Costs for Tuberculosis Care in Canada

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ABSTRACT

Objectives: We have estimated tuberculosis (TB)-related expenditures by governments and other third parties in Canada in 2004, in order to compare spending on different activities, by various jurisdictions, and in different regions.

Methods: To ascertain health system costs (including public health costs), a self-administered questionnaire was completed by all federal, provincial, and territorial health departments and laboratories involved in TB activities and a sample of local health departments. Hospitalization information was obtained from the Canadian Institute for Health Information, while costs for care were derived from published literature. Costs borne by patients and families were not included. All costs were ascertained for 2004 and expressed in Canadian dollars.

Results: In 2004, total TB-related expenditures in Canada were $74 million, equivalent to $47,290 for every active TB case diagnosed in that year. Research accounted for $4.5 million (or 6% of the total). Non-research-related federal spending accounted for $16.3 million (22%) and provincial/territorial expenditures accounted for $53.1 million (72%). Active tuberculosis accounted for $31 million or 59% of provincial/territorial expenditures. There were substantial regional differences in TB-related expenditures; the highest expenditures were in the Northern Territories ($72,441 per active TB case), followed by the four Western provinces ($35,914), and lowest in the Atlantic provinces ($28,259).

Conclusions: Total TB-related expenditures in Canada in 2004 were considerable, of which almost 60% were for curative services and only 40% for prevention and control activities. Regional differences likely reflect differences in accessibility of the populations to health care services, and greater interventions in communities with ongoing TB transmission.

Key words: TB control; costs for control; public health costs; TB costs

La traduction du résumé se trouve à la fin de l'article.

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Tuberculosis (TB) has proven to be difficult to eliminate. Although incidence in Canada declined throughout most of the 20th century, there were 1,574 active cases of tuberculosis in 2004 – a 7.6% reduction over the previous three years.[1] This slow decline has been noted in many other high-income countries, despite intensive control efforts. To enhance TB control efforts may require increased, albeit targeted expenditures.

Before planning such expenditures, it is important to know what is currently spent for TB care and prevention. However this is unclear in Canada, because federal, provincial, territorial, county and municipal governments, as well as hospitals, clinics, and individual providers, are all involved in different aspects of TB care. Adding to the complexity are the diverse populations affected by TB – including Aboriginals, elderly, immigrants, and urban poor.[2]

A comprehensive survey of TB costs has never been conducted in Canada. Therefore, we have ascertained current government spending for tuberculosis care and prevention in Canada, in order to compare expenditures for care of active TB vs. prevention activities, and to compare spending by different government jurisdictions, and in different regions.

METHODS*

Survey methods

The survey was conducted between September 2005 and March 2006. Self-administered questionnaires were mailed to TB control services in all 10 provinces and 3 territories, plus federal government departments involved in TB care – Medical Services Branch of Citizenship and Immigration Canada (CIC), the Public Health Agency of Canada (PHAC), First Nations and Inuit Health Branch (FNIHB) of Health Canada, and Correctional Services of Canada (CSC). This questionnaire asked about jurisdictional responsibilities in TB, numbers of patients treated for active and latent TB, close and casual contacts investigated, other screening activities, and budget information including staff and other expenses. The federal, provincial or

* Additional details of the methods in tabular form are provided in an online supplement. This appendix can be found at http://www.mcgill.ca/recru/documents (Accessed September 2008).

TABLE I

Sources of Information (Other than Direct Survey)

Parameter			Value	Source
Hospitalization				
Proportion of TB patients hospitalized (1996-2000)			50.2%	Data directly supplied by CIHI
Number of TB patients in 2004			1574	PHAC[1]
Number of admitted TB patients			790	Calculated
Average length of stay of TB patients (1996-2000)			20.6 days	Data directly supplied by CIHI
Average cost per day (2004)			$929.96	OCCI*[3]
Total cost per hospitalized TB patient			$19,157	Calculated
Average cost for hospitalization for all TB patients			$9,617	Calculated
Inflation Index			Varies by year	[6]
Salary Scales (2004)				
Specialist	Federal government - Medical Officer		$115,895.25	Treasury Board of Canada†
	Federal government - Medical Specialist		$126,351.88	Treasury Board of Canada†
	Non-federal government specialist		$165,000.00	FMSQ
Nurse	Hospital		$66,560.22	Treasury Board of Canada†
	Community health		$72,416.75	Treasury Board of Canada†
Lab Technician			$45,500.00	HRSDC‡
Clerical			$39,726.00	Treasury Board of Canada†
Other (average of clerical, technical, administrative)			$44,151.00	Treasury Board of Canada†
Benefits			22%	(Approximate average from survey)
Investigations (2004 unless specified)				
TST (material $9.13; labour $5.00)			$14.13	(Sanofi Pasteur)
Mycobacteriology	AFB smear (including ZN if positive)		$9.90	Interim Federal Health fee schedule
	TB culture (liquid media only)		$22.00	IFH fee schedule
	AFB smear & TB culture		$31.90	IFH fee schedule
	AFB smear & TB culture (labour costs)		$21.83	Calculated (see methods)
	AFB smear and culture - supplies		$10.07	Calculated (see methods)
Out-patient Costs	Diagnosis of active TB			[5]
	(excluding mycobacteriology)		$320.50	
	(1996 study inflated to 2004)		$374.70	
	Diagnosis/evaluation of latent TB			[5]
	Cost in 1996 study		$132.07	
	Inflated to 2004 (X 1.169)		$154.40	
	Drug costs			
	Active TB (average – see Table S1 in online appendix)		$1,265.59	
	Latent TB (average – see Table S1 in online appendix)		$105.72	
	Follow-up/treatment (no drug costs)			
	Latent TB	1996 Study	$285.44	[5]
		Inflated to 2004	$333.70	
	Active TB	1996 Study	$837.30	[5]
	(Non-hospital portion)	Inflated to 2004	$978.87	

* Average cost per day, represented the average cost per day of the 14 most common causes of acute care hospital admission with medical illnesses taken from Ontario case costing initiative in 2004. www.occp.com (Accessed April 2006).
† www.tbs-sct.gc.ca/pubs_pd/hrpubs/ratesotpay/ra97_e.asp (Accessed April 2006).
‡ www.hrp/sp/industry_profiles/med_lab.shtml&hs=h7p (Accessed April 2006).

Abbreviations: CIHI – Canadian Insititute for Health Information; FMSQ – Fédération des Médecins Spécialistes de Québec; HRSDC – Human Resources and Social Development Canada; IFH – Interim Federal Health; OCCI – Ontario Case Costing Initiative; PHAC – Public Health Agency of Canada

regional TB reference laboratories completed separate surveys regarding responsibilities, workload budget, and staffing. These questionnaires were developed by the authors, pretested with a small sample of users, and revised accordingly. (The questionnaires used are available from the authors.) Follow-up reminders were sent twice to non-respondents, followed by telephone calls to enhance participation. Telephone calls were also made to clarify responses in some cases.

In BC, Manitoba, Saskatchewan, Nunavut, Yukon and the Northwest Territories, the single centralized service providing all diagnostic, curative and preventive out-patient TB services for the entire population, was surveyed. In Alberta, in addition to the provincial authority, two clinics serving as Departments of Health (DOH) for Edmonton and Calgary were surveyed. In Quebec, Ontario, Nova Scotia and Newfoundland, the provincial authorities were surveyed, plus a sample of local DOH. All DOH from large urban areas were selected and approximately one third of the rural DOH, where few cases are diagnosed each year, were asked to participate. As a result, the DOH surveyed accounted for 85%-94% of all TB cases in those provinces.

Costs for clinical care

These costs are summarized in Table I. Total hospitalization days were calculated from average length of stay for TB patients (from the Canadian Institute for Health Information - CIHI), proportion of TB cases hospitalized (CIHI), plus TB incidence (from ref. 1). We used data from the Ontario Case Costing Initiative Reports[3] for the average per diem cost for the 14 most common medical causes of acute care hospitalization (such as pneumonia, or heart failure) in Ontario in 2003-2004. These Ontario costs were adjusted to average Canadian costs using relative costs published in the Hospital Financial Performance Indicators report of CIHI.[4]

In Ontario, Quebec and the Atlantic Provinces, out-patient care of TB patients is provided on a fee-for-service basis. Costs for this care were based on a micro-costing survey of all patients treated for latent TB infection and active TB at the Montreal Chest Institute,[5] inflated to 2004 values.[6] In Manitoba, Saskatchewan, Alberta,

TABLE II

Total Full-time Equivalent Public Health Staff and Salaries for TB-related Activities, by Jurisdiction

		Physician	Nurse	Technicians	Clerical	Other	Total Salaries
TOTAL		50.5	166.6	62.3	143.5	44.4	
Federal	Other staff	28.7	28.0	2.8	63.6	7.2	$10,499,202
	Laboratory	1	0	6.0	0.5	0	$540,293
Provincial	Public Health	8.3	37.8	2.7	49.6	14.0	$8,160,381
	Laboratory	5.9	0	50.1	16.5	0	$4,651,290
DOH	Total	6.7	100.8	1	30.3	23.2	$12,897,679
							TOTAL
Salaries (includes benefits)		$7,151,913	$14,717,150	$344,190	$6,952,448	$2,391,562	$31,557,262
Lab salaries		$1,253,550	0	$3,114,111	$823,922	0	$5,191,583
TOTAL Salaries		$8,405,463	$14,717,150	$3,458,301	$7,776,370	$2,391,562	$36,748,845

British Columbia and the three Northern territories, out-patient clinical care of TB patients is the responsibility of the designated TB services; hence these costs were included in the surveys. TB care of Aboriginals living on reserves in these provinces is paid by funds from FNIHB; hence these contributions were included as part of each province's expenditures.

The federal reference laboratory, 6 provincial and 2 regional reference laboratories, and 4 hospital laboratories (2 in Ontario and 2 in Quebec) were surveyed with regard to staff, workload, and policies. Estimation of salary costs for the provincial and federal laboratories was based on survey responses. Estimating TB lab supply costs was based on the reimbursement schedule of the Interim Federal Health (IFH)* programme of Citizenship and Immigration Canada. This is based on inter-provincial agreements regarding health care costs, and therefore can be considered reasonably representative of average Canadian costs. To estimate the number of AFB (Acid Fast Bacilli) smears and cultures performed, we used the experience in Ontario in 2004, when a total of 68,000 AFB smears and cultures were performed and 662 cases were diagnosed throughout the province. This meant that in Ontario about 100 AFB smears and cultures were performed for each active case identified. We extrapolated from this to all jurisdictions, that the workload of AFB smears and cultures performed would equal 100 times the number of active cases in that jurisdiction in 2004.

Drug Costs

For all provinces and territories, we estimated drug costs from the fee schedule of the *Régie de l'assurance maladie du Québec* for payment to community pharmacies for drugs and pharmacists fees. This enabled us to standardize drug costs across all jurisdictions. (See Table S1 in the online appendix for calculations). We assumed that 85% of patients with active TB would receive standard treatment of 2 months daily Isoniazid, Rifampin, Pyrazinamide and Ethambutol (2HRZE) followed by 4 months daily Isoniazid and Rifampin (4HR). Another 14% of patients would have INH resistant organisms or INH intolerance, and receive 2HRZE followed by 10 months daily Rifampin and Ethambutol (10RE). MDR (multi-drug resistant) cases account for 1% of all cases in Canada.[7] Drug costs for MDR treatment were taken from World Health Organization estimates for high-income countries.[8]

For treatment of latent TB infection, we assumed that 85% of patients would receive 9 months daily Isoniazid (INH) and 15% would receive 4 months daily Rifampin, because of INH resistance or intolerance.[9] To account for non-compliance, it was assumed that 50% of those who started would complete treatment.[10-14] The remainder would take about one third of the total doses required.[15]

Staff Costs

Staff salary costs were calculated based on number of full-time equivalents (FTEs) reported in the survey, multiplied by average Canadian salaries for that type of health care professional, from the federal government Treasury Board.[16] We added 22% for benefits (the average of benefits paid to workers – from the surveys).

Other screening costs

Across Canada almost all jurisdictions perform tuberculin skin test (TST) screening of contacts and other high-risk groups, and some conducted school screening. Hence, de facto this was included in the expenditures of the DOH or provincial/territorial jurisdictions. However, TST screening of adult workforces, such as health care workers, is usually performed by the employers (i.e., health care facilities). We obtained the number of health professional students graduating each year,[17] and assumed each would have at least one TST. For current health care workers, we used information from the Infection Control Departments of two large urban tertiary care health centres – the Toronto Hospital, and the McGill University Health Centre (MUHC). At these centres, between 16% and 18% of all health care workers undergo TST each year, for screening at hiring, post-exposure testing, or annual screening (unpublished internal reports). Given that these estimates were from tertiary care hospitals in urban centres, we assumed that only 5% of all health care workers in Canada with direct patient care responsibilities would undergo a TST each year. (See also Table S2 in the online appendix). Costs were based on the manufacturer's unit cost for Tuberculin skin test material (PPD) (Sanofi Pasteur) and published estimates of labour costs.[14,18]

Research

Research costs were estimated by a direct survey of current annual research grant and salary support from external agencies, held by researchers at Canadian institutions with active research programmes in TB.

RESULTS

Of 59 jurisdictions sent questionnaires, 57 (97%) responded. Respondents reported management of 1,562 active TB cases (or 99% of the 1,574 cases reported in 2004), initiation of latent TB treatment for 11,935 persons, and investigation of 27,547 close and casual contacts.

As seen in Table II, over half of all salaried physicians working in TB control

* Information on the IFH program is available at http://www.cic.gc.ca/english/index.html (Accessed July 2007).

activities are employed by the federal government, while the majority of nurses work at provincial and local DOH levels. Active TB accounted for the largest single proportion of provincial/territorial spending, with a total of $31.1 million, or $19,906 per active TB case (Table III) – almost half of which was for hospitalization. Provincial/territorial spending for treatment of latent TB cost $10 million in total, or $845 per patient started on therapy for LTBI. Contact investigations accounted for $8.3 million in expenditures, or $300 per contact screened.

Federal government spending related to tuberculosis exceeded $16.3 million. The largest part was for screening for active TB among immigrants and refugees, and the second largest part was for federal contributions to Aboriginal TB care. Federal funding for research, through peer-reviewed agencies, totalled approximately $4.5 million annually.

As shown in Table IV, total government expenditures at all jurisdictional levels and including all types of activities was almost $74 million, corresponding to $47,290 per active case. As seen in Table V, the Northern territories spent the greatest amount per case of active TB ($72,441 per case), and the Atlantic provinces the least ($28,259). After accounting for FNIHB contributions, spending per TB case in the 4 Western provinces was almost identical to that in Ontario and Quebec.

TABLE III

Breakdown of Provincial Costs by TB Control Activity*

	Active TB	Latent TB	Contacts	Other Screening	Other Activities
Public Health					
Salaries	$6,573,277	$4,140,847	$7,656,458	$1,310,261	$1,025,600
Other expenses	$571,376	$461,541	$616,885	$113,625	$101,134
Diagnosis					
Provincial TB labs	$4,708,643	–			
Hospital TB labs	$895,034	$1,635,796			
Other investigations	$375,166				
Hospitalization	$15,033,102	–			
Treatment - drugs	$1,977,105	$1,214,796			
Follow-up costs	$960,008	$2,631,864			
TOTAL	$31,093,661	$10,084,845	$8,273,343	$1,423,886	$1,126,734
Cases	1562	11,935	27,547		
Cost per case	$19,906	$845	$300		

* Excludes Research, Health Care Worker Screening, and Federal Contributions

TABLE IV

Total Government Expenditures by Jurisdictional Level

	Salaries + Benefits	Other Expenditures	Calculated Total
Federal			
Other staff	$10,499,202	$5,315,665	$15,814,867
Reference Laboratory	$540,293		$540,293
Subtotal Federal	$11,039,495	$5,315,665	$16,335,160
Provincial/Territorial			
Public Health staff	$8,160,381	$1,285,009	$9,445,390
Reference Laboratory	$4,651,290	$57,353	$4,708,643
Local departments of health	$12,897,679	$681,088	$13,578,767
Subtotal provincial/territorial	$25,709,350	$2,023,450	$27,732,800
TB drugs			$3,191,901
Hospitalization for active TB			$15,033,102
Clinical care (by non public health providers)			$3,591,872
Hospital laboratories			$2,905,996
Research			$4,498,000
Other screening of health care workers			$557,739
TOTAL			$73,866,570
Per case of active TB (N=1562†)			$47,290

† Cases in the North were highly variable from year to year. Therefore three-year average (2002-2004) used. As a result, total number of cases for 2004 actually slightly less than reported.

DISCUSSION

In 2004, total government expenditures for TB in Canada was $74 million. This is equivalent to more than $47,000 per active case of TB – almost identical to the cost of $48,339 estimated in the US,[19] after accounting for inflation[6] and rates of exchange in 2004. This estimate is much higher than earlier Canadian estimates of government expenditures for TB of $15,000-18,000 per case,[5,20] or a recent estimate of costs for lung cancer of $10,928-$15,350 per patient in Northern Alberta.[21] In this study, costs were higher because of inclusion of all types of expenditures, such as for salaried public health employees, hospital costs, physician fees, research and institutional screening. As well, all jurisdictional levels were included, which is important since federal expenditures accounted for 23% of all TB-related government expenditures.

Significant regional differences were noted in this survey. The Eastern provinces had very low expenditures, but this seems reasonable given the very low, and still declining incidence of TB. The Northern territories had the highest costs per case – in part reflecting the difficulties of providing care to a very dispersed population. In addition, rates of disease are high, and there is evidence of ongoing transmission in these populations,[22] justifying greater efforts in TB prevention and control activities. One interesting finding was the similarity in spending between the 4 Western provinces, where TB care is very centralized, and Ontario and Quebec, which have a decentralized approach. This similarity was not expected, and suggests that the major determinants of spending are the patterns of disease, and populations affected – which are similar in the 6 provinces.

This survey had a number of important limitations. A large proportion of the information came from self-administered questionnaires, which can be inaccurate. Although bias in reporting seems unlikely, estimation of non-salary budget items such as overhead costs was incomplete. Other screening activities in nursing homes or schools may have been underestimated. Patients' costs were not included because there is limited published information regarding patients' direct or indirect costs in Canada. Inclusion of costs for research and screening immigrants for TB may be questioned, but was considered justified because if there was no TB at all in Canada, these expenditures would likely be discontinued.

Strengths of this survey include the high response rate to the survey (98%), and measurement of all major government expenditures for TB diagnosis, treatment, and prevention across Canada. Estimates of total staff and time spent on different TB

TABLE V

Regional Spending on TB in 2004*

	Northern Territories	Western Canada	Ontario & Quebec	Atlantic Provinces	TOTAL
Number of Activities					
Active TB cases	35‡	622	880	25	1562
Latent TB – started on treatment	215	4130	7536	54	11,934
Contacts investigated	2264	9156	15,608	519	27,547
Expenditures by Type of Expense†					
Salaries + benefits (excluding laboratories)	$1,492,956	$8,113,547	$11,325,508	$126,049	$21,058,060
Other budget	$476,809	$911,431	$568,196	$9,660	$1,966,097
TB drugs	$67,279	$1,176,881	$1,910,393	$39,196	$3,191,101
Hospitalization	$338,518	$5,981,774	$8,462,960	$249,850	$15,033,102
Clinical care	–	$170,439	$3,376,067	$45,366	$3,591,872
Reference laboratories	$112,288	$1,984,180	$2,529,296	$82,879	$4,708,643
Hospital labs	$46,785	$674,618	$2,165,424	$19,169	$2,905,996
Expenditures by Control Activity†					
Active TB (includes hospital, labs and care)	$668,257	$12,014,617	$17,954,851	$455,934	$31,093,661
Latent TB (includes care)	$905,090	$3,259,206	$5,870,772	$49,778	$10,084,845
Contact investigations	$640,821	$2,369,937	$5,200,093	$62,493	$8,273,343
Other screening	$160,635	$383,935	$879,316	$0	$1,423,886
Other activities	$160,635	$553,095	$412,137	$865	$1,126,734
FNIHB contributions	–	$3,757,646	$838,718	$137,417	$4,733,781
TOTAL	$2,535,438	$22,338,436	$31,155,887	$706,487	$56,736,250
TOTAL per active case	$72,441	$35,914	$35,404	$28,259	$36,323

* Excludes HCW screening, federal† and research funding

† Federal funding, including FNIHB contributions for TB care to Aboriginal populations, were excluded from analysis of costs by type of expenditure, but were included in analysis of type of control activity – as separate line item, as well as in Totals and Total/case.

‡ Cases in the North were highly variable from year to year. Therefore three-year average (2002-2004) used.

activities were made by managers or administrators in each jurisdiction, who had a detailed understanding of the time and responsibilities of all personnel working in tuberculosis. All federal costs, all provincial/territorial public health costs, all numbers of TB cases, contacts and persons with LTBI, and costs of care in the 4 Western provinces and Northern territories were based on direct survey results. Hence costs of care were based only partially on published literature. Drug costs were based on the number of latent and active TB cases treated in each jurisdiction and thus should have been reasonably accurate and consistent across all jurisdictions.

Of all expenditures that were attributable to particular TB control activities, care of active TB accounted for 59%, while preventive activities accounted for a minority of costs. A large part of the costs for care of active TB were for hospitalization, which may seem surprising but is consistent with several earlier surveys in Canada,[5,23] and the US.[19,24,25] This is because the diagnosis of TB is often missed or delayed in emergency rooms[26,27] and after admission to hospital.[23,28,29] As incidence declines further, delays in diagnosis are more likely,[23] further increasing hospitalization and length of stay.[23,30]

The costs related to active cases could be reduced through greater efforts at prevention. For example, investigation and treatment of contacts can be cost-effective,[5] but the impact and cost-effectiveness of this screening and prevention programme is often substantially reduced. This is because, of all persons eligible for LTBI therapy, less than 50% start and 25% complete therapy.[31] It has been shown that additional expenditures to enhance programme performance would be cost-effective if they improved completion of LTBI therapy.[5] The high costs for care of active TB identified in this survey could be reduced through greater spending on prevention. The finding that only 40% of expenditures were for activities to prevent what could, in theory, be a totally preventable disease, seems evidence that the emphasis in TB needs to shift more toward greater expenditures in TB prevention which could lead in the long term to overall reduction in TB.

We conclude that TB-related expenditures remain high in Canada. Greater expenditures for TB screening and prevention appear justified, given the high level of current expenditures for active TB.

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RÉSUMÉ

Objectifs : Nous avons estimé les sommes consacrées à la lutte antituberculeuse par les gouvernements et d'autres organismes au Canada en 2004 afin de comparer les dépenses par activité, par province ou territoire et par région.

Méthode : Pour vérifier les coûts du système de santé (y compris les coûts de santé publique), nous avons envoyé un questionnaire à tous les services de santé et laboratoires fédéraux, provinciaux et territoriaux intervenant dans les activités antituberculeuses et à un échantillon de services de santé locaux. L'Institut canadien d'information sur la santé nous a communiqué les données sur les hospitalisations, et nous avons estimé les coûts des soins d'après les études publiées sur le sujet. Les coûts défrayés par les patients et les familles n'ont pas été comptabilisés. Tous les coûts visent l'année 2004 et sont exprimés en dollars canadiens.

Résultats : En 2004, les dépenses liées à la tuberculose au Canada se sont chiffrées à 74 millions de dollars (M$), soit 47 290 $ par cas de tuberculose active diagnostiqué pendant l'année. La recherche a coûté 4,5 M$ (6 % du total). Les dépenses fédérales non liées à la recherche ont représenté 16,3 M$ (22 %), et les dépenses provinciales et territoriales, 53,1 M$ (72 %). La tuberculose active a coûté 31 M$, soit 59 % des dépenses provinciales et territoriales. On note d'importants écarts régionaux dans les dépenses liées à la tuberculose; les plus élevées ont été enregistrées dans les territoires nordiques (72 441 $ par cas de tuberculose active) et dans les quatre provinces de l'Ouest (35 914 $), et les dépenses les plus faibles, dans les provinces de l'Atlantique (28 259 $).

Conclusion : Les dépenses totales liées à la tuberculose au Canada en 2004 ont été considérables; près de 60 % ont été consacrées aux services de soins, et 40 % seulement aux activités de prévention et de contrôle. Les écarts régionaux reflètent probablement les différences dans l'accès des populations aux services de santé et les interventions plus poussées dans les localités où la tuberculose est endémique.

Mots clés : lutte antituberculeuse; coûts des interventions; coûts de santé publique; coûts de la tuberculose