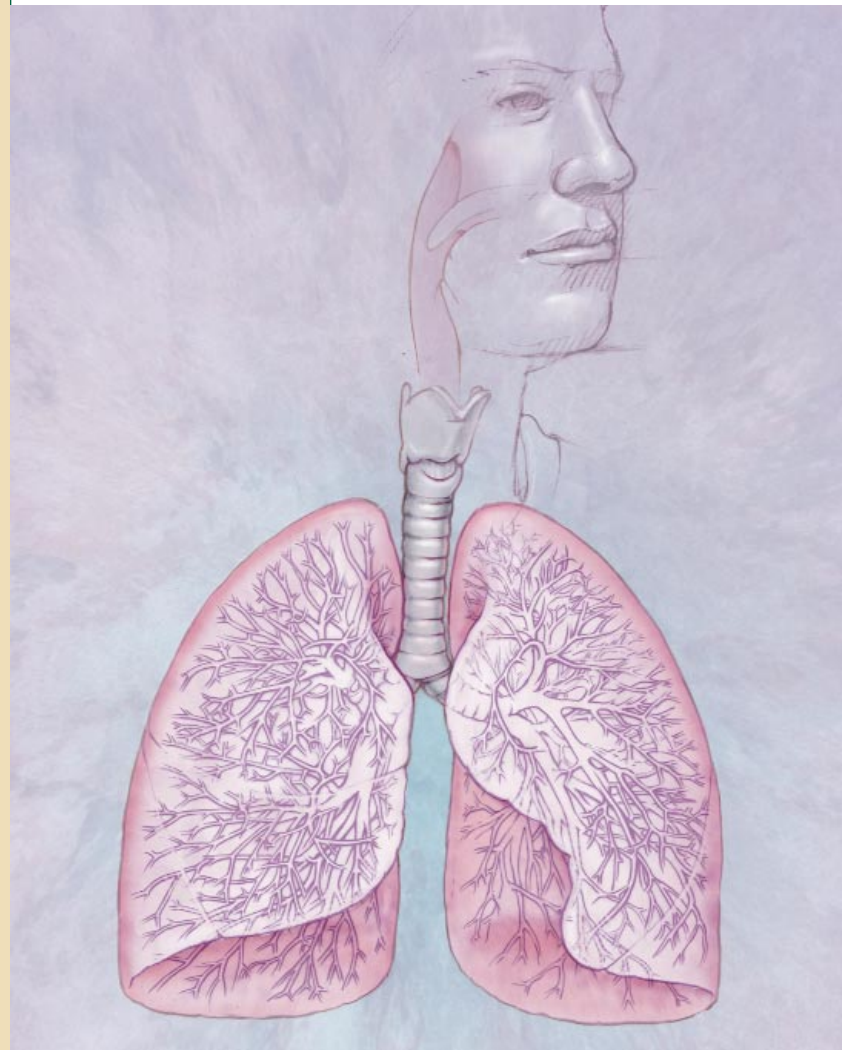


TUBERCULOSIS PREVENTION AND CONTROL

IN CANADIAN FEDERAL PRISONS 1998



REPORTED RESULTS OF THE
CORRECTIONAL SERVICE OF CANADA
TUBERCULOSIS TRACKING SYSTEM



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Tuberculosis Prevention and Control in Canadian Federal Prisons is published once a year in both English and French for the staff, management and inmates of the Correctional Service of Canada (CSC), the international corrections community and the general public.

Tuberculosis Prevention and Control in Canadian Federal Prisons is prepared by the Database Management Committee, with representation from CSC, Health Canada's Occupational Health and Safety Agency and Tuberculosis Prevention and Control.

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FOREWORD

Prisoners around the world are known to have higher rates of tuberculosis (TB) than the general population. An unchecked TB outbreak among inmates can quickly spread to other offenders and staff within and between correctional institutions. People outside the prison walls could also get sick (e.g., visitors, health care workers, community contacts). Public health experts agree that effective TB control within prisons is essential to protect the health of inmates, staff and the rest of society.

Two departments within the Government of Canada have worked very hard to ensure TB prevention and control among people living and working within Canadian federal prisons. The Correctional Service of Canada (CSC) and Health Canada have forged a strong partnership to combat the threat of communicable disease. TB screening is offered to offenders and staff in all 52 federal prisons across Canada. Infected individuals are offered personalized advice on how to prevent progression to active TB disease. Inmates with TB disease are offered treatment to restore their health and limit the spread of TB to others.

The task of understanding the TB status of CSC inmates and staff began in the 1990s; preventing TB disease within our prisons will continue in the new millenium. The Correctional Service of Canada Tuberculosis Tracking System is a model for TB surveillance within correctional institutions. This public health initiative is also a shining example of inter-departmental collaboration and efficiency.

Canadian inmates have not experienced the multidrug resistant TB outbreaks that our American counterparts have suffered. The Government of Canada has learned from their lesson and thanks to the vigilance of our staff and the cooperation of inmates will continue to protect the health of Canadians against this ancient disease threat.



Irving Kulik
Assistant Commissioner, Correctional Operations and Programs
Correctional Service of Canada

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INTRODUCTION

The Correctional Service of Canada (CSC), in collaboration with Health Canada's Tuberculosis Prevention and Control (TBPC) and Occupational Health and Safety Agency (OHSA) has developed a protocol and an infrastructure for surveillance of tuberculosis (TB) in people within Canadian federal correctional facilities.

The Correctional Service of Canada Tuberculosis Tracking System (CSC TBTS) was developed in 1997 to capture information on reported TB screening results. CSC nurses in all federal correctional facilities across Canada report their results on inmate TB screening to TBPC; OHSA nurses report their results on staff TB screening separately to TBPC. Tuberculosis Prevention and Control subsequently analysed the collected data and, together with the other Database Management Committee (DMC) members (see Appendix 1), has produced this inaugural report. *Tuberculosis Prevention and Control in Canadian Federal Prisons, 1998* contains TB screening information collected on offenders and staff in 1998.

EXECUTIVE SUMMARY

A total of 12,171 offenders and 4,255 staff had tuberculin skin tests (TST) through the Correctional Service of Canada Tuberculosis Tracking System (CSC TBTS) program in 1998. Reported TST results were negative for most participating offenders and staff. Twenty per cent of the offenders who completed TST testing upon entry into Canadian correctional facilities in 1998 had a positive result. The province with the highest proportion of positive TST results among offenders who completed screening was Quebec. Fourteen per cent of the staff who completed TST baseline screening had positive TST results, with the highest rate reported in the Prairie Region. The data on TST results for the staff must be interpreted with caution, due to the low rate of participation in the TB screening program.

The vast majority (97.2%) of offenders with a positive TST result were identified upon entry into the penitentiary setting or were previously known to be positive. A small percentage of offenders (1.3% of previously TST negative offenders screened) experienced documented conversion from a negative TST result to a positive TST result in 1998. Similarly, 0.7% of previously TST negative staff screened had documented conversion. A cluster of TST conversions among offenders was reported in one Prairie Region institution in the

first quarter of 1998; staff participating in the CSC TBTS screening program did not show the same conversion pattern. Despite an epidemiological investigation by Tuberculosis Prevention and Control, the reason(s) for the apparent TST conversions remain(s) unknown.

Although the CSC TBTS was designed to capture data on tuberculosis (TB) infection among offenders and staff, information on the number of cases of active TB disease is essential to understand the scope of TB within Canadian federal penitentiaries. There were six cases of active TB disease reported among offenders in 1998. Adjusting for offender turnover throughout the year, the reported incidence of active TB disease among offenders was comparable to other high risk groups within Canada (e.g.: Canadian-born Aboriginals and foreign-born individuals).

These inaugural TB screening test results for participating offenders and staff, in which approximately one fifth of offenders entering the correctional system were infected with TB, have emphasized the ongoing need for a comprehensive TB prevention and control program. The rates of new TB infection acquired within the institutions appear to be low, but further analysis is needed to determine the risk factors for transmission. Staff participation in this screening program must be improved to accurately monitor their TB status within this setting.

BACKGROUND

Tuberculosis (TB) is caused by the bacterium *Mycobacterium tuberculosis* and is spread from one person to another. A person with active TB disease of the lungs or vocal cords can spread TB by coughing or sneezing without covering his or her mouth. *M. tuberculosis* goes into the air and people nearby can inhale the bacterium and become infected. TB is not as contagious as chickenpox or measles; people with active TB disease are most likely to infect those with whom they spend time every day (e.g.: people living in the same house).

Most adults who become infected with TB never get sick. The TB bacteria become latent – they are alive within the body but the immune system prevents the bacteria from growing or spreading. The infected person does not feel sick or exhibit any symptoms and cannot spread TB to others. Treatment with antibiotic(s) is effective in preventing progression of latent TB infection to active disease. Without these drugs, approximately 10% of infected adults may progress to active TB disease at some point during their lifetime.

Factors that weaken the immune system increase the risk of progression to active TB disease. These factors include HIV infection, diabetes mellitus, substance abuse, end-stage kidney disease, silicosis, anti-cancer drugs, radiotherapy and steroids. Individuals with certain conditions are also at risk, including those who are more than 10% underweight, are transplant recipients, or have cancer of the head or neck, lymphoma or leukemia. The weakened immune system cannot stop the TB bacteria from growing and spreading within the body, and symptoms appear. People with untreated TB disease of the lungs or vocal cords may be infectious to others. After a few weeks of taking antibiotics, most people will no longer be infectious and will feel much better. However, completing the full course of treatment (six months or more) is needed to kill all the TB bacteria and prevent recurrence.

DEFINITIONS

Tuberculin skin test

A small amount of tuberculin protein is injected under the skin of the forearm. If the body recognizes this protein, the immune system will react. This reaction can be felt as an induration (swelling or bump) at the injection site. The reaction to the tuberculin skin test (TST) is measured 48 to 72 hours later. If the induration diameter is more than 5 mm for those who are contacts of known tuberculosis (TB) disease or HIV-infected persons, (more than 10 mm for others), the test is considered to be positive. A positive test is likely due to TB infection, although both false positive and false negative results can occur (see Limitations).

Baseline (2-step)

Offenders and staff living and working in Canadian federal correctional facilities are offered annual tuberculin skin test (TST) testing. To determine an accurate baseline for repeated testing, the Canadian Tuberculosis Standards recommends that participants have a 2-step TST. This means that all individuals with a negative initial TST result should have a second TST performed 1 to 3 weeks later.¹ The second test will be positive if the person was previously infected with tuberculosis (TB) but their immune system needed a little more

time to respond to the challenge of the TB protein. If the second TST is omitted, it is considered an incomplete 2-step and their baseline TB infection status has not been properly established. If the test is positive on their next routine annual screening TST, it is impossible to determine whether this represents new TB infection (conversion) or the person needed that second test to awaken their immune system. To obtain adequate baseline data within the correctional facility environment, a 2-step TST is required if the first test is negative.^{2,3}

Converter

The term "converter" refers to a person whose tuberculin skin test result was negative but changes to positive on subsequent tests. This means that infection with tuberculosis (TB) has occurred during the period between skin tests. Converters have a 5% risk of developing active TB disease within the first two years of infection.⁴ Antibiotics can help reduce this risk of developing active disease. For purposes of this report, converters are those whose TST status changed in 1998 while living or working within federal correctional facilities.

Tuberculosis infection = Latent tuberculosis infection

The person has inhaled the tuberculosis (TB) germ from someone who has infectious TB disease. People with latent TB infection do not exhibit any symptoms and cannot transmit the TB bacterium to anyone else. The

body's immune system has confined the TB germ, which lies dormant within the body. Changes in the lungs from TB infection can sometimes be seen on a chest X-ray. Most (90%) adults never develop active TB disease. Antibiotics can help reduce the risk of developing active disease.

Active tuberculosis disease

The infected person has now developed symptoms of active disease (e.g.: fever, cough, chest pain, coughing blood, fatigue, hoarse voice, loss of appetite, weight loss, night sweats). Most tuberculosis (TB) disease remains within the lung, and about half of all persons with active TB are capable of transmitting the germ to others by the time they are diagnosed.⁴ Some develop TB disease outside the lung (e.g.: in the lymph nodes or bone); these people usually cannot transmit the germ to others. Antibiotic treatment for at least six months is necessary to cure active TB disease.

Old tuberculosis disease

A person with old tuberculosis (TB) disease had TB infection that progressed to active TB disease, received treatment or the disease healed spontaneously, but has no symptoms now. Their tuberculin skin test is usually positive for the rest of their life. They cannot transmit TB to others unless they develop active TB disease again. Chest X-rays may reveal characteristic patterns, some of which seldom reactivate into active TB disease (e.g.: calcified apical nodules) and some have a greater risk of reactivation (e.g.: fibrotic scars).⁵

Drug resistant tuberculosis, Multiple drug resistant tuberculosis

Resistant tuberculosis (TB) bacteria can grow despite the presence of certain antibiotics. Standard treatment for TB disease may be ineffectual if the bacteria are resistant to the drugs; treatment should always be tailored to the susceptibility of the TB bacteria to the antibiotics. Multiple drug resistant tuberculosis (MDR-TB) is defined as isoniazid (INH) and rifampin (RIF) resistance, but other drug resistant patterns occur. Drug resistant TB is harder to treat, as the alternative antibiotics are usually more expensive and have more side effects. Drug resistant TB is not more infectious than regular TB,⁶ and adults with an intact immune system have the same risk of developing active disease with MDR-TB as with drug sensitive strains⁷ (10% lifetime risk). This is fortunate, as there are no proven antibiotic regimens to prevent MDR-TB infection from developing into active disease.⁷

Rate of tuberculosis infection/disease

Rates rather than absolute numbers are required to accurately compare between institutions or regions. Rates account for the differing sizes of the populations – five positive TSTs may not be worrisome in an institution with 1,000 offenders, but may be of great concern in an institution with only 10 offenders. Rate per 100,000 is a standard epidemiological calculation reported in the literature and is used in this report to describe TB infection and disease.

CORRECTIONAL SERVICE OF CANADA TUBERCULOSIS PREVENTION AND CONTROL PROGRAM

Offenders

The Correctional Service of Canada (CSC) is responsible for providing health promotion and treatment services for persons convicted of federal offences (i.e. those sentenced to two years or more). Tuberculosis prevention and control is guided by the *Technical Annex on Screening, 1996*.⁸ Tuberculosis (TB) screening and subsequent treatment are voluntary activities for offenders. The following provides a summary of the Tuberculosis Prevention and Control Program as it pertained to offenders in 1998.

An offender entered the federal correctional system through a reception facility and was given an initial health assessment on admission. To screen for TB infection and disease, a tuberculin skin test (TST) and symptom review were recommended for all new offenders. A chest X-ray was recommended if the TST was positive or if the offender refused the TB screen. A chest X-ray was strongly recommended for all offenders who reported symptoms suggestive of active TB disease. Offenders with a negative TST result were offered a second TST one to three weeks later, to provide an adequate 2-step baseline. Offenders suspected of having active TB disease were isolated from other offenders until investigations could confirm the diagnosis and determine the infectious risk. Offenders with latent TB infection (positive TST) or active TB disease were offered antibiotic therapy as appropriate.

Thereafter, ongoing assessment of offenders' TB status occurred annually while they were incarcerated. Offenders who were released from a CSC facility

and subsequently re-entered were also evaluated as an ongoing assessment if their TST status had been previously reported to the Correctional Service of Canada Tuberculosis Tracking System (CSC TBTS). If their TST result was negative, an Ongoing Negative Assessment form was completed; if their TST result was positive, an Ongoing Positive Assessment form was used. The offender was offered an annual TST screen for TB infection if their previous TST result was negative. Symptom review was also conducted annually. A chest X-ray was offered if they subsequently tested positive (i.e. a "converter") and/or if symptoms suggestive of active TB disease were reported. All offenders who had a positive TST result or who refused the TST screening were offered symptom review and a chest X-ray to rule out active disease.

Offenders who entered CSC with active TB disease or who developed active TB disease within the correctional environment were identified via the initial assessment, routine annual screening or by spontaneously reporting symptoms. Offenders suspected of having active TB disease were isolated (preferably in a negative pressure isolation room), until infectiousness was ruled out. If the active TB disease was diagnosed while the offender was in a federal correctional facility, the institution's Chief of Health Services and the Regional TB Coordinator ensured appropriate contact tracing occurred. Each of the identified contacts and offenders living or working within areas where transmission may have occurred (e.g.: cell blocks) who had a documented negative TST result or unknown status were offered TST testing to determine the likelihood of TB infection. Baseline TST and follow-up TST three months later, as per the Canadian Tuberculosis Standards,⁹ were recommended for offender contact tracing. Chest X-rays and symptom checks to rule out active TB disease were recommended for

contacts with positive TST results (e.g.: previous "positives" and converters). Contact tracing occurred within more than one institution and/or region, as infectiousness sometimes was prolonged and inmate movement between institutions was frequent. Offenders identified as contacts who were subsequently released required community contact tracing, which was carried out in collaboration with local public health officials.

Active cases of TB disease among offenders were monitored by CSC Health Services. The local Medical Officer of Health received a copy of laboratory-confirmed *M. tuberculosis* reports for all residents within his or her jurisdiction, including offenders. Provincial, territorial and national TB disease statistics for 1998 include the offender population. However, offender cases of TB can be distinguished because of the communicable disease statistics kept by CSC Health Services.

TB screening and treatment were voluntary activities for offenders. Some offenders refused initial TST screens and/or symptom checks on admission to a CSC facility. Similarly, some refused TST and/or symptom checks in the context of annual screening or contact tracing. Offenders cannot be forced to participate; however, if they had signs and symptoms of active pulmonary TB disease, they were isolated until the risk of transmission was ruled out. Offenders with confirmed TB infection or active disease cannot be forced to take medication but were isolated if they were deemed to be an infectious risk to others. Other public health options to control TB were explored for those offenders without pulmonary symptoms. Refusal of one modality to monitor TB status (e.g.: TST) did not necessarily imply refusal to assess TB status through other means (e.g.: chest X-ray, symptom check).

Staff

The Occupational Health and Safety Agency (OHSA), Health Canada is responsible for offering tuberculosis (TB) screening to Correctional Service of Canada (CSC) employees. Tuberculosis prevention and control is guided by the *Technical Annex on Screening, 1996*.⁸ TB screening and subsequent treatment are voluntary activities for staff. The following provides a summary of the Tuberculosis Prevention and Control Program as it pertained to staff in 1998.

All staff were offered tuberculin skin test (TST) testing and symptom review during their pre-employment assessment. If the initial TST result was negative, the worker was offered a second TST one to three weeks later to provide an adequate 2-step baseline to determine TB infection status. In 1998, a documented TST within 24 months of a person's pre-employment TST was considered sufficient for the first step; the pre-employment TST completed their baseline testing (see Limitations). Workers with a positive TST result and/or symptoms suggestive of active TB disease were referred to their physician for further investigation, including a chest X-ray.

Thereafter, the worker was offered an annual TST screen for TB infection if their TST result was negative. An Ongoing Positive Assessment form or Ongoing Negative Assessment form was completed, depending on their TST status. Workers with a positive TST and/or symptoms suggestive of active TB disease were referred to their physician for further investigation, including chest X-ray. Those who refused the TST screening were offered

symptom review and encouraged to have a chest X-ray done by their physician to rule out active disease.

Workers with symptoms suggestive of active TB disease identified through the initial or ongoing assessment, by spontaneous reporting of symptoms or on observation of suspect symptoms by others in the workforce were asked by their manager to remain off work until their physician could confirm the diagnosis. Cases of active TB disease in workers within federal correctional facilities were not reported to OHSA or CSC, as there was no legislation governing reporting to these agencies. Instead, cases were reported to the local Medical Officer of Health according to provincial legislation, and therefore cases of active TB disease in workers appear as part of the population burden of TB disease for the given province. Unlike cases of active TB disease in offenders, cases involving workers within federal correctional facilities cannot be distinguished from those of the general population.

Workers who were exposed to active TB disease within a CSC institution were offered a TST immediately and at three months by OHSA. Workers with previously positive TST results and converters were referred to their physician for a symptom check and chest X-ray to rule out active TB disease. Those on contract and volunteers were notified of their exposure, and the local public health agency coordinated contact tracing.

TB screening and treatment were voluntary activities for workers within federal correctional facilities. Staff who chose not to participate in OHSA TB screening may have gone to their family doctor, TB clinic or local public health agency for testing.

CORRECTIONAL SERVICE OF CANADA TUBERCULOSIS TRACKING SYSTEM DATABASE

In July 1997, the Correctional Service of Canada (CSC) transferred responsibility for the Correctional Service of Canada Tuberculosis Tracking System (CSC TBTS) database to Tuberculosis Prevention and Control, Health Canada. The Database Management Committee was created to assist in the development and management of this national database.

The objectives of the CSC TBTS database are:

- to determine the number of new infections (conversions) in staff and offenders;
- to identify "hot spots" for further investigations; and
- to allow for international comparisons.

The core of the database was developed and system testing began in December 1997. System testing was completed in February 1998 and CSC and the Occupational Health and Safety Agency sent in completed tuberculosis screening assessment forms to the Tuberculosis Prevention and Control Division. Full implementation began in February 1998 with the hiring of three individuals for data entry.

METHODOLOGY

The Initial Tuberculosis Assessment Form was completed for all offenders at reception by the Correctional Service of Canada (CSC) nurse. Thereafter, annual and/or contact tracing Ongoing Tuberculosis Assessment Forms were completed for offenders. These initial and ongoing forms were mailed to CSC National Headquarters, and then forwarded to Tuberculosis Prevention and Control. Data discrepancies were identified under Tuberculosis Prevention and Control's supervision and clarified with the CSC nurse at the institution before data were entered into the Correctional Service of Canada Tuberculosis Tracking System (CSC TBTS) database.

Similarly, the Initial Tuberculosis Assessment Form was completed for staff within the institution by an Occupational Health and Safety Agency (OHSA) nurse. Thereafter, annual and/or contact tracing Ongoing Tuberculosis Assessment Forms were completed for workers. Initial and ongoing forms were sent to each OHSA Regional office for data entry into the Immunization Records System/Medgate database. Completed forms were subsequently forwarded to Tuberculosis Prevention and Control

and discrepancies rectified before data were entered into the CSC TBTS. Information about contractors and volunteers were not included in the staff data contained in this report.

More than one assessment was reported for some people. The database eliminates duplication by linking the records via their unique staff or offender identifier and the assessment date. This report focuses on the results of the most recent assessment performed in 1998. Assessment data were entered via three remote stand-alone personal computers and exported/imported to the master database periodically. Data confidentiality was strictly preserved at each step of data collection, storage and entry. Offender assessments were stored separately from those of staff.

Tuberculosis Prevention and Control professionals analysed the 1998 data for offenders and staff and prepared this inaugural Annual Report. The draft report was approved by the Database Management Committee (DMC) before distribution to the Regional Tuberculosis Coordinators and Regional OHSA staff for feedback and comments. The same process of report drafting, DMC approval and Regional feedback will be followed to generate future reports.

Some offenders moved between institutions during 1998; certain institutions (e.g.: Regional Reception Centres) experienced more turnover than others. Some offenders entered and exited correctional facilities in less than a year's time. The mid-year offender population quoted in this report was therefore an underestimate of the true number of offenders within CSC in 1998.

The rate of positive tuberculin skin test (TST) results among offenders/staff who completed screening was calculated using the number of offenders/staff with positive TST results (initial, ongoing positive and converters) as the numerator and the number of offenders/staff who completed TST screening (total minus refusals, contraindications, incomplete 2-step and unknown) as the denominator. The rate of conversion was calculated using the number of people who were originally TST negative in 1998 and subsequently tested positive in 1998 as the numerator and the number of ongoing negatives plus the converters as the denominator. The rate of active tuberculosis (TB) disease for offenders was calculated using the mid-year offender population as the denominator. No rate of active TB disease could be calculated for staff, as this information was not collected.

RESULTS

The total offender population in federal correctional facilities across Canada as of June 1, 1998, was 14,398. The number of staff working within these institutions as of December 1998 was 11,184.

The Tuberculosis Prevention and Control Division received a total of 17,230 assessments for 16,429 individuals in 1998. Offenders accounted for

about three quarters of the assessments, staff for the remaining quarter. The majority of assessments were considered routine annual screenings, only 2% were reported as a result of contact tracing for known or suspected active cases of tuberculosis (TB) disease.

About 90% of offenders at the initial and ongoing assessment stages completed tuberculin skin test (TST) testing, while 95% of those tested in the context of contact tracing completed TST testing. Reasons for incomplete TST results

included refusals, contraindications and unknown (Table 1). Initial assessments accounted for 40% of offenders screened. Eight per cent of offenders refused the initial TST screen, while 6.3% refused later assessments.

Overall, 23.7% of offenders who completed screening had a positive TST result in 1998: 8% on initial screening, 15% ongoing positives and 0.7% converters. Of offenders entering Correctional Service of Canada (CSC) correctional facilities in 1998 who

Table 1. Reported tuberculin skin test results by reason for assessment – 1998

ASSESSMENT REASON	TUBERCULIN SKIN TEST RESULT						
	POSITIVE	NEGATIVE	REFUSED	CONTRA-INDICATED	INCOMPLETE 2 STEP	UNKNOWN	TOTAL
Offender							
<i>Initial</i>	875	3,448	394	73	–	80	4,870
<i>Annual screening</i>							
Ongoing positive	1,593	–	–	–	–	–	1,593
Ongoing negative	66	4,690	685	9	–	23	5,473
Subtotal annual	1,659	4,690	685	9	0	23	7,066
<i>Contact tracing</i>							
Initial	1	16	4	–	–	–	21
Ongoing positive	41	–	–	–	–	–	41
Ongoing negative	5	159	9	–	–	–	173
Subtotal contact	47	175	13	–	–	–	235
OFFENDER TOTAL	2,581	8,313	1,092	82	0	103	12,171
Staff							
<i>Initial</i>	103	616	123	2	166	–	1,010
<i>Annual screening</i>							
Ongoing positive	403	–	–	–	–	–	403
Ongoing negative	21	2,563	146	1	–	1	2,732
Subtotal annual	424	2,563	146	1	0	1	3,135
<i>Contact tracing</i>							
Initial	–	5	3	–	–	–	8
Ongoing positive	10	–	–	–	–	–	10
Ongoing negative	–	87	5	–	–	–	92
Subtotal contact	10	92	8	–	–	–	110
STAFF TOTAL	537	3,271	277	3	166	1	4,255

completed TST testing, 20.2% tested positive.

Only 38% of staff participated in the Correctional Service of Canada Tuberculosis Tracking System (CSC TBTS) screening in 1998. About one quarter (22.3%) of staff assessments were initial assessments. Of those who presented for their initial assessment, 71.2% completed TST testing and 12.2% refused TST testing, although they completed the Initial Assessment Form. Some staff (16.4%) complied with the first test but not with the 2-step baseline testing (Table 1).

Ongoing assessments accounted for about three quarters of staff assessment forms forwarded for entry into the CSC TBTS database. Staff who reported for ongoing assessments were more compliant; completion rates were about 95% for both annual screening and contact tracing. Only 5.3% refused TST screens in ongoing assessments.

Overall, 14.1% of staff who completed screening had a positive TST result in 1998: 2.7% on initial screening, 10.8% ongoing positives and 0.6% converters. Of staff who completed baseline testing, 14.3% tested positive.

The majority of offenders tested in 1998 were TST negative. The province with the highest proportion of positive TST results among tested offenders was Quebec (Figure 1). The Prairie Region had the highest proportion of positive TST results among tested staff (Figure 2). Refusal rates were highest in Quebec and the Pacific Region for offenders, and the Prairie Region, Quebec and Atlantic Region for staff.

Staff had a higher rate of refusals than did offenders in all but Quebec and the Pacific Region (Figures 1 and 2). The overall coverage for TST screening reported to the CSC TBTS was much lower for staff than offenders.

Figure 1. Reported results by region – Offenders – 1998

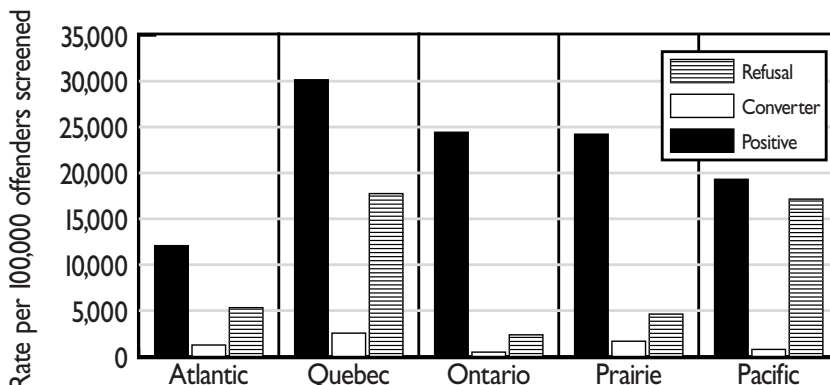
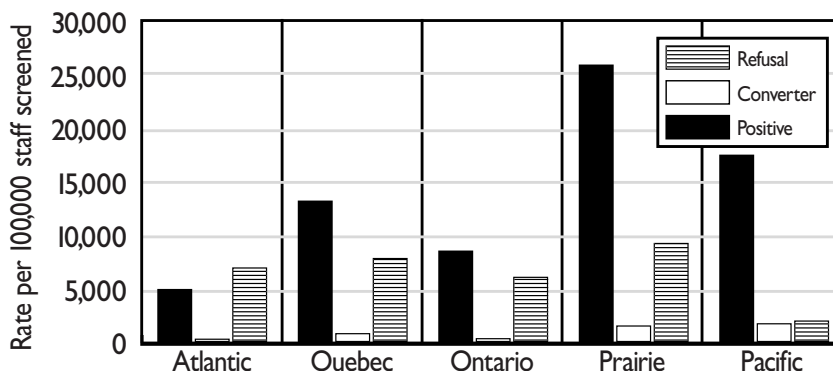


Figure 2. Reported results by region – Staff – 1998



Only 4,255 staff (estimated 38% of total staff population) were registered in the database in 1998, compared to 12,171 offenders (84.5% of the mid-year total offender population).

Six cases of active TB disease were reported among offenders, which represents a rate of 41.7 cases of active TB disease per 100,000 offenders in 1998. Quebec reported two thirds of these cases, and the Pacific Region accounted for the remainder. Figure 3 presents the rate of active TB disease reported in CSC offenders in 1998 compared to

the rate for other population subgroups of Canada (data for the latter were provided by Tuberculosis Prevention and Control from national surveillance statistics¹⁰).

These confirmed cases and other suspect cases resulted in the screening of 235 offenders and 110 staff through contact tracing. One offender whose baseline TST at 0 months was positive had not received TST testing prior to the contact tracing; this was considered an initial positive TST as it occurred prior to the incubation period

Canadian-born Aboriginal people had approximately twice the rate of positive TST results of those born in Canada who were non-Aboriginal.

Most staff on assessment did not report medical condition(s) or risk factor(s) predisposing them to development of active TB disease. Of all staff who reported this variable, being a contact of a known case of active TB (85%) was the most common factor; diabetes, transplantation, silicosis and steroid use were sporadically reported. Staff with positive TST results reported only diabetes and/or being a contact as predisposing factors.

Most offenders did not report predisposing medical condition(s) or risk factor(s). Of those who responded, being a contact of a known case of TB was the leading risk factor identified for offenders with a positive TST result.

Table 2 shows that injection drug use was consistently reported as a risk factor among both TST positive and negative offenders.

Some staff and offenders with positive TST results reported multiple medical conditions and/or risk factors. The most frequent combination reported by staff was diabetes and being a contact

Figure 5. Reported origin of offenders/staff with positive tuberculin skin test result – 1998

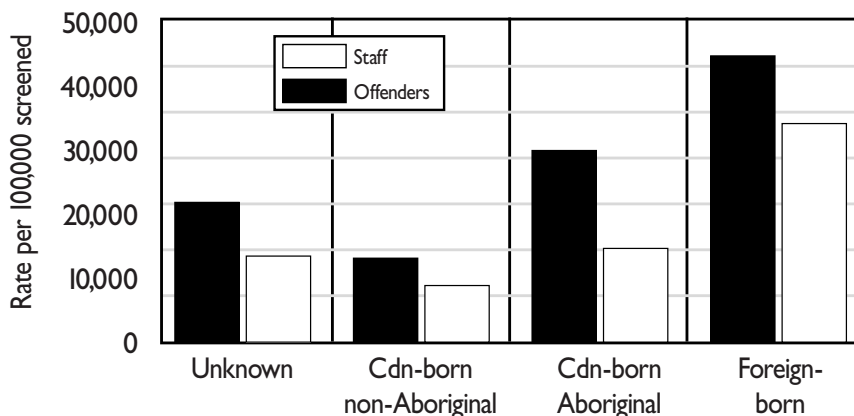


Table 2. Reported tuberculin skin test results by medical condition/risk factor – Offenders – 1998

MEDICAL CONDITION / RISK FACTOR	TUBERCULIN SKIN TEST RESULT				
	POSITIVE	NEGATIVE	REFUSED	OTHER*	TOTAL
Contact ¹	147	302	40	18	507
Diabetes ²	6	50	13	1	70
Dialysis ³	4	13	1	1	19
Silicosis	2	11	2	0	15
Transplant ⁴	3	16	0	0	19
Injection drug use	127	887	78	25	1,117
Lymphoma	1	14	4	1	20
HIV/AIDS	5	88	12	3	108
Anti-cancer drugs	2	21	2	0	25
Steroids	9	98	10	2	119

* - Includes Contraindicated, Incomplete 2-step and Unknown
¹ - Contact with a known or suspected case of active TB disease
² - Insulin-dependant diabetes mellitus
³ - Renal failure requiring hemodialysis
⁴ - Organ transplant recipient

of a known case of TB disease (0.2% of staff screened). The most frequent combinations reported by offenders were injection drug use and being a contact of a known case of TB disease (5.7% of offenders screened), injection drug use and HIV (0.3% of offenders screened) and injection drug use and steroids (0.2% of offenders screened).

Overall, 9.4% of offenders screened and 4.8% of staff screened reported symptoms suggestive of TB disease. The most common symptom reported by both groups was fatigue (12% of offenders and 27% of staff reporting symptoms). Only offenders reported coughing blood (1.1% of offenders reporting symptoms).

Over 1,200 offenders (48.2%) and 195 staff screened (36.3%) who had positive TST results reported symptoms or had an abnormal chest X-ray. The most frequent symptom reported by offenders with a positive TST result was fatigue. Symptoms were also reported among 10.7% of offenders and 3.2% of staff who had negative TST results.

Multiple symptoms were reported by some staff and offenders. Many of the symptom constellations were very suggestive of active TB disease in screened offenders (e.g.: coughing blood, sputum production and night sweats), which underscores the vigilance needed by CSC health services staff to maintain effective TB control within institutions. Some screened staff also reported multiple symptoms compatible with active TB disease.

DISCUSSION

The inaugural year of the Correctional Service of Canada Tuberculosis Tracking System (CSC TBTS) database was successful in providing a comprehensive tuberculosis (TB) risk assessment for offenders within federal correctional facilities across Canada. More offenders than staff participated in the program, thus offender information has more internal and external validity than staff data. Extrapolation of these results cannot be applied to Correctional Service of Canada (CSC) staff who did not participate in the screening program.

Although less than 5% of the assessments required discrepancy follow-up, this process greatly prolonged the data entry time. Fortunately, as the year progressed, the number of forms requiring discrepancy follow-up declined in most regions.

Most offenders within CSC who completed their tuberculin skin test (TST) screening in 1998 had negative TST results. The vast majority (97.2%) of offenders with a positive TST result were positive on entry into the penitentiary setting or were previously known to be positive. Relatively few offenders had documented conversion of their TST status within federal correctional facilities in 1998.

Individuals are at higher risk of developing active TB disease within the first two years of becoming infected with *M. tuberculosis*.⁴ Identifying those at highest risk of developing disease provides dual protection: individuals can be counseled and offered treatment for their TB infection, and the population within the correctional facility benefits from the early identification of TB infection and disease.

The literature on TB in the prison environment focuses primarily on cases of active disease, and the data consistently demonstrate an increased rate of active TB disease within prisons compared to that of the general population.^{11,12} Transmission of TB within the prison environment has been similarly well documented;¹²⁻¹⁵ it has been shown to be related to overcrowding and the duration of incarceration.

The rate of active TB disease reported in CSC offenders in 1998 is double that of Canadian-born Aboriginal people and foreign-born individuals in the general population, and 28 times greater than that reported for non-Aboriginal people born in Canada.¹⁰ However, this rate is an overestimate, as the denominator used (mid-year population) is less than the total number of offenders within CSC in a given year due to high turnover. A turnover rate of 40%¹⁶ would decrease this rate to 29.8 cases per 100,000 offender population, which is comparable to the Canadian-born Aboriginal and foreign-born populations.¹⁰

The increased risk of active TB disease for offenders within correctional institutions has resulted in active case-finding and documentation of TB infection status upon admission. A 1992-93 survey of U.S. correctional facilities reported annual offender TST screening in 78% of federal and state prisons, and 32% of local jails.¹⁷ The prevalence of positive TST results ranges from 6.7% in New York City,² 12.5% in Washington state,¹⁸ and 27% in a San Francisco county jail.¹⁹ A study of institutions in New South Wales revealed a rate of positive TST results of 13% in 1996.²⁰ The prevalence of positive TST results among offenders within Canadian correctional facilities in 1998 as reported through CSC TBTS was 21%, which falls within the range of these figures reported in the literature.

The risk of TB infection is extended to people working within correctional facilities: one third of new positive TST results among New York state prison employees were attributed to occupational exposure.²¹ A study of full-time employees of a provincial prison for women in Montreal found that 32% of participating Quebec-born employees had a positive TST result.²² The proportion of positive TST results increased for staff with a history of work in institutions that incarcerate male offenders.²² The prevalence of positive TST results among staff reported to the CSC TBTS in 1998 was 12%, which is lower than the figures reported in the literature. However, the CSC TBTS result must be interpreted with caution, as the majority of staff did not participate in the screening program.

On initial assessment, a higher rate of pre-existing positive TST results was observed among offenders screened through the CSC TBTS compared to the rate for staff. Offenders recorded as "initial" were either first-time federal offenders or offenders on re-entry who were released from a CSC prison prior to 1998. However, examining the time spent by federal offenders at provincial or territorial correctional facilities, which are known to have a high rate of positive TST results compared to the general population,^{3,18,19,23} is beyond the scope of this report.

Similarly, staff may have worked within the correctional environment or other high risk environment (e.g.: health care, military) before their TB status was assessed through the CSC TBTS screening program. For these reasons, it is difficult to determine whether positive TST results reported to CSC TBTS in 1998 represented TB infection acquired within the federal correctional environment.

Conversion rates observed among offenders and staff reported to the CSC TBTS in 1998 were very low. Only 1.3% of offenders converted, a much lower percentage than those reported in the literature. Conversion rates among offenders in New York City were approximately 7%² and 6.5% in New Mexico.³ However both of these studies concluded that a 2-step TST was necessary to establish a proper baseline and that their results were suspect. A two-year follow-up in Maryland revealed 6.3 conversions per 100 person-years.²³

Most offender conversions were observed in the context of routine annual screening rather than contact tracing. The date of exposure to TB is therefore unknown, and the potential for undiagnosed cases of infectious active TB disease cannot be ruled out. In a Maryland state prison in 1994, despite an intensive investigation linking converters to known cases of active TB disease, the source of most (72%) conversions could not be determined.²⁴

One study of New York State prison employees in 1992 demonstrated a conversion rate of 1.9%,²¹ while multi-drug resistant TB outbreaks were ongoing within state hospitals and prisons.²⁵ The CSC employee conversion rate in 1998 was lower than this figure, which might be expected in a non-outbreak situation. A cluster of offender conversions in a Prairie Region institution in the first quarter of 1998 without an identified source did not provoke a similar cluster of conversions among staff screened by CSC TBTS. However, conversions may have occurred among the staff who chose not to participate in the TB screening program.

Occupational conversion without a documented exposure to a known infectious TB disease case is well described in the literature. For example, a cluster of five conversions occurred in hospital employees with no patient care or contact.²⁶ The new laboratory technique of more precise characterization of bacteria from TB cases within a community or a state has uncovered links between cases that traditional contact tracing methods failed to detect.²⁷ The CSC TBTS database offers an opportunity to detect subtle transmission of TB, but its success depends on a high rate of staff and offender participation.

LIMITATIONS

Turnover of offenders within certain institutions (e.g.: Reception Centres) is very high and transfer of offenders among different facilities within regions and between regions makes the calculation of rates difficult. Rates of positive tuberculin skin test (TST) results reported to the Correctional Service of Canada Tuberculosis Tracking System (CSC TBTS) are based only on the number of offenders who completed screening, not on the total number of offenders within the system.

The majority of positive TST results were inferred, as the person did not have a numeric value for the TST reported. However, their assessments were completed using the Ongoing Positive Assessment form, so it was assumed that they had had a positive TST result. No systematic evaluation of offenders or staff with ongoing positive TST results was undertaken to determine how many had converted while in the federal penitentiary setting prior to 1998.

This report assumes that a positive TST implies tuberculosis (TB) infection. False positives are known to occur, notably with environmental mycobacteria or previous BCG exposure.⁹ Children in some Canadian provinces (e.g.: Quebec and Newfoundland) and Aboriginal children on-reserve were vaccinated with BCG for several decades; some of the staff and offenders may therefore have positive TST results because of the residual effect of BCG rather than TB infection.⁹ However, the positive predictive likelihood of the TST remains high in offenders as the prevalence of active TB disease in the offender population is elevated compared to that of the general population of Canada¹⁰ and in accordance with the literature.^{2,11-15,17-21} For staff, the positive predictive value of the TST is less clear.

The TST may also result in false negatives.⁹ For example, in Table 2, some of the immunocompromised offenders reported as having negative TST results may indeed be infected with TB. However, all offenders reporting TB symptoms are offered further medical investigations to rule out active TB disease, regardless of their TST status.

The six confirmed and several suspect cases of active TB disease among offenders in 1998 generated many hours of contact tracing within multiple institutions across Canada. The number of offenders assessed through contact tracing was more than the 235 reported to the CSC TBTS. This underestimate may have been a function of the design of the assessment forms which listed the "contact" or "routine annual" as the last variable. If this variable was left unanswered, it was assumed to be "routine"; this assumption may account for the underestimate of contact assessments. Initial and ongoing assessment forms were subsequently modified in April 2000; an artefactual increase in contact tracing after this date may be seen in future CSC TBTS reports.

Transmission of TB has been well documented within the correctional facility environment.^{13-15,23-25,28-31} Converter data for 1998 were restricted to reports of persons who had at least one ongoing negative assessment in 1998, and who subsequently had a positive TST result that year. The resultant figure is an underestimate of the true conversion rate, as those who were known to have a negative TST result in previous years may have become positive in 1998. As the database matures, this discrepancy will lessen.

Conversion may be associated with re-entry of offenders after a period of release,¹⁹ implying that their TB infection was acquired through community contacts. Converters within the CSC TBTS database in 1998 were not examined with respect to parole or release. Similarly, other risk factors for staff conversion (e.g.: travel to an endemic country)²² were not explored.

Although Canadian standards recommend that the 2-step TST testing interval coincide with the incubation period for TB infection (i.e.: one to three weeks to distinguish conversion from booster effect⁹), logistical problems prevented the Occupational Health and Safety Agency (OHSA) from complying with this specification. Allowing a person's documented TST result (within 24 months of their pre-employment TST) to complete their initial testing was a compromise between best practice and reality. However, a positive TST result obtained through this method could not reliably distinguish between true conversion and booster effect.

Again due to logistical difficulties, some staff reported their TST results to OHSA by telephone rather than keeping the follow-up appointment 48 to 72 hours after the TST was administered. Their TST results were read either by themselves (commonly if they were a health-care provider), or by a local nurse or physician. This practice may have underestimated positive TST results as induration does not always present as an obvious swelling; transverse lighting and special techniques are sometimes required to ensure an accurate measurement. Overestimation of positive TST results was also possible (if redness rather than induration was used as the marker).

Reliable figures for the rate of positive TST results within the general population of Canada are lacking. A recent American Thoracic Society publication estimates an *M. tuberculosis* infection rate of 5–10% in the general U.S. population.⁵ Staff data recorded in the 1998 CSC TBTS database yielded a percentage at the upper end of this estimate (14%). Most revealing were the reported figures for positive TST results on initial assessment: 20% for offenders and 14% for staff. This illustrates the higher prevalence of TB infection (and subsequent active TB disease) among offenders, a finding that is well documented in the literature.^{5,11-12,18-20}

Only the initial assessment form collects information on the person's country of origin and Aboriginal status. These variables were not reported on the majority of both staff and offender assessments. Clearly, better reporting is needed before reliable conclusions can be drawn. However, the reported origins of people with positive TST results (a proxy for TB infection) accorded well with the national surveillance database of reported cases of active TB disease.¹⁰

The internal validity of offender data is compromised by the lack of data validation; however, such a process would generate an immense workload. Conclusions are therefore tentative but are representative of the general inmate population, as the data capture for both TB infection and active disease is high.

Staff data can be validated, but selection bias compromises the external validity of these results. Conclusions are limited to the data provided by participating staff (38%). No information on cases of active TB disease among staff was reported to OHSA or Tuberculosis Prevention and Control, limiting the discussion to TB infection. Increasing staff participation and addressing the logistical problems that limit accurate TST results will improve the internal and external validity of the CSC TBTS results for staff.

Generally, offenders had a lower rate of refusals than staff (except in Quebec and the Prairie Region), and more data were captured regarding offenders than staff. The majority of staff chose not to participate at all; half of those who refused did so at the initial assessment. Staff data that remained in the database may reflect selection bias among CSC personnel (i.e.: the most compliant staff may have participated in the screening program in 1998).

The time from offender/staff assessment to data analysis was almost two years. This prolonged interval was due to the inherent problems of implementing a new database (e.g.: data entry time, discrepancy follow-up and data validation), as well as determining the optimal reporting format. This time lapse should shorten in the coming years, but the rate defining steps will be the time from assessment, completion of the forms, discrepancy follow-up and analysis.

ASPIRATIONS

Person-years of tuberculosis (TB) conversion could be calculated by linking the unique offender identifier in the Correctional Service of Canada Tuberculosis Tracking System (CSC TBTS) database with the Offender Management System (OMS) database. The former would supply the TB infection status; the latter, the years of imprisonment. Data capture for offenders is sufficient to support the external validity of results. One American study has estimated that for offenders infected with TB, the odds of developing active TB disease increased with the number of admissions to a correctional facility.³² It would be interesting to find out whether Canadian offenders with positive tuberculin skin test results share similar risks of developing active TB disease upon re-entry. Linkages between CSC TBTS and the OMS could explore this hypothesis.

Further examination of specific risk factors for TB infection and subsequent development of active disease in offenders is possible. Monitoring the numbers receiving preventive therapy for latent infection and the numbers that have completed therapy can also help predict the number of cases of active TB disease expected and their probable time frame. The number of cases of active TB disease prevented can be similarly estimated.

If more staff can be recruited into the screening program, then a comprehensive picture of occupational TB transmission risk within Canadian prisons is possible. Staff conversions could be linked to the known cases of active TB disease occurring within the Correctional Service of Canada (CSC) facilities to determine the relative risk of TB infection for a given exposure. Current staff participation levels preclude definitive conclusions, even in the context of a special epidemiologic investigation of a cluster of offender conversions.

If CSC were to develop an automated system for infectious disease surveillance, CSC institutional health services staff could input the offender data directly into the CSC TBTS database. Discrepancy checks could be performed on site and the responses updated more readily. This would improve data quality and timelines by several months, facilitating monthly data analysis to scan for occult outbreaks or clusters. Eventually the scan itself could become automated, as data trends would indicate the level of "expected" infection for each institution and region. Analysis could also rapidly identify outliers in risk factors (e.g.: clusters within Aboriginal or HIV-infected populations). Automation would facilitate the management of the database by CSC with assistance from Tuberculosis Prevention and Control. These formative years are capacity-building.

Strain identification of bacteria grown from the active cases of TB disease in offenders may provide insights as to transmission patterns.^{24,28-30} Identifying the contacts of known cases and following them as a subset within the database may provide insight into subsequent cases of active TB disease in future years.

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