	0	0	0	0
INH & RMP & EMB & RBT	0	0	0	0	0	0	1 (0.6)	0	0	0	0
INH & RMP & SM & RBT	0	0	0	0	0	1 (0.5)	2 (1.2)	0	0	0	0

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
INH & RMP & ETH & RBT	0	0	0	0	0	0	1 (0.6)	0	0	0	0
INH & RMP & EMB & SM & RBT	0	0	0	0	1 (0.5)	0	0	0	0	0	0
INH & RMP & EMB & ETH & RBT	0	0	0	1 (0.5)	0	0	0	0	0	0	0
INH & RMP & PZA & ETH & RBT	0	0	1 (0.4)	0	0	0	0	0	0	0	0
INH & RMP & PZA & EMB & RBT	0	0	0	0	0	0	1 (0.6)	0	0	0	0
INH & RMP & EMB & PZA & SM & ETH	0	0	0	0	0	0	0	1 (0.5)	0	0	0
INH & RMP & EMB & PZA & SM & RBT	0	0	0	0	0	0	0	0	1 (0.5)	0	0
INH & RMP & PZA & SM & KM & CM & ETH	0	0	0	0	0	0	1 (0.6)	0	0	0	0
INH & RMP & PZA & SM & AK & KM & CM	0	0	0	0	0	1 (0.5)	0	0	0	0	0
INH & RMP & EMB & PZA & SM & KM & PAS & RBT	0	0	0	0	0	0	0	0	0	0	1 (0.5)
Extensively drug-resistant‡	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**1 (0.5)**

ABBREVIATIONS: AK, akamycin; CM, capreomycin; EMB, ethambutol; ETH, ethionamide; INH, isoniazid; KM, kanamycin; MDR-TB, multidrug-resistant tuberculosis; MOX, moxifloxacin; OFL, ofloxacin; PAS, para-amino salicylic acid; PZA, pyrazinamide; RBT, rifabutin; RMP, rifampin; SM, streptomycin; TB, tuberculosis; XDR-TB, extensively drug-resistant tuberculosis.

* Includes *Mycobacterium bovis* isolates: 2 in 2003, 2007, 2009, 2013; 2 in 2004, 2006, 2010; 3 in 2011; 4 in 2012; *Mycobacterium caprae*: 1 in 2006; *Mycobacterium africanum*: 1 in 2003, 2005, 2006 and 2008; 2 in 2007, 2012 and 2013; 3 in 2009 and 2011; and 4 in 2010.

† MDR-TB is TB that is resistant to at least INH and RMP but which does not meet the definition of XDR-TB.

‡ XDR-TB is TB that is resistant to at least INH and RMP plus resistance to any fluoroquinolone and at least one of three injectable second-line drugs: AK, CM and KM.

TABLE 18: Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* complex isolates to anti-tuberculosis drugs, Saskatchewan: 2003–2013

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
Total number of isolates tested for INH, RMP, EMB and PZA*	**46 (100.0)**	**34 (100.0)**	**74 (100.0)**	**58 (100.0)**	**60 (100.0)**	**81 (100.0)**	**77 (100.0)**	**54 (100.0)**	**66 (100.0)**	**72 (100.0)**	**71 (100.0)**
Isolates susceptible	**45 (97.8)**	**32 (94.1)**	**72 (97.3)**	**57 (98.3)**	**59 (98.3)**	**79 (97.5)**	**72 (93.5)**	**51 (94.4)**	**62 (93.9)**	**68 (94.4)**	**69 (97.2)**
Isolates resistant to one or more of the first line drugs (INH, RMP, EMB, PZA)	**1 (2.2)**	**2 (5.9)**	**2 (2.7)**	**1 (1.7)**	**1 (1.7)**	**2 (2.5)**	**5 (6.5)**	**3 (5.6)**	**4 (6.1)**	**4 (5.6)**	**2 (2.8)**
Monoresistance	**1 (2.2)**	**2 (5.9)**	**2 (2.7)**	**1 (1.7)**	**1 (1.7)**	**2 (2.5)**	**3 (3.9)**	**2 (3.7)**	**4 (6.1)**	**4 (5.6)**	**2 (2.8)**
INH	1 (2.2)	2 (5.9)	2 (2.7)	1 (1.7)	1 (1.7)	2 (2.5)	3 (3.9)	2 (3.7)	4 (6.1)	1 (1.4)	1 (1.4)
EMB	0	0	0	0	0	0	0	0	0	0	0
PZA	0	0	0	0	0	0	0	0	0	3 (4.2)	1 (1.4)
Other Patterns	**0**	**0**	**0**	**0**	**0**	**0**	**1 (1.3)**	**0**	**0**	**0**	**0**
INH & EMB	0	0	0	0	0	0	1 (1.3)	0	0	0	0
Multidrug-resistant†	**0**	**0**	**0**	**0**	**0**	**0**	**1 (1.3)**	**1 (1.9)**	**0**	**0**	**0**
INH & RMP & RBT	0	0	0	0	0	0	0	1 (1.9)	0	0	0
INH & RMP & SM	0	0	0	0	0	0	1 (1.3)	0	0	0	0

ABBREVIATIONS: EMB, ethambutol; INH, isoniazid; MDR-TB, multidrug-resistant tuberculosis; PZA, pyrazinamide; RBT, rifabutin; RMP, rifampin; SM, streptomycin; TB, tuberculosis; XDR-TB, extensively drug-resistant tuberculosis.

* Routine testing for PZA not conducted.

† MDR-TB is TB that is resistant to at least INH and RMP but which does not meet the definition of XDR-TB (see methods section for definition of XDR-TB).

TABLE 19: Reported results for routine drug susceptibility testing of *Mycobacterium tuberculosis* complex isolates to anti-tuberculosis drugs, Yukon: 2003–2013

	REPORTING YEAR										
	2003 TOTAL (%)	2004 TOTAL (%)	2005 TOTAL (%)	2006 TOTAL (%)	2007 TOTAL (%)	2008 TOTAL (%)	2009 TOTAL (%)	2010 TOTAL (%)	2011 TOTAL (%)	2012 TOTAL (%)	2013 TOTAL (%)
Total number of isolates tested for INH, RMP, EMB and PZA*	1 (100.0)	3 (100.0)	2 (100.0)	2 (100.0)	2 (100.0)	7 (100.0)	3 (100.0)	5 (100.0)	2 (100.0)	1 (100.0)	1 (100.0)
Isolates susceptible	1 (100.0)	3 (100.0)	2 (100.0)	2 (100.0)	2 (100.0)	7 (100.0)	3 (100.0)	5 (100.0)	2 (100.0)	1 (100.0)	1 (100.0)

ABBREVIATIONS: EMB, ethambutol; INH, isoniazid; PZA, pyrazinamide; RMP, rifampin.

* Routine testing for PZA not conducted.

TABLE 20: Reported tuberculosis drug resistance by sex and age group, Canada: 2013

AGE GROUP (YRS)		ISOLATES		ANY RESISTANCE		MULTIDRUG–RESISTANT		EXTENSIVELY DRUG-RESISTANT	
		NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%
Total		**1,380**	**100.0**	**112**	**100.0**	**14**	**100.0**	**1**	**100.0**
0–4	Males	10	0.7	1	0.9	0	0.0	0	0.0
	Females	2	0.1	0	0.0	0	0.0	0	0.0
	Unknown	0	0.0	0	0.0	0	0.0	0	0.0
	Total	12	0.9	1	0.9	0	0.0	0	0.0
5–14	Males	12	0.9	0	0.0	0	0.0	0	0.0
	Females	20	1.4	1	0.9	0	0.0	0	0.0
	Unknown	0	0.0	0	0.0	0	0.0	0	0.0
	Total	32	2.3	1	0.9	0	0.0	0	0.0
15–24	Males	102	7.4	9	8.0	2	14.3	0	0.0
	Females	83	6.0	5	4.5	1	7.1	0	0.0
	Unknown	0	0.0	0	0.0	0	0.0	0	0.0
	Total	185	13.4	14	12.5	3	21.4	0	0.0
25–34	Males	93	6.7	8	7.1	3	21.4	0	0.0
	Females	128	9.3	18	16.1	1	7.1	0	0.0
	Unknown	1	0.1	0	0.0	0	0.0	0	0.0
	Total	222	16.1	26	23.2	4	28.6	0	0.0
35–44	Males	109	7.9	3	2.7	0	0.0	0	0.0
	Females	104	7.5	14	12.5	3	21.4	1	100.0
	Unknown	0	0.0	0	0.0	0	0.0	0	0.0
	Total	213	15.4	17	15.2	3	21.4	1	100.0
45–54	Males	129	9.3	12	10.7	0	0.0	0	0.0
	Females	75	5.4	11	9.8	3	21.4	0	0.0
	Unknown	1	0.1	0	0.0	0	0.0	0	0.0
	Total	205	14.9	23	20.5	3	21.4	0	0.0

AGE GROUP (YRS)		ISOLATES		ANY RESISTANCE		MULTIDRUG–RESISTANT		EXTENSIVELY DRUG-RESISTANT	
		NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%
55–64	Males	107	7.8	5	4.5	0	0.0	0	0.0
	Females	51	3.7	7	6.3	1	7.1	0	0.0
	Unknown	0	0.0	0	0.0	0	0.0	0	0.0
	Total	158	11.4	12	10.7	1	7.1	0	0.0
65–74	Males	86	6.2	7	6.3	0	0.0	0	0.0
	Females	63	4.6	3	2.7	0	0.0	0	0.0
	Unknown	0	0.0	0	0.0	0	0.0	0	0.0
	Total	149	10.8	10	8.9	0	0.0	0	0.0
75+	Males	116	8.4	4	3.6	0	0.0	0	0.0
	Females	88	6.4	4	3.6	0	0.0	0	0.0
	Unknown	0	0.0	0	0.0	0	0.0	0	0.0
	Total	204	14.8	8	7.1	0	0.0	0	0.0
Unknown	Males	0	0.0	0	0.0	0	0.0	0	0.0
	Females	0	0.0	0	0.0	0	0.0	0	0.0
	Unknown	0	0.0	0	0.0	0	0.0	0	0.0
	Total	0	0.0	0	0.0	0	0.0	0	0.0
Total	**Males**	**764**	**55.4**	**49**	**43.8**	**5**	**35.7**	**0**	**0.0**
	Females	**614**	**44.5**	**63**	**56.3**	**9**	**64.3**	**1**	**100.0**
	Unknown	**2**	**0.1**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**

REFERENCES

1 Christianson S, Jamieson F, Sharma M, Wolfe J. Appendix D: Tuberculosis and mycobacteriology laboratory standards. In: Menzies R. & Wong T, editors. *Canadian Tuberculosis Standards.* 7th ed. Canadian Thoracic Society & Public Health Agency of Canada; 2013.

2 World Health Organization. Definitions and reporting framework for tuberculosis—2013 revision. Geneva: WHO Press; 2013 [cited 2014 Oct 6]. Available from: http://apps.who.int/iris/bitstream/10665/79199/1/9789241505345_eng.pdf

3 Woods GL, Brown-Elliott BA, Conville PS, et al. Susceptibility testing of mycobacteria, nocardiae, and other aerobic actinomycetes; Approved standard—second edition. Wayne, PA: Clinical and Laboratory Standards Institute; 2011.

4 Sharma M, Thibert L, Chedore P, et al. Canadian multicentre laboratory study for standardized second-line antimicrobial susceptibility testing of mycobacterium tuberculosis. J Clin Microbiol. 2011;49(12):4112–6.

5 Public Health Agency of Canada. *Directive for the collection, use and dissemination of information relating to public health.* Unpublished document. Ottawa, ON: 2013.

6 World Health Organization. *Global tuberculosis report 2013.* Geneva: WHO Press; 2013 [cited 2014 Oct 6]. Available from: http://apps.who.int/iris/bitstream/10665/91355/1/9789241564656_eng.pdf